

COLLECTIVE REPUTATION AND QUALITY

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ABSTRACT

Firms who sell a regional or specialty product often share a common or collective reputation, which is based on the group's aggregate quality. The dynamic problem of collective reputation is similar to the natural resource extraction problems. Therefore, for the analysis of this particular problem, we use differential games. If there is unrestricted access to a common property resource (the reputation stock), agents perceive its shadow value to be zero and extract too rapidly; i.e, they all “cheat” on quality, “milking” the rents generated by the existence of the resource (reputation stock). We show that when there exists a collective product reputation without firm traceability, the firms will extract too much from the stock of reputation. A firm is said to “extract” reputation from the reputation stock when it sells low-quality products at high prices given by the high past levels of quality. The firm builds on the group's reputation when it provides a product with a quality level which is higher than the expected level of quality. The results from this work support minimum quality standards for producer groups and regional and specialty products. This is in contrast to the findings of previous work. Finally, the implications of these results are discussed as they relate to the case study of Washington apples.

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Collective Reputation and Quality

1. Introduction

High quality, seasonal, authentic, and local food products have become a more important part of consumer purchases in recent years. Producers have responded by marketing food products that come from specific geographic areas. The recent food safety scares in Europe have added to the demand for origin-specific foods. This trend in consumers' preferences has led the European Union (EU) to introduce protected designations of origin labels and protected geographical identification labels, which provide protection of food names on a geographical or traditional basis, ranging from Parmesan cheese to such lesser-known items as Galician veal. In the United States, there are popular state products which carry labels such as: Washington apples, Idaho potatoes, and Florida Citrus.

One of the elements that dictate the success of specialty or local products is the collective reputation of the product. When the collective reputation of the product is good, the designation will be a powerful tool to signal quality. Tirole (1996) modeled the idea of collective reputation as an aggregate of individual reputations. In Tirole's model, the individual firm's past behavior is unknown to the consumer, so the consumer uses the past behavior of the member's group to predict the individual firm's future behavior.

The concept of collective reputation is important for many food products, where the individual producers are not known directly by the consumer. The consumer relies on the image of the cooperative or consortia that guarantees and promotes the particular product. Landon and Smith (1997, 1998) find that reputation is a significant factor in determining price premia for Bordeaux wine creates a price premium, and Quagrainie,

McCluskey, and Loureiro (2003) find that a common reputation exists for Washington apples.

In this paper, the reputation of the product is assumed to be similar to a common property resource, which is exclusive to the group of firms that are able to use the group label. In the spirit of Tirole's collective reputation, it is assumed that the firms in the group share a common reputation, which is based on the group's aggregate quality. Since reputation is a dynamic concept, we can apply tools from natural resource modeling. The dynamic problem of collective reputation is similar to the common property natural resource extraction problem studied by Levhari and Mirman (1980) and many others.

As Karp (1992) points out, if there were unrestricted access to a natural resource (the reputation stock), agents perceive its shadow value to be zero and extract too rapidly; i.e, all "cheat" on quality, "milking" the rents generated by the existence of the resource (reputation stock). However, when access is restricted to a finite number of firms, additional dynamics may exist. We will show that for markets of quality, if there is no monitoring agent who controls the quality level, and given the asymmetric information situation between firms, all firms will extract from the stock of reputation. The stock of reputation at time t , may increase or decrease depending on the "extractions" or "increments" on the reputation stock. A firm is said to "extract" reputation from the reputation stock at time t when it sells low-quality products at high prices given by the high past levels of quality. The firm builds on the group's reputation when it provides a product with a quality level which is higher than the expected level of quality.

For the analysis of this particular problem, we use differential games. Following the standard game theoretic-optimal control setup, when choosing his or her strategy,

each player is aware of the other players and how the other players' choices of their control variables affects his or her payoff. That is, all players choose their control variables simultaneously. Each player knows the others' strategies. When there is no incentive for any of the players to revise his or her choice of control variable, then the choices are said to be in equilibrium.

