

## **Strength of Protection for Geographical Indications: Promotion Incentives and Welfare Effects**

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### **Abstract**

This paper addresses the question of how the strength of protection for geographical indications (GIs) affects the GI industry's promotion incentives, equilibrium market outcomes and the distribution of welfare. We develop a model whereby GI producers engage in informative advertising by associating their true quality premium (relative to a substitute product) with a specific label emphasizing the GI's geographic origin. The extent to which the names/words of the GI label can be used and/or imitated by competing products (i.e., the strength of GI protection) determines how informative the GI promotion messages can be. Consumers in the model are assumed to have heterogeneous preferences, vis-à-vis the quality premium of the GI product, in a vertically differentiated framework. On the production side, both the GI industry and the substitute product industry are assumed to be competitive (with free entry), and to display upward-sloping industry supply functions. The model is calibrated and solved for alternative parameter values of interest. The computational results that we obtain show that the strength of GI protection has clear impacts on GI producers' incentives to promote their product. What strength is best from the aggregate welfare point of view, however, depends on the model's parameters, and an intermediate level of protection might be optimal in some circumstances. Producers of the GI and of the lower-quality substitute good have divergent interests: GI producers are generally better off with full protection, whereas the substitute good's producers prefer intermediate levels of protection (but they never prefer zero protection because they benefit indirectly if the GI producers' incentives to promote are preserved). For consumers, the preferred level of protection depends on the degree of knowledge of the substitute good, and a less-than-strongest protection may be optimal.

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## **Introduction**

Geographical Indications (GIs) are names of places or regions used to brand goods with a distinct geographical connotation. Many GIs pertain to wines and agricultural and food products. The characterizing feature of GI products is that some quality attribute of interest to consumers is considered to be inherently linked to, or determined by, the nature of the geographic environment in which production takes place (e.g., climate conditions, soil composition, local knowledge, traditional production methods)—i.e., to the notion of “terroir” (Josling 2006). GIs are similar to trademarks in that they identify the origin or the source of the good and help differentiate individual products among similar goods by communicating the “specific quality” that is due to the geographical origin (Kireeva 2009). This suggests that GIs might also share some of the key economic functions recognized for trademarks: to reduce consumers’ search costs for the desired product by avoiding confusion between goods that might appear identical before purchase (e.g., experience goods); and by providing firms with an incentive to supply the attributes that consumers of the trademarked product demand, i.e., a tool to facilitate reputation effects (Economides, 1998; (Landes and Posner, 2003). As a result of these perceived important economic functions, GIs have gained recognition as a distinct form of intellectual property (IP) rights in the TRIPS agreement of the World Trade Organization (WTO).

Whereas the TRIPS agreement requires WTO member countries to provide a minimum level of protection for GI names,<sup>1</sup> the form and strength of IP protection granted to GIs varies greatly among countries. In the European Union (EU), only products genuinely originating in a given area can be labeled with the area’s geographic name (i.e., the rights over the use of GI names for branding are exclusive to the producers operating in the designated production areas). In contrast with the strong protection of GI names enforced in the EU, in many other countries it is legally permissible to use GI names to label products that do not originate within the denoted geographical region (i.e., IP rights are not exclusive). For example, in the United States it is permissible to label sparkling wines produced in California as Champagne and to label a cheese made in Wisconsin as Romano.<sup>2</sup> These

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<sup>1</sup> Specifically, the TRIPS agreement requires WTO member countries to provide legal means to prevent any use of GI names “which constitutes an act of unfair competition” (TRIPS Art.22.2).

<sup>2</sup> This branding practice is subject to some restrictions including the fact that the “real origin” of the product must be specified on the label.

conflicting forms and strengths of IP protection are a source of ongoing controversy internationally and is a topic of current debate among WTO members (Fink and Maskus 2006). Some countries, predominantly those with large stocks of GI products, are in favor of more stringent IP policies for GIs. They are requesting that IP rights over GIs become exclusive, effectively reallocating IP rights from producers outside to producers inside the GI regions. But other countries, including the United States, oppose the strengthening of IP provisions for GIs.

The focus of this paper is on the “strength” of IP protection for GIs. Despite a number of recent contributions studying various economic aspects of GIs,<sup>3</sup> the question of how strong GI protection ought to be has not been modeled explicitly. Indeed, this question is somewhat elusive and does not appear to have been addressed directly in the context of trademarks either. To fill this gap we develop a model that parameterizes the level of IP protection for GIs in a meaningful and interesting way, and use the model to study the impact of alternative levels of protection. Specifically, we analyze how the strength of IP protection affects the incentives of producers to promote (i.e., to provide information to consumers about products) and, in turn, how it affects the distribution of welfare among producer groups and consumers, and across international markets. The polar case of strongest IP rights is represented by EU regulations on GIs which, as explained above, guarantee protection in any labeling context. To comply with EU regulations, labels used by producers outside a given GI area must be significantly different from the area’s geographical name so as to avoid even the “evocation” of the GI in the minds of the consumers. For example, the trademark Cambozola for blue cheese, which arguably sounds similar to Gorgonzola, was challenged on the basis of evocation of the protected designation of origin Gorgonzola. The other polar case is represented by the lack of any protection for GI names, a hypothetical case in which (plain) counterfeiting is allowed. Currently, US laws fall in between these two polar cases. As discussed earlier, US law allows, under certain conditions, the use of a GI name (or similar-sounding names) to label products independently of the product’s origin.

The model that we develop establishes a critical link between the strength of GI protection and the incentives for promotion efforts that can inform consumers on the value

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<sup>3</sup> Recent studies include Anania and Nistico 2004; Zago and Pick 2004; Lence et al. 2007; Moschini, Menapace and Pick 2008; Costanigro, McCluskey and Goemans 2010; Menapace and Moschini 2011.

of GI products. As noted by others (e.g., Menapace and Moschini, 2011), GI names can be thought of as collective trademarks and, as noted earlier, the economic value of trademarks is rooted in their ability to improve consumer information. To investigate what we perceive as the critical information issues in this setting, GI promotion is modeled as “informative advertising,” following one of the main strands of economic analysis of firms’ promotion activities (Bagwell, 2007). Specifically, when consumers lack information regarding the existence or the features of a product, there is scope for producers to expand market demand through promotion. GI promotion, in this context, attains the “extending reach” function of advertising discussed by Norman, Pepall and Richards (2008). Also, in line with existing literature on GIs (e.g., Zago and Pick 2004; Anania and Nisticó 2004; Lence et al. 2007; Moschini, Menapace and Pick 2008), our analysis is based on the assumption that GI products possess some “specific quality” due to their geographical origin, which cannot be replicated elsewhere, and that consumers value this GI attribute relative to generic versions of the product that can be produced elsewhere. Consequently, we model consumer demand in a vertical product differentiation setting.

By affecting the information effectiveness of GI labels, the strength of IP protection indirectly affects the ability of promotion to inform consumers in two possible ways. First, weak IP rights favor spillovers of information across products. For example, a promotional effort that informs consumers that “Pecorino Romano” is a “hard, salty and sharp” cheese also informs consumers that all Romano-labeled cheese is “hard, salty and sharp.” Hence, promotion by the producers of either the GI product or its generic substitutes expands the demand facing all firms when products share similar labels. Other things equal, the presence of spillovers increases the amount of information generated by each dollar spent in promotion, but also creates the potential for free-riding behavior. Second, weak IP protection might favor the dilution of the “specific” informational content of GI promotion. When the GI product and its substitutes share important name similarities, it might be more difficult for GI producers to successfully inform consumers about the distinctive features of the GI so that, with some probability, the piece of information regarding the GI’s specific quality goes unnoticed or is erroneously attributed to the generic substitute. *Ceteris paribus*, dilution reduces the amount of correct information produced from each dollar spent by GI producers, thereby reducing the incentive of GI producers to promote.

In this market environment, producers of the GI-like product have at least two types of incentives to use brand names that resemble the GI. One consists of the counterfeiting motive, i.e., firms producing a lesser quality product have the incentive to pass them off as that of a better quality competitor in order to capture the price premium associated with the better quality. A second motive is that firms can free ride on information spillovers (and information dilution) of the promotion of a substitute good. In this paper we concentrate on the second motive and thus assume that promotion/advertising is truthful. Still, as we will show, when producers of the substitute products are legally permitted to choose labels similar to those of GIs, the information spillover and dilution effects mentioned earlier turn out to play important roles.

