Journal of Agricultural and Resource Economics 29(1):150–165

Labeling Policies in Food Markets: Private Incentives, Public Intervention, and Welfare Effects

Angelo M. Zago and Daniel Pick

This study considers the welfare impact of labeling policies of agricultural commodities with specific characteristics. Using a model of vertical differentiation, the effects on equilibrium and welfare levels are calculated. The introduction of the regulation and the emergence of two differentiated competitive markets leaves consumers and high-quality producers better off, while low-quality producers are worse off. With high costs and low quality differences, the total welfare impact of the regulation can be negative. Findings show that when high-quality producers can exercise market power, the regulation could be more easily accepted by producers, but it would have a negative effect on consumers.

Key words: asymmetric information, food markets, labeling, market power, vertical differentiation, welfare effects

Introduction

This study considers the intervention of the European Union (EU) in markets for typical products, i.e., agricultural commodities or finished products with specific organoleptic characteristics related to a production area or technology. According to widespread beliefs, markets for typical products are impaired by inadequate asymmetric information: higher quality products cannot be recognized as such by consumers with higher willingness to pay, and thus high-quality producers cannot have appropriate incentives. The objective of this analysis is to investigate the welfare effects of the EU regulation which grants producer groups the right to label typical products to make them easily recognizable by consumers. However, the results are more general, and the analysis encompasses similar emerging issues in other markets and types of regulations.[1]

With the MacSharry reform of the Common Agricultural Policy (1992), the EU has changed its approach to agricultural policies, with a major emphasis on nondistortionary policy interventions. At the same time, the EU has instituted a series of policies to increase the diversification of agricultural production to achieve a better balance between supply and demand and to benefit the rural economy, in particular of less-favored and

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Review coordinated by DeeVon Bailey.

[1] The EU regulation refers to *typical* products, but this paper more generally deals with *specialty* products, a term we believe should be more meaningful to a wider audience. Another example of specialty products is *kosher* foods.

remote areas. One intervention following these broad objectives is Regulation No. 2081/92 on the protection of Products with Geographical Indications (PGIs) and Designations of Origin (PDOs). This regulation recognizes that consumers are attaching greater importance to the quality of foodstuffs, and "in order to be able to make the best choice they [consumers] must be given clear and succinct information regarding the origin of the product...." The regulation's aim is to recognize, protect, and foster trade among Member States of PGI and PDO products to secure higher incomes for farmers in return for a genuine effort to improve quality.[2]

Since the pioneering contribution of Akerlof (1970), economists and policy makers have become increasingly aware of the importance of information for the proper functioning of markets. Most are familiar with the many instances of market failures due to information problems, and many agree on the need to overcome them in order to increase social welfare. What is more controversial, though, is whether a public intervention (e.g., Stiglitz, 1996) or the emergence of a different institution, such as warranties, reputation, labeling, etc., is the most suitable correction.

The regulation investigated in this study aims to increase both consumers' and producers' surplus. According to the regulator, consumers with higher willingness to pay get what they pay for, while producers find the incentives to provide the quality level sought by richer consumers and ensure themselves higher profits. This investigation undertakes a welfare analysis of the regulation and argues that, although the motives are noble, the results may be welfare decreasing.

The next section provides a review of the relevant literature and gives some background information about the impact of the regulation. The model is then introduced. By choosing assumptions carefully, we always make the choices that are more optimistic about the impact of the regulation. In other words, a best-case scenario approach is used for the regulator, and it is assumed there is a market failure and a need for public intervention because we have a credence good, for which private or market institutions (e.g., branding, intermediaries, forward integration, etc.) may not emerge or fully resolve the information asymmetry. In addition, the market regulation is allowed to work perfectly, in the sense that once introduced it is trusted and perfectly observed by consumers.[3]

In general, findings indicate the impact on consumers' welfare depends on the characteristics of the product, on technology conditions, and on the degree of market competition associated with the label. For producers, those granted labeling rights will gain while other producers will lose. These results may not be surprising. However, we go a step further and show, depending on demand and technology parameters and on the costs of managing the regulation, the change in total welfare may be negative despite the potential gains to consumers and to those producers who are protected by the regulation. We therefore argue that a careful cost-benefit analysis is needed when deciding whether to grant the label to a group of producers.

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[2] The scope of the regulation is limited to commodities with a link to geographical origin. The link and the specific quality, reputation, or other characteristics attributable to the area and the production-processing-preparation practices must be proven during the application and are evaluated by the EU. For more details on the regulation and its effects on the demand for a particular product, see, e.g., Loureiro and McCluskey (2000).

[3] This best-case scenario may not be very realistic. For example, many of the products using the regulation were already well known by consumers [e.g., Italian (Arfini, 1999), French, and Greek cheeses]. Clearly, when there is no need for the regulation, or when it does not work properly, things would not improve compared with this benchmark scenario, which may be considered an upper bound for the welfare effects of the regulation.

The analysis also considers the possibility that producers may exercise some market power following the introduction of the regulation. The success of this form of label or brand owned by producers in fact rests on their ability "to restrict additional production from within the group...," from which ability "comes freedom from the boom-bust price cycles associated with commodity markets..." (Hayes, Lence, and Stoppa, 2003, p. 5). But we show that this ability by producers is always associated with a negative welfare effect for consumers, which may outweigh the benefits associated with the creation of the new market for differentiated commodities. Following a discussion of some policy implications, concluding remarks are provided, and suggestions are offered for some extensions and further research areas.

The Regulation and Related Literature

Since 1992, many products have been proposed by producers and their organizations to be recognized as Products with Geographical Indications (PGIs) or with Designations of Origin (PDOs). By the end of 1999, approximately 530 products were granted the right to use these labels. The major countries benefiting from the regulation are France (22% of granted labels), followed by Italy (20%), Greece and Portugal (both 14%), and Germany (11%). While for France and Germany the majority of products labeled were local breads and beers, for Italy and other Southern Europe countries the products included cheeses, meat products, fruits and vegetables, and olive oil (Nomisma, 2000).

The importance of information for the proper functioning of markets is well known and documented. Since the pioneering work of Akerlof (1970) and Klein and Leffler (1981), economists have investigated the causes of and remedies for market failures due to the lack of information on product quality. It has been shown that the suboptimal equilibria resulting from these information problems may be improved through the emergence of different institutions in the form, for example, of warranties, certification (De and Nabar, 1991), signaling and reputation (Kreps and Wilson, 1982; Shapiro, 1983), and various intermediaries (Spulber, 1999).