We will use feedback strategies to obtain an equilibrium rather than open-loop strategies. In open loop strategies the players commit to his entire sequence of actions throughout time at the outset of the game. This condition is rarely met in the real world, but because of their simplicity this types of strategies are frequently used. A more realistic way of modeling the agent's behavior is to suppose that he or she can change his or her behavior at each point of time on the basis of the state of the system. This is achieved by the feedback strategies. Thus, a feedback strategy allows the player to choose the best response in every sub-game. Consequently, a feedback strategy is sub-game perfect (Kamien and Schwartz, 1993).

The paper proceeds as follows: We provide a brief literature review of previous related studies, followed by a presentation and analysis of the theoretical model using differential games. Next we provide a discussion of the Washington apple industry in light of our analytical findings. Finally, conclusions and policy implications are presented.

2. Related Literature

There is an extensive theoretical literature on reputation issues¹. Shapiro (1983) shows theoretically that price premiums are necessary for producers to invest in quality and

reputation. When the collective reputation (Tirole, 1996) of a product is good, the product's label will be a powerful tool to signal quality.

Noe and Rebello (1995) consider competition between producer groups when consumers prefer costly “ethical” production technologies, which result in final products that have credence attributes.² The tradeoff between cost savings versus individual reputations within the producer group and ethical considerations determine the trajectory of group adherence to the production standards. They find that social pressures from members of the group may induce producers to adopt the preferred technology. Although related to the current paper, Noe and Rebello model the producer’s utility, which includes preferences for ethical technology and social pressures within the producer group.

Zago (1999) uses an agency theory approach to analyze the interaction of hidden information and the democratic process and the quality choices of a group of heterogeneous producers who are members of a producer organization that has a reputation for quality. Each producer has hidden information about his/her type. The producer organization has perfect information about each producer’s quality level and can ensure that the payment to producers will be a function of quality provided.

3. Model

We assume there are N identical firms that produce a specialty product. Each of the firms is risk neutral and maximizes profits. The price they receive for their specialty product is a function of their collective reputation, and costs are a function of quantity and quality produced. We assume that collective reputation evolves as a Markovian process of past reputation and the present quality produced. In order to focus on the firm's quality

decision, we assume that each firm produces a fixed quantity in each period and, for simplicity, the quantity produced is assumed to be one unit. We will assume that, for an N firm industry, each firm chooses quality to maximize the following equation

$$(1) \quad \max_{q_i \geq 0} \int_0^{\infty} e^{-rt} [p(R) - c(q_i)] dt, \quad i = 1, \dots, N,$$

subject to

$$(2) \quad \dot{R} = \sum_{i=1}^N \left(\frac{q_i}{N} \right) - R; \quad R(0) = R_0 > 0$$

where R is the collective reputation, and q is the firm quality choice. These values are normalized so that they are in the same units. Price is denoted as p and costs are denoted as c . Since each firm maximizes profits subject to the state equation for collective reputation, the current value Hamiltonian for each firm's is,

$$(3) \quad \tilde{H}_i = [p(R) - c(q_i)] + \lambda_i \left[\sum_{i=1}^N \left(\frac{q_i}{N} \right) - R \right] = \tilde{L}_i + \lambda_i f$$

where λ_i represents the shadow price that also take into account the discount factor.

The first order conditions of the current value Hamiltonian for the differential game are as follows:

$$(4a) \quad \tilde{H}_{q_i} = -c'(q_i) + \frac{\lambda_i}{N}$$

$$(4b) \quad \tilde{H}_R = p'(R) - \lambda_i$$

$$(4c) \quad \tilde{H}_{\lambda_i} = \sum_{i=1}^N \left(\frac{q_i}{N} \right) - R$$

Given that the firms are identical, then $q_i = q$ for all i , and there is a single state variable, the system of differential equations is given by (Mehlman),

$$(5) \quad \dot{R} = q - R$$

$$(6) \quad \dot{q} = \frac{(1+r)c'(q)N - p'(R)}{Nc''(q)}.$$

Setting \dot{R} and \dot{q} equal to zero, we obtain the following isoclines,

$$(7) \quad R = q$$

and

$$(8) \quad p'(R) = (1+r)c'(q)N.$$

Although q is ambiguous from equation (8), if we assume a structural form we can solve for q explicitly. In our model, we will assume price is log function and cost exponential increases with quality so that

$$(9) \quad p(R) = \alpha \ln(R)$$

and

$$(10) \quad c(q_i) = \beta e^{q_i}$$

where α and β are positive constants. From equation (6) this yields,

$$(11) \quad \dot{q} = \frac{(1+r)N\beta q e^q - \frac{\alpha}{R}}{N\beta(q^2 e^q + e^q)}$$