We show that GI producers and producers of a lower-quality substitute good have divergent interests when it comes to the degree of IP protection for GIs. GI producers are generally better off with strong IP protection and, hence, they are likely to benefit from a strengthening of current GI provisions in important markets, such as the United States, where relatively weak protection is currently afforded to GIs. For producers of the substitute good, the largest gains from GI protection are achieved with an intermediate level of protection: whereas they never prefer full protection, zero protection is also always dominated by an intermediate level from their point of view (the information provided by the GI industry's promotion benefits the substitute good producers by expanding the demand for their goods via spillovers/dilution). Consumers may well prefer lesser strength of GI protection. This is the case when there is either very poor or very good knowledge of the existence and the basic features of the good. When the knowledge of the good in question is low, spillovers of information generated under relatively weak GI protection favor market participation (spillovers of information inform consumers about a lower-priced generic good). When the good's existence and generic features are well known to consumers, an overly strong GI protection tends to raise the price of the GI good (promotion is oversupplied from their viewpoint). But the strongest GI protection is optimal for consumers at intermediate levels of knowledge of the substitute good. In this case, the main contribution to welfare from GI promotion comes from increasing market reach through accurate information provided by promotion.

## The Model

We consider a market with two goods, a GI product (labeled G) and a substitute good (labeled S). On the demand side, it is assumed that these two goods are vertically differentiated in the sense of Mussa and Rosen (1978). Both products G and S are characterized by the same basic attributes measured by the parameter  $u > 0$ . Product G, in addition, is characterized by a “specific quality” that is measured by the parameter  $h > 0$  (both  $u$  and  $h$  are exogenous). Consumers are heterogeneous vis-à-vis their preference for quality. Specifically, we assume a population (i.e., potential market) of mass  $M \in \mathbb{R}_{++}$  of consumers with uniformly distributed types  $\theta \sim U[0,1]$  and unit demand. For a consumer of type  $\theta$  who is fully informed, preferences are characterized as follows:

$$(1) \quad U = \begin{cases} \theta(u+h) - p_G & \text{if one unit of product G is purchased} \\ \theta u - p_S & \text{if one unit of product S is purchased} \\ 0 & \text{if nothing is purchased} \end{cases}$$

where  $p_G$  and  $p_S$  are the prices of goods G and S, respectively.

Good G is assumed to be produced by a competitive industry with free entry, with numerous potential firms and diseconomies of scale at the industry level. This characterization of a typical GI industry is consistent with common institutional features of GI standards and captures some key elements of the production setting (Moschini, Menapace and Pick 2008). Specifically, we assume that each potential firm either produces at an optimal efficient scale, equal to  $\ell > 0$ , or stays out of the market. Firms are heterogeneous with respect to their production cost, which is determined by the inefficiency parameter  $\eta_G$ . For simplicity, we assume that the per-unit cost of production for a firm of type  $\eta_G$  is equal to  $c_G(\eta_G) = v_G + \delta_G \eta_G$ , and that there is a large number  $H_G$  of potential GI producers. Specifically, the inefficiency parameter is uniformly distributed  $\eta_G \sim U[0, H_G]$  with unit density. The parameters of this cost function satisfy  $v_G \geq 0$  and  $\delta_G \geq 0$ . Note that when  $\delta_G > 0$  the GI industry is characterized by an increasing aggregate marginal cost function, i.e., an upward sloping aggregate supply. Similarly, the S-good industry is also assumed to have an upward-sloping aggregate supply, with the per-unit cost of production

for a firm of type  $\eta_S$  equal to  $c_S(\eta_S) = v_S + \delta_S \eta_S$ , where  $v_S \geq 0$  and  $\delta_S \geq 0$ , and  $\eta_S \sim U[0, H_S]$  with unit density.

As noted, GI firms act as independent profit-maximizers when deciding whether or not to (i.e., whether to join the industry) and take prices and promotion costs as given. But because GI firms share the GI label, the decision of how much to promote is assumed to be made collectively by the producer association representing the GI industry so as to maximize the aggregate industry profit (Lence et al. 2007; Moschini, Menapace and Pick 2008). Promotion costs are shared equally on a per-firm (or, equivalently, per-unit) basis. We denote by  $F \geq 0$  the aggregate investment in promotion by sector G.

#### *Promotion, Consumer Information and the Strength of IP Protection*

A critical element of the model being developed is to define the number of consumers who are informed of the GI product. Following the approach pioneered by Butters (1977), suppose that the promotion budget  $F$  buys a given number  $F/t$  of advertising messages that randomly reach one (and only one) consumer, where  $t > 0$  is the unit cost of promotion. Then the probability that a given consumer remains uninformed after the GI promotion campaign (i.e., she does not get any of the messages) is  $(1 - 1/M)^{F/t}$ . This approach to model informative advertising has been used extensively for differentiated products (Grossman and Shapiro, 1984; Tirole, 1988, chapter 7; Hamilton, 2009). For a large market size,  $(1 - 1/M)^{F/t} \cong e^{-F/tM}$ , and so the fraction of the market reached by the GI promotion efforts, labeled  $\phi_G$ , can be written as  $\phi_G = 1 - e^{-F/tM}$ . Similarly, the market reach  $\phi_S$  of the substitute good could be related to promotion activities undertaken by the producers of this good. To focus on the promotion incentive effects for GI producers, however, in what follows we will abstract from an explicit characterization of such as a step and will take  $\phi_S$  as given.<sup>4</sup>

To be more specific, the GI industry promotes its product by associating its overall quality level  $(u + h)$  with its GI label  $\Lambda_G$ . That is, the promotion messages of the GI

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<sup>4</sup> This condition could be rationalized from a number of perspectives. For instance, the industry of the substitute good could lack a structure for the explicit promotion of its product, but this product could already be known to a fraction  $\phi_S$  of consumers because of pre-existing shopping patterns.

industry consist of a pair  $\{\Lambda_G, u+h\}$  which, by the foregoing, reaches a fraction  $\phi_G$  of consumers. Correspondingly, we can think of the promotion messages of the substitute product as the pair  $\{\Lambda_S, u\}$  having reached a fraction  $\phi_S$  of consumers. Hence, the fraction of the market reached by either, both, or none of the messages is as represented in Table 1.

Table 1. Promotion messages and market reach

		Message $\{\Lambda_G, u+h\}$	
		No	Yes
Message $\{\Lambda_S, u\}$	No	$(1-\phi_S)(1-\phi_G)$	$\phi_G(1-\phi_S)$
	Yes	$\phi_S(1-\phi_G)$	$\phi_G\phi_S$

The next step is to decide what fraction of the market associates which quality with each label. In principle each label could be associated with one of three qualities  $\{0, u, u+h\}$ . But because promotion is by assumption truthful, if the labels  $\Lambda_G$  and  $\Lambda_S$  were perfectly distinct, consumers would either be ignorant (if a promotion message was not received), or associate the correct quality to each label. The distinctiveness of the labels  $\Lambda_G$  and  $\Lambda_S$ , in turn, depends on the strength of protection afforded to GIs. For example, consider the case of feta cheese, where GI producers are located in Greece and the feta-like products can be produced anywhere. If the word “feta” can be used by both G and S producers alike (which is possible in the Unites States, but not in the EU), it is possible some consumers remain confused about the distinction between G-feta and S-feta, even if they have received the corresponding messages.

To fix ideas, consider the polar case where the label of the S product is allowed to be identical to that of the G product. In such a case consumers cannot distinguish the goods based on their labels and they, by necessity, associate the same quality to both labels. Consumers who only got the message  $\{\Lambda_S, u\}$  will associate quality  $u$  with either label; consumers who only got the message  $\{\Lambda_G, u+h\}$  will associate quality  $u+h$  with either

label; and consumers who got both messages will be confused. One way to resolve the confusion would be to randomly associate one of the two qualities with either label, say with the same probability. In such a case, a fraction  $\phi_S(1 - \phi_G) + \phi_S\phi_G/2$  of the market will associate quality  $u$  with either label, a fraction  $\phi_G(1 - \phi_S) + \phi_S\phi_G/2$  of the market will associate quality  $u$  with either label, and a fraction  $(1 - \phi_S)(1 - \phi_G)$  of the market will remain uninformed (i.e., will associate zero quality with either label).

Generalizing the foregoing approach, we parameterize the strength of GI protection in terms of the parameter  $\gamma \in [0,1]$ , where  $\gamma = 0$  denotes identical labels, and  $\gamma = 1$  denotes perfectly distinct labels. Specifically we postulate that, if a consumer only got one message, she will attach the correct label to the quality stated in the message only with probability  $\gamma$ , and with probability  $(1 - \gamma)$  she will attach the quality in the message to both labels. Similarly, a consumer who received both messages will correctly associate qualities and labels with probability  $\gamma$  and with probability  $(1 - \gamma)$  she will associate one of the two qualities (with equal probability) to both labels. Hence, for given market reach parameters  $\phi_G$  and  $\phi_S$ , the shares of the market that associate which quality to which label are as represented in Table 2.

