

# GEOGRAPHICAL INDICATIONS AND THE COMPETITIVE PROVISION OF QUALITY IN AGRICULTURAL MARKETS

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The economics of geographical indications (GIs) is assessed within a vertical product differentiation framework that is consistent with the competitive structure of agriculture. It is assumed that certification costs are needed for GIs to serve as (collective) credible quality certification devices, and production of high-quality product is endogenously determined. We find that GIs can support a competitive provision of quality and lead to clear welfare gains, although they fall short of delivering the (constrained) first best. The main beneficiaries are consumers. Producers may also accrue some benefit if production of the high-quality products draws on scarce factors that they own.

*Key words:* competitive industry, free entry/exit, geographical indications, Marshallian stability, quality certification, trademarks, welfare.

The market provision of quality is notoriously fraught with difficulties under asymmetric information: when producers cannot credibly signal the quality of their products, consumers' choices are predicated on the perceived average quality on the market, and this pooling equilibrium has undesirable welfare properties. Following Akerlof's (1970) seminal contribution, such market failures have been the object of considerable research. One possible solution has emphasized the role of firms' reputation as conveyed by their brands (Klein and Leffler 1981; Shapiro 1983). Brand names must themselves be informative, of course, and that in turn requires a credible trademark system. Trademarks thus serve as useful information tools for consumers by allowing them to more readily identify the goods of interest, thereby reducing the possibility of consumer confusion and economizing on their search costs (Landes and Posner 1987). Given that effect, trademarks also provide an incentive for firms to produce goods of consistent quality, as expected by consumers, lest they lose consumer

loyalty and suffer a loss on their investments in trademark development.<sup>1</sup>

Brands and trademarks are best understood in an imperfectly competitive setting. Their role in agriculture and food production, largely characterized by competitive market conditions, remains an open question. Individual firms are typically too small to credibly signal quality to consumers directly, and this is one of the justifications for specific types of government intervention such as the development of food standards and grades, a specific mandate of U.S. federal agencies (Gardner 2003; Lapan and Moschini 2007).<sup>2</sup> Alternatively, producers could bundle together to achieve the critical mass required for brand name and trademark development. A particularly interesting instance of such cooperation in the provision of quality is represented by the use of geographical indications (GIs). This use of geographically based labels to brand products has been in use for a long time, especially in Europe, but interest in GIs increased considerably after they were recognized as a distinct form of intellectual property (IP) rights in the TRIPS agreement of the World Trade Organization

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<sup>1</sup> This standard result of reputation models was anticipated by Akerlof (1970), (p. 499), who noted that "Brand names not only indicate quality but also give the consumer a means of retaliation if the quality does not meet expectations."

<sup>2</sup> Two recent instances of government intervention in food and agricultural products labeling are the introduction of new organic food standards by the U.S. Department of Agriculture (USDA) in October 2002, and the new regulation for labeling genetically modified food and feed products in the European Union (EU) in April 2004.

(WTO) (Josling 2006). In the context of GIs, quality attributes of interest to consumers are presumed linked to the specific geographic origin of the good and/or particular production methods used in that region (the notion of “terroir”), and such attributes cannot be determined through inspection by the consumer prior to purchasing the good. The fundamental role of GIs in this setting, therefore, is that of providing a credible certification mechanism that solves a real-world information problem.

Some recent contributions have addressed directly some of the specific economic issues related to GIs. Zago and Pick (2004) question the desirability of GIs by showing that, with an exogenously determined supply of quality, the welfare implications of a fully credible certification system based on GIs are ambiguous. In Anania and Nisticò (2004), low-quality producers can choose to sell their product on the high-quality market (i.e., to cheat). Given an imperfect enforcement mechanism, a GI regulation might be desirable for both low- and high-quality producers. A few studies have suggested that GIs can be interpreted as “club goods” (nonrival, congestible, and excludable), as discussed in Rangnekar (2004), chapter 4, and this interpretation is adopted by Langinier and Babcock (2006). The government provides GI certification rights to high-quality producers, who are free to decide the size of the club (i.e., who among the high-quality producers has access to it). Lence et al. (2007) focus on the problem of developing new GIs. The key to developing such products is a fixed cost. Certification is implicitly free in their setting, and thus costless imitation is possible, so that some degree of supply control may be necessary to encourage geographic product differentiation.

In this article, we emphasize that the natural institutional setting for GIs is that of competitive markets. Contrary to standard trademarks, which are owned and used by a single firm, GIs are essentially public goods and are used by many firms simultaneously. Moreover, the use of a GI cannot be denied to any producer in the specified geographical area, an issue that has been overlooked by previous work. Indeed, in the European Union (EU) where GIs are widely used, there are typically no limitations on which or how many firms can use a given GI (provided that all product specifications, including the geographical origin, are met). Similarly, in the United States where GIs are mainly protected as certification marks, any firm that meets the certifying standards is entitled to use

the corresponding certification mark. Accordingly, the purpose of this article is to investigate the impacts of a credible GI certification system in a competitive market setting characterized by the possibility of free entry, and we derive and discuss the welfare effects to be expected in such a context.

Our analysis complements and adds to existing studies in this area in some novel ways. For instance, most studies discussed in the foregoing (Anania and Nisticò 2004; Zago and Pick 2004; Langinier and Babcock 2006) assume that producers are *ex ante* and exogenously identified as either of the low- or high-quality type. In particular, high-quality producers supply the high-quality product regardless of whether or not they are certified and/or receive a price premium in the market. We relax this constraining assumption and allow the (costly) provision of quality to be endogenously determined. Furthermore, in our model the production of high- and low-quality goods can coexist in equilibrium in the same area, which also captures a feature of the real world where not all producers in a given GI region take advantage of their right to supply the GI products. Finally, and perhaps most importantly, we analyze explicitly the implications of competitive entry within a coherent model of quality certification through GIs, an issue that, to date, has not been addressed.

In what follows we first review the institutional setting for GIs, with emphasis on policies implemented in the EU, a leader in the development and use of GIs. This allows us to substantiate our premise that both the letter of existing regulations and the observed practice in the predominance of cases suggest that the relevant market setting is a competitive one. In particular, entry of new firms that wish to produce GI-certified high-quality goods is possible. Based on that, we then specify a model to study how the competitive structure of agricultural production affects the supply of quality in the presence of a mechanism that mimics the nature of a GI. The model, although by necessity very stylized, captures the essential elements of the problem at hand. In particular, the demand side of the model is rooted in the economics of product differentiation, which provides an attractive formulation on how consumer preferences value quality. On the supply side, our model allows for different production costs for high- and low-quality goods and permits the supply of the high-quality (GI-certified) good to be endogenous.

The characterization of equilibrium centers on the competitive conditions with free entry/exit. In the benchmark case, in which all input costs are parametrically given, the need for costly certification that involves a fixed cost induces increasing returns to scale at the industry level. Consequently, the competitive equilibrium is not Pareto efficient; specifically, it underprovides the high-quality good. This equilibrium, however, does entail welfare gains relative to the absence of GI certification, and thus, it does ameliorate the information market failure that motivates interest in GIs. In this setting, some simple policies that subsidize the GI certification of quality would restore Pareto efficiency to the competitive equilibrium. Perhaps not surprisingly, given the long-run nature of the competitive equilibrium that we consider, the welfare gains due to GIs mostly take the form of increased consumer surplus. The availability of GIs benefits producers only when the production of the high-quality good draws on scarce factors owned by producers.

### The Institutional Framework

Whereas recent motives of interest in GIs stem from their recognition as distinct IP rights in TRIPS and the ongoing efforts to strengthen such rights, protection of GIs has a long history in some European countries and elsewhere. GIs are protected under two similar yet distinct legal notions: appellations of origin and marks. The primary difference is that an appellation of origin requires the existence of a special tie between the quality of the product and its geographical origin, whereas in the case of a mark such a relation is not necessary.<sup>3</sup>

The EU framework is rooted in its Council Regulation (EEC) 2081/92, adopted in 1992, which established an EU-wide harmonized system of protection of GIs for agricultural products and foodstuffs (but excluding wines and spirits).<sup>4</sup> This regulation defines two types of GIs, Protected Designations of Origin (PDOs) and Protected Geographical Indications (PGIs), that differ depending on how closely a product is linked to geogra-

phy (European Commission 2007). Protection under a PDO mandates the more stringent conditions, as it requires the quality or characteristics of the product must be essentially or exclusively due to natural and human factors characterizing the geographic area of origin (e.g., climate, soil quality, local production knowledge). Also, for a PDO the entire production process, including the production and processing of raw materials, must occur within the defined geographic area of origin. In contrast, the PGI merely requires that a portion of a designated product's characteristics and production occur within the specific geographical area.