It is common in the economics literature to distinguish goods according to whether their quality can be identified by consumers. The quality of search goods is easily detected before consumption. For experience goods, consumers need to actually consume the good before being able to discern its intrinsic quality. For credence or trust goods, quality can never be known by consumers with certainty (Nelson, 1970). While for search and experience goods the emergence of market "remedies" for quality assurance can be relatively effective and sufficient to avoid market failures (Laffont and Tirole, 1991), in the case of credence goods, the instances in which suboptimal equilibria exist are more common (Darby and Karni, 1973).

In studies of the food industries, recent contributions recognize that many aspects of food quality and safety can be considered credence attributes (Antle, 1996; Caswell and Mojduszka, 1996; Crespi and Marette, 2001; Giannakas, 2002; Giannakas and Fulton, 2002; McCluskey, 2000; Mojduszka and Caswell, 2000). Although the theoretical contributions dealing with credence goods in general are relatively few, their applications to food industries are increasing. Bureau, Marette, and Schiavina (1998) consider the case of the dispute over hormone-treated beef between the EU and the United States, and conclude the positive effect of trade liberalization on welfare may be offset by the increase in imperfect information about product quality.

In a related paper, Marette, Crespi, and Schiavina (1999) investigate the impact of common labeling by a cartel of producers when there is asymmetric information about product quality. They find, with high cost of labeling, a cartel providing information about product quality may improve total welfare even when colluding to reduce output. Anania and Nisticò (2002) consider different scenarios for a public regulation, according to which degree of "trust" or credibility the regulation can obtain from consumers. Auriol and Schilizzi (1999) investigate quality signaling through certification with fixed certification costs, and conclude the costlier the certification, the higher the need for public intervention. Based on findings of a study examining credence goods, Kirchhoff (1999) reports firms may voluntarily over-comply in environmental labeling, i.e., produce high quality even when doing so implies giving up short-run profits. Extending previous results in the literature, Ibanez (1998) shows the market is able to generate inefficiencies if the population has a certain pro-social behavior.

The Model

The model builds on the earlier work of Bureau, Marette, and Schiavina (1998) and considers a vertically differentiated market. The starting point of the analysis is a situation in which a good may present different quality levels but appears undifferentiated to consumers. Indeed, let us assume a credence good for which consumers are not able to distinguish between different variants of the same commodity.[4] It is also assumed the producers who are granted the label by the regulator are really producing a better commodity, i.e., the regulator is unbiased and can perfectly detect the quality of the commodity.[5] By introducing the label, the superior version of the good becomes recognizable by consumers and can be distinguished from the lower quality variants. In practice, the regulation creates two distinct products: one with the label, with higher quality, sold to consumers with a higher willingness to pay, and the other with a lower quality level.

Consider an agricultural commodity as a credence good: its quality can vary and is not known by consumers either before or after consumption. Some consumers would be willing to pay more for a better variant of the commodity in which characteristics are linked to special features of the production technology and/or area of production because they believe they would get higher utility from its consumption. The regulator can alleviate the problem of asymmetric information by granting a label to those producers who follow certain rules and by helping them to establish a reputation for higher quality. It is assumed the regulator knows with certainty which firm produces the high-quality product or from which production areas the commodity comes. For this and other reasons, consumers trust the public provision of the certification.[6]

It is reasonable to assume the quality, s, of the good under consideration is exogenous. It depends on the peculiar climate and soil conditions, and on some traditional practices

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[4] Credence goods are considered first because it is reasonable to think that in many instances consumers are not able to discern whether a commodity is really from a particular area and/or has been produced with a particular technology. In addition, some eligible commodities may also have some experience attributes, but with experience goods, institutions may emerge to solve the information problem without government intervention. As explained in the introduction, this analysis seeks to give the regulator the best conditions for the regulation to be needed and to work properly.

[5] The analysis does not consider political economy pressures, which could lead to a situation in which some differentiating qualities are "exaggerated" in the label.

[6] For a paper which explicitly considers when the certification is only partially trusted, see Anania and Nisticò (2002).

the regulation intends to preserve. Thus, the quality can be either low (s_L) or high (s_H).[7] Assume there is an exogenous number of producers: n_L producers of the low-quality variety (s_L) of the commodity, and n_H producers of the higher quality (s_H).[8] Producers from different areas have different production technologies and costs of production. Also, producers specializing in the high-quality commodity are assumed to use a more restrictive (costly) technology—i.e., because they follow traditional techniques, or because even though they have a potential for high quality, this technology simply requires more effort.

Let us assume a quadratic[9] cost function: $0.5c_i(q_{ij})^2 n_i$, where $q_{ij} \in \Re_+$ is the quantity level of the type $i = L,H$ commodity for the individual producer j; c_i is a cost parameter such that $c_L < c_H$; and n_i ensures constant-returns-to-scale technology. To begin, consider individual producers j as price takers. Their profit is given by the following:

$$\pi_{ij} = q_{ij}p_i - 0.5c_i(q_{ij})^2 n_i, \quad i = L,H. \tag{1}$$

The optimal level of individual production is $q_{ij} = p_i/c_i n_i$, while the aggregate supply is the summation of individual supplies:

$$Q_i(p_i) = n_i q_{ij} = \frac{p_i}{c_i}. \tag{2}$$

Note that $Q(p) = Q_L(p_L) + Q_H(p_H) = (p_L/c_L) + (p_H/c_H)$.

To represent consumer preferences, consider a demand structure à la Mussa and Rosen (1978). Consumers can choose one unit of the good with quality s. If they consume it, they receive the following utility:

$$V = \theta s - p, \tag{3}$$

where θ is a taste parameter which represents different intensity of preferences for quality, and p is the price of the good of quality s. Assume the taste parameter θ is distributed uniformly over the interval $\theta \in [\underline{\theta}, \overline{\theta}]$, and the distribution is normalized such that $\underline{\theta} = 0$ and $\overline{\theta} = 1$.[10] The consumers will consume as long as $\theta > p/s$.