Table 2. Consumer information and market reach

		Label $\Lambda_G$		
		0	$u$	$u + h$
Label $\Lambda_S$	0	$(1 - \phi_S)(1 - \phi_G)$	-	$\gamma\phi_G(1 - \phi_S)$
	$u$	$\gamma\phi_S(1 - \phi_G)$	$(1 - \gamma)\phi_S(1 - \phi_G) + (1 - \gamma)\phi_G\phi_S/2$	$\gamma\phi_G\phi_S$
	$u + h$	-	-	$(1 - \gamma)\phi_G(1 - \phi_S) + (1 - \gamma)\phi_G\phi_S/2$

### *Consumers' Choices*

Given prices  $p_G$  and  $p_S$  of goods G and S, for consumers who are perfectly informed about the existence and attributes of both G and S products—which, from the foregoing, happens with probability  $\gamma\phi_G\phi_S$ —there is a meaningful choice between product G, product S or the outside option with zero normalized net utility, as per the utility function in equation (1). Consumers who only receive the G message and correctly retain it—which happens with probability  $\gamma\phi_G(1-\phi_S)$ —will choose according to the following utility function:

$$(2) \quad U = \begin{cases} \theta(u+h) - p_G & \text{if one unit of good G is purchased} \\ 0 & \text{if nothing is purchased} \end{cases}$$

Consumers who only receive the S message and correctly retain it—which happens with probability  $\gamma\phi_S(1-\phi_G)$ —will choose according to the following utility function:

$$(3) \quad U = \begin{cases} \theta u - p_S & \text{if one unit of good S is purchased} \\ 0 & \text{if nothing is purchased} \end{cases}$$

Consumers who associate the same utility level  $u$  to both labels—which happens with probability  $(1-\gamma)\phi_S(1-\phi_G) + (1-\gamma)\phi_G\phi_S/2$ —will choose according to the following perceived payoff function:

$$(4) \quad \tilde{U} = \begin{cases} \theta u - p_G & \text{if one unit of good G is purchased} \\ \theta u - p_S & \text{if one unit of good S is purchased} \\ 0 & \text{if nothing is purchased} \end{cases}$$

Consumers who associate the same utility level  $(u+h)$  to both labels—which happens with probability  $(1-\gamma)\phi_G(1-\phi_S) + (1-\gamma)\phi_G\phi_S/2$ —will choose according to the following perceived payoff function:

$$(5) \quad \tilde{U} = \begin{cases} \theta(u+h) - p_G & \text{if one unit of good G is purchased} \\ \theta(u+h) - p_S & \text{if one unit of good S is purchased} \\ 0 & \text{if nothing is purchased} \end{cases}$$

Equations (1)-(5) identify separate market segments, with market shares defined by Table 2, that effectively determine the aggregate demand for goods G and S. Note that, because a fraction  $(1 - \phi_S)(1 - \phi_G)$  of the market remains uninformed of either product, GI promotion (i.e., an increase in  $\phi_G$ ) will obviously affect the total market reached. And, when  $\gamma < 1$ , such GI promotion will spill over to the S good. Hence, the strength of GI protection (i.e., the level of the parameter  $\gamma$ ) will play a meaningful role in the analysis that follows.

### Equilibrium

As noted, the market reach  $\phi_S$  of the S good and the strength of GI protection  $\gamma$  are predetermined. Given that, the timing of the relevant actions is as follows; first, GI producers choose the amount  $F \geq 0$  to invest in promotion, e.g., they choose the market reach parameter  $\phi_G$ ; next, market demands are defined and competitive equilibrium is attained. Operating by backward induction, let us first consider market equilibrium for given  $\phi_G$ ,  $\phi_S$  and  $\gamma$ . Concerning market demand functions, the actual parametric form of the resulting (linear) demands for the two goods depend on a number of cases that can arise. A complete classification of such cases is reported in the Appendix. For example, when prices satisfy  $0 < p_S < p_G$  and  $0 < p_S/u \leq (p_G - p_S)/h \leq 1$ , which is perhaps the most general case of interest, market demands are:

$$(6) \quad D_G = M \left[ \left( 1 - \frac{p_G}{u+h} \right) x_1 + \left( 1 - \frac{p_G - p_S}{h} \right) x_2 \right]$$

$$(7) \quad D_S = M \left[ \left( \frac{p_G - p_S}{h} - \frac{p_S}{u} \right) x_2 + \left( 1 - \frac{p_S}{u} \right) (x_3 + x_4) + \left( 1 - \frac{p_S}{u+h} \right) x_5 \right]$$

where  $x_i$  ( $i=1$  to 5) represent the market reach shares in Table 2, that is:

$$(8) \quad x_1 \equiv \gamma\phi_G(1 - \phi_S)$$

$$(9) \quad x_2 \equiv \gamma\phi_G\phi_S$$

$$(10) \quad x_3 \equiv \gamma\phi_S(1 - \phi_G)$$

$$(11) \quad x_4 \equiv (1 - \gamma)\phi_S(1 - \phi_G) + (1 - \gamma)\phi_G\phi_S/2$$

$$(12) \quad x_5 \equiv (1 - \gamma)\phi_G(1 - \phi_S) + (1 - \gamma)\phi_G\phi_S/2$$

As for the supply side, recall that to supply an aggregate quantity  $Q_G$  of the GI product it takes  $Q_G/\ell$  producers, where  $\ell$  is the efficient scale of each producer. This efficient scale is essentially an arbitrary constant that depends on the unit of measurement of output and on the interpretation of the market size measure  $M$ ; thus, without loss of generality, in what follows we set  $\ell = 1$ . Because GI producers have to share the promotion cost  $F$ , the supply price (i.e., the inverse supply function) is

$$(13) \quad p_G(Q_G) = v_G + \delta_G Q_G + \frac{F}{Q_G}$$

Thus, as discussed in Moschini, Menapace and Pick (2008), because the cost of promotion is effectively a fixed cost for the industry, the GI industry displays a forward-falling supply curve (at least over a range of output). For the substitute product we similarly assume an increasing-cost industry, but in this case we are presuming no industry-financed promotion expenditures, and thus we write the supply price of the S product for a given quantity  $Q_S$  as

$$(14) \quad p_S(Q_S) = v_S + \delta_S Q_S$$

To characterize the competitive equilibrium, let the inverse demand functions for the two goods be denoted by  $p_G^D(Q_G, Q_S)$  and  $p_S^D(Q_G, Q_S)$ . For example, for the case when  $0 < p_S < p_G$  and  $0 < p_S/u \leq (p_G - p_S)/h \leq 1$ , these inverse demand functions are obtained by inverting the demand functions in equations (6)-(7). Market equilibrium—for a given  $\phi_G$ ,  $\phi_S$  and  $\gamma$ —is then characterized by

$$(15) \quad p_G^D(Q_G^*, Q_S^*) - \left( v_G + \delta_G Q_G^* + \frac{F}{Q_G^*} \right) = 0$$

$$(16) \quad p_S^D(Q_G^*, Q_S^*) - (v_S + \delta_S Q_S^*) = 0$$

where  $F = -tM \cdot \log(1 - \phi_G)$ . Because the GI industry displays a forward-falling supply for a range of output, there may be more than one equilibrium solution, as illustrated in Figure 1. For reasons discussed in Moschini, Menapace and Pick (2008), in such a case we rely on the notion of Marshallian stability to identify the relevant equilibrium.<sup>5</sup>

A distinct market equilibrium case can arise when it happens that  $p_S = p_G \equiv p$ . This is obviously relevant in the extreme situation when there is no GI protection ( $\gamma = 0$ ), in which case there is effectively one demand function, but it can also arise for intermediate protection levels. In such a case, assuming  $0 < p/u \leq 1$ , total demand is:

$$(17) \quad D_G + D_S = M \left[ \left( 1 - \frac{p}{u+h} \right) (x_1 + x_2 + x_5) + \left( 1 - \frac{p}{h} \right) (x_3 + x_4) \right]$$

Inverting total demand in equation (17) yields the inverse demand functions  $p^D(Q_G + Q_S)$ , and the equilibrium condition can be written as:

$$(18) \quad p^D(Q_G^* + Q_S^*) - \left( v_G + \delta_G Q_G^* + \frac{F}{Q_G^*} \right) = 0$$

$$(19) \quad p^D(Q_G^* + Q_S^*) - (v_S + \delta_S Q_S^*) = 0$$

provided that

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<sup>5</sup> The stability conditions relate to the Jacobian of the equilibrium conditions (15)-(16). Because this Jacobian is symmetric, the stability conditions reduce to the sufficient conditions for this Jacobian to be negative definite (Takayama 1985, chapter 3).

$$(20) \quad Q_G^* \geq M \left( 1 - \frac{p}{u+h} \right) (x_1 + x_2)$$

$$(21) \quad Q_S^* \geq M \left( 1 - \frac{p}{h} \right) x_3$$

The constraint qualifications in (20) and (21) arise because in this case the demand by consumers in segments  $x_1$  and  $x_2$  must be met by the GI good supply and the demand by consumers in segment  $x_3$  must be met by the S-good supply (consumers in segments  $x_4$  and  $x_5$ , on the other hand, do not care which good they get, thus their demand can be met by the supply of either good).