PDO or PGI protection can be obtained by an association of producers and/or processors. The process requires the definition of so-called "specifications," which identify the required conditions for the GI label, including the characteristics of the product, the production method, and the geographic area of production. In addition, the association seeking protection must designate a third-party inspection body in charge of the certification and inspection along the entire supply chain. Such activities are meant to ensure that products carrying PDO or PGI labels comply with the specifications and to ensure that the information conveyed via labeling is verifiable, thus bolstering the credibility of the GIs system. It is critical to note that once a product is registered, all producers within the geographic region who comply with the product specifications, regardless of whether or not they are a member of the association that originally applied for the registration, are entitled to use the PDO or PGI label on their product (Article 8 of Regulation 510/2006).<sup>5</sup>

Over 700 PDO and PGI products are currently registered in the EU. Table 1 reports

<sup>3</sup> More details and discussion of the GI institutional framework may be found in OECD (2000) and Josling (2006).

<sup>4</sup> Regulation 2081/92 was recently updated by Council Regulation (EC) 510/2006 to comply with the TRIPS agreement. It abrogates the "reciprocity principle" and it simplifies the bureaucratic procedure for application. In particular, it simplifies the procedure for third-country parties to apply for GI registration in the EU and/or to pursue opposition against the EU registration of any GI.

<sup>5</sup> An example to illustrate the foregoing is the Italian cheese Asiago. The protection of the Asiago denomination under Italian law dates back to 1954, while the PDO status was obtained in 1996. The Asiago production area comprises a vast region in north-eastern Italy, encompassing four provinces (Trento, Vicenza, and parts of the lowland provinces of Padua and Treviso). Physical and sensorial characteristics as well as production procedures, from cow-feeding to the cheese ripening process, are outlined in detail in the production specifications. Local know-how and traditions (documented as far back as 1,000 AD) are deemed to be key element in the production of Asiago cheese. The "Consorzio Tutela Formaggio Asiago" is in charge of supervision, custody, promotion, and development of the denomination. Non-members are free to brand their product as Asiago PDO as long as production occurs according to the specifications and the product is certified by the appointed third-party inspection body. Control and inspection activities of Asiago producers (both consortium members and nonmembers) are performed by an independent inspection body (the "Certificazione Qualità Agroalimentare s.r.l.").

**Table 1. Number of PDO and PGI Products in the European Union**

	Total	Cheese	Meat- Based	Breads and Bakery	Oils	Fish	Beer	Other Drinks	Fruits and Vegetables	Fresh Meat	Other Animal Products	Table Olives	Other
Belgium	5	1	2	1	1								
Czech Republic	6			1		1	3		1				
Denmark	3	2							1				
Germany	67	4	8	4	1	2	12	31	2	3			
Greece	84	20		1	25	1			22		1	10	4
Spain	105	19	10	7	20				30	13	3		3
France	155	45	4	2	9	2		5	26	51	6	3	2
Ireland	4	1	1			1				1			
Italy	159	32	28	3	38				47	2	2	2	5
Luxemburg	4		1		1					1	1		
Netherlands	6	4							2				
Austria	12	6	2		1				3				
Poland	1	1											
Portugal	104	12	28		6				21	26	10	1	
Slovenia	1				1								
Finland	1								1				
Sweden	2	1		1									
United Kingdom	28	11				3	2	3	1	7	1		
<b>Total</b>	<b>747</b>	<b>159</b>	<b>84</b>	<b>20</b>	<b>103</b>	<b>10</b>	<b>17</b>	<b>39</b>	<b>157</b>	<b>104</b>	<b>24</b>	<b>16</b>	<b>14</b>

Source: Compiled by authors from EU data available at [http://ec.europa.eu/agriculture/foodqual/quali1\\_en.htm](http://ec.europa.eu/agriculture/foodqual/quali1_en.htm) (accessed on October 2007).

their distribution by country and by product category. The majority of these GIs come from Mediterranean countries—more than 75% of the products are registered in five southern EU states (France, Italy, Greece, Portugal, and Spain). Nevertheless, the registration of GIs by northern countries has increased over time. Of the 268 applications for new denominations that are currently being considered, more than half come from countries other than the aforementioned five southern countries (including eleven from nonmembers countries).

In most other developed countries outside the EU, the trademark system provides a legal framework for the protection of GIs. In the United States, geographical names can be registered as certification marks. Certification marks are characterized by the fact that the use of the mark is not restricted to any person or entity, as long as the attributes required for certification are met. U.S. certification marks are typically administered by a governmental body, the presumption being that such an agency is best positioned for “...preserving the freedom of all persons in the region to use the term and, second, preventing abuses or illegal uses of the mark...” (USPTO 2007, undated, p. 3).<sup>6</sup> Similarly to the appellations

system, the product that is labeled with a certification mark is subject to inspection. Inspection activities are in this case the responsibility of the mark’s owner and not of a third-party inspection body (but the implications are analogous because the owner of the certification mark does not conduct production or commercial activity; it merely concedes the use of the mark to independent producers).

In some instances, GI protection in the United State can also be obtained through individual trademarks or collective marks. Specifically, that is possible when one can establish that the geographic term in question has acquired a “secondary meaning” to consumers. Collective marks identify the products of many firms belonging to a group (e.g., an association or cooperative). They are meant “for use only by its members...” (USPTO 2007, undated, p. 4), and as such they arguably have the nature of club goods.

TRIPS accords stronger GI protections to wines and spirits, and even in the EU wines are treated separately. “Quality wines produced in a specified region” and table wines with a “typical geographic indication,” excluded from Regulation (EEC) 2081/92, are protected within the framework of the common market organization for wine (European Commission 2006). This framework limits the grape-growing potential of the EU with planting rights restrictions, including a ban on new vine plantings. These instruments have only been partially successful in trying to reduce the chronic overproduction in the EU (over the

<sup>6</sup> A well-known example of a U.S. certification mark is that of Vidalia onions, which is held by the Georgia Department of Agriculture (Clemens 2002). Producers must apply for an annual license from the Georgia Department of Agriculture to sell Vidalia onions, providing information regarding the type of onions planted, total number of acres and location. Licenses are free. The production area covers all or part of the 20 Georgia counties.

last two decades the stocks of the aforementioned protected quality wines have actually been growing at a faster rate than consumption and exports to third countries). In any event, planting rights restrictions apply to total cultivation of grapes and do allow shifting wine production into GIs, if desired. Indeed, over time, planting rights have been allocated or reallocated to higher-quality productions, increasing the incidence of GIs on total wine (European Commission 2002).

### GI Product Markets and Competition

The analysis of the institutional framework for the protection of GIs in the preceding section suggests that, typically, all producers located in the relevant specified production area have the option to produce and market the corresponding GI product. Thus, it would seem that competitive entry is a feature of the supply context of GI products that is fully consistent with most current regulations governing GIs.

Despite the possibility of competitive entry/exit, of course, expanding production of a given GI may be hampered by limitations on the accessibility of relevant inputs. Given the great heterogeneity of existing GIs in this respect, no simple assessment is possible on how much such a consideration matters. For instance, if the geographic area identified by a given GI is sufficiently small, and/or the GI product accounts for much of the local agricultural production (e.g., Champagne), land and/or other factors may seriously affect potential supply response. In other cases, such as those of Greek feta cheese and Italian grappa, the appropriate geographic area encompasses virtually a whole country. The actual level of utilization of GI labels within a specified area of production also varies significantly among different GIs, and often a significant share of total production is commercialized without the GI label. For example, olive oil produced in the Italian region of Lazio involves about 130,000 producers who grow olive trees on 195,000 acres. A GI label is used on less than 10% of the olive oil that could potentially be branded with any one of the three regional GIs (Sabina PDO, Canino PDO, or Tuscia PGI) (Carbone 2003). Similarly, in the case of the Italian wine sector where a high degree of heterogeneity exists among different wines, the utilization of GIs is only about 40% (ISMEA 2005). Thus, considerable expansion of production of a number of GI wines would seem possible, even given

the overall constraint posed by EU planting rights.