Since the determinant of the Jacobian matrix is negative, the differential equations result in a saddle point equilibrium. If we take the implicit derivative of q with respect to N at the equilibrium point we get,

$$(12) \quad \frac{dq}{dN} = \frac{-\alpha}{N^2(1+r)\beta(2qe^q + q^3e^q)}.$$

Since all of the parameters are positive, this expression has a negative value. This implies that as the number of firms increases, the quality decreases. Therefore, firms are free-riding, and the industry is not maximizing profits. Figure 1 shows the phase diagram with equilibria for both the monopoly and duopoly.

This model has implications for enforceable minimum quality standards for producer groups, regional and specialty products. Our conclusions with collective reputations are different from previous work that does not consider collective reputations. Bockstael (1984) concludes that minimum quality standards can not increase social welfare nor do they increase producer returns. Bockstael argues that minimum quality standards may be a more politically acceptable method to limit the quantity of a good, thereby giving rents to many firms in the industry. Her assumption is that consumers know the quality of each good, before it is purchased. Our paper implies that if reputation is collective, then minimum quality standards are Pareto improving.

4. The Case of Washington Apples

The State of Washington benefits from the reputation that its producers grow high quality apples (Quagraine, McCluskey, and Loureiro, 2003). In recent years, however, there have been industry concerns regarding the declining “eating” quality of Washington Red Delicious apples. One would expect this to have a negative effect on the reputation of Washington apples and consequently on demand. We present the case of Washington apples in light of the results of the analytical model. We discuss how individual producers’ incentives are not aligned with the collective group and discuss findings of

declining reputation.

The Northwest apple is undergoing a period of economic crisis with many growers teetering at the brink of bankruptcy. The current economic crisis is quite dramatic in terms of low prices (see Figure 2) when contrasted with the relatively prosperous period from 1975 to 1995—although during that period there were a few years with lower prices, including the aftermath of the panic over the use of the chemical Alar in 1989. The market price for apples has been low since the mid 1990s, and per unit returns to growers is below cost of production. The Red Delicious variety epitomizes the woes of the industry. It commands the lowest prices (see Figure 3), even though it is the most widely produced and celebrated apple in the Northwest. Per-capita consumption of apples has been flat (see Figure 4). There is concern in the Northwest apple industry that domestic consumption has gone flat because of diminished quality in terms of taste and texture.

When the eating experience does not meet with expectations, consumers are less likely to buy those apples again. After a bad eating experience, consumers will likely eat fewer apples, change varieties, or switch to other types of fruits. Consistency in quality is important because consumers want to be confident of the same eating experience each time they buy apples. In sum, if a subset of producers are selling bad apples, it hurts all growers.

The “Washington Apple” sticker only signals origin; and it does not reflect specific quality or production standards. Some Washington apple producers use their own logos in addition to the “Washington Apple” logo to differentiate their apples. Many large packing houses, such as Stemilt Growers, put their own stickers on their

apples. However, the smaller producers, who do not attempt to differentiate their product, still have the economic incentive to cut costs by selling lower quality products while still benefiting from the collective reputation that Washington has built up over time.

An example of misaligned incentives is the sale of old fruit—last year’s crop—in the fresh market. Apples stored (even in controlled atmospheres) for periods greater than nine months can be negatively affected in terms acid loss, sugar development, and loss of crispness or firmness (Fellman, 2002). Collectively, apple growers in Washington should want to ban the sales of last year’s crop to consumers who believe they are buying fresh apples. The apple industry got the state legislature to pass a law that generally prohibited the sale of last year’s crop after October 1 (Ashton, 2002). Growers could still sell their fruits to juicers and canners but at a much lower price compared to the fresh market. Evans Fruit Company, a Yakima, Washington packing house, sued the state Department of Agriculture, contending that the law was unconstitutional. In September 2002, Yakima County Superior Court Judge Susan Hahn granted Evans request (Ashton, 2002). This example illustrates how individual growers have the incentive to sell their last year’s crop as fresh, while the industry as a whole would be better off if the old fruit were banned from the fresh market.

