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Quality Certification by Geographical Indications, Trademarks and Firm Reputation

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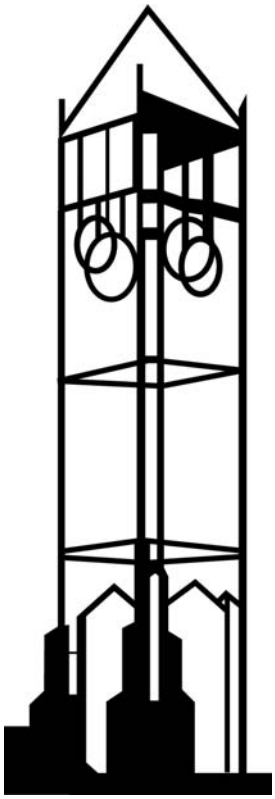

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Abstract

We study firm reputation as a mechanism to assure product quality in perfectly competitive markets in a context in which both certification and trademarks are available. Shapiro's (1983) model of reputation is extended to reflect both collective and firm-specific reputations, and this framework is used to study certification and trademarks for food products with a regional identity, known as geographical indications (GIs). Our model yields two primary results. First, in markets with asymmetric information and moral hazard problems, credible certification schemes reduce the cost of establishing reputation and lead to welfare gains compared to a situation in which only private trademarks are available. Hence, certification improves the ability of reputation to operate as a mechanism for assuring quality. Second, the actual design of the certification scheme plays an important role in mitigating informational problems. From a policy perspective, our results have implications for the current debate and negotiations on GIs at the World Trade Organization and the ongoing product quality policy reform within the European Union. With regard to the instrument of choice to provide intellectual property protection for GIs, our model favors a *sui generis* scheme based on *appellations* over certification marks. Finally, our model supports the validity of the traditional specialities guaranteed scheme of the European Union as an instrument for the provision of high-quality products that are not linked to a geographic area.

JEL Codes: D23, D82, L14, L15, Q1

Key Words: Asymmetric Information, Certification, Geographical Indications, Quality, Reputation.

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1. Introduction

The strand of literature sparked by the pioneering work of Shapiro (1983) on the role of firm reputation offers a possible solution to the market failure identified by Akerlof (1970) in settings characterized by asymmetric information and moral hazard problems. When firms identify themselves to consumers through trademarks, product quality can be credibly signaled to consumers who cannot observe it at the time of purchase. The emergence of this information about quality is achieved in competitive markets through an equilibrium price structure that provides the necessary incentives for competitive firms to develop and maintain reputation for producing a given quality. This literature also shows that reputation is an imperfect mechanism to assure quality and that high-quality items can only be provided at a premium above production costs. The size of the premium increases with the degree of the informational problem, which, in turn, depends upon the frequency of purchase, the delay and difficulty in detecting quality and the speed at which reputations are updated. More importantly for our purpose, the extent of the informational problem can be affected by the availability of tools for reputation building (e.g., trademarks, certification).

In this paper we extend the theory of firm reputation as a mechanism to assure quality in competitive markets to a context in which both certification and trademarks are available to firms as quality indicators. The primary motivation of this paper is to show that, in such markets with asymmetric product quality information, credible certification schemes that are accessible by all firms or subsets of the firm population support the creation of information regarding quality, reduce the cost of establishing reputation and lead to welfare gains. The reputation approach to the problem of moral hazard also draws attention to the fact that the design of certification schemes is important in determining the extent of informational problems and the distribution of benefits among heterogeneous consumers.

For concreteness, our model is specifically tailored to markets for food products with a regional identity. For these products, the geographic names of the location of production, known as geographical indications (GIs), represent an option for branding. GIs, like trademarks, are a form of intellectual property rights, and were introduced in 1994 with the TRIPS agreement of the World Trade Organization (WTO). The markets for GIs are befitting for several reasons. First, given the abundance and importance of experience and credence attributes among food products, these markets are fraught with asymmetric information and moral hazard problems (Winfree and McCluskey 2005). Second, these markets are typically characterized by the presence of numerous autonomous firms that make independent business decisions and retain their own profits, but share

a geographic brand and act in competitive conditions (Fishman et al. 2008; Moschini, Menapace and Pick 2008). Third, the use of formal certifications for this category of products is common in many large export markets including the European Union (EU) and growing in popularity in emerging markets and developing economies (EU 2008; WIPO 2007). Fourth, the concurrent use of certification and trademarks for branding these products is also common (Bramley and Kirsten 2007).

GIs have recently attracted the interest of academics in economics, marketing, law and sociology. In particular, a growing economics literature has assessed the role of GIs as a certification tool in alleviating market failures due to the presence of asymmetric information when quality cannot be credibly signaled otherwise (Zago and Pick 2004; Anania and Nisticó 2004; Lence et al. 2007; Moschini, Menapace and Pick 2008). In this paper, we assess the role of GIs when quality can alternatively be sustained through trademarks, and consider GIs and trademarks as alternative and complementary means for signaling quality. We expand the existing literature on GIs in several ways. First, we explicitly incorporate the role of reputation and hence consider a dynamic rather than a static setting. Critically, we shift the focus from considering a generic certification scheme for GIs that allows for the emergence of a high-quality market in which a single product is considered in isolation, to the design of a certification scheme that applies to a broadly defined type of product available under many different private and collective brands and potentially supplied from many different GI regions.

The model we propose in this paper relies on Shapiro's (1983) notion of reputation, which we extend to reflect both collective and firm-specific reputations in competitive markets. Specifically, an initial investment via the production of high-quality product is necessary for a firm to gain private reputation. Collective reputation is obtained through certification and is determined by the conditions required for certification (e.g., minimum quality, production technology, etc.). In equilibrium, quality in excess of the minimum commands a premium above marginal costs, which, as in Shapiro, represents a fair return on the private investment in reputation. In this setting, certification reduces the cost of building reputation by constraining the moral hazard behavior of producers.

Our model can differentiate the two primary certification schemes currently used for GIs, the European-style *sui generis* scheme based on *appellations* and the American-style scheme based on certification marks, and allows us to investigate the potential of the EU's traditional specialities guaranteed scheme (EU 2009a). These schemes differ substantially with regard to (i) the eligibility

conditions for geographic names to receive intellectual property (IP) protection and (ii) the requirements for certification. In a second-best world with asymmetric information, these differences are relevant because they affect the collective reputation of certified products and hence the cost of providing quality.

Several instructive aspects of the role of certification in quality provision and reputation formation emerge from the model. First, we show that certification reduces the divergence between the reputation equilibrium and the equilibrium that would prevail under perfect information by lowering the cost of establishing reputation compared to a situation with only trademarks. Hence, certification improves the ability of reputation to operate as a mechanism for assuring quality. Second, we provide a motivation for industry resistance to the introduction of certification. Surprisingly we find that resistance from producers is not limited to those that are excluded from the certification but can also arise from those producers that are eligible for certification but already sell high-quality product when certification is introduced. This is because certification raises the price that entrants can command thereby reducing the cost of building and the value of established reputation.

In addition, our model has interesting implications for the current debate and negotiations over alternative forms of IP protection for GIs at the WTO and the ongoing consultations on product quality policy reform within the European Union. First, we provide a rationale to favor a *sui generis* scheme based on *appellations* over standard instruments such as certification marks. We show that this is the case even if the current certification mark system were to be adapted to include a screening based on the presence of a demonstrable quality/geography nexus similar to that used for *appellations*. Second, our model discusses the potential welfare gains associated with the traditional specialities guaranteed scheme, a scheme for traditional products used in the European Union, whose validity is currently being assessed by the EU Commission (EU 2009b). Such a scheme, based exclusively on quality (rather than on geographical) requirements, provides certification for products that meet given quality standards independently of the location of production.

In what follows, we first provide a review of the institutional setting for GIs and then introduce the model and the reputation formation mechanism. Next, we define and derive a long-run, rational-expectation, stationary Nash equilibrium under three different IP scenarios characterized by (i) the absence of a certification scheme, (ii) the presence of a *sui generis* certification scheme and (iii) the presence of a certification mark scheme. In the last part of the paper, we discuss domestic and trade welfare implications and explore the traditional specialities guaranteed scheme.

2. Institutional Framework

Geographical indications, which are typically names of places or regions used to brand goods, are a distinct form of intellectual property rights. Many GIs pertain to wines (e.g., Burgundy), agricultural products (e.g., Thai Hom Mali rice) and foods (e.g., Parmigiano-Reggiano cheese), but also non-food products (e.g., handicrafts and textiles) are common, particularly from developing countries (e.g., Mysore silk).[1] The distinctive feature of GIs is that the quality attributes of the goods they identify are considered to be inherently linked to the nature of the geographic location in which production takes place (e.g., climate conditions, soil composition, local knowledge), i.e., to the notion of "terroir" (Barham 2003; Josling 2006).[2]

GIs are considered one of the earliest instruments used to counteract market failures resulting from asymmetric information (Rangnekar 2004) and their protection has a long tradition in Europe dating back to the fifteenth century (O'Connor 2004). However, following the EU's Common Agricultural Policy reform in 1992, which moved EU policies progressively away from price supports towards programs to promote food quality and rural development, GIs have taken center stage as the "main pillar of the EU's quality policy on agricultural products" (EU 2003). Following their recognition as a distinct form of intellectual property rights in the TRIPS agreement, GIs have also received significant international attention outside of the EU (Moschini 2004). In particular, significant interest in GIs has emerged recently among developing countries.[3]

As for other types of brands (e.g., trademarks), the ability of GIs to alleviate market failures due to the presence of asymmetric information rests on their credibility, thus necessitating IP protection. While trademark protection is well established and relatively harmonized across countries, the protection of GIs varies to a large degree, and its implementation is a question of intense disagreement in ongoing WTO negotiations. The TRIPS agreement requires countries to

[1] Other agricultural products not intended for human consumption are ornamental plants, flowers, cork, hay, cochineal, wool, wicker and essential oils.

[2] See the definition of GIs in the TRIPS agreement (Article 22.1).

[3] For example, several countries are introducing or expanding their own GI laws, regulations and promotion programs including China (Xiaobing and Kireeva 2007), India (Rao 2006), South Korea (Suh and MacPherson 2007), and Colombia (Teuber 2010). Noteworthy is the Kenian-Swiss ongoing project aimed at establishing a functioning GI protection scheme in Kenya and at raising awareness on GIs in the East African Community member states (see the Swiss Institute of Intellectual Property's website at https://www.ige.ch/en.html).

provide legal means for protecting GIs against unfair competition, but it does not specify the means by which protection should be provided.