If it were possible to manage GIs as privately owned labels with the power to control total supply, as in the notion of farmer-owned brands articulated in Hayes, Lence, and Stoppa (2004), that might create the potential for attractive noncompetitive returns for GI producers. The lure of noncompetitive returns in agriculture is, of course, not new; it has been of interest to farmers for a long time, as evidenced by the history of the cooperative movement and marketing orders in the United States (Crespi and Sexton 2003).<sup>7</sup> Producer associations with direct responsibility for managing GIs (called "consortia" in Italy) are perhaps best positioned to pursue noncompetitive goals, especially when they gather most of the producers of the relevant GI product. In fact, antitrust authorities have intervened with regard to a number of prominent GI products: the Italian Parma ham and San Daniele ham, the Italian Grana Padano, Parmigiano-Reggiano and Gorgonzola cheeses, and the French Cantal cheese (OECD 2000). The anticompetitive behavior that was investigated concerned attempts by producer associations to control total supply through the imposition of individual production quotas to their membership and through market share agreements between the consortia (OECD 2000). In all cases, after the antitrust intervention, production quota and market share agreements were abandoned, and competitive conditions were restored.<sup>8</sup>

A final consideration that will inform our modeling choice concerns the production technology of GI products. Whereas it is true that the geographic attributes of GIs are often critical to support their perceived higher quality, it should also be clear that there are other elements of the production technology that are part of a GI's specifications and that affect

<sup>7</sup> For example, Vidalia onions, mentioned earlier, have had a federal marketing order since 1989. The order's provisions endow growers with some supply control. The effects of the marketing order, of course, are conceptually distinct from those of the certification mark.

<sup>8</sup> Consortia used to carry out monitoring activities to ensure that members' production satisfies the desired specifications. After the introduction of the 1992 EU regulation on GIs, however, consortia lost any authority they might have had over the control of production, as well as the responsibility for all inspection activities (which were assigned to independent bodies). In particular, when awarded a PDO or PGI, consortia had to give up their property right over the protected name in exchange for the legal protection of the GI provided by the European regulation (Nomisma 2001). At present, consortia have custody of the collective brand identifying the GI and grant its use to producers who meet the requirements.

not only quality but also the cost of production. To illustrate, consider the example of Parmigiano-Reggiano cheese. The specifications for this PDO require production to take place in a clearly delimited region of northern Italy but also mandate a number of other production constraints. These include restrictive cow-feeding guidelines; notably, it is forbidden to feed silage to cows that produce the milk used in manufacturing Parmigiano-Reggiano (by contrast, use of silage is allowed in the production process of the other competing parmesan-type cheese, the Grana Padano). Such restrictions are deemed essential to achieve the desired cheese quality but are also known to increase considerably the cost of milk production, by approximately 20% by some estimates (de Roest and Menghi 2000). Similarly, PDO brie production requires manual techniques that may increase production costs by approximately 25% (Benitez, Bouamra-Mechemache, and Chaaban 2005).

We conclude that, for the case of most GI products, the presumption that GI producers have an effective way to control the aggregate quantity supplied of their product is not tenable. Thus, in the model that follows we will maintain the possibility of competitive entry in a setting in which producers can elect to supply either the GI product or its generic counterpart, and where the production of the GI product entails higher production costs than its generic counterpart. The implications of the fact that some necessary factors in the production of GIs may be in scarce supply will also be investigated.

### A Model for the Competitive Provision of Quality Using GIs

The specification of the model that follows implements all the main features that appear to be relevant based on the foregoing review of the institutional framework and real world examples. Specifically, in the model: (a) consumers value quality as in the standard vertical product differentiation framework; (b) producers can supply quality by undertaking production processes that are costlier than those required for the alternative, low-quality product; (c) GIs can serve as (collective) quality certification devices, although for their function to be credible additional promotion and certification costs are required; and (d) producers operate in a competitive industry (with free entry and exit).

### Demand: Vertical Product Differentiation

As with other studies in this area, we presume that the quality to be supplied through the use of GIs is valued by consumers within the vertical product differentiation structure of Mussa and Rosen (1978). Specifically, we consider the simple unit-demand version of the vertical product differentiation model whereby each consumer buys at most one unit of the good in question and her preferences are described by the (indirect) utility function

$$(1) \quad U = \begin{cases} \theta q - p & \text{if the good is bought} \\ 0 & \text{otherwise.} \end{cases}$$

where  $q \in \mathbb{R}_{++}$  indexes the quality of the good,  $p \in \mathbb{R}_{++}$  is the price of the good, and the preference parameter  $\theta \in [\underline{\theta}, \bar{\theta}] \subseteq \mathbb{R}_+$  indexes consumer types. The hypothesis here is that of heterogeneous preferences for quality so that the population of consumers can be characterized by the distribution function  $G(\theta)$  of the preference parameter.

More specifically, suppose that there are only two possible qualities in this market, a “low” quality  $q_L$  and a “high” quality  $q_H > q_L$ . If these two qualities are available at prices  $p_L$  and  $p_H$ , respectively, where  $p_H > p_L > 0$ , then the consumer decision problem is to select the action that yields the highest utility among the three possible options:

$$(2) \quad U = \begin{cases} \theta q_H - p_H & \text{if the high-quality} \\ & \text{good is bought} \\ \theta q_L - p_L & \text{if the low-quality} \\ & \text{good is bought} \\ 0 & \text{otherwise} \end{cases}$$

To simplify the analysis, as in related studies in this area, we put further restrictions on the distributions of consumers. That is, we postulate that the distribution  $G(\theta)$  is uniform and that  $\theta \in [0, 1]$ . The latter condition, in particular, implies that the market will be “uncovered” (i.e., as long as prices are strictly positive, some consumers with a low enough  $\theta$  will not buy anything). More specifically, let

$$(3) \quad \hat{\theta} \equiv \frac{p_H - p_L}{q_H - q_L}$$

$$(4) \quad \tilde{\theta} \equiv \frac{p_L}{q_L}.$$

Throughout we will consider the typical case where  $0 < \tilde{\theta} \leq \hat{\theta} \leq 1$ . For that parametric case, consumers with  $\theta \in [\hat{\theta}, 1]$  will buy the high-quality product, consumers with  $\theta \in [\tilde{\theta}, \hat{\theta}]$  will buy the low-quality product, and consumers with  $\theta \in [0, \tilde{\theta}]$  will buy nothing. For the population of  $M$  consumers, market demand is readily obtained by integrating the unit demand of each consumer given the distribution of consumer types. For the uniform distribution assumption invoked earlier, the aggregate market demand functions are

$$(5) \quad X_H^D = M \left( 1 - \frac{p_H - p_L}{q_H - q_L} \right)$$

$$(6) \quad X_L^D = M \left( \frac{p_H - p_L}{q_H - q_L} - \frac{p_L}{q_L} \right).$$

Sometimes it is convenient to work with the inverse demand functions. Inverting (5) and (6), for given quantities  $X_i \in [0, M]$  ( $i = L, H$ ) satisfying  $X_L + X_H \leq M$ , yields

$$(7) \quad p_H = q_H - \frac{(q_L X_L + q_H X_H)}{M}$$

$$(8) \quad p_L = q_L \left( 1 - \frac{X_L + X_H}{M} \right).$$

Equations (7) and (8) display the market's willingness to pay for the two qualities, for given supply levels, but also implicitly define the willingness to pay for the "additional quality" that the high-quality good provides over the low-quality one. By using (7) and (8), the (inverse) derived demand for the additional quality ( $q_H - q_L$ ) is

$$(9) \quad p_H - p_L = (q_H - q_L) \left( 1 - \frac{X_H}{M} \right).$$

Note that this (market) willingness to pay for the additional quality depends only on the quantity supplied of the high-quality good (because this quantity implicitly defines the marginal consumer that is indifferent between purchasing the high- or low-quality good).

#### *Supply: Competitive Production of Quality*

We presume a standard competitive industry populated by numerous (actual or potential) producers who behave as price takers, and each of whom can produce either the high-quality

good or the low-quality good (or zero quantity). Initially, we suppose that these producers are identical and are operating with a production technology that admits cost functions  $C_H(x_H)$  and  $C_L(x_L)$  for the high- and low-quality goods, respectively, where  $x_i \geq 0$  ( $i = H, L$ ) denotes the level of firm's output for either the low- or high-quality product. We assume that the cost functions  $C_i(x_i)$  are strictly increasing and display standard U-shaped average cost curves. In a long-run equilibrium with free entry and exit, therefore, firms will be operating at a strictly positive efficient scale. Furthermore, we assume that  $C_H(x) > C_L(x)$ ,  $\forall x > 0$ . The presumption that the high-quality good requires a costlier production process is rather intuitive, as discussed in the preceding section (e.g., more labor care, need for higher-quality inputs, need for additional inputs, restrictions on the use of some inputs, etc.).