The market equilibrium allocations determine the profits of the two industries ( $\Pi_G$  and  $\Pi_S$ ), consumer surplus  $CS$ , and aggregate welfare  $W \equiv CS + \Pi_G + \Pi_S$ . Clearly, they will depend on the given market reach parameters  $\phi_S$  and  $\phi_G$ . Whereas in our setting  $\phi_S$  is taken as predetermined, the assumption is that  $\phi_G$  is determined optimally by the GI industry to maximize the equilibrium value of GI industry profit, i.e., the shaded area in Figure 1. If  $\Pi_G(\phi_G)$  denotes such profits, then  $\phi_G^* = \arg \max \Pi_G(\phi_G)$ . Naturally, this optimal solution will depend on the strength of GI protection parameterized by  $\gamma$ . In what follows we provide some evidence on this and related effects.

### Computational Results

The model that we have outlined is not amenable to an analytical solution. To proceed, we have parameterized the model and solved it for a variety of parameter values using Matlab. The parameters of the baseline model are chosen to represent a situation in which the GI and the substitute good are of roughly equal importance, and where there is a nontrivial quality premium associated with the GI. In particular, we follow the following calibration procedure. The basic utility parameter is set to  $u = 1$ , and the GI added value is put to  $h = 0.5$ . The size of the market is set to  $M = 1,000$  (this arbitrary value is inconsequential, it simply permits us to pin down the value of the marginal cost parameter). For given market reach parameters  $\hat{\phi}_G$  and  $\hat{\phi}_S$ , if a fraction  $(1 - \hat{\theta})$  of consumers were served that would

require an aggregate quantity  $\hat{Q}_G + \hat{Q}_S = M(1 - \hat{\theta})[1 - (1 - \hat{\phi}_G)(1 - \hat{\phi}_S)]$ . To supply these quantities, the industry marginal costs at  $\hat{Q}_G$  and  $\hat{Q}_S$  need to equal the consumers' demand prices  $\hat{p}_S^D = \hat{\theta}u$  and  $\hat{p}_G^D = p_S^D + \tilde{\theta}h$ , where  $\tilde{\theta}$  indexes the consumer that is indifferent between good S and good G (in this calibration we implicitly assume the case of  $\gamma = 1$ ). Given  $\hat{\theta}$ , assuming that the total market is served equally by the S and G goods ( $\hat{Q}_G = \hat{Q}_S$ ) determines  $\tilde{\theta}$ , as well as both demand prices. Further assuming that  $\nu_G = \nu_S = 0$  (marginal costs are born in the origin), and that the efficiency of production of the G good reflects the additional quality level, then  $\delta_S = p_S^D / \hat{Q}_S$  and  $\delta_G = \delta_S(u + h)/u$ . The total promotion expenditure that is implied is therefore  $\hat{F} = (\hat{p}_G^D - \delta_G \hat{Q}_G) \hat{Q}_G$ , and recalling that  $\hat{F} = -tM \cdot \log(1 - \hat{\phi}_G)$  determines the value of the promotion parameter  $t$ . Selecting the benchmark scenario target as  $\hat{\phi}_S = \hat{\phi}_G = 2/3$  and  $\hat{\theta} = 1/3$ , we calibrate the following remaining parameters of the model:  $\delta_S = 0.0011$ ,  $\delta_G = 0.00165$  and  $t = 0.045$ .

A few more details on the Matlab procedure used to solve the model are perhaps in order. For a given set of values of the parameters ( $\gamma$ ,  $u$ ,  $h$ ,  $M$ ,  $\delta_S$ ,  $\delta_G$ ,  $t$ ,  $\nu_G$ ,  $\nu_S$  and  $\phi_S$ ), the Matlab code finds the competitive equilibrium for a given level of promotion in sector G (i.e., for a given value of  $\phi_G$ ). The procedure loops through all possible market demand cases (illustrated in the Appendix) and checks that the corresponding conditions on prices and the stability conditions are satisfied. When possible, the market equilibrium is solved analytically and the program then evaluates the numerical values of the equilibrium outcomes. When an analytic solution is not possible (for instance in cases 1 and 11), our Matlab procedure finds the roots of the two-equation system of market clearing conditions, in quantity space, by means of the routine "Newton" (see Miranda and Fackler, 2002, for a discussion). The numerical evaluation is repeated over a grid of values of  $\phi_G \in [0, 1]$ . Finally, the optimal investment of promotion by the GI industry,  $\phi_G^*$ , is obtained (for any given set of parameter values) by a sorting algorithm that selects the value of  $\phi_G$  that yields the largest value of the GI industry's profit.

In our analysis it quickly became clear that the level of the (exogenous) market reach of the substitute good,  $\phi_S$ , matters considerably. Hence, Table 3 reports the computed equilibrium promotion level of the GI industry ( $\phi_G^*$ ), given the calibrated baseline parameters, conditional on three different levels of the S-good promotion, and for a grid of possible values of the protection parameter  $\gamma$ . It is apparent that, as the strength of GI protection decreases away from  $\gamma = 1$ , the incentives for GI promotion diminish and the equilibrium value of  $\phi_G^*$  in general falls. Specifically, the GI protection parameter needs to be above a certain level for  $\phi_G^*$  to take on strictly positive and nontrivial levels, and that this minimum threshold level of  $\gamma$  is increasing in the exogenously given market reach of the S good. For all the cases in which the strength of GI protection  $\gamma$  is below this minimum threshold (and hence  $\phi_G^*$  is virtually zero), the GI industry does not find it worthwhile to signal the higher quality, and competition drives the price of the GI good down to the level of S-good price. Consistently, we find that the relevant demand structure for all of these cases is given by equation (17), the case in which there is only one price on the market.

For virtually all other combinations of parameter values considered in Table 3, the relevant demand structure is given by equation (6). It is precisely with reference to equation (6) that it can be best appreciated why the incentives for GI promotion diminish with decreasing strength of GI protection. The total (effective) market reach of the GI good satisfies  $x_1 + x_2 = \gamma\phi_G$ , and thus the marginal impact of promotion on this market reach is directly proportional to  $\gamma$ . The GI promotion level thus tends to be highest when  $\gamma = 1$ , and to decrease as the strength of protection declines. This effect is certainly evident for low levels of the S-good market reach.

That promotion efforts  $\phi_G^*$  tend to be higher when the S-good market reach is lower (e.g.,  $\phi_S = 0.1$ ), can be understood by looking at the composition of the GI good's market reach. Clearly, other things equal, the GI industry would rather reach a consumer who is not already informed about the S good than one who is. The measure of the GI industry's uncontested market is  $x_1 \equiv \gamma\phi_G(1 - \phi_S)$ , and thus the marginal effect  $\partial x_1 / \partial \phi_G = \gamma(1 - \phi_S)$  is inversely related to  $\phi_S$ . By contrast, the share of the contested market is  $x_2 \equiv \gamma\phi_G\phi_S$ , and

the associate marginal effect  $\partial x_2 / \partial \phi_G = \gamma \phi_S$  is positively related to  $\phi_S$ . On net, for a given value of  $\gamma$  the marginal impact of promotion on the GI good market reach decreases in  $\phi_S$  and we observe lower values of  $\phi_G^*$  when the S-good market reach is higher.

Unlike the case  $\phi_S = 0.1$ , when  $\phi_S = 0.5$  and  $\phi_S = 0.9$  Table 3 shows that the promotion efforts  $\phi_G^*$  tend to increase, although slightly, as the strength parameter decrease away from  $\gamma = 1$  before dropping off to minimal/zero levels. This fact can be best appreciated by recalling that, when the S-good market reach is high, the contested market dominates. Consequently, the effect of GI promotion on the GI industry profits is influenced by the interaction with the two competing products. *Ceteris paribus*, a marginal increase in  $\phi_G$  has a larger effect on the GI demand elasticity when  $\gamma$  is small, so that, as the strength parameter decrease, the GI industry tries to counter the negative impact on market reach by increasing its promotion effort. At some point (at  $\gamma = 0.3$  for  $\phi_S = 0.5$  and  $\gamma = 0.5$  for  $\phi_S = 0.9$ ) this endeavor becomes too costly, and the GI industry's effort drops to minimal/zero levels.<sup>6</sup>

To determine the extent to which the levels of promotion efforts  $\phi_G^*$  are socially desirable turns out to be a difficult task. As reviewed by Bagwell (2007), in the context of privately supplied informative advertising there are several external effects that play a role and that influence whether private agents are expected to supply too much or too little promotion. Such effects include a *market size* effect: promotion by the GI industry expands total market reach, which is equal to  $\phi_G^* + \phi_S - \phi_G^* \phi_S$ . Not only is the promoting industry not able to appropriate the full welfare impact of promotion (which are shared with consumers), but with imperfect GI protection ( $\gamma < 1$ ) the competing industry can also benefits. Promotion by the GI industry can also improve *matching* of the consumers' tastes with the appropriate quality good, and again the associate welfare gains are partly appropriated by consumers. Whereas both of the foregoing effects would suggest that the promoting industry is likely to undersupply promotion, there are also other effects that pull in the

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<sup>6</sup> There are also other effects brought about by the interaction with the S-good market. For example, with  $\gamma < 1$ , GI promotion also expands S-good demand and, via an upward push S-good price, indirectly also expands the demand faced by the GI industry.

opposite direction. A well-known effect identified by the literature on advertising in imperfectly competitive markets is the *business stealing effect*. This effect arises whenever there is a difference between the marginal contribution of advertising to aggregate and individual profits. In our context it is possible that GI promotion messages that reach consumers already informed of the S-good existence reallocate demand away from the S good and towards the GI good with profit gains for the latter that exceed the gains of the aggregate industry.