Two primary legal notions, marks and *appellations*, essentially two alternative forms of certification, are used to protect GIs. Where marks are used, generally in common law countries including the United States, GIs are protected within the trademark system and are usually registered as certification marks.[4] Certification marks simply certify that products meet given conditions and, in the case of GIs, the only such condition is the geographic area of production. It is critical to emphasize that the right to use a certification mark is collective in nature. In the case of a GI in the form of a certification mark, all producers that operate within the geographic area indicated by the GI have access to certification and can use (subject to obtaining certification) the GI to label their products. In contrast, usage rights over trademarks are private and belong to a single entity or firm. Only under special circumstances, specifically when a geographic term has acquired a "secondary meaning," can a GI be registered as a trademark.[5] When this is the case the rights over the GI are private and belong to a single entity or firm.

Alternatively, GIs are protected through so-called *sui generis* schemes based on *appellations*, originally developed and used in Roman law countries, and currently adopted in the European Union (OECD 2000), several Asian and a few North American and Latin American countries[6] (WIPO 2007). The main distinctive characteristic of a *sui generis* scheme is the requirement of a specific link between a good's qualities and its geographical origin. In other words, for a geographic name that identifies a given good to be eligible to receive IP protection in the form of an *appellation*, evidence must be provided that the quality or characteristics of the good are due to the natural and human factors (e.g., climate, soil quality, local knowledge) characterizing the geographic area of origin (EU Reg. 510/2006 Art. 2 and Art. 4.2.f). This requirement for *appellations* rests on the notion of "terroir," the idea that the nature and characteristics of the geographic location of production are responsible for the goods' distinct quality attributes of interest to consumers.

[4] In the United States, certification marks used for GIs are registered with the United States Patent and Trademark Office.

[5] This means that when the "secondary meaning" of a geographic name in consumers' minds is a production or manufacturing source (while the primary meaning is the geographic place), then it is possible under US trademark law to register a geographic name as a trademark, a private rather than collective IP right (USPTO 2007).

[6] These include China, Mongolia, North Korea, Thailand, Vietnam, Colombia, Venezuela, Cuba and Costa Rica.

In addition to the existence of a specific quality/geography link, the *sui generis* scheme requires the definition of a code of rules for each GI product (commonly referred to in the literature as the specification). The specification details all the product characteristics[7] and the geographic area of production, and effectively mandates two conditions: (i) a minimum level of quality that the product needs to satisfy, and (ii) the geographic area in which production takes place (EU Reg. 510/2006 Art. 4).

The US system for GIs based on certification marks, by contrast, does not require the existence of any link between quality and geography – in fact the patent office does not scrutinize certification mark applications based on the characteristics to be certified or require the definition of quality standards. Indeed, when a certification mark includes a geographic name it is understood that the only attribute to be certified is the origin of the good (USPTO 2007).

Finally, with the *sui generis* scheme, usage rights over a GI are granted to all producers within a designated production area who comply with the product specification (EU Reg. 510/2006 Art. 8). Hence, GIs, whether in the form of certification marks or *appellations,* are a collective form of property rights (i.e., collective brands).

3. Model

Our model can be characterized as a dynamic discrete time model with a period-between-sales interest rate of $r > 0$. We consider the market for an experience good (e.g., parmesan cheese, sparkling wine, dry-cured ham) that can be produced in a continuum of qualities indexed by $q \in \mathbb{R}_+$. We assume that all products in the market are subject to a minimum quality standard (MQS), $q_0 > 0$, which can be interpreted as the minimum quality necessary to ensure consumer safety and sanitary conditions. The MQS is enforced.

We assume that there are two types of production areas, the GI regions and the other regions, and that each single region is identified by a distinctive name. Two different production technologies exist: the GI technology and the standard technology. The GI technology is available in each of the GI regions but not in the other regions, the standard technology is only available in the other regions. The technologies, represented by the cost functions $c^G(q)$ and $c(q)$ respectively, satisfy standard assumptions. Specifically, $c^G(q)$ and $c(q)$, are assumed to be continuous, (strictly)

[7] The product characteristics include the physical, chemical, microbiological and organoleptic characteristics of the raw materials and of the final product.

increasing and (strictly) convex functions of quality, q. Hence, $c_q(q)>0,\ c_{qq}(q)>0,\ c_q^G(q)>0,$ and $c_{qq}^G(q)>0.$ Furthermore, we assume that the GI technology displays a comparative advantage in the production of the upper-end of the quality spectrum, $q>\tilde{q}.$ Specifically,

$$\text{for all } q\le\tilde{q},\quad c^G(q)\ge c(q),$$
$$\text{for all } q>\tilde{q},\quad c^G(q)<c(q),$$

where $\tilde{q}$ is such that $c(\tilde{q})=c^G(\tilde{q}).$ The comparative advantage assumption is intended to capture the notion of "terroir," the fact that the nature and characteristics of the conditions of production in the GI regions facilitate the attainment of quality. Specifically, we assume that the comparative advantage in the high-quality range confers the GI regions the quality/geography nexus that is necessary for eligibility to receive IP protection under a *sui generis* scheme.

We assume that all producers are price-takers and that the industry (both the standard and the GI-certified product sectors) is characterized by free entry. The role of competitive markets and free entry into the GI sector has been discussed by Moschini, Menapace and Pick (2008), and we refer the reader to their paper for additional details. While for simplicity, we assume that each active firm produces a fixed quantity of output per period, normalized to unity, we let each firm choose a sequence of qualities to maximize the present value of profits.[8]

3.1. Branding Options: Trademarks and GI Labels

In addition to choosing quality, producers use brands to differentiate their products from those of other producers. A brand can be a trademark, a mix of a trademark and a GI label or a GI label. A GI label takes the form of an *appellation* or a certification mark depending upon whether a *sui generis* scheme or a certification mark scheme is in place. Trademarks and mixed brands (i.e., combinations of a trademark and a GI label) are used to convey firm-specific reputations. GI labels alone convey collective reputations. We assume that each producer can, at any time, adopt and use a trademark at no cost and that there is an infinite supply of potential trademark names. Instead, to be able to use a GI label, a producer needs to obtain certification.

[8] By fixing the size of the firm, we abstract from the issues regarding the presence of economies or diseconomies of scale in establishing reputation. The issue of economies of scale in establishing collective reputation has been addressed in a recent working paper by Fishman et al. 2008. The relationship between firm size, investment in quality and individual brand reputation is investigated by Choi (1997), Cabral (2000) and Rob and Fishman (2005).

Whether a producer is able to obtain certification depends upon two sets of conditions – accessibility of certification and the certification requirements – which vary across certification schemes. We say that producers in a given area have access to certification when they have the right to register the geographic name of their production area as a GI. With regard to accessibility we consider two options: schemes that require the existence of a quality/geography nexus and schemes that do not. Schemes that require the existence of a quality/geography nexus (e.g., the *sui generis* scheme) limit accessibility to certification to producers that operate in a GI region (by definition, GI regions are characterized by the GI technology and the quality/geography nexus). Schemes that do not require the existence of a quality/geography nexus (e.g., the certification marks scheme) make certification available to producers in all regions.

Once a geographic name is registered, the right to use it to brand a given product is conditional on the product meeting the scheme's certification requirements. We consider two requirements: a location of production and an MQS requirement. To satisfy the location of production requirement, a product needs to be produced in the geographic area corresponding to the GI label. In other words, GI labels must be truthful with regard to the geographic origin of the good. To satisfy the MQS requirement, a product needs to meet a GI-specific MQS, q_0^G. We assume that q_0^G is scheme specific, meaning that it can vary across different schemes but is the same for all GI labels registered under the same scheme, and is such that $q_0^G \geq q_0$. This last assumption means that the minimum quality standard imposed by a GI scheme is at least as strict as the baseline standard that applies to all products.

Consistent with the collective nature of GI rights, we assume that all producers that satisfy the certification requirements for a given GI are entitled, subject to paying the certification cost, to use the GI to brand their products. A GI label can be used in addition to, or in place of, a trademark. We assume the per-period, per-unit certification cost to be the same across all considered schemes and to be equal to ω. Finally, we postulate an economy with a fully credible trademark system and a fully credible certification scheme for GIs (i.e., there is no counterfeit product on the market and all certified products meet the requirements established by the certification scheme).

3.2. Reputation and Information Structure

In the economic literature on branding, the ability of sellers to develop a reputation rests on the ability of brands to convey information regarding the firm's actions or characteristics (or both).

Consumers, who at the time of purchase cannot observe product quality but observe brands, rely for their purchase decisions on the firms' reputations captured by their brands. In the literature on the economics of information, the concept of reputation is formalized in various ways depending upon the source of the uncertainty regarding quality (Bar-Isaac and Tadelis 2008). When quality uncertainty is due to unobservable characteristics (markets primarily characterized by adverse selection problems), reputation is commonly modeled as consumer beliefs regarding a firm's type and is assumed to evolve based on signals (e.g., the firm's performance). When, as in our case, the uncertainty regarding quality is primarily due to unobservable actions (markets characterized by moral hazard problems), reputation is conceptualized as a firm's past quality, and a "good" reputation is assumed to persist until the firm cheats by cutting its quality. The latter notion of reputation is based on the seminal papers of Klein and Leffler (1981) and Shapiro (1983).

For convenience, we adopt the simplest form of reputation building proposed by Shapiro (1983). Specifically, we assume that firms acquire reputation by selling high quality product at low prices over one period of time. We assume that reputation, R, is common knowledge among all consumers in a given market, is market-specific,[9] brand-specific, and adjusts immediately from period to period. Hence, for a brand k at time t,

$$R_t^k = q_{t-1}^k. \tag{1}$$

In our context, a brand k can be a trademark, a mix of a trademark and a GI label or a GI label. Consumers identify products of different firms through brands and make purchase decisions based on the firms' reputations for quality as conveyed by the brands. Consumers are rational and have full information about technologies, MQSs, and the other parameters of the model but cannot observe quality. In addition, consumers cannot observe which technology was used, the location of production or brand ownership.

Consumers are heterogeneous with respect to their taste for quality but consider brands of like quality to be perfect substitutes.[10] We assume that there is a continuum of consumer types, $\theta \in [0, \overline{\theta}]$, with distribution $F(\theta)$. Consistent with previous literature, we assume that consumers

[9] This assumption is relevant for the discussion of the trade implications of GI protection.