In addition to production cost, to market the high-quality good, producers need to undertake costly activities that credibly certify, in the eyes of consumers, the claimed higher quality. Such activities may relate to marketing, promotion, and/or monitoring of production standards. In principle such activities should be open to each producer individually, as would be the case for firms marketing with individual trademarks, and we therefore allow for that possibility. But the case for GIs rests on the presumption that firms may not be able to muster the required resources to do that individually, that is, there is scope for producers to act cooperatively in this regard. Hence, we interpret GIs as a common brand whereby producers can bundle together to share the marketing, promotion, and certification costs that are necessary for a credible GI. This assumption is quite consistent with the existence of producer organizations that take an active part in the marketing of GI products, such as the consortia discussed in the preceding section. Specifically, we assume that producers share the GI promotion and certification costs via a charge per unit of output produced, so that the total cost of producing the GI-certified high-quality product is  $C_H(x_H) + \alpha x_H$ , where  $\alpha > 0$  is the unit certification cost.<sup>9</sup>

<sup>9</sup> An alternative assumption might be a cost-sharing rule that takes the form of a per-firm charge. As long as firms are identical, as postulated here, the two assumptions would appear largely equivalent. The sharing rules that we follow does, however, simplify the characterization of long-run equilibrium (because the minimum efficient scale of the high-quality firms is not affected by the size of  $\alpha$ ). Also, the assumed rule might be more appealing when the model is generalized to allow for firm heterogeneity.

One of the reasons for the existence of an incentive for firms to share the costs required for a credible certification is that what these activities produce—consumer goodwill toward the product with the given GI—has the nature of a public good from the producers' perspective. Some of the required costs are largely independent of the aggregate quantity of good that is eventually produced; this would be the case, for example, for activities connected to marketing, promotion and advertising, and overhead costs of the producer organization in charge of performing such functions. We measure the cost of such activities by  $F > 0$ . Other costs, however, are likely to depend on the amount produced. We contend that this is the case, in particular, for the portion of certification costs that are meant to monitor production standards and prevent cheating and free riding. A credible certification system, in fact, must recognize (and deal with) the possibility that producers purporting to sell a GI product have an incentive to behave opportunistically (i.e., they may claim to sell the high-quality good while producing the low-quality good). Producer organizations have a variety of mechanisms at their disposal to monitor and limit the opportunistic behavior of members. In our context, the challenge is to represent such activities explicitly, so that their effects on equilibrium can be assessed, and to do so in a parsimonious way that is consistent with the rest of the model. To that end, the enforcement mechanism that we postulate is a sequential "auditing game" (e.g., Rasmussen 2007, pp. 85–87), as follows.

A producer who wants to supply a quantity  $x$  of certified, high-quality GI product has two strategies: to comply with the relevant GI specifications or to violate them (by producing the lower-quality good at cost  $C_L(x) < C_H(x)$  instead). In the enforcement mechanism that we envision, the monitoring agency moves first by announcing an inspections policy  $\{\phi, T\}$ , where  $\phi \in [0, 1]$  is the probability of inspection to verify that the product specifications are met (or, more precisely,  $\phi$  is the fraction of producers that will be subject to inspection), and  $T > 0$  is a finite penalty that is paid if a producer fails the inspection. The individual producer then chooses whether to comply with or to violate the production specifications. Given this enforcement mechanism, the total expected cost to the producer associated with the "comply" strategy is  $C_H(x) + \alpha x$  (and the assumption, of course, of no errors at the compliance-verification stage), whereas the total expected

cost is  $C_L(x) + \alpha x + \phi T$  if the "violate" strategy is used.<sup>10</sup> Clearly, to induce compliance the minimum penalty needs to be at least as large as the production cost difference  $[C_H(x) - C_L(x)]$ . Specifically, for any given  $T > [C_H(x) - C_L(x)]$  there exists an inspection probability  $\phi \equiv [C_H(x) - C_L(x)]/T$  that makes "comply" a best response strategy for the producer. Given that, and if the aggregate returns to producers from everyone complying (net of the cost of inspections) exceeds those of tolerating violation, then it is an equilibrium strategy for the monitoring body to adopt the policy  $\{\phi, T\}$  at the initial move stage.<sup>11</sup>

The main point of the foregoing is that compliance is obtained with an inspection probability that is high enough, given the penalty level. But such a monitoring scheme is costly because it requires that firms be inspected with some probability. Specifically, we assume that the cost of each inspection that is carried out is proportional to the level of a firm's output, that is,  $\beta x_H$ , where  $\beta > 0$ . Thus, the expected monitoring cost for each producer to be certified is  $\phi \beta x_H$ .<sup>12</sup> Note that, in this setup, the total monitoring cost is increasing with the number of producers to be certified, an appealing feature that is lost when total certification cost is treated as a fixed cost only.

The remaining question concerns how many producer groups we should expect to see in a GI market. As stated earlier, our working assumption is that the full certification cost, as given by the fixed cost  $F$  and the variable cost of monitoring, is shared among the members of the producer organization on a per-unit-of-output basis, with the portion of total cost attributable to the certification service written as  $\alpha x_H$ . Thus, under full cost-sharing (we will return to this issue later, in the context of possible policy implications), if there are  $n$  producers sharing such costs, it must be that  $\alpha x_H = \phi \beta x_H + F/n$ . Given these

<sup>10</sup> The presumption is that there is no error in the inspection/auditing activities. Anania and Nisticò (2004) also rely on a similar simple and error-free monitoring and enforcing scheme.

<sup>11</sup> In this Nash equilibrium, the monitoring agency must carry out the inspections even though, in equilibrium, compliance is obtained. Thus, we are assuming that the monitoring authority can credibly commit to carrying out inspections, consistent with the overall requirement of a certification system that needs to be credible in the eyes of the consumer.

<sup>12</sup> Because only the product  $\phi T$  matters to induce compliance, and because  $\phi$  affects the monitoring cost whereas  $T$  does not (in equilibrium everyone complies and no penalty is assessed), ideally one would want to make  $T$  as high as possible and  $\phi$  as small as possible. The existing legal and institutional framework (as well as firms' limited financial assets), however, likely puts bounds on how large  $T$  can be; given that level of  $T$ , the inspection frequency  $\phi$  can in principle be calculated.



structural assumptions, the question of how many producer groups we should expect reduces to a simple coalition formation problem. Suppose that, in a competitive equilibrium, there are  $N_H$  producers engaged in the production of the high-quality good, each producing the same quantity  $x_H$ , and consider the possibility of there being  $m$  groups of size  $n < N_H$  (so that  $n \equiv N_H/m$ ), each independently promoting and certifying their high-quality product. Then this would be a stable coalition structure if no member can gain by switching coalitions, that is, by leaving its current group to join another group (making the latter of size  $n + 1$ ). Thus, the hypothesized coalition structure would be stable if

$$(10) \quad \frac{F}{n} + \phi \beta x_H \leq \frac{F}{(n+1)} + \phi \beta x_H.$$

But clearly this cannot hold. The larger coalition attains lower unit promotion and certification costs and pulls in new members, so that in equilibrium we are left with only one (grand) coalition of size  $N_H$ .

The other condition we need to check is the possibility that a member has of defecting from the coalition with the intention of supplying the high-quality product on its own. In such a case, the producer has to undertake the entire fixed cost  $F$  individually but saves the need for monitoring costs. This possibility is not profitable if

$$(11) \quad p_H x_1 - C_H(x_1) - F \leq p_H x_H - C_H(x_H) - \phi \beta x_H - \frac{F}{N_H}$$

where  $x_1$  is the scale of production of the firm that incurs  $F$  individually.<sup>13</sup> For approximately equal production levels ( $x_1 \cong x_H$ ) and a reasonably large number of producers  $N_H$ , the condition is approximately  $F \geq \phi \beta x_H$ . Thus, as long as the fixed cost of certification is large enough relative to the monitoring cost, defecting to market the high-quality product with one's own trademark is not profitable.