The respective expressions for consumers' and producers' surplus are:

$$CS = \int_{\underline{\theta}}^{\overline{\theta}} (\theta s - p)\, d\theta \quad \text{and} \quad PS_i = \int_{\underline{q}}^{\overline{q}} (p_i - c_i q)\, dq,$$

where $[\underline{\theta}, \overline{\theta}]$ and $[\underline{q}, \overline{q}]$ are generic integration intervals.

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[7] In models with vertical differentiation, it is also possible to have endogenous quality when firms may invest in quality improvement, incurring either an increase of fixed or variable costs. For an in-depth analysis of endogenous quality in the food industries, see Sutton (1991).

[8] It is reasonable to assume no entry for the high-quality producers, since quality is linked to a particular area where the essential factors of production (e.g., land) are given. The case of low-quality products is different, because these products may be replicated somewhere else. The analysis concentrates on the short-run impact and leaves the free-entry case as a possible extension. The reader should be aware that with free entry, different results could emerge.

[9] Following Bureau, Marette, and Schiavina (1998), the quadratic form is chosen for simplicity and ease of calculation. However, the qualitative nature of results should be robust to the exponent in the variable cost function.

[10] This corresponds to a situation in which the market is not covered, i.e., some consumers prefer not to buy the commodity offered. The other case is when the market is covered, which we do not consider for the moment. When a market is covered, demand cannot be inverted, and so quantity competition à la Cournot cannot be used (Motta, 1993, p. 116).

Before the Regulation: The Undifferentiated Market

Consider the case before the regulation, when one indistinguishable variety of the good is offered, and assume that in equilibrium both variants of the commodity are sold but consumers are not able to distinguish between them. With a unique price in the market, consumers form expectations about the quality of the commodity they buy. Using rational expectations, consumers expect that the average quality of the undistinguished commodity is the weighted (by the relative quantity) average of the quality levels of the two varieties of the good. The expected quality is then the following:

$$\bar{s} = \frac{Q_L(p_L)}{Q(p)} s_L + \frac{Q_H(p_H)}{Q(p)} s_H = \frac{s_L c_H + s_H c_L}{c_H + c_L}. \tag{4}$$

Since consumers are implicitly risk-neutral, the demand for the good of quality $\bar{s}$ sold at price $\bar{p}$ may be determined by the following expression:

$$D(\bar{s}) = \frac{\overline{\theta} - \theta_0}{\overline{\theta}}, \tag{5}$$

where θ_0 represents the consumer who is indifferent between buying and not buying the good, and thus $\theta_0 = \bar{p}/\bar{s}$. Recalling that $\overline{\theta} = 1$, then the demand, when there is only one undistinguished good offered, is specified as $D(\bar{p}, \bar{s}) = 1 - (\bar{p}/\bar{s})$.

The equilibrium quantity and price can be determined by setting the (aggregate) supply equal to the demand: $Q(p) = (p_L/c_L) + (p_H/c_H) = 1 - (\bar{p}/\bar{s}) = D(p)$, to obtain the following:

$$q^{\bar{s}} = \frac{\bar{s}}{\bar{s} + \bar{c}} \quad \text{and} \quad p^{\bar{s}} = \frac{\bar{s}\bar{c}}{\bar{s} + \bar{c}}, \tag{6}$$

where $\bar{c} = (c_H c_L)/(c_H + c_L)$. Here, the superscript notation refers to an equilibrium, while the subscript refers to the different types, i.e., producers of the low-quality variety (s_L) of the commodity or of the high-quality variety (s_H).

The levels of consumers' and producers' surplus (avoiding the intermediate calculations) are denoted by:[11,12]

$$CSB = \int_{\theta_0}^{1} (\theta\bar{s} - p^{\bar{s}})\, d\theta = \frac{\bar{s}^3}{2(\bar{c} + \bar{s})^2}, \tag{7}$$

$$PSB_H = \int_0^{q_H^{\bar{s}}} (p^{\bar{s}} - c_H q)\, dq = \frac{\bar{s}^2 \bar{c}^2}{2c_H(\bar{c} + \bar{s})^2},$$

$$PSB_L = \int_0^{q_L^{\bar{s}}} (p^{\bar{s}} - c_L q)\, dq = \frac{\bar{s}^2 \bar{c}^2}{2c_L(\bar{c} + \bar{s})^2}.$$

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[11] The letter "*B*" in the terms *CSB*, PSB_H, and PSB_L stands for "before" the regulation.

[12] Consumers do not know individual goods or firms, but can form some expectations on their distribution. This assumption, which allows us to find an equilibrium, is similar to that used in principal-agent models, where the principal knows the distribution of the efficiency parameter in the firms' population but does not know the efficiency of the individual firm.

The resulting level of total welfare, which can be considered the benchmark when evaluating the effects of the regulation, is:

$$TWB = CSB + PSB_L + PSB_H = \frac{\bar{s}^2\bar{c}(1+\bar{s}\bar{c})}{2(\bar{c}+\bar{s})^2}.$$

The Effects of the Regulation

Now we consider the case in which, after the regulation, consumers can distinguish between two goods offered at quality s_L and s_H, with $s_L < s_H$, and at prices of p_L and p_H, with $p_L < p_H$. In this case, there are two indifferent consumers. The first, $\tilde{\theta}$, is indifferent between the high-quality and the low-quality good, i.e., $\tilde{\theta}s_H - p_H = \tilde{\theta}s_L - p_L$, such that $\tilde{\theta} = (p_H - p_L)/(s_H - s_L)$. The other consumer, θ_0, is indifferent between buying the low-quality good and not buying at all, i.e., $\theta_0 s_L - p_L = 0$, such that $\theta_0 = p_L/s_L$. The demand for the two goods is expressed as follows:

$$D^H(\mathbf{s},\mathbf{p}) = \frac{\bar{\theta} - \tilde{\theta}}{\bar{\theta}} = 1 - \frac{p_H - p_L}{s_H - s_L}, \tag{8}$$

$$D^L(\mathbf{s},\mathbf{p}) = \frac{\tilde{\theta} - \theta_0}{\bar{\theta}} = \frac{p_H - p_L}{s_H - s_L} - \frac{p_L}{s_L}. \tag{9}$$

The Competitive Case

Following the regulation, two competitive markets emerge: one for the high-quality type of the commodity, and the other for its low-quality variety. The aggregate supplies in the two markets are $Q_L(p_L) = p_L/c_L$ and $Q_H(p_H) = p_H/c_H$. The equilibrium quantities and prices in both markets are:

$$p_L^c = (c_L c_H s_L)/\sigma, \quad p_H^c = c_H(s_L\Delta s + c_L s_H)/\sigma,$$
$$q_L^c = c_H s_L/\sigma, \quad \text{and} \quad q_H^c = (s_L\Delta s + c_L s_H)/\sigma,$$

where $\sigma = c_L c_H + c_H s_L - s_L^2 + c_L s_H + s_L s_H$, and $\Delta s = s_H - s_L$. The superscript c refers to the competitive scenario equilibrium, while the subscript refers to the different quality levels, high and low.