[10] It is taste heterogeneity with regard to quality that supports a range of different qualities exchanged in equilibrium. We recognize that some consumers might value the very fact that a product is produced in a specific geographic area independently of the actual quality of the product. For simplicity, our model only considers consumer preferences over quality.

purchase the quality that provides the highest positive surplus, and otherwise buy nothing, where the surplus from purchasing quality q at price $p(q)$ for a consumer of type θ is given by

$$U(q;\theta)-p(q).$$

We make the following standard assumptions regarding consumers: (i) consumers value quality; (ii) the marginal utility of quality is decreasing; (iii) consumers with higher taste for quality (higher values of θ) value quality more; and (iv) the marginal utility of quality is larger for consumers with higher values of θ. Mathematically, we have $U_q>0,\ U_{qq}<0,\ U_\theta>0,$ and $U_{\theta q}>0.$ Because consumers cannot observe quality at the time of purchase and rely on reputation, which evolves according to equation (1), producers can surprise consumers (for one period) with a lower quality than expected. Such a quality cut is discovered by consumers with a one-period delay, and consumers punish the seller by boycotting the brand thereafter (Allen 1984).[11]

4. Long-Run Partial Equilibrium

We consider a rational-expectation, stationary Nash equilibrium in a long-run partial equilibrium setting.[12] Specifically, the reputation equilibrium we consider is a steady state configuration with a price function across qualities, $p(q)$, and a distribution of firms, $n(q)$, such that (i) each consumer, knowing $p(q)$, chooses his most preferred quality level or decides not to purchase anything; (ii) markets clear at every level of quality (thus determining $n(q)$); (iii) any firm with reputation R finds it optimal to produce quality $q=R$ rather than to deviate; and (iv) there is no entry or exit.

We focus on the case in which land and all other factors of production are in perfectly elastic supply and derive the price-quality schedule relying on cost considerations (because in a long-run equilibrium with perfectly elastic factor supplies, output prices are determined exclusively by costs) and basic assumptions regarding consumer preferences: (i) consumers are indifferent between products of equal quality; (ii) utility is strictly increasing in quality and strictly decreasing in the price

[11] Because brand ownership is not observable to consumers, a producer that has cheated and has lost all his customers could re-enter the market using a different brand.

[12] Consumer expectations of quality are adaptive but rational in equilibrium: consumers expect firms to maintain their reputation and firms do.

paid for quality; and (iii) consumers have heterogeneous preferences regarding quality.[13] We believe that the assumption of perfectly elastic factor supply is justifiable in the context of markets for food and agricultural products that are broadly defined (e.g., extra virgin olive oil, wine). In these markets, we observe the presence of many private brands and numerous GI labels from a variety of geographical areas (for example, in the European Union over one hundred GIs for extra virgin olive oil and several thousand GIs for wines are currently registered).[14]

In what follows, we consider three IP scenarios and, for each scenario, we derive the equilibrium market price-quality schedule. The first scenario, our benchmark case, is one in which trademarks are the only branding option. In the second and third scenarios, we consider two alternative certification schemes for GIs, the *sui generis* scheme based on *appellations* and the certification mark scheme respectively.

4.1. The Benchmark Case with Trademarks Only

In this section, we derive the equilibrium market price-quality schedule when, absent a certification scheme, trademarks are the only available branding option for producers. First, consider a representative firm that uses the standard technology and whose reputation in equilibrium is equal to q. If this firm remains honest, it earns a discounted profit equal to $\frac{1+r}{r}\left[p(q)-c(q)\right]$, while, if it cheats, the most profitable avenue is to cut quality to the minimum level thereby earning a one-period profit equal to $p(q)-c(q_0)$. The credibility constraint, which determines the range of prices at which a producer has no incentive to cheat, can therefore be written as

$$p(q) \geq c(q) + r\left[c(q)-c(q_0)\right].$$

As in Shapiro (1983), we argue that the presence of a potentially infinite supply of fly-by-night sellers who could overrun the market with minimum quality and the fact that consumers know that product quality is at least equal to the minimum level, q_0, imply that the entry price for a new brand, p_e, is equal to the cost of producing minimum quality, $c(q_0)$. Hence, $p_e = c(q_0)$. In equilibrium, a

[13] Assumptions (i) and (ii) rule out "irrelevant" price-quality combinations. Assumption (iii) supports a range of different qualities to be exchanged in equilibrium.

[14] See the DOOR and E-BACCUS databases on the EU's website at http://ec.europa.eu/agriculture/quality/database/index_en.htm and http://ec.europa.eu/agriculture/markets/wine/e-bacchus/.

potential entrant incurs a sure loss equal to $c(q_0)-c(q)$ in the entry period when the brand is still unknown and earns a profit equal to $p(q)-c(q)$ in any subsequent period. Free entry, which requires discounted profits of potential new brands to be non-positive, $c(q_0)-c(q)+\frac{1}{r}\left[p(q)-c(q)\right]\leq 0$, imposes a second restriction on the equilibrium price configuration, which can be written as

$$p(q)\leq c(q)+r\left[c(q)-c(q_0)\right].$$

Together the credibility constraint and the free-entry condition imply an equilibrium price-quality schedule for producers who use the standard technology equal to

$$A(q)\equiv c(q)+r\left[c(q)-c(q_0)\right] \quad \text{for } q\geq q_0. \tag{2}$$

Similar conditions can be derived for producers who use the GI technology. Given that the technology of production is undetectable for consumers, and that the cost of in-house production of minimum quality using the GI technology exceeds the cost of outsourcing production to firms that use the standard technology, $c^G(q_0)>c(q_0)$, the most profitable cheating option for these producers is outsourcing at a cost equal to $c(q_0)$. The credibility constraint for producers who use the GI technology is then equal to

$$p(q)\geq c^G(q)+r\left[c^G(q)-c(q_0)\right].$$

Being unable to detect the technology of production, consumers are willing to pay $c(q_0)$ for any reputationless brand independently of the actual technology used. The free entry condition for producers who use the GI technology is then equal to

$$p(q)\leq c^G(q)+r\left[c^G(q)-c(q_0)\right].$$

Hence, the credibility constraint and the free-entry condition for producers who use the GI technology imply an equilibrium price-quality schedule equal to

$$N(q)\equiv c^G(q)+r\left[c^G(q)-c(q_0)\right] \quad \text{for } q\geq q_0. \tag{3}$$

Because consumers are indifferent between products of equal quality (hence, they would purchase only brands with the lowest price for any given quality), and given that consumer utility is strictly increasing in quality (hence, consumers purchase only brands with the highest quality at any given price), from (2) and (3), the market price-quality schedule that prevails in equilibrium – absent a GI scheme – is

$$P(q) \equiv \begin{cases} A(q), & \text{for } q \in [q_0, \tilde{q}) \\ N(q), & \text{for } q \geq \tilde{q} \end{cases} \tag{4}$$

where $\tilde{q}$ is the quality level that separates the comparative advantage ranges of the two technologies. The market schedule, $P(q)$, is represented in Figure 1 by the bold curve.

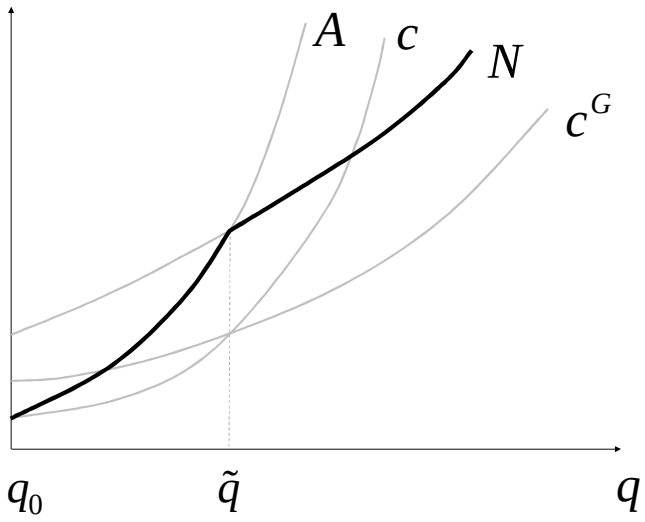

Figure 1. Market Price-Quality Schedule with Trademarks Only

4.2.The Sui Generis Certification Scheme based on Appellations

Three features (the geographic/quality nexus, the product specification and the collective nature) characterize the *sui generis* scheme and distinguish GI labels (i.e., here *appellations*) from trademarks. First, eligibility for registration and protection of a geographic name as an *appellation* requires a demonstrable link between the characteristics of a specific geographic region and the quality attributes of the product. No such nexus between geography and quality is required for registration and protection of a trademark. In our setup, only the names of the GI regions, identified through GI logos,[15] receive IP protection with the *sui generis* scheme. Hence, only producers that use the GI technology have access to certification.

Second, the *sui generis* scheme requires the establishment of the product specification that includes two certification requirements: a GI-specific MQS and a location of production

[15] While trademarks are identified by the ® or the TM symbols, *appellations* with the EU's *sui generis* scheme are identified by GI-specific logos that are available at http://ec.europa.eu/agriculture/quality/logos/index_en.htm.

requirement. Hence, all GI certified product must be of quality equal to or in excess of q_0^G and must have been produced in the area identified by the GI label.[16]

Third, usage rights over a GI label are granted to all producers within the GI area who meet the MQS requirement. Hence, when a *sui generis* certification scheme is in place, all firms using the GI technology that produce a quality equal to or in excess of q_0^G can certify their product at a per-period cost ω and can use the GI label corresponding to their area of production for branding. These firms can also elect to use a trademark in addition to the GI label. Whether or not an additional trademark is used, the cost of producing and certifying quality $q \geq q_0^G$ is equal to $c^G(q)+\omega$.

The derivation of the equilibrium price-quality schedule for producers who certify requires discussing the entry price that consumers are willing to pay for a new GI-certified product, and the best cheating option for producers. By a "new GI-certified product" we mean any product that is sold on the market with a pure GI label (i.e., without a trademark) or with a mixed brand (i.e., a GI label and a trademark) when the trademark is unknown to consumers.[17]

First, we argue that the entry price for a new GI-certified product is $c^G(q_0^G)+\omega$. To this end, we note that consumers know that a GI-certified product is produced using the GI technology and is of quality at least q_0^G. Consumers also know that the quality produced by an entrant who certifies and wants to stay in business must be such that the entrant's brand is (at least weakly) preferred over alternative brands of equal quality once reputation is built and, hence, that the quality must be above

[16] In a setup like ours in which all GI regions are characterized by the same GI technology and in which consumers care about quality but have no preference over origin *per se*, the presence of a location of production requirement does not generate additional information compared to the case of a scheme that conditions eligibility to the existence of a quality/geography nexus and is characterized by an MQS requirement alone. Nevertheless, the distinction between the eligibility condition and the location of production requirement is important to meaningfully discuss the welfare properties of alternative certification schemes that are used or that could be used for food products.