In conclusion, a credible certification system can be supported by a GI producer association that implements a simple monitoring scheme. Assuming that (11) is satisfied, a coalition may form to supply the high-quality good, and the

process should lead to just one coalition of size  $N_H$ .<sup>14</sup> Whereas in equilibrium the scheme may ensure compliance by producers, it will impose additional costs on the producers of the high-quality good. In particular, the total cost function for low-quality producers is simply  $C_L(x_L)$  whereas the high-quality firms have a total cost function of  $C_H(x_H) + \alpha x_H$ , where  $\alpha$  is the cost of GI certification per unit of output; that is,

$$(12) \quad \alpha \equiv \frac{F}{N_H x_H} + \phi \beta.$$

## Equilibrium and Welfare

In this section, we consider the long-run partial equilibrium conditions that are relevant when it is possible for firms to enter and/or exit the industry of interest (e.g., Mas-Colell, Whinston, and Green 1995, chapter 10). Initially we assume no diseconomies at the industry level; that is, the prices of all production inputs are constant and exogenous to the industry. For a given output price  $p_L$  of the low-quality good, low-quality producers choose the production level  $x_L$  that maximizes profit  $p_L x_L - C_L(x_L)$ . The possibility of entry/exit drives profit to zero, so that each firm will be producing at the minimum efficient scale  $x_L^*$ , that is, at the point that minimizes average cost

$$(13) \quad x_L^* = \arg \min_{x_L} \{C_L(x_L)/x_L\}.$$

Let  $c_L \equiv C_L(x_L^*)/x_L^*$  denote the unit cost for the low-quality good at this efficient production scale. Then, the competitive equilibrium price for the low-quality good must satisfy<sup>15</sup>

$$(14) \quad p_L^* = c_L.$$

<sup>14</sup> Note that the underlying presumption of a competitive market is maintained throughout. Taking for given the U-shaped cost structure at the farm level that we have assumed, an alternative hypothesis would be to allow the merger of several farms/plants to be run as a single firm, thereby allowing the fixed cost  $F$  to be shared over a larger (private) output that could then be marketed with a firm's own trademark. Such a hypothesis, of course, would lead to an oligopolistic market structure. We rule that out by assumption because such a strategy would raise difficult agency problems of its own. Allen and Leuck (1998) provide a convincing account of why farming has generally not changed from small family-based firms to large corporate firms. Indeed, the reasons that slant the trade-off between moral hazard and specialization in favor of small farming operation are likely to be even more compelling in the context of producing the kind of high-quality products identified by the traditional specifications of GI products.

<sup>15</sup> Here and in what follows, we abstract from the possible "integer" problem (technically, a nonconvexity) that arises when the firms' efficient scale is strictly positive, so that, strictly speaking, the long-run industry supply correspondence is an integer multiple of the efficient scale.

<sup>13</sup> The production level of the firm that incurs  $F$  individually would differ from that of the firm sharing costs because its cost structure is changed (it incurs a fixed certification cost instead of a unit certification cost).

As for the high-quality good, whether in equilibrium it will be supplied at all obviously depends on the level of the required certification cost, *vis-à-vis* the consumers' willingness to pay for high quality. In an equilibrium in which the high-quality good is also supplied, for a given price  $p_H$  individual producers choose the production level  $x_H$  to maximize profit  $p_H x_H - C_H(x_H) - \alpha x_H$ . The possibility of entry and exit, however, requires the number of producers  $N_H$  to adjust to ensure the zero-profit condition (which, in turn, affects the per-unit certification cost  $\alpha$ ). Hence, a long-run equilibrium needs to specify the equilibrium price  $p_H^*$ , the equilibrium production level  $x_H^*$  of each high-quality firm, the equilibrium number  $N_H^*$  of high-quality firms, and the equilibrium per-unit certification cost  $\alpha^*$ . The required conditions are

$$(15) \quad p_H^* = C_H'(x_H^*) + \alpha^*$$

$$(16) \quad p_H^* x_H^* = C_H(x_H^*) + \alpha^* x_H^*$$

$$(17) \quad \alpha^* x_H^* \equiv \frac{F}{N_H^*} + \phi \beta x_H^*$$

$$(18) \quad N_H^* x_H^* = M \left( 1 - \frac{p_H^* - p_L^*}{q_H - q_L} \right).$$

Equation (15) is the optimality condition for firm-level profit maximization, whereas equation (16) displays the zero-profit condition due to the assumed free entry/exit possibility. For any given per-unit certification cost, these two equations in conjunction establish that the equilibrium production level  $x_H^*$  must satisfy  $C_H'(x_H^*) = C_H(x_H^*)/x_H^*$ . Hence, as for the low-quality producers, each firm in equilibrium produces at its minimum efficient scale (the point that minimizes average cost). Let  $c_H \equiv C_H(x_H^*)/x_H^*$  denote the unit production cost (not including the certification cost) of the high-quality product. Then by using equations (16) and (18), the equilibrium number of high-quality producers  $N_H^*$  must satisfy

$$(19) \quad (q_H - q_L) \left( 1 - \frac{x_H^* N_H^*}{M} \right) = c_H - c_L + \frac{F}{x_H^* N_H^*} + \phi \beta.$$

Thus, the equilibrium condition in (19) equates consumers' demand for the additional

quality provided by the high-quality good (relative to the low-quality good), as given by equation (9) derived earlier, with the additional (industry) unit cost of producing this extra quality.<sup>16</sup>

It is useful to note that, at the industry level, the per-unit certification cost is declining in the number of firms that produce the GI product (because of the assumed fixed cost of promotion and certification  $F$ ). The right-hand-side of equation (19) effectively defines the competitive "industry supply" function for the high-quality good. Under the usual assumption that a firm's individual production is small relative to industry output, the individual firm takes the unit cost as parametrically given. Yet, at the industry level the industry's unit cost of production is decreasing in the number of high-quality producers (i.e., decreasing in industry output). Any given firm exerts a positive externality on all other firms by sharing the fixed certification cost  $F$  but does not internalize this benefit in its decision to enter/exit the industry. This positive externality is a source of increasing returns to scale. This fact is bound to have relevant implications for an equilibrium, but it is also the case that such an instance of parametric external economies of scale are quite consistent with the existence of competitive equilibrium (Chipman 1970), although it does give rise to the possibility of multiple equilibria, as discussed next.

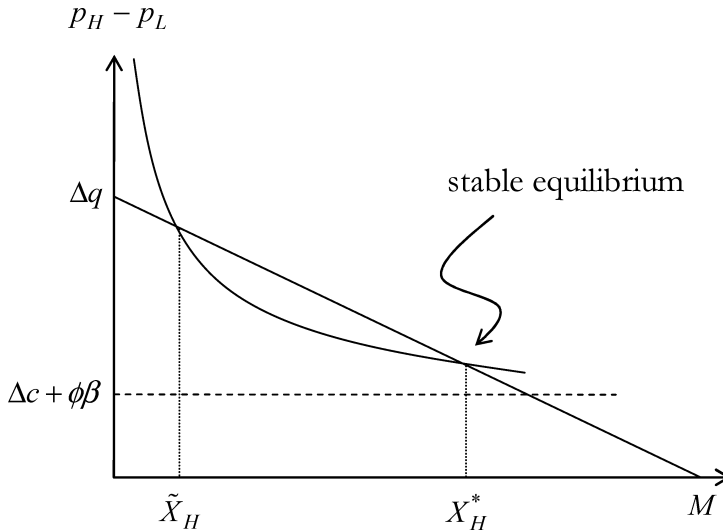
Rather than solving for the equilibrium number of firms, one can equivalently solve for the equilibrium aggregate quantity of the high-quality product. Define  $X_H^* \equiv x_H^* N_H^*$ . Then from equation (19),  $X_H^*$  must be a root of the quadratic equation

$$(20) \quad \frac{\Delta q}{M} (X_H^*)^2 - (\Delta q - \Delta c - \phi \beta) X_H^* + F = 0$$

where, for notational simplicity, we define  $\Delta q \equiv q_H - q_L$  and  $\Delta c \equiv c_H - c_L$ . The roots of this equation are given by the standard formula:

$$(21) \quad \frac{(\Delta q - \Delta c - \phi \beta) \pm \sqrt{(\Delta q - \Delta c - \phi \beta)^2 - 4F\Delta q/M}}{2\Delta q/M}.$$

<sup>16</sup> In an equilibrium in which both the high- and the low-quality products are supplied, the zero-profit condition of course ensures that firms are indifferent as to which of the two goods they produce.