The foregoing discussion, however, pertains to imperfectly competitive situations that differ from our setting in some important aspects. For example, our model of the strength of GI protection envisions the possibility of information spillover and dilution, and the potential of promotion to improve matching is clearly eroded when  $\gamma < 1$ . In particular, promotion by the GI industry can have an *adverse matching* effect when  $\gamma < 1$ . This is because some of the consumers in segment  $x_5$ , who after receiving the GI message purchase good S believing that it is of quality  $u + h$ , can end up being worse off by their participation in the market. Indeed, by purchasing good S some consumers may receive a net negative surplus, while had they remained uninformed their surplus would have been zero. A separate issue concerns what we might call the *competitive equilibrium effect*, i.e., the impact of the assumed competitive structure on the incentive to promote. In our setting the GI promotion's objective is taken to be the maximization of industry profit net of promotion costs (i.e., producer surplus) in a context where the industry cannot control its own supply (e.g., there is free entry into GI production). Effectively, therefore, GI promotion maximizes the competitive output of the GI industry, and in so doing promotion may be oversupplied. That is, whereas any additional promotion potentially benefits consumers, by reaching consumers that would otherwise not be informed, the net consumer benefit is mediated by the prices that they will end up paying (which will reflect the cost of increased promotion), and the competitive GI industry's objective may not properly internalize this effect.

To understand how the various effects discussed in the foregoing balance out, one needs an explicit welfare benchmark. To that end, we define the welfare-optimal level of promotion, labeled  $\phi_G^{**}$ , as that which maximizes the total Marshallian surplus  $W \equiv CS + \Pi_G + \Pi_S$ , where  $CS$  denotes consumer surplus,  $\Pi_k$  denotes aggregate profits for the  $k$ th industry ( $k = G, S$ ), and the cost of promotion associated with  $\phi_G^{**}$  is imputed to the

GI industry.<sup>7</sup> In other words,  $\phi_G^{**}$  tells us what society would want the GI industry to do, taking as a given all of the parameters and constraints facing the industry (including the strength of protection  $\gamma$ ). Note that, in particular, the promotion levels  $\phi_G^{**}$  are not first best solutions.

The computed welfare-optimal promotion levels  $\phi_G^{**}$  are reported in the rightmost half of Table 3. Comparing the equilibrium values  $\phi_G^*$  with the corresponding welfare-optimal levels  $\phi_G^{**}$ , it emerges that the GI industry oversupplies informative advertising when the protection level is suitably high,<sup>8</sup> whereas, at least in the case of  $\phi_S = 0.1$  and  $\phi_S = 0.5$ ,  $\phi_G^*$  falls below  $\phi_G^{**}$  as the GI protection level declines. For the high level of S-good market reach ( $\phi_S = 0.9$ ), the GI industry oversupplies promotion whenever it provides a positive amount of it. In the lower range of values of  $\gamma$  for which the GI sector does not promote, the welfare-optimal promotion and the GI profit maximizing promotion are both equal to zero.

Although the foregoing is helpful in assessing the equilibrium GI promotion level, ultimately it is the impact of the strength of protection on aggregate welfare that is most interesting. It is also of some concern how alternative GI protection levels would impact the distribution of welfare among consumers and the producers of the two goods. To analyze such issues, in Table 4 we report the computed optimal protection level  $\gamma$  for alternative objective functions and alternative parameter combinations. The rows labeled **maxW**

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<sup>7</sup> When advertising shifts demand for a given good, which of the two demands functions (pre- and post-advertising) is relevant as a representation of preferences for the purpose of welfare evaluation might be unclear (Dixit and Norman, 1978; Shapiro, 1980). This is particularly an issue in the context of persuasive advertising. In our context promotion is informative, but the dilution effect that arises when  $\gamma < 1$  implies that some consumers might purchase the S good believing that it has quality attribute  $(u + h)$  when in fact it only has quality  $u$  (this pertains to consumers in the market segment labeled  $x_5$ ), and some consumers might purchase the GI good believing that it has quality attribute  $u$  when in fact it only has quality  $(u + h)$  (this pertains to consumers in the market segment labeled  $x_4$  and can happen only when the equilibrium prices of the two goods are the same). In computing welfare for such consumers we attribute them the welfare associated with the true quality level of the good consumed.

<sup>8</sup> In our grid,  $\gamma \geq 0.7$ ,  $\gamma \geq 0.4$  and  $\gamma \geq 0.6$ , respectively, for the three given values of the S-good market reach.

report the values of  $\gamma$  that maximize Marshallian surplus  $W \equiv CS + \Pi_G + \Pi_S$ , given the actual market equilibrium outcome, that is, conditional of the GI industry choosing their preferred promotion level for the given level of  $\gamma$ . The cost of promotion is reflected in the producer surplus accruing to the GI industry ( $\Pi_G$ ) and in the prices paid by consumers (as illustrated in figure 1).<sup>9</sup>

When the market reach of the S good is low ( $\phi_S = 0.1$ ), we find that the optimal protection level is not the strongest possible level. For the various parameter combinations that we explore for this case, the optimal welfare maximizing  $\gamma$  varies from 0.63 to 0.85. The reason is that, because the pre-existing market reach of the S good is low, some dilution is beneficial (because of spillover of information, i.e., consumers learn also of the existence of a cheaper substitute). Although reducing the strength parameter  $\gamma$  erodes the GI industry's promotion incentives, this impact on the total market reach is small and it is offset by a matching effect whereby more consumers end up in the competitive market segments  $x_4$  and  $x_5$  and buy the S good. That the welfare effect here is driven by the impact of the strength of protection on consumer surplus is underscored by the value of  $\gamma$  that maximizes consumer surplus (reported in the `maxCS` rows), which ranges from 0.62 to 0.82 when  $\phi_S = 0.1$ . The GI industry here would prefer the strongest possible level of protection, whereas the S industry does not. But interestingly, the GI-competing S industry does not prefer the lowest level of protection either: its benefiting from the dilution effect of promotion when  $\gamma < 1$  also relies on the GI industry having some incentive for promotion (to increase total market reach), which requires  $\gamma > 0$ . But on average producers benefit for stronger protection: were we to consider total producer surplus, i.e.,  $PS \equiv \Pi_S + \Pi_G$ , the optimal strength of GIs when  $\phi_S = 0.1$  is the highest ( $\gamma = 1$ ). The effects of the other parameters on the optimal protection level for the case of  $\phi_S = 0.1$  are perhaps predictable: stronger protection is more desirable from a welfare maximizing viewpoint when the quality premium of the GI product (parameterized by  $h$ ) is large; as the unit cost of advertising

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<sup>9</sup> Consistent with the approach used in the computation of  $\phi_G^{**}$ , explained earlier, consumers who purchase good S erroneously believing that it has quality attribute  $(u + h)$ , and consumers who purchase good G erroneously believing that it has quality attribute  $u$ , are assigned the welfare associated with the true quality level of the good they actually consumed.

(parameterized by  $t$ ) increases, *ceteris paribus*, stronger protection is more desirable (it is now more important to preserve the incentive for the GI industry to engage in promotion); and, as the GI industry production become less efficient relative to the S industry (the ratio  $\delta_G/\delta_S$  increases), the optimal welfare maximizing promotion level declines.

Increasing the pre-existing market reach  $\phi_S$  of the S industry initially appears to uniformly increase the optimal protection. For the case  $\phi_S = 0.5$ , in particular, we find that  $\gamma = 1$  is optimal from the point of view of consumers, GI producers and aggregate welfare for all parameter combinations considered. Producers of the S good still would prefer a lower-than-maximum protection level, although the optimal  $\gamma$  from their perspective are also uniformly higher than the optimal values that attain when  $\phi_S = 0.1$ .