[17] Any GI-certified product that is sold without a trademark is expected from consumers to be of quality q_0^G. To build reputation in excess of q_0^G, the use of a trademark in addition to a GI label is needed.

a given threshold.[18] Given these pieces of information, a new GI-certified product represents a bargain at a price $c^G(q_0^G)+\omega$. At the same time, any price above $c^G(q_0^G)+\omega$ would attract fly-by-night producers into the market hence, it is assumed that consumers protect themselves from such potential suppliers by refusing to pay more than $c^G(q_0^G)+\omega$.

Second, we note that the presence of certification limits the cheating options for producers. Once a mixed brand is known to consumers to be GI-certified, the firm must continue certifying the product; otherwise consumers would anticipate that the firm is cheating.[19] Conditional on certifying, the most profitable cheating avenue is to produce minimum quality q_0^G at cost $c^G(q_0^G)+\omega$. Based on these considerations regarding the entry price and the best cheating option, we conclude that the price-quality schedule for producers who certify is equal to

$$G(q) \equiv c^G(q) + r\left[c^G(q) - c^G(q_0^G)\right] + \omega \quad \text{for } q \geq q_0^G. \tag{5}$$

Producers who use the GI technology can also decide not to certify. In this case, producers can choose any quality equal to or above the baseline minimum quality, $q \geq q_0$, which costs $c^G(q)$ to produce. Without certification, their only branding option is to use trademarks. Because consumers cannot observe the technology used in production, the entry price for these producers must be equal to the entry price for unknown brands produced with the standard technology, $c(q_0)$. In addition, because $c^G(q_0) > c(q_0)$, the most profitable cheating option is to outsource the production of q_0 at a cost $c(q_0)$. It follows that the price-quality schedule for producers who use the GI technology but do not certify coincides with (3). Finally, the presence of a *sui generis* scheme does not affect the price-quality schedule of producers who use the standard technology. For them, the price-quality schedule coincides with (2).

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[18] As explained below, the quality must be at least $q \geq \min\left\{q_0^G, \hat{q}\right\}$ where $\hat{q}$ is defined as the quality at which (5) and (2) intersect.

[19] In the case of a firm using a pure GI label as a brand, discontinuing certification means selling an unbranded product, which is expected by consumers to be of baseline minimum quality q_0.

To focus on the relevant case in which, for all certification schemes considered, reputation building through certification is a viable option, in what follows we assume that the following parametric condition holds:[20]

$$\omega < r\left[\min\left\{c^G(q_0), c\left(q_0^G\right)\right\} - c(q_0)\right]. \tag{6}$$

The market price-quality schedule prevailing in the presence of a *sui generis* scheme corresponds to the "lower envelope" of the three schedules in (2), (3) and (5). Its mathematical form, which is given by (7), varies depending on the value of q_0^G and requires the following implicit definitions of $\hat{q}$, $\overline{q}$, $\underline{\overline{q}}$, q_1 and q_2:

$$\begin{aligned} G(\hat{q}) &= A(\hat{q}), \\ A(\tilde{q}) &= c^G(\overline{q}) + \omega, \\ A(\underline{\overline{q}}) &= c^G(\underline{\overline{q}}) + \omega, \\ A(q_1) &= c^G(q_0^G) + \omega, \\ N(q_2) &= c^G(q_0^G) + \omega. \end{aligned}$$

Depending on the value of q_0^G, we identify three cases corresponding to (a) $q_0^G \in [q_0, \underline{\overline{q}})$, (b) $q_0^G \in [\underline{\overline{q}}, \overline{q})$ and (c) $q_0^G \geq \overline{q}$. In all cases, (a), (b) and (c), the schedule corresponds to that of the producers using the standard technology in the bottom range of the quality spectrum (for q smaller than $\hat{q}$, q_1 and $\tilde{q}$ respectively) and to that of the GI-certified producers in the upper range of the quality spectrum (for q larger than $\hat{q}$ in case (a) and larger that the GI-specific MQS, q_0^G, in cases (b) and (c)). In case (c) only, the intermediate range of quality spectrum, between $\tilde{q}$ and q_2, is supplied by producers who use the GI technology and do not certify. Moreover, while in case (a), the schedule is continuous, in cases (b) and (c) the schedule presents a discontinuity, indicating a

[20] For given functional forms of the cost functions and for given values of r and q_0, this restriction places an upper bound on the value of the certification cost, ω, or a lower bound on the value of the GI-specific minimum quality standard, q_0^G.

quality gap that is typical in the presence of production technologies with comparative advantage over different quality ranges.[21] Thus, the market price-quality schedule can be written as

$$P^G(q) \equiv \begin{cases} \begin{cases} A(q), & q \in [q_0, \hat{q}) \\ G(q), & q \geq \hat{q} \end{cases} & \text{for } q_0^G \in [q_0, \underline{\overline{q}}) \\ \begin{cases} A(q), & q \in [q_0, q_1) \\ G(q), & q \geq q_0^G \end{cases} & \text{for } q_0^G \in [\underline{\overline{q}}, \overline{q}) \\ \begin{cases} A(q), & q \in [q_0, \tilde{q}) \\ N(q), & q \in [\tilde{q}, q_2) \\ G(q), & q \geq q_0^G \end{cases} & \text{for } q_0^G \geq \overline{q} \end{cases} \tag{7}$$

The market price-quality schedule, $P^G(q)$, is represented by the bold curve in Figures 2(i) and 2(ii). Specifically, Figure 2(i) represents case (a) where $q_0^G \in [q_0, \underline{\overline{q}})$ and Figure 2(ii) represents case (c) where $q_0^G \geq \overline{q}$. To facilitate comparison, the dashed curve in Figures 2(i) and 2(ii) represents the price-quality schedule, $P(q)$, that would prevail absent a certification scheme. Finally to keep the pictures as clean as possible, the value of the certification cost, ω, is considered to be equal to zero.

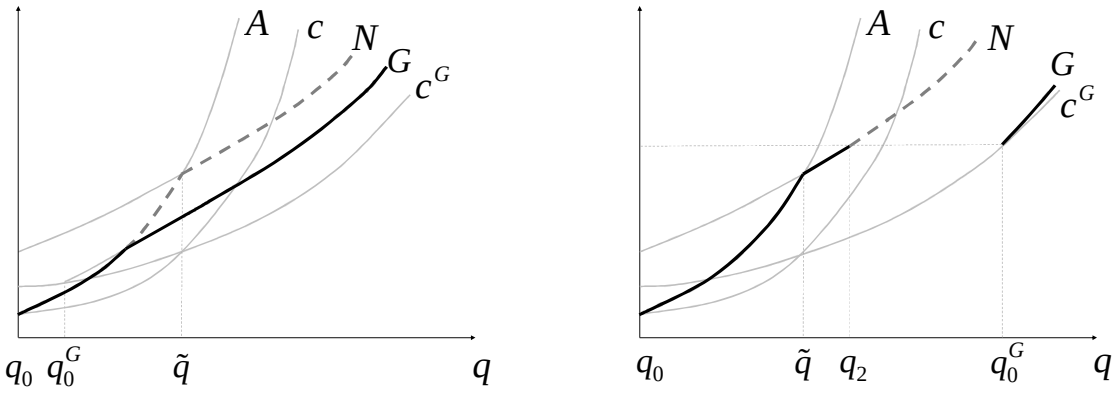

Figure 2(i): Case (a) **Figure 2(ii): Case (c)**

Figure 2. Market Price-Quality Schedule with a *Sui Generis* Scheme

[21] Quality gaps in the presence of production technologies with comparative advantage over different quality ranges appear also in Falvey and Kierzkowski (1987) and in Flam and Helpman (1987), among others.

4.3.The Certification Scheme Based on Certification Marks

IP protection for GIs in the United States is provided through the trademark system usually as certification marks. An example of a GI protected as a certification mark is "Washington Apples." This mark certifies that the apples are produced in the state of Washington, while no quality standard is needed to be met by producers (Winfree and McCluskey 2005). A critical feature of the trademark system is that certification marks that consist of geographic names can only be use to certify the geographic origin of products, while normally no additional requirements can be included in the mark definition. Nor is the eligibility for registration of a certification mark that consists of a geographic name conditioned upon the presence of a link between quality and geography (USPTO 2007). Given these features, the certification mark system can be framed in our setup as a scheme with no limitation regarding accessibility to certification (i.e., every region's name is eligible to be protected as a certification mark), with a location of production requirement and no MQS requirement. With this scheme, a GI label in the form of a certification mark informs consumers that the certified product originates in the area indicated by the label.

Following the same procedure used thus far, we derive the market price-quality schedule that prevails under a certification mark scheme. Here, we assume that consumers have no knowledge regarding which technology is available in which area and hence are not able to infer the production technology from the GI label (this assumption will be relaxed in section 5.1). Now, for a producer who uses the standard technology and certifies, the cost of quality $q \geq q_0$ is equal to $c(q)+\omega$. In equilibrium, if a firm with reputation equal to q remains honest, it earns a discounted profit equal to $\frac{1+r}{r}\left[p(q)-c(q)-\omega\right]$, while, if it cheats, the most profitable avenue is to cut quality to the minimum level while continuing to certify, thereby earning a one-period profit equal to $p(q)-c(q_0)-\omega$.[22] The credibility constraint can therefore be written as

$$p(q) \geq c(q)+r\left[c(q)-c(q_0)\right]+\omega.$$

Given the potentially large number of non-GI regions (and hence of certification marks from non-GI regions), we argue that the entry price for a new certified brand under the certification

[22] The firm must continue certifying the product; otherwise, consumers would correctly infer that the firm is cheating.

mark scheme is $c(q_0)+\omega$.[23] This is based upon the argument that consumers protect themselves from potential suppliers from non-GI regions by refusing to pay more than $c(q_0)+\omega$. In equilibrium, a potential entrant incurs a sure loss equal to $c(q_0)-c(q)$ in the entry period when the brand is still unknown and earns a profit equal to $p(q)-c(q)-\omega$ in any subsequent period. Free entry, which requires discounted profits of potential new brands to be non-positive, $c(q_0)-c(q)+\frac{1}{r}\left[p(q)-c(q)-\omega\right]\leq 0$, imposes the following restriction on the equilibrium price configuration:

$$p(q)\leq c(q)+r\left[c(q)-c(q_0)\right]+\omega.$$

Together the credibility constraint and the free-entry condition imply an equilibrium price-quality schedule for producers who use the standard technology and certify equal to

$$B(q)\equiv c(q)+r\left[c(q)-c(q_0)\right]+\omega \quad \text{for } q\geq q_0. \tag{8}$$

The cost of quality $q\geq q_0$, for producers who use the GI technology and certify, is $c^G(q)+\omega$. Because consumers cannot infer the production technology from the GI label, they are willing to pay the same amount for any new certified brand. Hence the entry price for producers who use the GI technology and certify must be equal to $c(q_0)+\omega$. Also, their best cheating option is to cut quality to q_0 and continue to certify at a cost $c^G(q_0)+\omega$. Based on the entry price and the best cheating option, we can conclude that the equilibrium price-quality schedule for producers who use the GI technology and certify is equal to

$$H(q)\equiv c^G(q)+r\left[c^G(q)-c(q_0)\right]+\omega \quad \text{for } q\geq q_0. \tag{9}$$

Finally, the presence of a certification mark scheme does not affect the price-quality schedule of producers who use the standard technology and do not certify – for whom the price-quality schedule coincides with (2) – or the price-quality schedule of producers who use the GI technology and do not certify – for whom the price-quality schedule coincides with (3).