**Figure 1. Equilibrium with  $F < \bar{F}$**

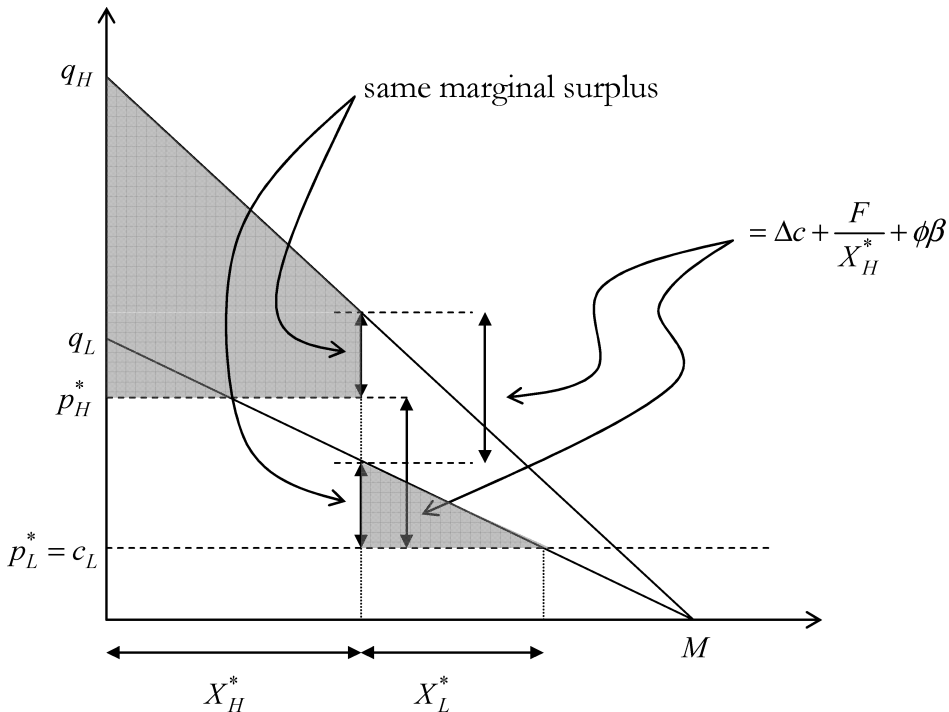
The sign of the discriminant  $D \equiv (\Delta q - \Delta c - \phi\beta)^2 - 4F\Delta q/M$  determines whether we have real roots and, if so, whether we have one or two roots. Note that  $dD/dF < 0$  so that, given the other parameters of the model, there exists  $\bar{F} \equiv (\Delta q - \Delta c - \phi\beta)^2(M/4\Delta q)$  such that  $D = 0$  when  $F = \bar{F}$ . In such a case, there is only one real root to the equilibrium equation. When  $F > \bar{F}$ , there are no real roots, that is, certification is just too costly and the competitive equilibrium does not include production of the high-quality good. When  $F < \bar{F}$ , there are two distinct roots for the quadratic equation, i.e., we have two candidate equilibrium solutions  $\tilde{X}_H$  and  $X_H^*$ . The case of  $F < \bar{F}$  is illustrated in figure 1, where the linear downward-sloping curve represents the consumers' willingness to pay for the "additional" quality, and the nonlinear decreasing curve represents the additional (industry) unit cost of supplying the high-quality good.

To distinguish between the two candidate equilibria when  $F < \bar{F}$  we appeal to stability conditions, but the choice of the relevant condition requires some care. Two concepts with a long history, conventionally labeled as Walrasian stability and Marshallian stability, differ in terms of what variable is viewed as changing in a situation of disequilibrium.<sup>17</sup>

Whereas the two stability concepts agree when demand and supply functions have the usual slope, they yield conflicting conclusions when the supply curve is sloping downward (in our case the equilibrium associated with  $\tilde{X}_H$  is Walrasian stable, whereas the equilibrium associated with  $X_H^*$  is Marshallian stable). An important element, in such a situation, concerns why the supply function is downward sloping. When the negative slope reflects the existence of industry-wide external economies (the so-called forward-falling supply curve, as opposed to the case of individual backward-bending supply curves), Marshallian stability is arguably more appropriate, and indeed supported by strong experimental evidence (Plott and George 1992). Accordingly, in this study we rely on Marshallian stability and thus identify  $X_H^*$  as the stable equilibrium of interest. We should also note that the Marshallian stability concept, with its reliance on output adjustment, is appealing in a production context such as ours that allows for firms' entry and exit. For example, if the supply of high-quality product were to be to the left of  $X_H^*$ , then high-quality producers would be making positive profits, which would stimulate entry and thus expansion of the high-quality supply.

The competitive stable equilibrium satisfies some intuitive comparative static properties. In particular, for the case of  $F < \bar{F}$ ,  $\partial X_i^*/\partial M > 0$ ,  $i = H, L$  (a *ceteris paribus* increase in the market size increases the

<sup>17</sup> Walrasian stability posits a price change in response to excess demand at that price, whereas Marshallian stability supposes that quantity adjusts when supply and demand prices differ at that quantity (e.g., Silberberg 1990, chapter 19).



**Figure 2. Consumer welfare in equilibrium**

equilibrium quantities of both goods);<sup>18</sup>  $\partial X_H^*/\partial F < 0 < \partial X_L^*/\partial F$  (e.g., a decrease in the fixed cost of certification  $F$  increases the equilibrium level of the high-quality good);  $\partial X_H^*/\partial \Delta q > 0 > \partial X_L^*/\partial \Delta q$  (e.g., a larger quality markup for the GI product increases the equilibrium level of this good and decreases that of the low-quality good); and  $\partial X_L^*/\partial \beta > 0 > \partial X_H^*/\partial \beta$  (e.g., a larger unit monitoring cost decreases the equilibrium quantity of the high-quality product and increases that of the low-quality product). The impact of  $\Delta c$  is, of course, qualitatively the same as that of the monitoring cost parameter  $\beta$ .

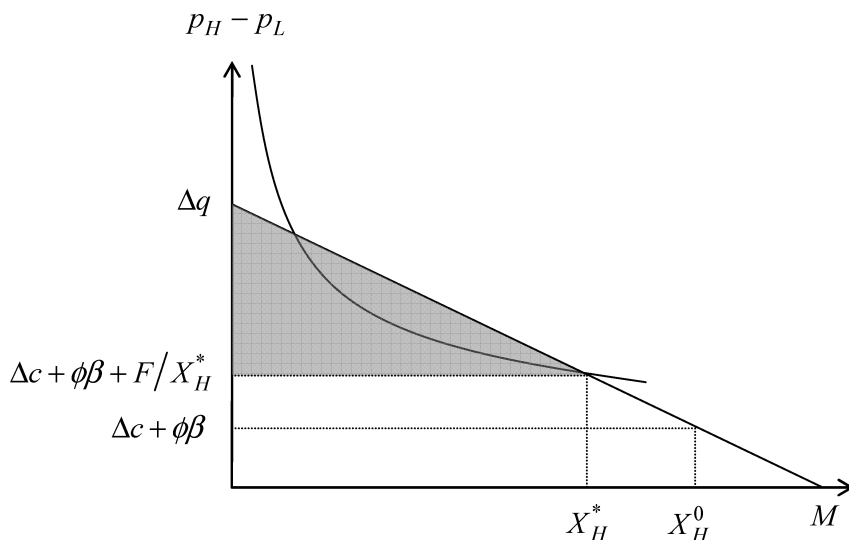
### Welfare

One way to articulate the welfare implication of a GI mechanism is to suppose that the high-quality good is technologically feasible but institutional constraints (e.g., lack of legal protection for the right to use the GI) prevent the establishment of a coalition of producers that can credibly deliver the high-

quality good in a competitive fashion. Relaxing such constraints would bring about a new equilibrium with both goods being supplied. Before the introduction of a GI, only the low-quality good is supplied, with the competitive equilibrium condition  $p_L^* = c_L$ . After the introduction of a GI, consumers who do buy the high-quality good in equilibrium are better off, whereas consumers who continue to buy the low-quality good are unaffected. The welfare properties of the GI equilibrium can be illustrated as in figure 2, which relates the equilibrium outcome that we have characterized to the vertically differentiated demand structure of the model. The downward-sloping lines of figure 2 depict the marginal utility functions of the population of  $M$  consumers, as implied by the preference structure in (2) (along with the assumption that the preference parameter  $\theta$  is uniformly distributed on  $[0, 1]$ ). Total consumer surplus is given by the shaded areas.

Of course, to compute the gain in consumer surplus due to the GI mechanism one needs to consider that consumers who buy the high-quality good, in this equilibrium, would still enjoy some surplus if only the low-quality good were supplied. The difference between the two measures is positive whenever the GI equilibrium entails both types of goods being

<sup>18</sup> The comparative statics properties can be used to further illustrate the choice of the relevant stability concept by noting that the Walrasian-stable solution  $\bar{X}_H$  would produce rather counterintuitive results. For example,  $\partial \bar{X}_H/\partial M < 0$  (an increase in the market size decreases the equilibrium quantity of the high-quality good).