When the market reach  $\phi_S$  of the S industry is high ( $\phi_S = 0.9$ ), on the other hand, strong GI protection becomes, not surprisingly, less appealing. In particular, for several of the parameter combinations that we consider, the welfare maximizing protection level is a low interval that includes the minimum value  $\gamma = 0$ . Essentially, here we have parameter combinations for which the socially desirable GI promotion level is zero, and any value of  $\gamma$  that can bring about the level of promotion that is optimal. Strong protection ( $\gamma = 1$ ) here becomes socially optimal only when the quality premium of the GI good is high ( $h = 1$ ) or the unit cost of promotion is low ( $t = 0.02$ ). Producers of the GI good, and producers in aggregate, in general still prefer the highest protection  $\gamma = 1$ ; the exception is when the quality premium of the GI product is low ( $h = 0.1$ ), in which case GI producers would prefer the lowest protection level (and, perhaps interestingly, a lower level than what is preferred by S-good producers). In this case, GI producers do not attempt to differentiate their product from the lower quality substitute (competition drives the prices of the two products to the same level) and simply share the market segment  $x_4$ , with the competing industry free-riding on the information spillovers from the pre-existing market reach of good S. As the value of  $\gamma$  increases, information spillovers vanish and GI producers are left with no alternative other than investing in promotion. On the other hand, the S-good producers are better off when GI producers invest in promotion, which requires  $\gamma$  to be above a certain threshold. In this case, S-good producers can, in fact, free ride on the GI promotion by capturing consumers in segments  $x_4$  and  $x_5$  who purchase the good at the lowest price.

If the policy choice were restricted to the extremes of strong GI protection ( $\gamma = 1$ ) or no GI protection at all ( $\gamma = 0$ ), is it the case that the strongest protection level is to be preferred in terms of the welfare maximization criterion? And if so, how sizeable are the welfare losses associated with no protection? To address these questions Table 5 reports the welfare losses associated with  $\gamma = 0$ , relative to the case  $\gamma = 1$ , expressed as a percent of the welfare level achieved with  $\gamma = 1$ . For the low and intermediate levels of the market reach parameter of the S good,  $\phi_S = 0.1$  and  $\phi_S = 0.5$ , the strongest protection in general dominates no protection, as indicated by the percent welfare losses being positive. The one exception here is the case of low quality premium  $h = 0.1$  and low unit cost of promotion  $t = 0.02$ , for  $\phi_S = 0.1$ , in which case the welfare levels associated with zero protection is higher than maximum protection.<sup>10</sup> The welfare losses associated with zero GI protection could be quite high: for our benchmark parameters of  $h = 0.5$ ,  $t = 0.045$ , and  $\delta_G/\delta_S = 1.5$ , the welfare loss is calculated at 78.5% for  $\phi_S = 0.1$  and 25.6% for  $\phi_S = 0.5$ . When the pre-existing market reach of the S good is high, however, it is much more plausible for zero protection to be preferred to the strongest GI protection level. But even here, strong protection dominates zero protection if the GI quality premium (as parameterized by  $h$ ) is large enough.

## Conclusions

How strong GI protection ought to be has been a widely discussed policy question, but explicit economic analyses of this issue are lacking in the existing literature. To make progress in this context, this paper develops a model rooted in the structure of informative advertising, where the degree of GI protection is parameterized such that the strength of protection affects how informative the GI message can be. The model maintains some common attributes of recent GI studies, such as demand with vertical product differentiation and a competitive GI sector with free entry. By allowing for a meaningful characterization of the degree of GI protection, our analysis can shed light on the controversy among WTO members over strengthening the current TRIPS provisions for GIs. Also, this paper adds to the existing literature by providing a framework suitable to

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<sup>10</sup> Although this particular parameter combination is not explored in Table 4, we find the optimal welfare maximizing protection level here would be an intermediate one, specifically  $\gamma = 0.53$ .

study the role of GI promotion in expanding market demand when consumers lack information regarding either the existence or the features of the product. Specifically, we analyze how the strength of GI protection affects the incentives of GI producers to provide information to consumers and, in turn, how this affects the distribution of welfare among producer groups and consumers.

Our findings confirm that GI producers and substitute good producers are likely to have divergent interests when it comes to the desired degree of GI protection. We find that, in most cases, the welfare of GI producers increases monotonically with the strength of IP rights. This finding suggests that GI producers are likely to benefit from a strengthening of current GI provisions in important markets such as the United States, where relatively weak protection is currently afforded to GIs. “Marginal” GIs, that is those with a small quality advantage over generic substitute goods, might represent an exception: in markets where many consumers are familiar with the good’s existence and its generic features, producers of a marginal GI might not find it attractive to promote their product as distinct from substitute goods. In such a case there is little to gain from differentiation, and GI producers are better off when, under weak GI protection, competing products’ labels are similar to the GI name: GI producers can refrain from investing in promotion while taking advantage of the spillovers of information generated by similar-sounding labels of competing products.

As for the producers of the substitute good, our results show that they gain significantly from an above-zero level of GI protection that is sufficient to provide GI producers with incentives to invest in promotion (which has beneficial spillover effects). But substitute good producers never prefer the strongest GI protection level: the information provided by GI producers is less likely to expand the demand for the substitute good because the degree of substitutability between GI and substitute goods declines in the eyes of consumers as the GI protection becomes stronger (there is less dilution and spillovers of information). When considering the production sector as a whole, aggregate profits tend to be maximized when GI protection is strongest, with a few exceptions occurring when the goods are known by an intermediate share of the population. Specifically, this is the case when either the GI quality differential is small (i.e., when there is little to gain from differentiation) or when the cost of promotion is very low (so that promotion tends to be oversupplied) or when the GI sector is relatively inefficient compared to the S sector.

Consumers might also be better off with an intermediate level of GI protection. This is the case when there is either very poor or very good knowledge of the existence and the basic features of the good. When the good in question is virtually unknown, so that few consumers participate in the market, consumer surplus in aggregate reaches its highest value with intermediate levels of GI protection because of the positive effect of information spillovers (which informs consumers of the existence of a lower-priced generic good that is affordable to a large share of consumers reached by promotion). On the other extreme, when the good's existence and generic features are well-known to consumers, aggregate consumer surplus is again highest with an intermediate level of GI protection. In such a case, GI producers tend to oversupply promotion, from the consumers' perspective, in the attempt to win over consumers who purchase the lower-priced lower-quality substitute good, and this has adverse effects on the price paid by consumers. Although both consumers and producers of the substitute good are better off with intermediate levels of GI protection, the optimal protection level is not the same for the two groups. Which of the two groups prefers the high protection level depends critically on the degree of knowledge of the good (when the good is scarcely known, consumers prefer stronger GI protection than substitute good producers do, whereas the opposite is true when the good is already well-known in the market). Full GI protection is optimal for consumers for intermediate levels of knowledge of the good. In this case, the contribution to welfare of increasing market reach through accurate information provided by promotion dominates the benefits brought about by information spillovers.

Welfare, in the aggregate, is often maximized by less-than-full GI protection. This is specifically the case when the good is little known, because beneficial spillover effects (consumers learn of a lower-priced alternative via GI promotion) dominate the welfare impact of a better matching of (limited number of) consumers with their preferred product. But aggregate welfare is maximized by full GI protection for intermediate levels of knowledge of the good. Finally, when the good is known by a large share of the population, aggregate welfare and consumer interests are not directly aligned, and the welfare-maximizing level of GI protection can be at either extreme of the range considered. When the quality differential of the GI is low, aggregate welfare is maximized with weak protection so that GI producers are dissuaded from promoting. When the quality differential is high instead aggregate welfare is maximized with full GI protection. Likewise, when the cost of

promotion is low (the opportunity cost of providing clean information is low), aggregate welfare is maximized with full GI protection. The opposite is true when the cost of promotion is high.

Whereas it is hoped that our analysis might help to understand some elements of the current WTO debate concerning the level of protection to be provided for GIs, the model that we have presented has some limitations, and further work in this area is desirable. In particular, we have not explicitly modeled the labeling choice and the promotion level of the industry producing the GI-substitute good. Making such choices endogenous, which is the object of ongoing research, should provide a fuller representation of markets dynamics under different levels of strength of GI protection and yield improved insights on the question at hand.

Table 3. GI Protection and GI Industry Promotion Levels

$\gamma$	Profit maximizing promotion efforts $\phi_G^*$			Welfare-optimal promotion levels $\phi_G^{**}$		
	$\phi_S = 0.1$	$\phi_S = 0.5$	$\phi_S = 0.9$	$\phi_S = 0.1$	$\phi_S = 0.5$	$\phi_S = 0.9$
	1.0	<b>0.84</b>	<b>0.70</b>	<b>0.63</b>	0.76	0.67
0.9	<b>0.84</b>	<b>0.71</b>	<b>0.64</b>	0.78	0.68	0.55
0.8	<b>0.83</b>	<b>0.71</b>	<b>0.64</b>	0.79	0.69	0.55
0.7	<b>0.80</b>	<b>0.71</b>	<b>0.65</b>	0.79	0.69	0.10
0.6	0.79	<b>0.71</b>	<b>0.66</b>	0.79	0.69	0.00
0.5	0.77	<b>0.70</b>	0.00	0.78	0.69	0.00
0.4	0.74	<b>0.73</b>	0.00	0.76	0.70	0.00
0.3	0.67	0.04	0.00	0.70	0.30	0.00
0.2	0.48	0.04	0.00	0.51	0.30	0.00
0.1	0.00	0.03	0.00	0.03	0.30	0.00
0	0.00	0.03	0.00	0.03	0.30	0.00

Notes: (a) Computations conditional on the baseline calibrated parameters:  $u = 1$ ,  $h = 0.5$ ,  $\delta_S = 0.0011$ ,  $\delta_G = 0.00165$ ,  $\nu_S = \nu_G = 0$ , and  $t = 0.045$ ; (b) Bold values indicate that the GI sector oversupplies promotion compared to the welfare-optimal level.