In order to maintain and build on its good reputation, the apple industry in Washington should consider establishing minimum standards for what constitutes “eating quality” in addition to the normal grading of color, shape, and size. This suggests that reputation should be considered in any cost-benefit analysis for the industry. Loureiro and McCluskey (2000) found that if the protected geographical indications label

“Galician Veal” from Spain was present on meat products, Spanish consumers were willing to pay a significant premium. The use of the “Galician Veal” label requires producers to be located in the region and also meet very strict quality and production practice standards. The Washington apple industry should follow suit.

5. 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 to the group of producers. If there is more than one firm in a producer group, they will produce lower quality and free ride on the good group reputation. We show that when there exists a collective product reputation without firm traceability, the firms will extract too much from the stock of reputation. A firm is said to “extract” reputation from the reputation stock when it sells low-quality products at high prices given by the high past levels of quality. The results from this work support minimum quality standards for producer groups and regional and specialty products. This is in contrast to the findings of previous work that does not incorporate collective reputation.

References

- Ashton, L. "State Still May Sell Old Apples after Oct. 1." *Columbian*, Vancouver Washington (September 25, 2002):C2.
- Allen, F. "Reputation and Product Quality." *Rand Journal of Economics* 15(1984):311-27.
- Bockstael, N. "The Welfare Implications of Minimum Quality Standards." *American Journal of Agricultural Economics* 66(1984):466-471.
- Darby, M. and Karni, E. "Free Competition and the Optimal Amount of Fraud." *Journal of Law and Economics* 16 (1973):67 - 88.
- Kamien, I.M. and N. Schwartz. "Dynamic Optimization. The Calculus of Variations and Optimal Control in Economics and Management." In *Advanced Textbooks in Economics*, 31. Editors: C.J. Bliss and M.D. Intriligator (1993).
- Fellman, J. *Amicus Brief. Evans v. Washington State Department of Agriculture* 2002.
- Karp, L., "Social Welfare in a Common Property Oligopoly," *International Economics Review*, 33(1992):353-372.
- Kreps, D. and Wilson, R. 1982. Reputation and Imperfect Information. *Journal of Economic Theory* 27: 253-279.
- Levhari, D. and Mirman, L.J. "The Great Fish War: an Example Using a Dynamic Cournot-Nash Solution," *Bell Journal of Economics* (1980)11:322-334.
- Loureiro, M.L. and McCluskey, J.J. "Assessing Consumers Response to Protected Geographical Identification Labeling." *Agribusiness* 16(2000): 309-320.
- Mehlmann, Alexander. *Applied Differential Games*. New York: Plenum Press (1988).