Given (2), (3), (8) and (9), it can be readily seen that, for any value of $\omega\geq 0$, the market price-quality schedule prevailing in the presence of a certification mark scheme coincides with $P(q)$, as given by (4), and, in fact, for any value of q, $B(q)\geq A(q)$ and $H(q)\geq N(q)$. We can conclude that,

[23] Consistently, by a "new certified brand" we mean a GI label in the form of a certification mark or a mixed brand when the trademark is unknown to consumers.

when consumers have no knowledge regarding what technology is available in which area, the market price-quality schedule prevailing in the presence of a certification mark scheme is identical to the schedule prevailing absent any GI scheme, $P(q)$.

5. Welfare Implications

Depending on whether or not a *sui generis* scheme is in place, the market price-quality schedule that prevails in equilibrium is $P^G(q)$ or $P(q)$. As is typical in this type of reputation model, the minimum quality, q_0, for which no informational problems exist, sells at production cost. Similarly, the minimum quality guaranteed by the *sui generis* scheme, q_0^G, also sells at production cost when the product is certified.[24] Any other quality q in excess of the minimum quality, q_0, sells at a premium above production costs that is exactly equal to the one-time information cost that is needed in order to establish a reputation for quality q.

As can be easily verified by comparing (4) and (7), the price-quality schedules $P^G(q)$ or $P(q)$ overlap in the bottom range of the quality spectrum, while in the upper range of the quality spectrum $P^G(q)$ lies below $P(q)$. This means that the presence of a *sui generis* scheme leads to lower prices for high-quality products while the prices of lower qualities are unaffected. Lower prices for high-quality products are the result of reduced costs of establishing reputation in the upper quality range under the *sui generis* scheme. The cost reduction has two components, each of which is linked to the revelation of some information regarding the GI-certified product. The first piece of information regards the fact that the GI-certified product is produced with the GI technology (i.e., that the conditions of the area of production favor the attainment of quality). For any given value of the GI-specific MQS, q_0^G, such that $q_0^G < \tilde{q}$, the availability of the information regarding the technology of production curtails producers' incentives to milk their reputation by $c^G(q_0^G) - c(q_0^G)$ thereby increasing consumers' willingness to pay for a new GI-certified product by the same amount.[25] The second piece of information concerns the fact that the GI-certified product meets a stricter MQS than does a generic product, $q_0^G > q_0$. This curtails producers' incentives to milk their

[24] Clearly, certified quality q_0^G is viable only for $q_0^G \geq \underline{\tilde{q}}$.

[25] This effect occurs only for $q_0^G < \tilde{q}$, where $c(q_0^G) < c^G(q_0^G)$.

reputation by an additional $c(q_0^G) - c(q_0)$ and, by the same amount, increases consumers' willingness to pay for a new GI-certified product.

To the contrary, no information is revealed under the certification mark scheme that could lower the cost of building reputation compared to the case with trademarks only. Because all geographic names can be protected as GIs, registration itself does not convey any information regarding the actual technology used in production. As well, because no GI-specific MQS needs to be met, producers' incentive to milk their reputation is unchanged compared to the case in which only trademarks are used.

Given the effect on equilibrium market prices, the introduction of a *sui generis* scheme affects consumers and producers in different ways. Consumers, to the extent that they prefer high quality, are clearly better off with lower prices, while the effect on producer surplus depends upon whether or not the investment in reputation occurred before the introduction of the *sui generis* scheme. With zero discounted profits for new brands under every IP scenario, only producers with established brands (i.e., those that have invested in reputation before the introduction of the certification scheme) can be affected by the introduction of the *sui generis* scheme. We can conclude that the introduction of a *sui generis* scheme has the potential to increase aggregate welfare because it reduces the informational cost of building reputation for high quality in a market affected by asymmetric information problems. This conclusion provides a rationale for favoring a *sui generis* scheme over a certification mark scheme to provide IP protection for GIs. Moreover, the welfare gains are more likely to be larger when the introduction of the *sui generis* scheme occurs at an earlier stage, i.e., before the investments in reputation are sunk.

When the introduction of a *sui generis* scheme occurs after investments in reputation have taken place (hereafter *ex post*), welfare considerations regarding the introduction of a *sui generis* scheme need to take into account the effect on established producers (i.e., producers of an established brand). Starting from a situation of equilibrium in which producers have already invested in reputation, we analyze the case in which the government considers introducing a *sui generis* scheme. While established producers in the bottom-end range of the quality spectrum will not be affected by the introduction of the scheme, producers in the upper-end range of the quality spectrum might completely or partially lose their investment in reputation.

The bottom-end range of the quality spectrum in which established producers are not affected by the introduction of the scheme corresponds to $q \leq q^*$, where q^* represents the quality

of the non-certified product that would be purchased by the type of consumer who is indifferent between consuming a GI-certified product under the *sui generis* scheme and a non-certified product.[26] For all other qualities, $q > q^*$, established producers are at risk of completely or partially losing their investment in reputation when the *sui generis* scheme is introduced.

Specifically, there will be established brands that completely lose their reputation and are replaced by new GI-certified brands of the same qualities. Define the quality range Q^0 as follows:

$$Q^0 \equiv \begin{cases} [\hat{q}, \tilde{q}], & \text{if } q_0^G \in [\underline{q}, \overline{\underline{q}}) \\ [q_0^G, \tilde{q}], & \text{if } q_0^G \in [\overline{\underline{q}}, \overline{q}) \\ \varnothing, & \text{if } q_0^G \geq \overline{q} \end{cases}$$

In an equilibrium without a *sui generis* scheme, the qualities in Q^0 are supplied by producers that use the standard technology. As shown in appendix A1, if a *sui generis* scheme were introduced, all producers with established brands in the quality range Q^0 would lose their reputation because the introduction of a *sui generis* scheme makes cheating more attractive than maintaining the same quality. Finally, if these producers have access to the GI technology (e.g., when they can relocate to a GI region) or can sell their trademarks to producers within the GI region, then the loss of reputation is only partial. That producers operating in this quality range need to switch to a different technology to remain competitive is noteworthy because the technology they switch to is characterized by higher production costs.

Established brands in the quality range Q^0 are not the only brands produced with the standard technology that stand to completely lose their reputation. Depending on the shape of consumer preferences over quality, there will be a range of qualities to the left of Q^0 produced with the standard technology, and such that $q > q^*$, that no longer represents "good deals" for consumers, who now would rather purchase GI-certified products. These qualities will no longer be exchanged in the market.

Contrary to what intuition might suggest, the reputations of established brands produced with the GI technology (all of which are of quality $q \geq \tilde{q}$) are also negatively affected by the introduction of the *sui generis* scheme. But, unlike the case of established brands produced using the

[26] The value of q^* depends upon the shape of consumer preferences and on the value of q_0^G. See Appendix A3 for details regarding consumers selection of qualities.

standard technology, brands produced using the GI technology whose quality is at least q_0^G face a partial loss in reputation and are not forced out of the market. As shown in appendix A2, in fact, their ability to certify affects their incentive to cheat. For them, the best response is to continue producing the same quality and to start certifying as soon as the system is introduced.[27] We conclude that, given the complete and partial losses in reputation of a subset of established producers, the *ex post* introduction of a *sui generis* scheme is desirable only if consumer gains are larger than the losses in reputation of established brands.[28]

Finally, we address the following question: if a *sui generis* scheme were to be introduced before any investment in reputation has taken place, what should the GI-specific MQS, q_0^G, be in order to maximize aggregate welfare? From an *ex ante*[29] perspective, the optimal value of the GI-specific MQS maximizes aggregate consumer surplus. The value of the GI-specific MQS affects the shape and position of the equilibrium market price-quality schedule and hence the price-quality combinations that are available to consumers. The available price-quality combinations, in turn, determine the surplus that each consumer type can derive in the market. Hence, the specific welfare-maximizing value of the GI-specific MQS will generally depend on the distribution of consumer types. Nevertheless, as discussed in appendix A3, for all distributions of consumer types the optimal value of the GI-specific MQS has to balance the welfare losses of consumers whose purchase is constrained by the value of q_0^G and the welfare gains to consumers who purchase the GI-certified product. It follows that the welfare-maximizing value of the GI-specific MQS belongs in the quality range above $\underline{\overline{q}}+\varepsilon$, where $\underline{\overline{q}}+\varepsilon$ is defined as the smallest value of q_0^G such that at least one consumer type purchases the quality level corresponding to the GI-specific MQS.

[27] This is the case independent of whether or not the introduction of the system is announced ahead of time or unexpectedly introduced.

[28] Another aspect that needs to be taken into consideration is the welfare loss that occurs during the "transition" period (i.e., the period in which investment takes place). During the transition period quality is misallocated; new entrants sell products of heterogeneous quality at the same price and consumers are unable to select the exact quality that maximizes their utility.

[29] As opposed to *ex post*, here *ex ante* refers to the case in which the introduction of the *sui generis* scheme occurs before any investment in reputation has taken place.

5.1. Welfare Implications of a Certification Mark Scheme with Screening

Our conclusion that a certification mark scheme for GIs does not convey any information that could lower the cost of building reputation below the cost required when only trademarks are available is predicated on two assumptions regarding consumers: (i) consumers have no knowledge regarding which technology is available in which area and (ii) consumers have no preferences over origin *per se* (rather than as a signal for quality). When either assumption is relaxed, there conceivably are welfare gains from a certification mark scheme over a situation with only trademarks. Nevertheless, as we will show, the result that a *sui generis* scheme is preferable in terms of welfare to a scheme based on certification marks holds true even when consumers have full information regarding which technology is available in which area and value origin *per se* in addition to quality.

To this end we consider the following modification of the certification mark system in which an initial screening of geographic names based on the presence of a quality/geography nexus is introduced. We refer to this hypothetical scheme as the technology scheme. A technology scheme yields the same market price-quality schedule that a certification mark scheme would yield under the assumption that consumers have full knowledge of the production conditions in each region. This is the case because in either case (with a technology scheme or with a certification mark scheme with full information about regional production conditions) the same information – the technology used in production – is available to consumers.