Given the equilibrium quantities and prices, the level of consumers' surplus in the competitive scenario is designated by

$$CSA_L^c = \int_{\theta_0}^{\tilde{\theta}} (\theta s_L - p_L^c)\,d\theta \quad \text{and} \quad CSA_H^c = \int_{\tilde{\theta}}^{1} (\theta s_H - p_H^c)\,d\theta$$

for low and high quality, respectively.[13]

The costs of the administration of the program—the expenditures for the process of getting the EU recognition, for drawing and administering the rules for production and trade, etc.—are borne by the high-quality producers. It is reasonable to consider these

[13] A^c in these expressions stands for "after" the regulation, "competitive" scenario. The equations for CSA^c, CSA_H^c, and CSA_L^c are not reported because of space limitations, but are available from the authors upon request.

costs as fixed (Auriol and Schilizzi, 1999; Ibanez, 1998), and set them equal to F.[14] Taking into account the equilibrium quantities and prices that emerge and the fixed expenditures for the program, surplus levels for producers are denoted by:

$$PSA_H^c = \int_0^{q_H^c} (p_H^c - c_H q)\,dq = \left(c_H(c_L s_H + s_L \Delta s)^2\right)/2\sigma^2 - F,$$

$$PSA_L^c = \int_0^{q_L^c} (p_L^c - c_L q)\,dq = c_L c_H^2 s_L^2/2\sigma^2, \text{ and}$$

$$PSA^c = PSA_H^c + PSA_L^c = \left(c_L c_H^2 s_L^2 + c_H(c_L s_H + s_L \Delta s)^2\right)/2\sigma^2 - F.$$

The regulation aims to improve both consumers' and producers' surplus. As explained in the introduction, our choices regarding the model represent the best-case scenario from the point of view of the regulator (e.g., the regulation is needed), and the regulation is trusted and recognized by consumers as well. The results of the comparison between the welfare levels before and after the introduction of the regulation are summarized below.

■ PROPOSITION 1. *With competitive markets, after the regulation, consumers' consumption and surplus are greater. Production and surplus are lower for low-quality producers and higher for high-quality producers.*

Intuitively, before the regulation, consumers are forced to consume a commodity of uncertain quality due to imperfect information. Once a well-functioning regulation is introduced and markets remain competitive, consumers can choose according to the quality they prefer and are willing to pay for. For high-quality consumers, given that quality level is higher after the regulation, consumption and total surplus increase. For low-quality consumers, the quality level and the quantity consumed are lower, since these consumers did benefit from the uncertainty about quality prior to the regulation.[15]

For low-quality producers, the labeling decreases both the quantity demanded and the price they can receive; only low-quality consumers prefer their products, and thus they face a lower demand and their surplus decreases. For high-quality producers, the regulation increases surplus, since both quantity and price are higher than before the regulation. The size of the welfare impact on different agents depends on technology and demand conditions. To show the impact of the regulation and some comparative statics, the results of numerical simulations are reported.[16]

The results show the impact of the regulation on economic welfare as c_H, the marginal production cost of high-quality producers, changes from 110% to 250% of c_L, given $s_H = 1.1$ and $F = 0.005$ (figure 1).[17] The impact on consumers' surplus and high-quality producer profits is positive but decreasing with the increase in cost differences, while negative

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[14] The case of administrative expenses affecting variable costs, considered for example by Crespi and Marette (2001), is encompassed in our model, since $c_H > c_L$.

[15] This result is very similar to that of Bureau, Marette, and Schiavina (1998).

[16] Using Mathematica 4, we calibrate the model to have an initial situation with a functioning market even with uncertain quality, which is the case for many labeled products prior to the regulation (see footnote 3). We normalize ($c_L = 1$) and ($s_L = 1$), and change (c_H) and (s_H) to have differences in marginal costs and quality from 10% to 150%. Given the normalization of consumers' taste parameters, such that $\underline{\theta} = 0$ and $\overline{\theta} = 1$, the quantities, prices, and surplus levels are between zero and one.

[17] Fixed costs are chosen to be smaller than the increase in profits for the high-quality producers following the regulation. An $F = 0.005$ corresponds to 3–5% of high-quality producers' total revenues.

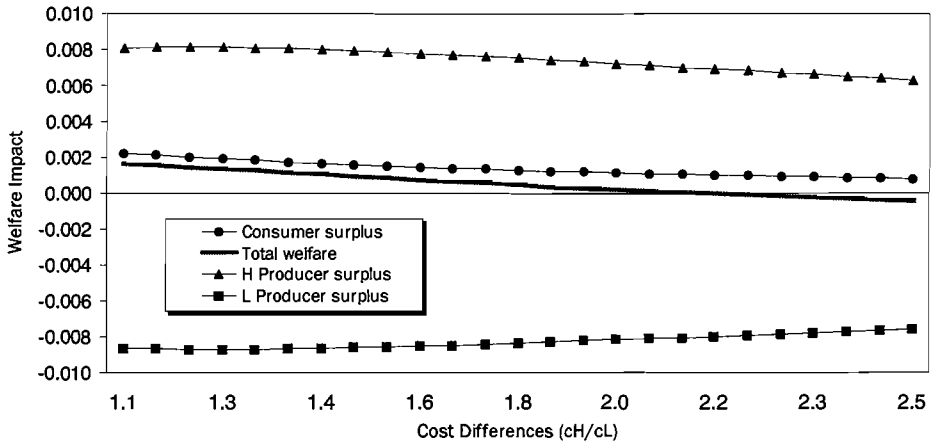

Figure 1. Welfare impact with competitive markets

but increasing with cost differences on low-quality producers' profits. To explain these impacts, two effects can be isolated. The first is the uncertainty about quality which penalizes high-quality producers and in part high-quality consumers, reducing their purchased quantity with no labeling. The other is related to the different production costs: if high-quality producers have much higher production costs, the positive surplus impact is reduced for these producers and consumers alike.[18]