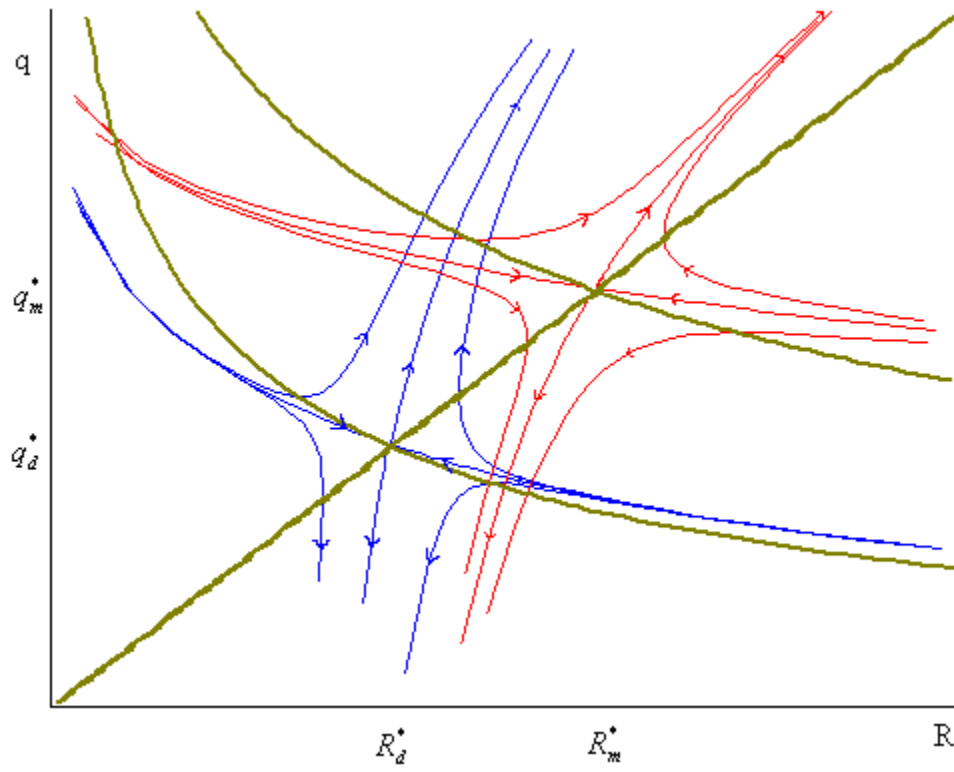
- Milgrom, P. and J. Roberts. "Predation, Reputation, and Entry Deterrence." *Journal of Economic Theory* 27(1982):280-312.
- Noe, T.H. and M.J. Rebello, "Consumer Activism, Producer Groups, and Production Standards." *Journal of Economic Behavior and Organization* 27(1995):69-85.
- Quagraine, K.K., J.J. McCluskey, and M.L. Loureiro. "A Latent Structure Approach to Measuring Reputation." *Southern Economic Journal* 67(2003):966-977.
- Rogerson, W.P. "Reputation and Product Quality." *The Bell Journal of Economics*," 14(1983):508-516.
- Shapiro, C. "Premiums for High Quality Products as Returns to Reputations," *The Quarterly Journal of Economics* 98(1983):659-79.
- Shapiro, C. "Consumer Information, Product Quality, and Seller Reputation," *The Bell Journal of Economics*, 13(1982):20-35.
- Tirole, J., "A Theory of Collective Reputations (with Applications to the Persistence of Corruption and to Firm Quality)," *Review of Economic Studies*, 63(1996):1-22.
- Zago, A.M. "Quality and Self-Regulation in Agricultural Markets: How do Producer Organisations Make the Rules?" *European Review of Agricultural Economics* 26(1999):199-218.

Endnotes

¹See for example, Kreps and Wilson (1982); Milgrom and Roberts (1982); Shapiro (1982, 1983); Allen (1984); Rogerson (1983); and Tirole (1996).

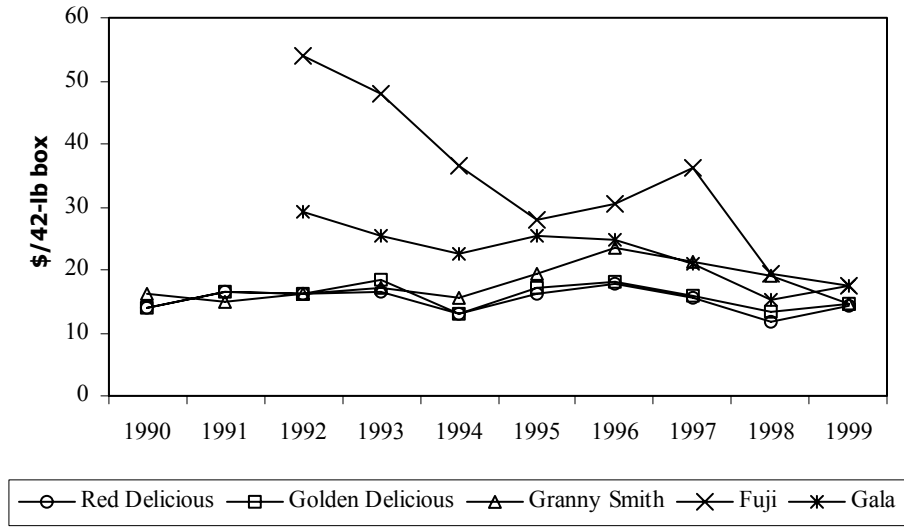
²Credence qualities are expensive to judge even after purchase, (Darby and Karni, p. 69).