Following the same procedure used thus far, we derive the market price-quality schedule that prevails with a technology scheme. The schedule can be written as follows:

$$P^T(q) \equiv \begin{cases} A(q), & \text{for } q \in [q_0, q^t) \\ T(q), & \text{for } q^t \geq \tilde{q}, \end{cases} \tag{10}$$

where we define q^t and q^{tt} as

$$A(q^t) = T(q^t)$$
$$A(q^t) = c^G(q^{tt}) + \omega,$$

and $T(q)$, the price-quality schedule for producers who use the GI technology and certify their product with the technology scheme, is

$$T(q) \equiv c^G(q) + r\left[c^G(q) - c^G(q_0)\right] + \omega \quad \text{for } q \geq q_0.$$

A comparison between (10) and (7) reveals that (i) for any given value of $q_0^G \leq q^{tt}$ every consumer type is at least as well off with the *sui generis* scheme as with the technology scheme because of lower

prices in the upper end of the quality range; and (ii) for any given value of $q_0^G > q^{tt}$ the scheme that provides the largest welfare depends on the distribution of consumer types. Specifically, for $q_0^G > q^{tt}$ the *sui generis* scheme leads to lower prices in the upper part of the quality spectrum, favoring consumers with relatively high values of θ, while the technology scheme might lead to lower prices in the intermediate quality range favoring consumers with intermediate values of θ. Finally, if the value of q_0^G can be chosen optimally so as to maximize aggregate welfare, the *sui generis* scheme is unambiguously better than the technology scheme for any given distribution of consumers. This is because it is always possible to set $q_0^G = q_0$.

The market price-quality schedule, $P^T(q)$, is represented by the bold curve in Figure 3. Specifically, Figure 3 represents the case with $q_0^G \leq q^{tt}$. To ease comparison, the schedule that would prevail with a *sui generis* scheme is also represented in Figure 3 by the dashed curve.

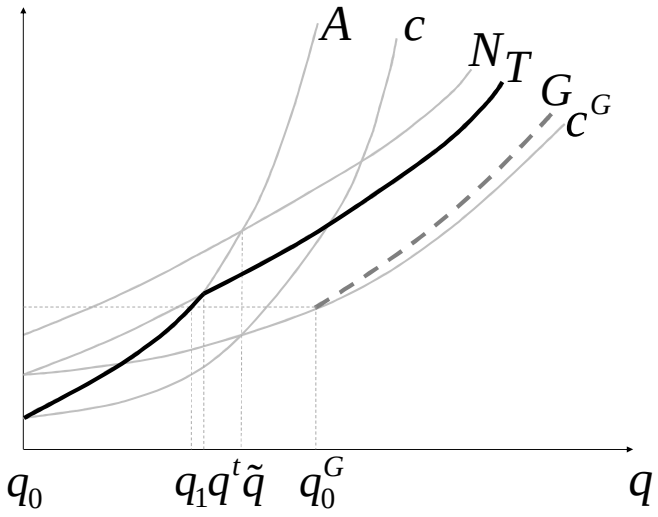

Figure 3. Market Price-Quality Schedule with a *Technology* Scheme

5.2.Trade Implications

In this section, we briefly discuss some welfare considerations regarding the introduction of a *sui generis* scheme in a trading context when reputation must be established independently in each country. We maintain the same partial equilibrium setup, add a second country – the rest of the world (ROW) – and allow for trade. We assume that the technology available in the home country is

the standard technology considered so far, $c(q)$, and that the two countries are otherwise identical; in particular, they have the same MQS, q_0, and discount rate, r. This setup is similar to Falvey (1989), but in Falvey each trading country has (only) one production technology, each with a range of comparative advantage.

We maintain the assumption that a *sui generis* scheme is in place in the country that is home to the GI (the home country) and consider two alternative scenarios for ROW: (i) ROW provides the same type of IP protection for GI as the home country (e.g., the same *sui generis* scheme), (ii) ROW does not provide IP protection for GIs. Given the setup, the general pattern of intra-industry trade is straightforward; in either scenario, ROW imports the higher end of the quality range, but the actual range depends upon whether ROW offers a *sui generis* scheme or not. Even though when reputation needs to be established independently in each country, trade alone does not "create a unified world market" (Falvey 1989, p. 611), the price-quality schedule that prevails with free trade is identical in both countries as long as they offer the same *sui generis* scheme, and coincides with (7). Instead, when ROW does not provide IP protection for GIs, the prevailing schedule in ROW is (4).

It follows directly that *ex ante* both countries have identical incentives to introduce a *sui generis* scheme, while *ex post,* ROW's producer losses involve a relatively smaller set of producers, those established producers operating in an intermediate range of the quality spectrum (using the standard technology), while the home country alone bears the losses of established producers operating in the upper range of the quality spectrum (those producers using the GI technology).

Finally, we comment on the informational role of country-of-origin labels (COOL) in markets where trademarks are important quality indicators. Falvey (1989) has shown that, in a setup in which countries are endowed with different technologies, COOL can reduce the cost of establishing reputation and can lower the price for high-quality products. Therefore in his setup, COOL regulations have a valuable non-protective role. In our framework, by contrast, when both countries have access to the same standard technology, COOL provisions are not sufficient to provide information to consumers regarding the quality of imports and hence are not a viable substitute for a *sui generis* scheme.

6. The Traditional Specialities Guaranteed Scheme

Next, we consider the traditional specialities guaranteed (TSG) scheme of the European Union. Like the *sui generis* scheme, the TSG scheme belongs to the set of the instruments used to foster product

quality within the EU policy framework but departs from the EU's GI scheme because of the absence of a link between the certified products and the geographic area of production. The aim of the TSG scheme is to allow high-quality products that are not necessarily linked to a geographic area to be differentiated from standard products.

Specifically, the TSG scheme certifies traditional products, such as "mozzarella" or "pizza napoletana," independently of the location in which production takes place. According to EU Regulation 509/2006, a traditional product is produced using traditional raw materials, has traditional composition or is obtained by a mode of production and processing that reflects traditional methods.[30] Even though not linked to a specific area of production, traditional products share many features with GIs. In particular, traditional product markets are also fraught with asymmetric information and moral hazard problems and are typically characterized by competitive conditions and by the concurrent use of certification and trademarks.

Similar to the case of product names registered under the *sui generis* schemes, registered TSG products are defined by a product specification, which includes "the key elements that define the product's specific character" (EU Regulation 509/2006 Art. 6). TSG certified products are subject to inspection to verify compliance with the product specification. We do not explicitly model what a traditional ingredient or a traditional mode of production or processing is, but rather interpret the traditional nature of these products as conferring them a given minimum quality, and in what follows we provide a justification for why this is a reasonable assumption.

As already discussed, we have modeled the quality/geography nexus required for a GI under the *sui generis* scheme as an attribute of the production technology*,* while we conceptualize the conditions for traditional products as a quality requirement. There is a striking conceptual difference between the production conditions associated with a quality/geography nexus and those characterizing traditional products. The former are typically present in marginal or mountain areas, among others, where topography and climatic conditions (e.g., including exposure, humidity, daily temperature swings etc.) favor the attainment of a high level of quality while limiting the ability to cost-efficiently provide standard mass-production commodities (e.g., limited mechanization possibilities). Hence, we have assumed production technologies with comparative advantage over

[30] The TSG scheme offers two types of registration of a name: with or without "reservation." When a name is registered with reservation, it can only be used to label the product made in accordance with the specification. When the name is registered without reservation, it can be used for products that do not correspond to the specification but without the indication "traditional specialities guaranteed," the abbreviation "TSG" or the Community symbol (EU 2009b).

different quality ranges. To the contrary, the traditional feature of products under the TSG scheme has little to do with the conditions of the production environment or the technology available for production but is rather attributable to the use of ingredients and production procedures that favor the attainment of specific organoleptic characteristics, appearance, consistency, taste, aroma, chemical, microbiological and other characteristics that are associated with high quality. For example, the product specification for "pizza napoletana" defines the handling, kneading, rising and baking process (including specific conditions regarding temperature and duration) that are considered necessary for high-quality pizza (see the Official Journal C40, February 14, 2008). We conceptualize these features in a one-dimensional quality scale.

The TSG scheme is currently under scrutiny within the European Union, and several policy options have been discussed, including abandonment of the scheme. A concern is that, to date, there is only a limited use of this scheme (only about 30 products are currently registered or have been published and 14 others have applied for protection). Also, it seems that the terminology and logos used to identified TSG-certified goods have proven to be difficult for the public to understand. Despite a widespread support for the scheme from stakeholders (EU 2009b), some confusion remains on the effectiveness of the scheme as a tool for fostering the provision of quality. Our analysis offers a rationale for maintaining the TSG scheme and shows the potential welfare gains that the TSG scheme can bring about compared to the *sui generis* scheme.

We frame the TSG scheme as a scheme with no limitation regarding accessibility to certification or a location of production requirement but with an MQS requirement.[31] Certified products under the TSG scheme are identified by a TSG logo.[32] With this scheme, the presence of a TSG logo informs consumers that the product meet the MQS, q_0^S.

Following the same procedure used thus far, we derive the market price-quality schedule that prevails with a TSG scheme. The schedule can be written as follows:

[31] Outside the food sector, there are many examples of certification schemes based on quality standards only. These include, among others, the *CE* mark indicating that products meet the health and safety requirements set out in the European Directives and the certification marks administered by Underwriters Laboratories for electronic devices.