**Figure 3. Gains in consumer surplus**

supplied. This could be readily established analytically, given the structure of our model, but a graphical illustration can suffice. Specifically, the shaded area in figure 3 illustrates the welfare (consumer) gains from the introduction of a GI by using the demand for the additional quality of equation (9) employed earlier to characterize equilibrium.

In conclusion, the foregoing analysis has established that the following implications are derived from the model. First, there are no profits to producers in equilibrium (as one would expect in a long-run competitive model with entry). Second, consumer surplus is affected by the availability of the high-quality GI product. Any institutional change that makes GIs feasible could result in sizeable benefits to consumers (even without returns to producers). Finally, only consumers of the high-quality good derive additional welfare from the establishment of a GI.

### Pareto Efficiency

Not surprisingly, given the existence of (industry) external economies in this setting, the competitive equilibrium fails to deliver the constrained first-best outcome. What we mean by the qualification “constrained” here is the choice  $X_H^0$  that a benevolent social planner would implement, conditional on having to undertake the same certification costs as in competitive equilibrium. To derive such a first-best allocation, denote with  $\Delta W$  the gain in welfare brought about by production of the

quantity  $X_H$  of the high-quality good, relative to zero quantity of this good (the no-credible-certification situation). Given the structure of this model,

$$(22) \quad \Delta W = \Delta q \left[ 2 - \frac{X_H}{M} \right] \frac{X_H}{2} - (\Delta c + \phi \beta) X_H - F.$$

The optimality condition for a maximum of  $\Delta W$  reduces to equating the marginal benefit of the high-quality product to its marginal cost (provided that  $\Delta W \geq 0$ ), yielding the first-best solution

$$(23) \quad X_H^0 = \frac{(\Delta q - \Delta c - \phi \beta)}{\Delta q} M.$$

It is readily verified that, at  $X_H^0$ ,  $\Delta W \geq 0$  requires the fixed costs of certification to satisfy  $F \leq F^0$ , where

$$(24) \quad F^0 = \frac{M}{2\Delta q} (\Delta q - \Delta c - \phi \beta)^2.$$

Hence, if the fixed certification costs are too high (i.e.,  $F > F^0$ ), provision of the high-quality good is not desirable. But for  $F \leq F^0$  it is socially desirable to supply the high-quality good by the given quality-certification technology, and in that case the optimal provision of the high-quality good ought to be at the efficient level  $X_H^0$  given by equation (23).

It is now apparent that the competitive equilibrium falls short of the first-best allocation in

two ways. First, because  $F^0 = 2\bar{F} > \bar{F}$ , then if the fixed cost parameter falls in the domain  $F \in (\bar{F}, F^0)$ , the competitive equilibrium entails  $X_H^* = 0$  and yet it is strictly socially desirable to have some high-quality good supplied. Second, even when a competitive equilibrium exists with  $X_H^* > 0$  because  $F \leq \bar{F}$ , the competitive equilibrium delivers a suboptimal level of output, that is,  $X_H^* < X_H^0$ , as can be readily verified by comparing the solution in equation (23) with the larger of the two roots in equation (21) (see figure 3).

The failure of the competitive equilibrium to deliver the first-best outcome could be remedied by simple subsidy policies. In the domain  $F \leq \bar{F}$ , the underprovision of the high-quality good is due to the fact that producers who pay a share  $F/X_H^*$  of the fixed costs of certification treat that as a marginal cost of production (and specifically do not internalize the contribution of their decision to enter the industry on the other firms' cost of production). One way to support the first-best outcome via the competitive equilibrium would be to provide a lump-sum subsidy to the producer association (e.g., the consortia) equal to the fixed cost  $F$  of quality promotion. Alternatively, the government could subsidize production by a unit subsidy  $s \equiv F/X_H^0$ , thereby offsetting the portion of certification costs due to existence of a fixed cost of certification.

The suggestion is sometimes offered that, to provide incentive for producer organizations to engage in the type of marketing and promotion required for a successful GI, it might be desirable to grant market power (i.e., the right to control supply) to producer associations in charge of GIs. In the model of Lence et al. (2007) this result arises from the assumption that a fixed cost is required to develop such products (very much as in our setting) and that there are no certification costs per se. Because costless imitation is possible in that context, some degree of supply control may be necessary (depending on the size of the required fixed cost) to encourage producers to develop a geographically differentiated agricultural product. Auriol and Schilizzi (2003), on the other hand, emphasize that certification costs are critical to achieve credibility. Our model explicitly accounts for the monitoring costs needed for credible certification, and in this context we find that market power cannot improve welfare. Specifically, if  $F \leq \bar{F}$ , a competitive equilibrium exists, although it underproduces relative to the first best; granting market power to a club of high-quality producers would not help, and actually would make

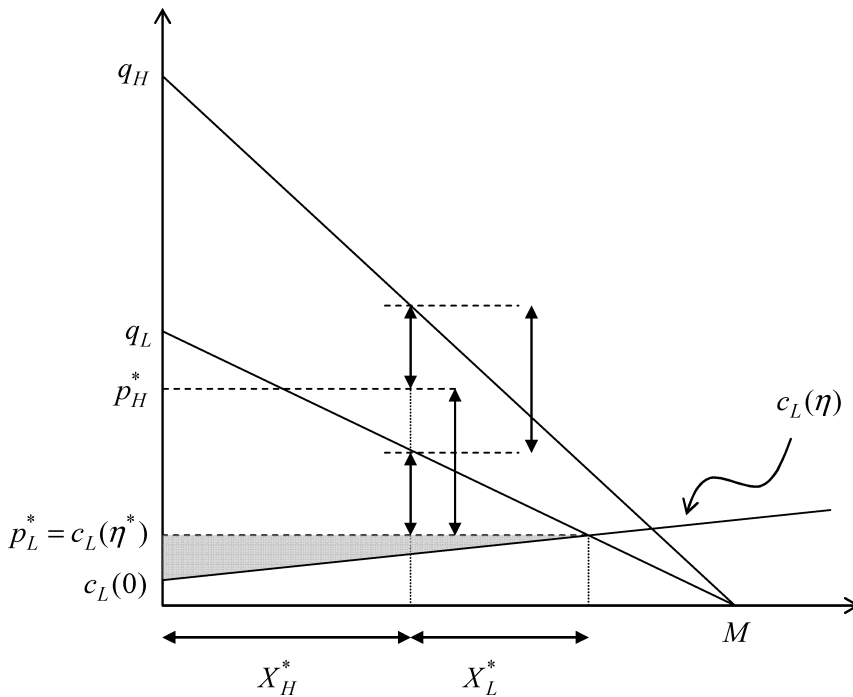
matters worse by further reducing the quantity supply away from  $X_H^*$  (and raise the thorny question of who, among the *ex ante* identical producers, should benefit from the ensuing noncompetitive profit). Similarly, if  $F > \bar{F}$ , the competitive equilibrium entails  $X_H^* = 0$ , but in this parametric case the right to control supply is worthless to a producer association (the industry average cost is everywhere above the relevant consumer demand).

A final observation might be appropriate at this juncture. We have seen that the failure of the competitive equilibrium to deliver the first-best outcome is very much related to the existence of the fixed cost  $F$ . Insofar as this type of cost is interpreted as the cost of marketing and promotion, to convince consumers that indeed the GI product in question is a high-quality product, the public authorities' endorsement of the GI system (as with the PDOs in the EU) might be construed as a policy that attempts to lower the firms' fixed cost of promotion (by conveying relevant information to consumers) and thus can contribute to the efficient competitive provision of quality in agricultural markets.<sup>19</sup>

### Upward-Sloping Industry Supply

The fact that there are no returns to producers in the foregoing model is predicated on two things: the assumed long-run competitive structure (i.e., with freedom of entry/exit), and the constancy of unit costs (no diseconomies at the industry level). The latter is of course questionable, and in fact we typically think of competitive aggregate supply functions in agricultural markets as being upward-sloping. Upward-sloping supply functions can arise when the inputs used by the industry are in limited supply (e.g., land) and their price is affected by the competitive demand of the industry of interest. One way to make this concept operational is to endogenize the price of the (otherwise homogeneous) input with upward-sloping supply (e.g., Hughes 1980; Lapan and

<sup>19</sup> The EU assists member countries in financing measures to promote agricultural products and food, both in the EU internal market and in third countries; see Council Regulation (EC) 2826/2000 and Council Regulation (EC) 2702/1999. These measures include information campaigns on EU quality and labeling systems, in particular on the EU system of PDOs and PGIs, and the EU system of quality wines produced in specified regions. The EU finances 50% of the cost of these measures, the remainder being met by producer organizations and/or member states. The current triennial program targeting the internal market has a total budget of €50.9 million. A third-country program targets the USA, Canada, India, Japan, and China and covers wine, fruit, meat, dairy products, olive oil, and organic product with a total budget of €18.2 million.