Table 4. Optimal protection level  $\gamma$  for alternative objective functions and alternative parameter combinations

	$\phi_S = 0.1$			$\phi_S = 0.5$			$\phi_S = 0.9$		
	$h = 0.1$	$h = 0.5$	$h = 1$	$h = 0.1$	$h = 0.5$	$h = 1$	$h = 0.1$	$h = 0.5$	$h = 1$
max $W$	0.63	0.75	0.86	1	1	1	[0, 0.60]	[0, 0.54]	1
max $CS$	0.62	0.74	0.82	1	1	1	[0, 0.60]	[0, 0.54]	[0, 0.42]
max $PS$	1	1	1	0.70	1	1	1	1	1
max $\Pi_G$	1	1	1	1	1	1	[0, 0.60]	1	1
max $\Pi_S$	0.42	0.27	0.23	0.70	0.36	0.30	0.90	0.55	0.43

	$\phi_S = 0.1$			$\phi_S = 0.5$			$\phi_S = 0.9$		
	$t = 0.02$	$t = 0.045$	$t = 0.09$	$t = 0.02$	$t = 0.045$	$t = 0.09$	$t = 0.02$	$t = 0.045$	$t = 0.09$
max $W$	0.71	0.75	0.85	1	1	1	1	[0, 0.54]	[0, 0.60]
max $CS$	0.71	0.74	0.78	1	1	1	[0, 0.40]	[0, 0.54]	[0, 0.60]
max $PS$	1	1	1	0.91	1	1	1	1	1
max $\Pi_G$	1	1	1	1	1	1	1	1	1
max $\Pi_S$	0.27	0.27	0.51	0.32	0.36	0.61	0.41	0.55	0.76

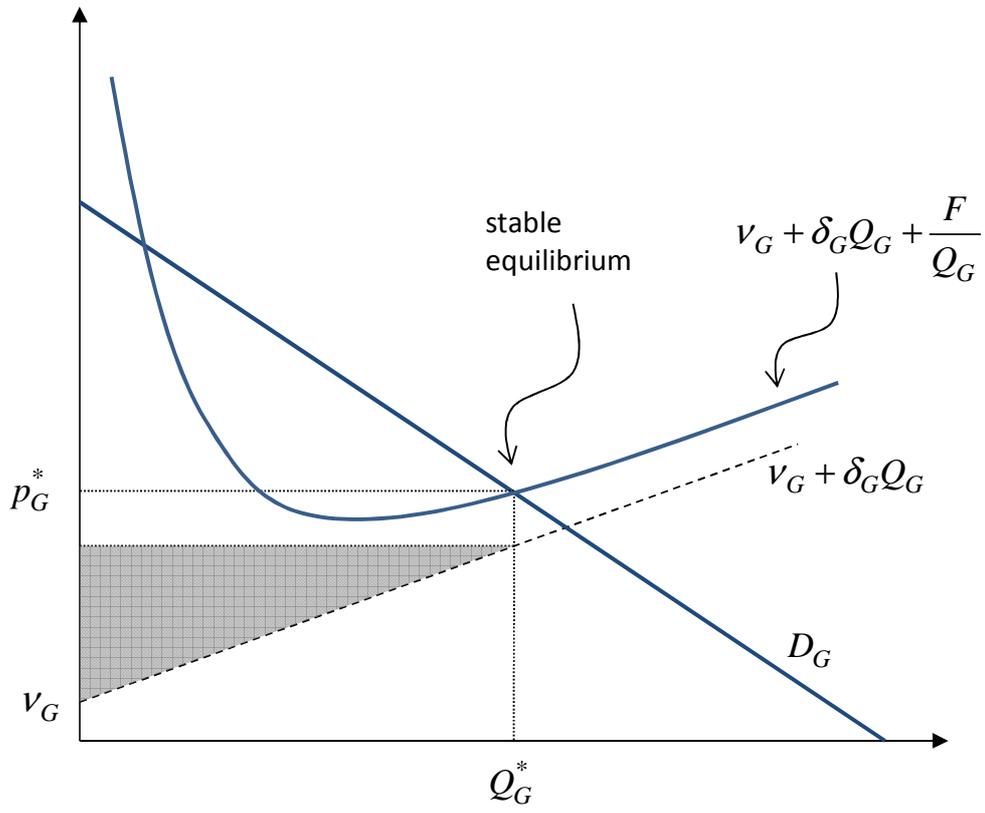
  

	$\phi_S = 0.1$			$\phi_S = 0.5$			$\phi_S = 0.9$		
	$\frac{\delta_G}{\delta_S} = 1$	$\frac{\delta_G}{\delta_S} = 1.5$	$\frac{\delta_G}{\delta_S} = 2$	$\frac{\delta_G}{\delta_S} = 1$	$\frac{\delta_G}{\delta_S} = 1.5$	$\frac{\delta_G}{\delta_S} = 2$	$\frac{\delta_G}{\delta_S} = 1$	$\frac{\delta_G}{\delta_S} = 1.5$	$\frac{\delta_G}{\delta_S} = 2$
max $W$	0.85	0.75	0.67	1	1	1	[0, 0.50]	[0, 0.54]	[0, 0.50]
max $CS$	0.81	0.74	0.67	1	1	1	[0, 0.50]	[0, 0.54]	[0, 0.50]
max $PS$	1	1	1	1	1	0.80	1	1	1
max $\Pi_G$	1	1	1	1	1	1	1	1	1
max $\Pi_S$	0.28	0.27	0.32	0.42	0.36	0.34	0.61	0.55	0.51

Table 5. Percent Welfare Loss from having  $\gamma=0$  relative to  $\gamma=1$  for alternative parameter combinations

	$\phi_S = 0.1$			$\phi_S = 0.5$			$\phi_S = 0.9$		
	$h = 0.1$	$h = 0.5$	$h = 1$	$h = 0.1$	$h = 0.5$	$h = 1$	$h = 0.1$	$h = 0.5$	$h = 1$
$t = 0.02$	-4.7%	15.9%	31.6%	7.1%	17.9%	30.7%	-0.5%	6.9%	18.9%
$t = 0.045$	69.7%	78.5%	84.2%	12.5%	25.6%	37.6%	-5.0%	-0.6%	11.1%
$t = 0.09$	58.5%	71.7%	80.4%	1.2%	13.2%	28.5%	-12.3%	-10.6%	-0.3%
$\delta_G/\delta_S = 1$	74.4%	81.1%	85.6%	10.0%	22.2%	34.1%	-6.1%	-1.5%	9.8%
$\delta_G/\delta_S = 1.5$	69.7%	78.5%	84.2%	12.5%	25.6%	37.6%	-5.0%	-0.6%	11.1%
$\delta_G/\delta_S = 2$	65.4%	75.9%	82.8%	11.4%	24.2%	37.8%	-4.2%	-0.1%	11.6%

Figure 1. Market equilibrium in the GI industry



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## Appendix. Demand cases

The demand situation discussed in the text corresponds to the situation in which the preference parameters and the prices of the two goods satisfy the conditions:

**Case 1:**  $0 < p_S < p_G$  and  $0 < \frac{p_S}{u} \leq \frac{p_G - p_S}{h} \leq 1$

The decision problem facing consumers is best illustrated with the aid of Figure A1 below.