[32] The TSG logo is available at http://ec.europa.eu/agriculture/quality/logos/index_en.htm.

$$P^S(q) \equiv \begin{cases} \begin{cases} A(q), & q \in [q_0, q^s) \\ M(q), & q \in [q_0^S, \tilde{q}) \\ L(q), & q \geq \tilde{q} \end{cases} & \text{for } q_0^S \in [\underline{q}, \tilde{q}) \\ \begin{cases} A(q), & q \in [q_0, q_1) \\ G(q), & q \geq q_0^S \end{cases} & \text{for } q_0^S \in [\tilde{q}, \overline{q}) \\ \begin{cases} A(q), & q \in [q_0, \tilde{q}) \\ N(q), & q \in [\tilde{q}, q_2) \\ G(q), & q \geq q_0^S \end{cases} & \text{for } q_0^S \geq \overline{q} \end{cases} \tag{11}$$

where $\underline{q}$ and q^s are defined as

$$A(q^s) = c(q_0^S) + \omega,$$
$$\underline{q} = \max\left\{ q_0, q \mid c^G(q) = \frac{\omega}{r} + c(q_0) \right\},$$

and $M(q)$, the price-quality schedule for producers who use the standard technology and certify, and $L(q)$, the price-quality schedule for producers who use the GI technology and certify, are respectively

$$M(q) \equiv \begin{cases} c(q) + r\left[c(q) - c(q_0^S) \right] + \omega, & \text{for } q \geq q_0^S \quad \text{for } q_0^S < \tilde{q} \\ c(q) + r\left[c(q) - c^G(q_0^S) \right] + \omega, & \text{for } q \geq q_0^S \quad \text{for } q_0^S \geq \tilde{q}, \end{cases}$$

and

$$L(q) \equiv \begin{cases} c^G(q) + r\left[c^G(q) - c(q_0^S) \right] + \omega, & \text{for } q \geq q_0^S \quad \text{for } q_0^S < \tilde{q} \\ G(q), & \text{for } q_0^S \geq \tilde{q}. \end{cases}$$

$M(q)$ and $L(q)$ are piecewise defined because, depending on the value of q_0^S, the optimal cheating strategy is either producing or outsourcing the minimum quality.

Finally, implicitly define q^m as the quality at which $M(q)$ and $G(q)$ meet when the minimum quality standard of the TSG scheme, q_0^S, has the same value as the GI-specific MQS (i.e., $q_0^S = q_0^G$),

$$M(q^m \mid q_0^G) = G(q^m \mid q_0^G).$$

Given a common value of the MQS standard across schemes (equal to q_0^G), the TSG scheme and the *sui generis* scheme differ in two regards. First, compared to a *sui generis* scheme, the TSG scheme reduces the informational content of the certified product since it does not pin down the technology used in production. This expands the cheating options of producers who use the GI technology when the value of the MQS is such that $q_0^G < \tilde{q}$. As an effect, when the value of the MQS is such that $q_0^G < \tilde{q}$, the TSG scheme leads to higher prices for qualities $q > q^m$ than the *sui generis* scheme. For the other values of the MQS, the cheating options of producers who use the GI technology are unaffected.[33]

The second difference between the *sui generis* and the TSG schemes concerns producers' access to the certification, because the TSG scheme is available to all producers independently of the technology used in production. The ability to certify lowers the cost of building reputation for producers who use the standard technology by increasing consumers' willingness to pay for their new but certified brands.[34] Hence, for $q_0^G < \tilde{q}$, the TSG scheme leads to lower prices for all qualities $q \in (\underline{\bar{q}}, q^m)$ than the *sui generis* scheme. For values of the MQS such that $q_0^G \geq \tilde{q}$, the ability to certify for producers who use the standard technology is not sufficient to make them competitive with producers who use the GI technology. It follows that, for a common value of the MQS across the two systems and such that $q_0^G < \tilde{q}$, qualities in the range $q \in (\underline{\bar{q}}, q^m)$ can be supplied at a lower cost with the TSG scheme while quality in the range $q > q^m$ can be supplied at a lower cost with the *sui generis* scheme. Hence, which scheme leads to higher aggregate surplus depends on the distribution of consumers $F(\theta)$.

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[33] For values of the MQS such that $q_0^G < \tilde{q}$, the TSG scheme expands the cheating options of producers who use the GI technology, thereby decreasing consumers' willingness to pay for new but certified brands by $c^G(q_0^G) - c(q_0^G)$, and increasing the reputation-building costs for these producers. In contrast, when $q_0^G \geq \tilde{q}$, the cost of producing the MQS quality is lower with the GI technology, $c^G(q_0^G) \leq c(q_0^G)$, and therefore outsourcing is not a cost-saving option for producers that use the GI technology. In this case, and independent of the type of certification scheme (TSG or *sui generis*), the best producers can do when cheating is to reduce quality to q_0^G.

[34] Consumers' willingness to pay increases by $c(q_0^G) - c(q_0)$ if $q_0^G < \tilde{q}$ and by $c^G(q_0^G) - c(q_0)$ if $q_0^G \geq \tilde{q}$.

Finally, we consider the possibility of choosing the values of the MQS, one for each certification scheme, so as to maximize aggregate welfare and show, in appendix A4, that when it is possible to choose the values of the MQSs optimally, the TSG scheme yields at least the same level of welfare as the *sui generis* scheme. We also show that the TSG scheme does strictly better than the *sui generis* scheme for some populations of consumers, $F(\theta)$, for which the optimized value of the MQS for the *sui generis* scheme, q_0^{G*}, happens to be such that $q_0^{G*} < \tilde{q}$.

The market price-quality schedule, $P^M(q)$, is represented by the bold curve in Figure 4, which specifically represents the case of $q_0^G = \underline{q} < \tilde{q}$. To ease comparison, the price-quality schedule that would prevail with a *sui generis* scheme is also represented in Figure 4 by the dashed curve.

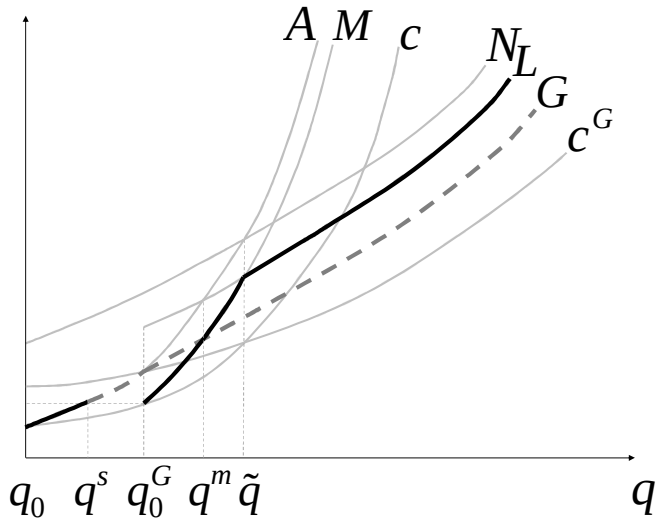

Figure 4. Price-Quality Schedule with a TSG scheme (Note $q_0^G = \underline{q}$)

7. Conclusions

We contribute to the stream of literature sparked by the pioneering work of Shapiro (1983) by extending the theory of firm reputation to a context in which both certifications and trademarks are available to firms as quality indicators. We tailor our analysis to assess the role of certification and trademarks for food products with a regional identity, known as geographical indications, whose markets, typically characterized by competitive conditions, are commonly fraught with asymmetric information and moral hazard problems. Specifically, we provide a rationale for producers of such goods to use certification (in addition to trademarks) when product quality could be alternatively sustained through trademarks, a fact that is consistent with the empirical evidence that the concurrent use of certification and trademarks is common for such products.

Several instructive aspects of the role of certification in quality provision and reputation formation that are applicable to many forms of certification (not just GIs) emerge from the model. First, we show that certification reduces the divergence between the reputation equilibrium and the equilibrium that would prevail under perfect information by lowering the cost of establishing reputation compared to a situation with only trademarks. Hence, certification improves the ability of reputation to operate as a mechanism for assuring quality. Second, we show that the welfare gains are more likely to be larger when the introduction of a certification scheme occurs at an earlier stage so as to limit the potential losses in the value of already established reputations. This is because certification, by raising the price that entrants can command, reduces the cost of building a reputation and hence the value of an established reputation. This observation also provides a rationale for industry resistance to the introduction of certification from eligible producers who have already committed resources towards building a reputation at the time the certification is introduced.

With this paper we expand the existing literature on geographical indications by shifting the focus to explicitly consider the design of the certification scheme. This is relevant because, as our model reveals, the design plays an important role in mitigating the informational problems in the market. Moreover, we show that different designs might be optimal for different populations of consumers depending on the distribution of their tastes for quality. From a policy perspective, our model offers specific recommendations concerning the current ongoing debate and negotiations on geographical indications at both the WTO and the EU levels. With regard to the type of IP protection instrument for GIs, our model indicates that a *sui generis* scheme based on *appellations* is preferable to standard instruments, such as certification marks, that are currently used in many important markets, including the United States. We have identified a feature of certification marks

(i.e., the fact that eligibility for registration is not conditioned upon the presence of a demonstrable link between the characteristics of a geographic region and the quality of the product) that limits their ability to convey information to consumers regarding the quality of GIs and lower the cost of building reputation (in this sense, certification marks are no better than trademarks). In addition, we show that even if the current certification mark system were to be adapted to include an initial screening of products seeking IP protection based on the presence of a demonstrable quality/geography nexus, a *sui generis* scheme, which combines geography and quality requirements, would still provide larger welfare gains than certification marks.

Our model also sheds light over the role of the EU's traditional specialities guaranteed scheme in the provision of high-quality products that are not linked to a geographic area. This scheme, which is currently under scrutiny by the EU commission, is used to register and protect the names of traditional products (i.e., products that are produced using traditional raw materials, have traditional composition or are obtained by a mode of production and processing that reflects traditional methods). Such a scheme, based exclusively on quality (rather than on geographic) requirements, certifies that traditional products meet given quality standards. We show that, for a given common value of the MQS, the traditional specialities guaranteed scheme more strongly reduces the cost of providing intermediate quality products compared to the *sui generis* scheme, while the *sui generis* scheme is better suited for reducing the cost of providing the higher end of the quality spectrum. Compared to the *sui generis* scheme, the traditional specialities guaranteed scheme has the advantage of extending the accessibility of certification to a larger set of producers. When it is feasible to optimally set the value of the MQS, this advantage leads to welfare gains compared to the *sui generis* scheme when the distribution of consumer preferences is clustered in the middle of the quality range. Finally, with regard to the informational role of country-of-origin labels, our model suggests that COOL provisions are not sufficient to provide information to consumers regarding the quality of imports that could lower the cost of building reputation and hence are not a viable substitute for a geographical indications scheme.

Appendix

This appendix establishes the welfare results discussed in sections 5 and 6.