**Figure 4.** Upward-sloping supply and constant marginal cost of high quality

Moschini 2000). Alternatively, as in Panzar and Willig (1978), one can presume that all firms differ in their endowment of a fixed input (e.g., location or soil quality) that affects production costs and that has no alternative use outside the industry of interest.

#### *Constant Marginal Cost of High Quality*

To simplify the approach of Panzar and Willig (1978), suppose that firms either produce at an optimal efficient scale  $x > 0$  (for either the low- or high-quality product) or stay out of the market, and that the firms' individual efficiency is indexed by a scalar  $\eta \in [0, \infty)$ . Specifically, the unit production cost for the low-quality good is written as  $c_L(\eta)$ , with  $c'_L(\eta) \geq 0$ . The industry supply curve of the low-quality good, consequently, is upward-sloping, because increased output can only come about by the production of increasingly less efficient firms. The production of the high-quality good requires additional costs, as discussed earlier, and in this case the unit cost of the high-quality good is written as

$$(25) \quad c_H(\eta) \equiv c_L(\eta) + \kappa$$

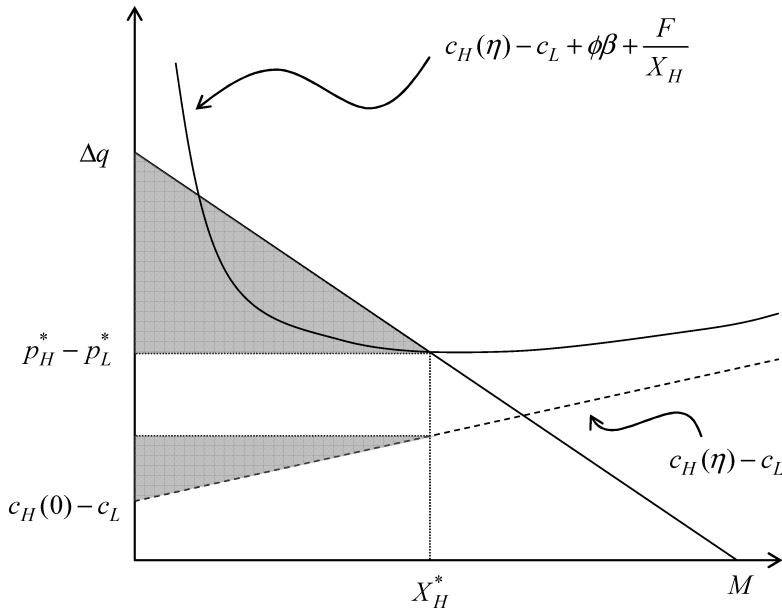
where  $\kappa$  is a constant. Hence, here we assume that the extra cost required to produce the

high-quality good is independent of the efficiency parameter  $\eta$ . With this assumption, the equilibrium condition in equation (20) still applies. Specifically, to illustrate the equilibrium when the parameters of the model are such that both goods are supplied, figure 2 can be adapted as in figure 4.

Note that in this case producers do enjoy a non-zero producer surplus in equilibrium (the shaded area in figure 4). But this return to producers does not depend on the production of the high-quality GI product and would be the same even if only the low-quality good were to be supplied. The area  $(p_H^* - p_L^*)X_H^*$  in equilibrium simply accounts for the additional production cost required for the high-quality product, and for the need for marketing and monitoring to deliver a credible GI certification for the high-quality good.

#### *Increasing Marginal Cost of the High-Quality Good*

More generally, one could postulate that the supply of additional quality ( $q_H - q_L$ ) is also upward-sloping. To make the implications of that condition more transparent, suppose that the unit production cost of the low-quality good is the same for all firms and equal to



**Figure 5. Upward-sloping supply due to increasing marginal cost of high quality**

$c_L$ , but the production cost of the high-quality good depends on the firm-specific efficiency parameter  $\eta$ , that is,

$$(26) \quad c_H(\eta) \equiv c_L + \kappa(\eta)$$

where  $c_L$  is a constant and  $\kappa'(\eta) \geq 0$ . In such a case, there are clearly no aggregate producer returns to producing the low-quality good, and the possibility of offering the high-quality good can bring about positive returns to producers (as well as returns to consumers).

The equilibrium determination of the high-quality production in our setting is best illustrated via the demand for quality upgrades used to characterize equilibrium. Thus, figure 3 is adapted as in figure 5, where the shaded areas denote the changes in consumer and producer surpluses brought about by the production of the high-quality GI product. Thus, it is certainly possible for the introduction of GI certification to benefit directly the producers of the high-quality product, consistent with the view of those advocating the use of GIs as a tool for rural development. Our model, however, makes clear that such an outcome is by no mean guaranteed, and it depends critically on the underlying structure of the agricultural production sector. Specifically, what is required is that production of the high-quality

products requires specialized inputs in scarce supply. Exactly how that characterizes real-world GI settings, of course, depends on the particular case at hand.

## Conclusions

In this article, we have developed a model that treats GIs as an effective certification tool for high-quality products that attempts to overcome the very real information problem that consumers face when quality cannot be readily ascertained prior to purchasing. This problem is arguably particularly relevant to food products that originate from a fragmented production structure, where individual farmers are too small to muster a credible quality-signaling effort. One of our major points is the competitive structure that justifies the need for producers to act collectively, as with GIs, also carries implications for the market equilibrium that arises with a credible GI mechanism. Thus, our analysis has emphasized the implications of a competitive equilibrium with the production of GI products, including the freedom of entry/exit in the production of the high-quality good. Our model has also maintained an attractive cost structure for the case at hand (higher-quality GI products are costlier to produce than their generic counterparts),



and explicitly models the promotion and monitoring activities required to make the GI a credible certification system. In addition, the demand for GI products is modeled in a vertical product differentiation context. This captures the likely heterogeneity of consumer preferences *vis-à-vis* GI products but also permits generic products to interact meaningfully with GI products both in the demand and in the supply side of the model.

The main conclusions of our analysis can be summarized as follows. First, it is possible to have competitive provision of quality in agricultural markets, through certification devices similar to geographical indications. Second, although a competitive equilibrium can exist, because the GI certification entails fixed costs shared by all high-quality producers, there are external economies of scale at the industry level and the competitive equilibrium is not Pareto efficient. In particular, the competitive equilibrium underprovides the high-quality good. The failure of the competitive equilibrium to achieve a constrained first-best outcome can be corrected by policies that subsidize the certification of the high-quality good. Also, we find that measures that allows for market power (i.e., supply control) for GI producer associations in this setting are not desirable. Finally, the implications of entry in a competitive framework are critical. The possibility of entry has been neglected in many previous studies, but, as we have shown, its consideration has important implications for the welfare results that may be deduced. In particular, whereas the resolution of the “lemons” problem that the credible certification through GI makes possible clearly benefits consumers, what it does for the welfare of producers in a competitive setting ultimately depends on the presence of scarce factors that they own.

Whereas it is hoped that this article has contributed to the clarification of some basic economic effects associated with the use of GIs as quality certification devices for agricultural products, the analysis that we have proffered has some limitations. In particular, we have analyzed the case of a closed economy and considered the role of one GI system in isolation. Among the interesting additional questions that arise, one may want to consider the interaction and competition of several GIs, possibly from different geographic regions in the same country/jurisdiction, and/or the interaction of GIs and other quality labeling (e.g., organic food labels), including the issue

of possible excessive label proliferation. Also, as noted earlier, GIs are of interest in the ongoing WTO negotiation and their implementation is a question of intense disagreement among countries (Fink and Maskus 2006). Developed countries are themselves divided on this topic, with a simmering transatlantic dispute rooted in contrasting approaches to trade, IP, and agricultural policy (Josling 2006). A variety of perspectives are invoked as germane in this setting, ranging from familiar economic arguments for IP protection (Moschini 2004) to the view of GIs as a tool to safeguard cultural heritage, and to foster the preservation of traditional methods of production (Broude 2005). Thus, it may be desirable to explore the international trade implications of the expanding reach of GIs, addressing explicitly the current WTO negotiation. Such desirable extensions, which are the object of current research, should benefit from the benchmark analysis presented in this article.

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