In addition to preferences and technology conditions, the overall impact of the regulation depends on its administrative costs. If these costs are relatively high, the impact on welfare may be negative. Indeed, if there are small quality differences between the two variants of the commodity, but which are relatively expensive to obtain, the decrease in surplus for low-quality producers may outweigh the increase of high-quality producers' and consumers' surplus. In other words, there may be instances in which the regulation would not pass the Kaldor-Hicks (potential) compensation test (Just, Hueth, and Schmitz, 1982) in a hypothetical cost-benefit analysis. Results are summarized below.

■ PROPOSITION 2. *With competitive markets, the positive welfare impact of the regulation is higher as quality differences between the two variants of the commodity increase, and as cost differences between different producers decrease. If the administrative costs of the regulation are high, quality differences low, and cost differences high, the regulation has a negative welfare effect.*

Since we are dealing with credence goods, markets are working, perhaps suboptimally, prior to the regulation. In addition, the regulation is financed by producers, and although its costs may be low enough to be profitably sustained by the high-quality producers, costs still may be high enough to have a negative impact on total welfare. This is a result one may find also in signaling models with costly separation (Riley, 2001). Notice that specialty products are often produced and traded in local markets of limited size, for which administrative costs can be relatively high.

[18] Keeping c_H as given and varying s_H shows that the impact on consumers' surplus, on high-quality producers' profits, and on total welfare is positive and increasing with quality differences, while the impact on low-quality consumers' profits is negative and decreasing. The entire results are available from the authors upon request.

Market Power via Land Restrictions

The regulation allows the group of high-quality producers to label and regulate production and trade of their specialty products. It is possible the group of producers can exercise market power. One natural and relatively uncontroversial practice would be to restrict the land producers may allocate to specialty products.[19] It is assumed, when the producers are granted the label, they expand the area only partially following the regulation.[20]

Following the regulation, with land restrictions for high-quality production, two competitive markets emerge with the following aggregate supplies: $Q_L(p_L) = p_L/c_L$ and $Q_H(p_H) = \bar{q}_H$, where $\bar{q}_H$ is the maximum amount of land the group may allocate to specialty products. The equilibrium quantities and prices that emerge are:

$$p_L^r = \left((1 - \bar{q}_H)c_L s_L\right)/(c_L + s_L),$$

$$p_H^r = \left((1 - \bar{q}_H)(\Delta s s_L + c_L s_H)\right)/(c_L + s_L),$$

$$q_L^r = \left((1 - \bar{q}_H)s_L\right)/(c_L + s_L), \text{ and}$$

$$q_H^r = \bar{q}_H,$$

where $\Delta s = s_H - s_L$, and the superscript r refers to the equilibrium of the competitive scenario with restricted land.

Notice that both equilibrium prices for high- and low-quality products and production of the low-quality variety are higher as restriction increases for the production of specialty products. Given the equilibrium quantities and prices, surplus for consumers and producers compared to the levels prior to the regulation are as described in the following.

■ PROPOSITION 3. *With supply restrictions after the regulation, the higher the quality differences between the two variants of the commodity, the bigger the negative impact on consumers' surplus and the positive surplus impact for high-quality producers.*

The regulation reduces the uncertainty about quality, and thus would allow high-quality consumers to increase their consumption of the variant they prefer and are willing to pay for. If the group of producers restricts the land allocated to the high-quality product, consumers find that the commodity they want is available in limited quantity, and this has a negative surplus impact on them. In addition, given that their utility depends on quality, the higher the quality differences between the low- and high-quality variants of the commodity, the bigger is, ceteris paribus, the negative impact (figure 2). The result on consumers' surplus is probably not surprising, because the

[19] In fact, the regulation recognizes those products with specialty traits related to the producing region and likely not reproducible in other areas. Another option we considered in the analysis, partially reported here, is the exercise of market power by price determination. A last form of market power, not considered, could be based on restrictions on the maximum yields allowed: often suggested as a means to increase the quality of the raw commodity, it is a practice quite common, for example, with *Appellation d'Origine* wines.

[20] We arbitrarily assume an increase of 20% of land allocated to specialty products after the recognition by the regulator. The higher the increase in allowed production—which in our model corresponds one-to-one to land—the closer are the results to the competitive scenario previously considered. Representing the optimal choice of land (i.e., production), we would obtain results similar to the case of price-fixing considered next in the text. Presumably, also with a different model based on a two-stage game (land allocation, then market competition), similar results would be obtained.