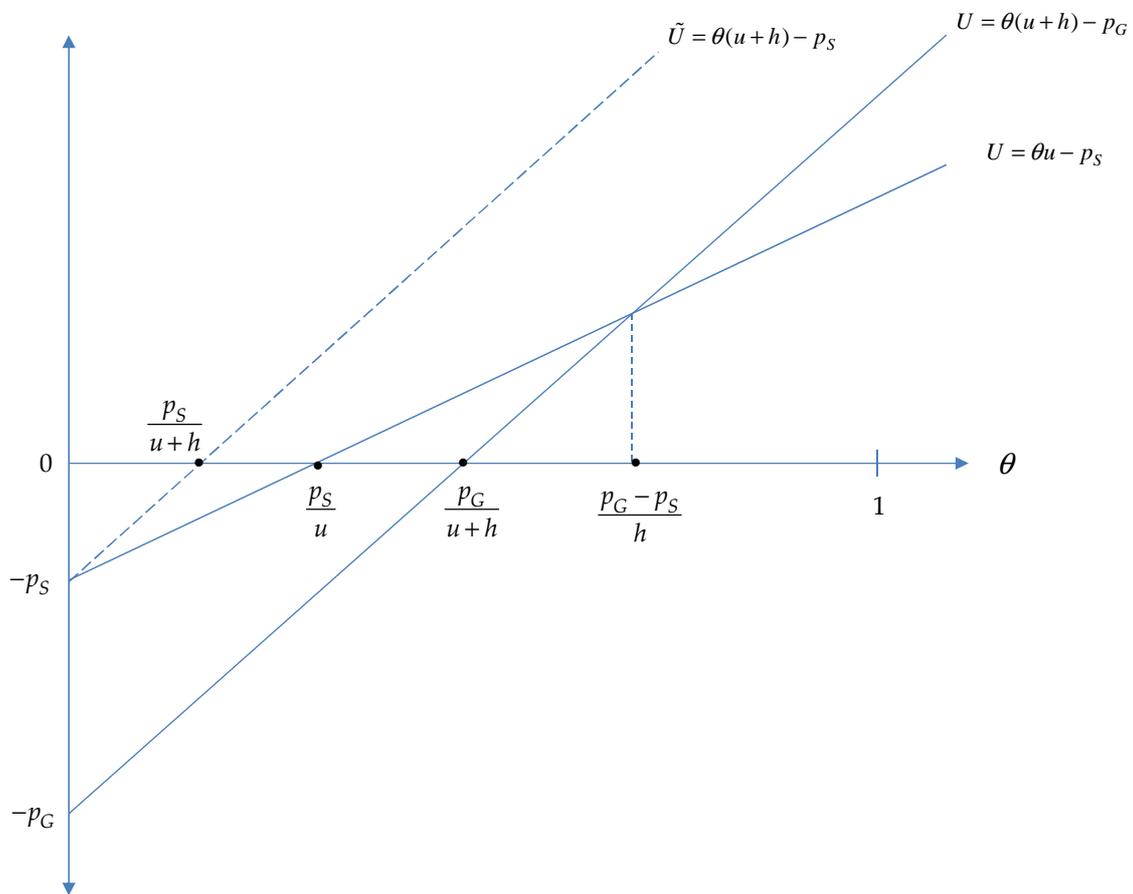


Figure A1. Payoff functions for Case 1

For consumers who only know about the GI good (the number of which is equal to a share  $x_1$  of the market), those with the preference parameter satisfying  $p_G/(u+h) \leq \theta \leq 1$  will buy a unit of the GI good, and the rest will prefer the outside option. Among the consumers who are fully informed (the number of which is equal to a share  $x_2$  of the market), those with  $(p_G - p_S)/h \leq \theta \leq 1$  will buy the GI good, those with  $p_G/(u+h) \leq \theta \leq (p_G - p_S)/h$  will buy the S good, and everybody else will buy neither. The foregoing completely identifies all consumers who will buy the GI good, yielding the demand function in equation (22). As for the S-good demand, there are two more demand segments. Specifically, a share  $(x_3 + x_4)$  of the market only knows about the S good (including those who, having been reached by the GI-good message, incorrectly attach quality  $u$  to the label  $\Lambda_S$ ), and of these consumers those with  $p_S/u \leq \theta \leq 1$  will buy the S good and everybody else will buy nothing. Finally, a share  $x_5$  of the market attaches utility  $(u+h)$  to both goods and will elect to buy the cheaper of the two. Hence, those consumers in this group with  $p_S/(u+h) \leq \theta \leq 1$  will buy the S good, and the remainder will buy nothing. Collecting all of the market segments that patronize good S yields the demand curve in equation (23).

$$(22) \quad D_G = M \left[ \left( 1 - \frac{p_G}{u+h} \right) x_1 + \left( 1 - \frac{p_G - p_S}{h} \right) x_2 \right]$$

$$(23) \quad D_S = M \left[ \left( \frac{p_G - p_S}{h} - \frac{p_S}{u} \right) x_2 + \left( 1 - \frac{p_S}{u} \right) (x_3 + x_4) + \left( 1 - \frac{p_S}{u+h} \right) x_5 \right]$$

A similar procedure will lead to the demand functions for all other possible cases that can arise, which are as follows.

**Case 2:**  $p_G > p_S > 0$  and  $0 < \frac{p_S}{u} < \frac{p_G}{u+h} \leq 1 < \frac{p_G - p_S}{h}$

The demand functions for Case 2 are:

$$(24) \quad D_G = M \left( 1 - \frac{p_G}{u+h} \right) x_1$$

$$(25) \quad D_S = M \left[ \left( 1 - \frac{p_S}{u} \right) (x_2 + x_3 + x_4) + \left( 1 - \frac{p_S}{u+h} \right) x_5 \right]$$

**Case 3:**  $p_G > p_S > 0$  and  $0 < \frac{p_S}{u} \leq 1 < \frac{p_G}{u+h} < \frac{p_G - p_S}{h}$

The demand functions for Case 3 are:

$$(26) \quad D_G = 0$$

$$(27) \quad D_S = M \left[ \left( 1 - \frac{p_S}{u} \right) (x_2 + x_3 + x_4) + \left( 1 - \frac{p_S}{u+h} \right) x_5 \right]$$

**Case 4:**  $p_G > p_S > 0$  and  $0 < \frac{p_S}{u+h} \leq 1 < \frac{p_S}{u} < \frac{p_G - p_S}{h}$

The demand functions for Case 4 are:

$$(28) \quad D_G = 0$$

$$(29) \quad D_S = M \left( 1 - \frac{p_S}{u+h} \right) x_5$$

**Case 5:**  $p_G > p_S > 0$  and  $0 < \frac{p_G}{u+h} < \frac{p_S}{u} \leq 1$

The demand functions for Case 5 are:

$$(30) \quad D_G = M \left( 1 - \frac{p_G}{u+h} \right) (x_1 + x_2)$$

$$(31) \quad D_S = M \left[ \left( 1 - \frac{p_S}{u} \right) (x_3 + x_4) + \left( 1 - \frac{p_S}{u+h} \right) x_5 \right]$$

**Case 6:**  $p_G > p_S > 0$  and  $0 < \frac{p_G}{u+h} \leq 1 < \frac{p_S}{u}$

The demand functions for Case 6 are:

$$(32) \quad D_G = M \left( 1 - \frac{p_G}{u+h} \right) (x_1 + x_2)$$

$$(33) \quad D_S = M \left( 1 - \frac{p_S}{u+h} \right) x_5$$

**Case 7:**  $p_G > p_S > 0$  and  $0 < \frac{p_S}{u+h} \leq 1 < \frac{p_G}{u+h} < \frac{p_S}{u}$

The demand functions for Case 7 are:

$$(34) \quad D_G = 0$$

$$(35) \quad D_S = M \left( 1 - \frac{p_S}{u+h} \right) x_5$$

**Case 8:**  $p_S > p_G > 0$  and  $0 < \frac{p_S}{u} \leq 1$

The demand functions for Case 8 are:

$$(36) \quad D_G = M \left[ \left( 1 - \frac{p_G}{u+h} \right) (x_1 + x_2 + x_5) + \left( 1 - \frac{p_G}{h} \right) x_4 \right]$$

$$(37) \quad D_S = M \left( 1 - \frac{p_S}{u} \right) x_3$$

**Case 9:**  $p_S > p_G > 0$  and  $0 < \frac{p_G}{u} \leq 1 < \frac{p_S}{u}$

The demand functions for Case 9 are:

$$(38) \quad D_G = M \left[ \left( 1 - \frac{p_G}{u+h} \right) (x_1 + x_2 + x_5) + \left( 1 - \frac{p_G}{h} \right) x_4 \right]$$

$$(39) \quad D_S = 0$$

**Case 10:**  $p_S > p_G > 0$  and  $0 < \frac{p_G}{u+h} \leq 1 < \frac{p_G}{u}$

The demand functions for Case 10 are:

$$(40) \quad D_G = M \left( 1 - \frac{p_G}{u+h} \right) (x_1 + x_2 + x_5)$$

$$(41) \quad D_S = M \left( 1 - \frac{p_S}{u} \right) x_3$$

**Case 11:**  $p_S = p_G \equiv p > 0$  and  $0 < \frac{p}{u} \leq 1$

This case was described in the main text.

**Case 12:**  $p_S = p_G \equiv p > 0$  and  $0 < \frac{p}{u+h} \leq 1 < \frac{p}{u}$

This case is very similar to Case 11, except that here total demand is

$$(42) \quad D_G + D_S = M \left[ \left( 1 - \frac{p}{u+h} \right) (x_1 + x_2 + x_5) \right]$$

Apart from this consideration, the discussion of Case 11 provided in the main text continues to apply.