Figure 1—Phase Diagram



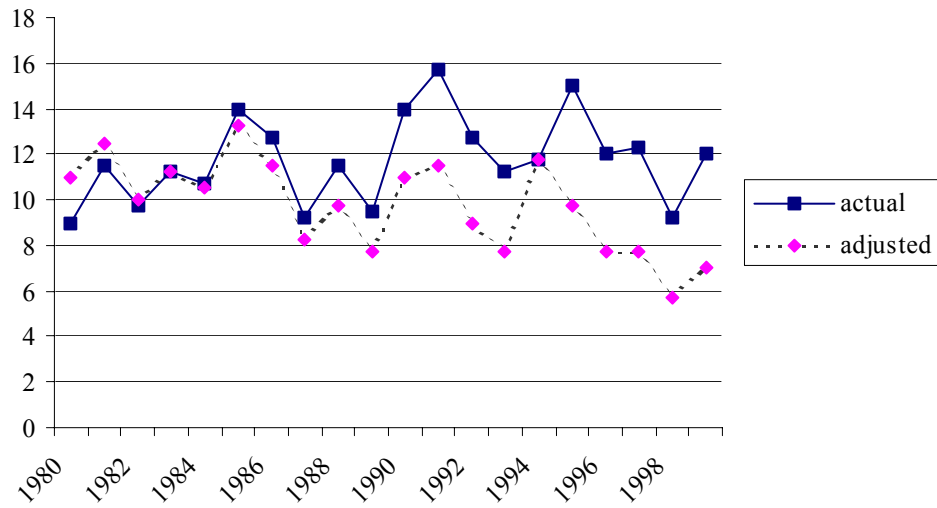
The subscript d denotes the duopoly equilibrium, and the subscript m denotes the monopoly equilibrium.

Figure 2—Season average prices (August – August) of selected apple varieties



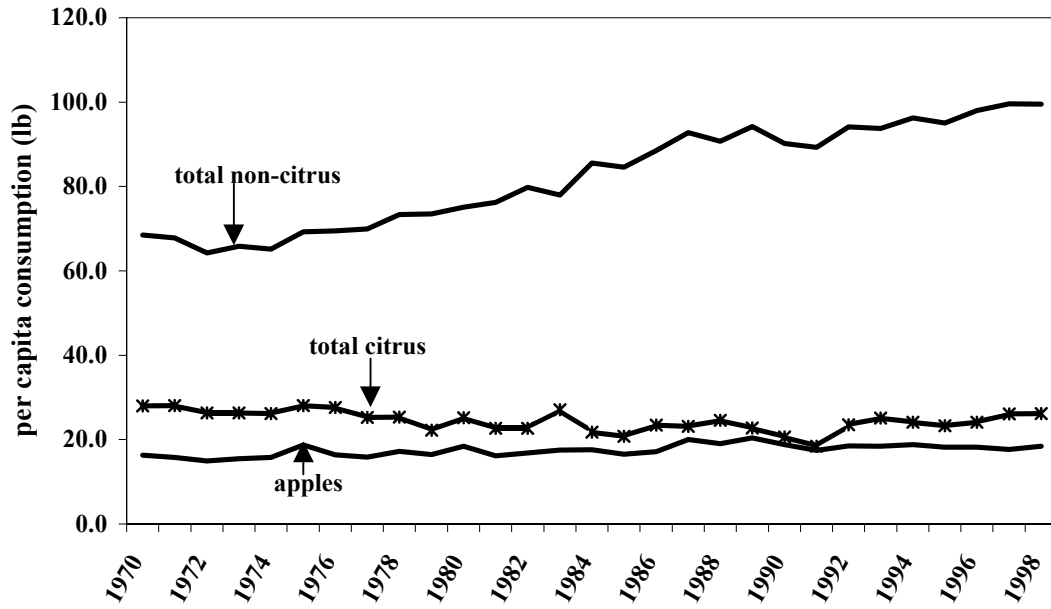
Source: Washington Growers Clearing House Bulletin

Figure 3—Washington State Red Delicious per box price history, in actual dollars and adjusted for inflation



Source: Data from Washington Growers Clearing House and Clark Seavert, Oregon State University, Printed in *Good Fruit Grower* (November 2000)

Figure 4—Per capita consumption of fresh fruit (retail weight)



Source: USDA/Economic Research Service.