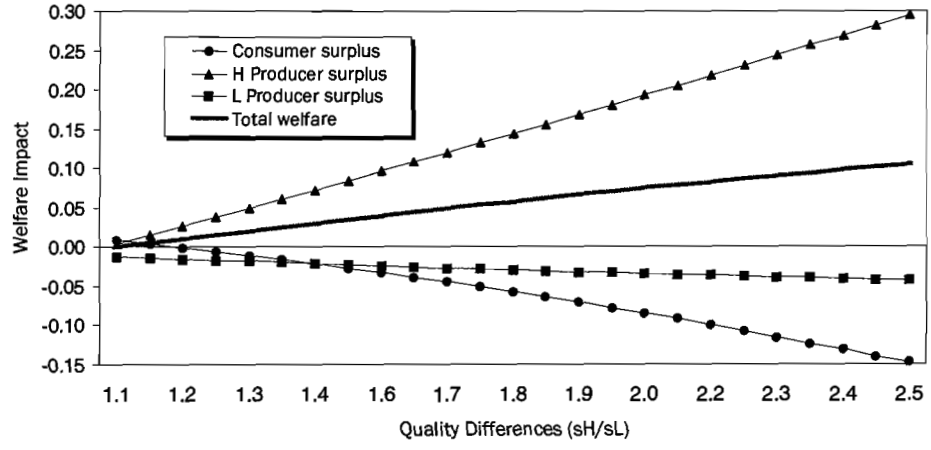

Figure 2. Impact on welfare with land restrictions

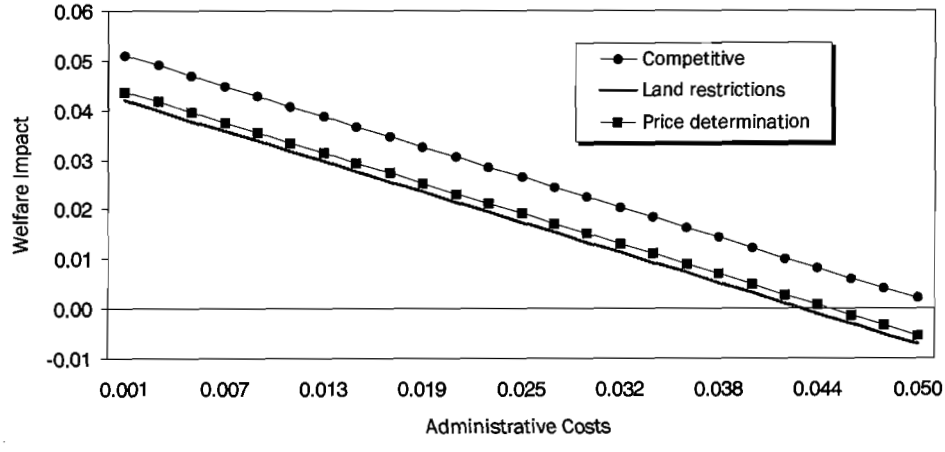

Figure 3. Total welfare impact of different market regimes

negative result is driven by the exercise of market power, whereby negative effects may outweigh the positive ones related to the creation of the new differentiated market. In other words, even with product differentiation and the emergence of a quality segment, the surplus effect on consumers will be negative if producers exercise market power.

High-quality producers are the main beneficiaries of the regulation, and the positive impact is increasing with the quality differences. As one would expect, compared with competitive markets, the welfare impact of the regulation is less positive with land restrictions, all else equal. If this latter restriction is binding, the impact on welfare is negative with a lower level of administrative costs. For example, if one considers what could be a reasonable scenario for the regulators to allow the label to be granted (high-quality differences, e.g., 50%, between the low- and high-quality variety, and with high-quality production not much more costly, e.g., 25%), the impact of the regulation with land restrictions is negative for values of the administrative expenses at $F = 0.04$, instead of $F = 0.05$ with competitive markets (figure 3).

Such value represents a fraction of 17% of revenues after the regulation.[21] It seems unlikely such high levels of administrative costs would occur in practice. Thus, when coupled with land restrictions by the group of producers, the regulation might be expected to have a negative effect on consumers' surplus. But, when granted to products with a high-quality potential associated with relatively inexpensive production costs and a reasonable level of administrative costs, the effect on total welfare should be positive.

Market Power via Price Determination

Next, consider the case of producer groups being able to fix prices like a monopolist. Dealing with differentiated products for which quantity and market volumes are often limited, it seems plausible to consider the group of producers being able to coordinate its activities and decide jointly some strategic variables, such as price.[22] When producers jointly determine the price of the high-quality commodity, the profit-maximization equation becomes:

$$\max_{p_H} \pi = p_H D^H(\mathbf{s}, \mathbf{p}) - n_H\left(c_H \frac{q_H^2}{2} n_H\right).$$

Given the constant-returns-to-scale technology,[23] represented by the parameter n_H, the aggregate supply of high-quality producers is $n_H q_H = Q_H(p_H)$. For market equilibrium, $D^H(\mathbf{s}, \mathbf{p}) = Q_H(p_H)$, and the maximization equation becomes the following:

$$\max_{p_H} \pi = \left[p_H - \frac{c_H}{2} D^H(\mathbf{s}, \mathbf{p})\right] D^H(\mathbf{s}, \mathbf{p}).$$

Thus the welfare levels to be compared to the situation prior to the regulation, after solving for the optimal price and the equilibrium prices and quantities, are as follows.

■ PROPOSITION 4. *With monopolistic price determination, consumers' surplus is lower after the regulation. Production and surplus are higher for high-quality producers and lower for low-quality producers.*

Compared with the competitive case, the distribution of the welfare impact is shifted. Consumers are able to make informed choices, but are hindered by the exercise of market power by producers, as with land restrictions (figure 4).[24] In addition, although the

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[21] As reported by Hayes, Lence, and Stoppa (2002), according to some estimates, the costs of (only) certification and inspection for specialty products are about 1% of the value of the product.

[22] Recently, the Italian Antitrust Authority investigated the producer groups of Parma and San Daniele hams and of Gorgonzola cheese because they imposed quantity restrictions on their members (Esposito, 1998). The paper considers the case of price determination, and not that of quantity determination, because it would likely be more difficult to detect and sanction for antitrust infractions. However, with vertical differentiation models, the qualitative nature of the analysis is very similar when considering quantity or price competition (Motta, 1993).

[23] Another interesting situation, suggested by a referee, would be when industry costs are not homogeneous, e.g., increasing returns. In this case, the results could be different than those presented here. However, without a proper analysis, it is difficult to formulate an educated guess of the welfare effects because of the interaction between the market structure emerging from the non-homogeneous technology and the effects of the label.

[24] Figure 4 has the same parameter values of figure 1, and thus can be directly compared. With price determination, we obtain a different result than Marette, Crespi, and Schiavina (1999), who find that in many instances the welfare increase following the provision of information by the cartel of high-quality producers more than offsets the reduction in welfare due to output reduction by the cartel itself. Note that Marette et al.'s paper considers a cartel of only two high-quality firms competing with a competitive fringe of low-quality firms.