Appendix A1: Proof that the reputation of established brands in the quality range Q^0 is lost when a *sui generis* scheme is introduced

First, suppose that a *sui generis* scheme is introduced at the beginning of time t unexpectedly. At time t, producers who have access to the GI technology can invest in reputation (i.e., produce a quality $q \geq q_0^G$ and sell it below production costs). At time $t+1$, reputation, $R = q$, is established and, from time $t+1$ on, the new equilibrium schedule $P^G(q)$ prevails in the market. Anticipating the new equilibrium schedule, a producer of quality $q \in Q^0$ with an established brand will be better off deviating at time t (i.e., producing the minimum quality) than maintaining the same quality from time t on if

$$-c(q) + \frac{1}{r}\left[P^G(q) - c(q)\right] < -c(q_0).$$

As can be readily verified, the above inequality can be rewritten as $P^G(q) < A(q)$, where $P^G(q)$ and $A(q)$ are given by (7) and (2) respectively. Over the range in which $P^G(q)$ is defined, $P^G(q) < A(q)$ always holds. It follows that producers are better off by deviating at time t. This is also true for those producers operating in the quality range where $P^G(q)$ is not defined (the discontinuity range), since the price at which they would be able to sell their products at time $t+1$ is strictly less then $A(q)$ (consumers can find higher qualities at prices $A(q)$). Knowing that it is optimal for these producers to cheat, consumers will not be willing to pay more than $c(q_0)$ for these brands at time t. It follows that established brands in the quality range Q^0 completely lose their reputation as soon as the *sui generis* scheme is introduced. Finally, if these producers have access to the GI technology (i.e., if they can relocate to a GI region) or can sell their trademarks to a producer with access to the GI technology, then the loss of reputation might be partial.

In the alternative case in which the introduction of a GI scheme at time t is announced and expected by both producers and consumers at time $t-1$, producers would immediately cheat and lose their reputation at time $t-1$. Consumers would correctly predict this behavior and would be willing to pay at most $c(q_0)$ in $t-1$. Finally, in the alternative case where in time $t-1$ only

producers anticipate the introduction of a *sui generis* scheme (but consumers are unaware), producers immediately cheat. Consumers, being unable to anticipate producers' behavior, are surprised by lower-than-expected qualities while producers recoup their original investments in reputation.

Appendix A2: Proof that the reputation of established brands of quality $q \geq q_0^G$ produced with the GI-technology is partially lost when a *sui generis* scheme is introduced

When a *sui generis* scheme is introduced, producers of established brands who use the GI-technology have the following options: (i) maintain the same quality q without certifying; (ii) cut the quality to q_0; (iii) maintain the same quality q and certify; (iv) cut the quality to q_0^G and certify.

Conditional on not certifying, producers are better off by cutting their quality to q_0, because their credibility constraint,

$$-c^G(q)+\frac{1}{r}\left[G(q)-c^G(q)\right] \geq -c(q_0),$$

does not hold for any value of $q \geq \tilde{q}$. Observing the absence of certification, consumers correctly anticipate that producers have cut their quality to q_0. Hence, conditional on not certifying, producers lose their reputation immediately and their future profits, discounted to time t, are equal to zero. Conditional on certifying, the credibility constraint is

$$-c^G(q)-\omega+\frac{1}{r}\left[G(q)-c^G(q)-\omega\right] \geq -c^G(q_0^G)-\omega.$$

Because, conditional on certifying, the credibility constraint holds (with equality) for all $q \geq \tilde{q}$, maintaining the same quality is a best response for producers. Observing the presence of certification, consumers correctly anticipate that maintaining quality is optimal for producers and, in this case, producers' future profits, discounted to time t, are equal to

$$N(q)-c^G(q)-\omega+\frac{1}{r}\left[G(q)-c^G(q)-\omega\right]=(1+r)\left[c^G(q)-c^G(q_0)\right]-\left[c^G(q_0^G)+\omega-c(q_0)\right],$$

By (6), these discounted profits are strictly positive for any $q \geq \max\left\{q_0^G, \tilde{q}\right\}$. We can conclude that, for producers of established brands of quality $q \geq \max\left\{q_0^G, \tilde{q}\right\}$ who use the GI-technology, the best response to the introduction of a *sui generis* scheme is to maintain and certify the same quality.

Finally, the future profits, discounted to time t, that producers would earn if no *sui generis* scheme were to be introduced are equal to $(1+r)\left[c^G(q)-c(q_0)\right]$. Hence, since for any $q \geq \max\left\{q_0^G, \tilde{q}\right\}$

$$(1+r)\left[c^G(q)-c(q_0)\right] > (1+r)\left[c^G(q)-c^G(q_0)\right]-\left[c^G(q_0^G)+\omega-c(q_0)\right],$$

the value of reputation is partially lost when the *sui generis* scheme is introduced. Finally, for producers with quality $\tilde{q} \leq q < q_0^G$ the loss of reputation is complete because these producers do not have the option to maintain the same quality and certify.

Appendix A3: Consumer Selection of Qualities and the Optimal Value of the MQS for a *sui generis* Scheme

If a *sui generis* scheme were to be introduced before any investment in reputation has taken place, what should the value of q_0^G be in order to maximize welfare? From an *ex ante* perspective, the optimal value of q_0^G maximizes aggregate consumer surplus. Based on our assumptions regarding consumer preferences, consumers can be divided into different groups depending on the product they opt to purchase: nonpurchasers $\left(0 \leq \theta < \theta_0\right)$; those who purchase standard product of minimum quality $\left(\theta_0 \leq \theta < \theta_1\right)$; those who purchase standard product of quality in excess of the minimum $q > q_0 \left(\theta_1 \leq \theta < \theta_2\right)$; those who purchase non-certified product from the GI region(s) $\left(\theta_2 \leq \theta < \theta_3\right)$; those who purchase GI-certified product of quality q_0^G $\left(\theta_3 \leq \theta < \theta_4\right)$; and those who purchase GI-certified product of quality $q > q_0^G$ $\left(\theta_4 \leq \theta < \bar{\theta}\right)$. Depending on the value of q_0^G one or more of these groups could be empty. Whereas the specific value of q_0^G that maximizes aggregate consumer surplus depends on the specific distribution of consumer types, $F(\theta)$, the following considerations apply for all possible $F(\theta)$. First, we note that the effect on welfare of the specific value of the GI-specific MQS, q_0^G, occurs through its effect on the position of the equilibrium market price-quality schedule. Second, we argue that no value of q_0^G such that $q_0^G \in \left[\underline{q}, \bar{q}\right]$ can be optimal. Suppose, in contradiction, that $q_0^G \in \left[\underline{q}, \bar{q}\right]$. A small increase in the value of q_0^G from its

initial value shifts down $G(q)$ while leaving $A(q)$ unaffected. The downward shift in $G(q)$ increases the surplus of those consumers who purchase the GI-certified product, the price of which has decreased. When $q_0^G \in \left[\underline{q}, \overline{\underline{q}}\right]$, at most four groups of consumers exist: (1) nonpurchasers, (2) purchasers of q_0, (3) purchasers of standard product of quality in excess of the minimum, and (4) purchasers of GI-certified product of quality $q > q_0^G$. Hence, $\theta_2 = \theta_3 = \theta_4$.

Moreover, because no consumer's purchase is constrained by q_0^G, a small increase in the value of q_0^G does not reduce the surplus of other consumers. Without costs for raising the quality standard, but with benefits due to the lower prices of the GI-certified product, welfare can be increased by raising the value of q_0^G to $\overline{\underline{q}}$. A small increase in q_0^G also causes substitution by the marginal consumers that are indifferent between buying standard and GI-certified product, with no first-order effect on welfare. Moreover, given that consumer indifference curves are smooth, additional gains in welfare can be achieved by marginal successive increases of the value of q_0^G above $\overline{\underline{q}}$ until the quality choice of some consumers becomes constrained by the value of q_0^G. Once q_0^G has reached such value, call it $\overline{\underline{q}} + \varepsilon$, a new group of consumers is formed, $\left(\theta_3 \le \theta < \theta_4\right)$. $\overline{\underline{q}} + \varepsilon$ is defined as the smallest value of q_0^G such that at least one consumer type, θ_3, buys quality q_0^G. These consumers buy quality q_0^G. Any additional increase in the value of q_0^G above $\overline{\underline{q}} + \varepsilon$ involves welfare losses to this new group of consumers whose purchases are constrained by the value of q_0^G. We conclude that the welfare-maximizing value of q_0^G has to balance the welfare losses of these consumers and the welfare gains to consumers who purchase the GI-certified product and therefore belongs in the range between $\overline{\underline{q}} + \varepsilon$ and the value at which all consumers who purchase GI-certified product are constrained by the value of the GI-specific MQS. Finally, note that depending on $F(q)$, the optimal value of the MQS could be above $\overline{q}$. When this is the case, there might exist a group of consumers that purchase non-certified product produced with the GI technology $\left(\theta_2 \le \theta < \theta_3\right)$.

Appendix A4: Proof that the TSG scheme (i) is at least as good as the *sui generis* scheme and (ii) can be strictly better than the *sui generis* scheme in terms of aggregate welfare

Suppose that it is possible to choose values of the MQS for the *sui generis* scheme, q_0^G, and for the TSG scheme, q_0^S, that maximize aggregate welfare. Suppose that for a given distribution of consumer types, $F(\theta)$, the optimal value of q_0^G happens to be $q_0^{G*} \geq \tilde{q}$. When this is the case, the TSG scheme is at least as good as the *sui generis* scheme because it is always possible to set the value of q_0^S in such a way that the resulting price-quality schedule coincides with the schedule under the *sui generis* scheme (by setting q_0^S equal to q_0^{G*}). Suppose instead that for a given distribution of consumer types, the optimal value of q_0^G happens to be $q_0^{G*} < \tilde{q}$. When this is the case, it is also possible to find a value of $q_0^S > q_0^{G*}$ such that $c^G\left(q_0^{G*}\right) = c\left(q_0^S\right)$. Denote this value $\hat{q}_0^S$. For such a pair of values, q_0^{G*} and $\hat{q}_0^S$, the price-quality schedule that prevails with the *sui generis* scheme, $G(q)$, and the price-quality schedule that prevails with the TSG scheme, $L(q)$, overlap in the quality range $q \geq \hat{q}_0^S$. Also, on the other side of the quality spectrum, in the range $q < q_0^{G*}$, the relevant price-quality schedules of the two schemes coincide and are equal to $A(q)$. Only the *sui generis* scheme provides the intermediate quality range, $\left[q_0^{G*}, \hat{q}_0^S\right)$. This range is provided at a price $G(q)$, which is strictly increasing in q. Specifically, the price for the minimum quality in this range, q_0^{G*}, is $G\left(q_0^{G*}\right)$. Because by construction $M\left(\hat{q}_0^S\right) = G\left(q_0^{G*}\right)$, at the price $G\left(q_0^{G*}\right)$ the TSG scheme provides quality $\hat{q}_0^S$, which is the supremum of the quality range $\left[q_0^{G*}, \hat{q}_0^S\right)$. Hence, as long as there is at least one consumer who would purchase a quality in the range $\left[q_0^{G*}, \hat{q}_0^S\right)$ when the *sui generis* scheme is in place, the TSG scheme is strictly better than the *sui generis* scheme in terms of aggregate welfare, because this consumer can purchase a higher quality at a lower (or at the same) price.

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