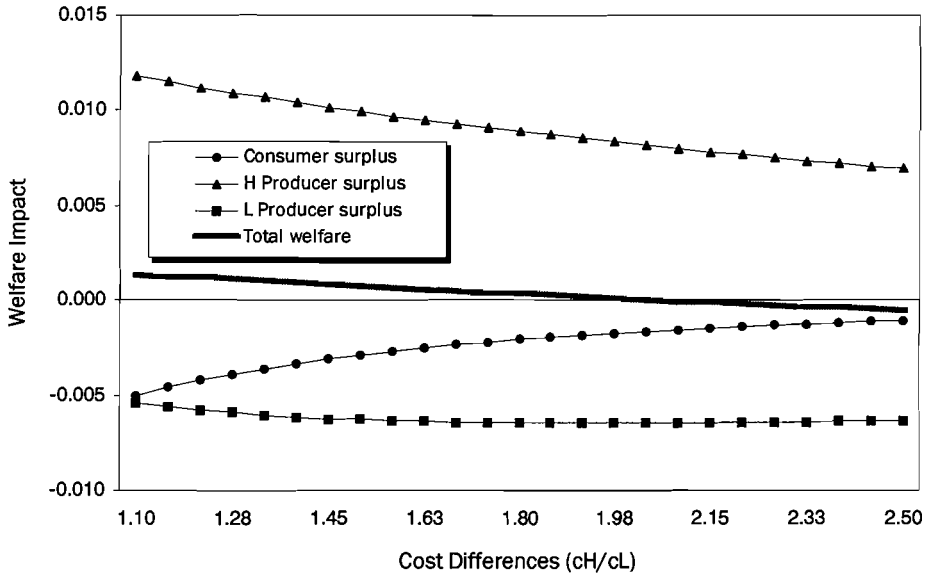

Figure 4. Welfare impact with price determination

surplus impact is less detrimental for low-quality producers, the total welfare impact is worse than with competitive markets (figure 3).[25]

High-quality producers make decisions based on a marginal revenue schedule, ensuring them a markup over marginal cost, which translates into an upward shifting of the demand for low-quality producers, who may now sell a higher quantity at a higher price but without the markup above marginal cost.[26] These results confirm the assertion of Anania and Nisticò (2002, p. 19) that "the interests involved in the introduction of a regulation go well beyond those of the producers of the high-quality good and involve other interests which may easily be stronger and more widespread...." Moreover, with a fully credible certification, the distribution of benefits is found to depend on the market structure and other policy details.

Concluding Remarks

This analysis considers the welfare impact of the introduction of the EU regulation which allows producers of agricultural commodities with specific characteristics to differentiate and label their products accordingly. With a model of vertical differentiation and a fully credible certification system, findings show that the introduction of the regulation, in combination with the emergence of two distinct competitive markets for the differentiated commodity, leaves both consumers and high-quality producers unambiguously better off, while producers of the low-quality commodity are unambiguously worse off.

[25] Under monopolistic price determination, it is always true that the total impact of the regulation is worse than under the competitive scenario, no matter the parameter values. However, the comparison with the case of land restrictions gives a ranking dependent on parameters.

[26] One may wonder whether there could be parameter values leading to collusion so profound it translates into a demand shift for low-quality producers so large as to actually increase profits compared with before the regulation. We checked with extremely low-quality differences (0.1%) and very high-cost differences (500%), confirming the surplus level for low-quality producers is always lower after the regulation.

In addition, when the administrative costs of the regulation are relatively high and quality differences low but still relatively expensive to obtain, the total impact of the regulation on economic welfare can be negative. With market power, either in the form of land restrictions or joint price determination, the impact on consumers is negative, worsening total welfare effects, notwithstanding an overall positive impact for producers, thus making the regulation more acceptable by producers in less favorable production areas. Because the results of the study are more general, the analysis can easily be extended to encompass other similar emerging issues in food markets.

To avoid potential negative welfare effects, we believe decisions on these matters should pass a cost-benefit analysis. Empirical work in this area is scarce, but applied economists should be well equipped to estimate the critical pieces of information on consumers' and producers' surplus, together with program costs. Particular care should be given to analysis of the degree of competition in specialty product markets.

A few considerations which may represent further caveats of the regulation are worth noting. High-quality production increases following the regulation: if this reallocation requires a higher use of inputs, it may translate into a worsening of the environmental impact of agricultural production.[27] The regulation also is intended to benefit rural communities in less developed areas of the EU. This can occur only if producers of high-quality commodities are located in these marginal areas. We believe this is not always the case,[28] and in some instances the regulation under examination could give the opposite results than expected by those fostering rural development in marginal areas.

For political economy constraints, policy makers and antitrust authorities at the EU and national levels could be more lenient toward monopolistic behavior of producers. With the exercise of market power by high-quality producers, the negative impact of the regulation on low-quality producers would be reduced.[29] A related issue is that national antitrust authorities may have contrasting attitudes in different EU countries. The varied attitudes of national authorities may depend on the political clout and relative importance of the agro-food sector in each country. In addition, the concern for national consumers may avoid the antitrust intervention for those specialty products with a larger share of exports. But these considerations pose the problem of a different treatment for a possibly similar behavior, and the allocation of jurisdiction at the national or international level (Neven and Roller, 2000).

In concluding, we must add that some citizens, and hence policy makers, may attach a value to specialty products per se. For example, some may want to buy a specialty product because they care about a particular region or production process, or because they are afraid of losing biodiversity in the form of those animal and vegetable species or cultivars deemed endangered in developed countries. We do not take into account this

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[27] There are instances in which better recognition of quality commodities and the higher price they can command has led to more intense use of pesticides (Cherobin and Zago, 2000). There is, however, no acknowledgment of this effect at the policy or research levels.

[28] In Italy, for example, over 70% of turnover for high-quality meats is from Prosciutto of Parma (Parma's ham), and over two-thirds of high-quality cheese turnover comes from Parmiggiano Reggiano (Parmesan cheese) and Grana Padano (Nomisma, 2000, p. 34). These specialty products, probably the most famous ones, are located in the Padana Valley, certainly not a marginal area in terms of rural development.

[29] This could make the regulation more accepted by EU producers in less favorable production areas. Only consumers would be worse off, but they are likely not very well organized to lobby, especially on issues related to products considered *gourmet delicatessen* within a local market. In addition, it could have a different impact when considering the international trade dimension (see Bureau, Gozlan, and Marette, 2001; Jansen and de Faria, 2002).

sort of externality, but believe it would deserve a thorough analysis—which might change both the magnitude and the nature of the results presented here.

[*Received July 2003; final revision received November 2003.*]

References

Akerlof, G. "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism." *Quart. J. Econ.* 84(1970):488–500.

Anania, G., and R. Nisticò. "Public Regulation as a Substitute for Trust in Quality Food Markets: What If the Trust Substitute Cannot Be Fully Trusted?" Work. pap. No. 18/02, Istituto Nazionale di Economia Agraria, Rome, Italy, 2002. Online. Available at www.inea.it/prin/risultati/.

Antle, J. M. "Efficient Food Safety Regulation in the Food Manufacturing Sector." *Amer. J. Agr. Econ.* 78(1996):1242–1247.

Arfini, F. "The Commercialization of Parmiggiano Reggiano Cheese at the Beginning of the New Millennium." Paper presented at the 9th IAMA Congress, Florence, Italy, 13–16 June 1999.

Auriol, E., and S. Schilizzi. "Quality Signaling Through Certification." Work. pap., IDEI Toulouse, France, 1999.

Bureau, J. C., E. Gozlan, and S. Marette. "Quality Signaling and International Trade in Food Products." CARD Work Pap. No. 01/wp283, Center for Agriculture and Rural Development, Iowa State University, Ames, 2001.

Bureau, J. C., S. Marette, and A. Schiavina. "Non-tariff Trade Barriers and Consumers' Information: The Case of the EU-U.S. Trade Dispute over Beef." *Euro. Rev. Agr. Econ.* 25(1998):437–462.

Caswell, J. A., and E. M. Mojduszka. "Using Informational Labeling to Influence the Market for Quality in Food Products." *Amer. J. Agr. Econ.* 78(1996):1248–1253.

Cherobin, E., and A. Zago. "Qualità dei Prodotti e Rispetto dell'Ambiente: Un Connubio Possibile?" *Rivista di Politica Agraria*, no. 4-5(2000):35–77.

Crespi, J. M., and S. Marette. "How Should Food Safety Certification Be Financed?" *Amer. J. Agr. Econ.* 83,4(2001):852–861.

Darby, M., and E. Karni. "Free Competition and the Optimal Amount of Fraud." *J. Law and Econ.* 16(1973):67–88.

De, S., and P. Nabar. "Economic Implications of Imperfect Quality Certification." *Econ. Letters* 37(1991): 333–337.

Esposito, F. M. "Antitrust Commission vs. Consorzi di Tutela: An Economic Evaluation." In *Typical and Traditional Products: Rural Effect and Agro-Industrial Problems*, eds., F. Arfini and C. Mora. Proceedings of the 52nd EAAE Seminar, Parma, Italy, 19 June 1998.

Giannakas, K. "Information Asymmetries and Consumption Decisions in Organic Food Product Markets." *Can. J. Agr. Econ.* 50(2002):35–50.

Giannakas, K., and M. Fulton. "Consumption Effects of Genetic Modification: What if Consumers Are Right?" *Agr. Econ.* 27(2002):97–109.

Hayes, D. J., S. H. Lence, and A. Stoppa. "Farmer-Owned Brands?" CARD Briefing Pap. No. 02-BP 39, Center for Agriculture and Rural Development, Iowa State University, Ames, 2003.

Ibanez, L. "Competition in Environmental Labeling." Work. pap., GREMAQ Université Toulouse I, France, 1998.

Jansen, M., and A. L. de Faria. "Product Labeling, Quality, and International Trade." Staff Work. Pap. No. DERD-2002-01, World Trade Organization, Geneve-CH, 2002.

Just, R. E., D. L. Hueth, and A. Schmitz. "Applied Welfare Economics and Public Policy." Englewood Cliffs, NJ: Prentice-Hall, 1982.

Kirchhoff, S. "Overcompliance, Labeling, and Lobbying: The Case of Credence Goods." Unpub. Ph.D. diss., Dept. of Agr. and Resour. Econ., University of Maryland, 1999.

Klein, B., and K. Leffler. "The Role of Market Forces in Assuring Contractual Performance." *J. Polit. Econ.* 89(1981):615–641.

Kreps, D., and R. Wilson. "Reputation and Imperfect Information." *J. Econ. Theory* 27(1982):253–279.

Laffont, J. J., and J. Tirole. *A Theory of Incentives in Procurement and Regulation.* Cambridge, MA: MIT Press, 1991.

Loureiro, M. L., and J. J. McCluskey. "Assessing Consumer Response to Protected Geographical Identification Labeling." *Agribus.: An Internat. J.* 16,3(2000):309–320.

Marette, S., J. M. Crespi, and A. Schiavina. "The Role of Common Labeling in a Context of Asymmetric Information." *Euro. Rev. Agr. Econ.* 26(1999):167–178.

McCluskey, J. J. "A Game-Theoretic Approach to Organic Foods: An Analysis of Asymmetric Information and Policy." *Agr. and Resour. Econ. Rev.* 29(2000):1–9.

Mojduszka, E. M., and J. A. Caswell. "A Test of Nutritional Quality Signaling in Food Markets Prior to Implementation of Mandatory Labeling." *Amer. J. Agr. Econ.* 82,2(2000):298–309.

Motta, M. "Endogenous Quality Choice: Price vs. Quantity Competition." *J. Industrial Econ.* XLI, 2(1993):113–131.

Mussa, M., and S. Rosen. "Monopoly and Product Quality." *J. Econ. Theory* 18(1978):301–317.

Nelson, P. "Information and Consumer Behavior." *J. Polit. Econ.* 78(1970):311–329.

Neven, D. J., and L.-H. Roller. "The Allocation of Jurisdiction in International Antitrust." *Euro. Econ. Rev.* 44(2000):845–855.

Nomisma. "Prodotti Tipici e Sviluppo Locale—VIII Rapporto Nomisma sulla Agricoltura Italiana." Rome, Italy, 11 July 2000.

Riley, J. G. "Silver Signals: Twenty-Five Years of Screening and Signaling." *J. Econ. Lit.* XXXIX(June 2001):432–478.

Shapiro, C. "Premiums for High Quality Products as Rents to Reputation." *Quart. J. Econ.* 98(1983): 659–680.

Spulber, D. F. *Market Microstructure: Intermediaries and the Theory of the Firm.* New York: Cambridge University Press, 1999.

Stiglitz, J. E. *Whither Socialism?* Cambridge, MA: MIT Press, 1996.

Sutton, J. *Sunk Costs and Market Structure.* Cambridge, MA: MIT Press, 1991.