Mandaroty labeling as a cost transfering mechanism.

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Abstract

In this work we provide a theory of mandatory labeling of quality. Our main tenor is that mandatory labeling is a means of redistributing the burden of certification costs from the high to the low quality producer. This redistribution may be necessary for the existence of the high-quality product, but in many instances may lead to the disappearance of the low-quality one. If the low-quality has positive value for consumers, redistribution can be performed only up to some extent. We determine the minimum (necessary) and the maximum limits within which a social-welfare increasing redistribution of certification costs can be performed, and show that the set between these two limits may in many cases not be empty. This implies that even when some redistribution of the certification cost is called for by normative arguments, the regulator has discretion over the final outcome, leaving the door open to political pressures.

Keywords: Label, Mandatory labeling, Imperfect consumer information, Vertical differentiation

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1 Introduction

Recently, consumers have been increasingly interested in various "invisible" goods-attributes. Several experimental and/or empirical studies have corroborated the existence of a positive consumer willingness to pay for attributes such as "green", "ethical", "fair-trade", "dolphin safe", "not tested on animals", "organic", "no child labor", "low cholesterol", etc. (see e.g. Disdier and Marette, 2012, Hainmueller et *al.*, 2011, Arnot et *al.*, 2006, Noussair et *al.*, 2004, Lusk et *al.*, 2005, and Teisl et *al.*, 2002). Many of the aforementioned attributes reveal a consumers' preference for specific production-processes. This preference is either rooted in the belief that certain types of production provide direct private benefits, mainly health ones (*e.g.* organic products and foodstuff not containing Genetically Modified Organisms–GMO),[1] or stems from ethical issues.

Credence attributes create asymmetric information and often result to either substantial reduction of trading volume, or total collapse of the related market, unless a way is found to assure consumers that their money is well spent. Since consumers remain unable to distinguish whether a firm's claim with respect to such attributes is true or false even after the purchased good's consumption, most market-devised mechanisms fail to improve information in markets related to credence attributes, leaving direct certification, usually performed by a credible third party, as the only mechanism able to do so. Since certification of the exact level of a credence attribute in every product type may be very costly and provide information that is very difficult for consumers to grasp, most often the certifying agency defines a standard and certifies whether the inspected product complies to it. Products thus certified receive a "label", allowing consumers to distinguish them from other varieties that do not satisfy the established criterion, or have not been inspected. For instance, a public label in Austria and Germany guarantees consumers that the labeled foodstuff contain no Genetically Modified Organisms (GMO). As GMO and GMO-free varieties are handled by the same facilities, some mingling is unavoidable, making it therefore, practically impossible to have products that are 100% free of GMO's. Instead

[1] Direct private benefits can be related to product-quality perceptions, as is the case of Geographic Indicators (GI). While some dimensions of quality, such as taste, can in principle be verified after consumption, most people rely heavily on the product's origin in order to assess its quality. For instance, even in their post-consumption evaluation of a wine, many non wine-connoisseurs rely less on their direct experience from tasting the wine, attributing more weight to their origin-related perception of the wine's quality.

of certifying the percentage of GMO in each firm's final product, the label sets a maximum level of acceptable GMO content and labels products as GMO-free, accordingly. Concerning energy-efficiency, electric appliances in the European market are certified according to a five-tier label..

Contrary to other forms of regulation, labeling is often voluntary, since the label allows a firm to reap the benefits from having certified its product as being of "high quality". In some cases, however, labels are "mandatory", requiring that all products in the market provide, directly or indirectly, information about their content in some attribute(s). Mandatory labeling is usually advocated on some of the following four grounds. The first relates to the potential insufficiency of price premia to provide the right incentive for labeling the high quality. The second, to shifting, partially or totally, the burden of the certification cost from the high to the low quality. This shift may be motivated by the aforementioned insufficiency of price premia, but may also be due to either purely redistributional considerations, or trade protectionism. The third, relates to controlling the quality level at which the label is granted.[2] Finally, there is a message communication argument: a quality label carried by a product that has a very small market share has itself very little visibility, therefore its absence on products representing the majority of sales in the market will go unnoticed. Instead, a negative label on the low quality would not only inform consumers about the quality of the product that carries the label, but also about the existence of the two qualities. The label "contains sulfites" found on the majority of wine bottles is an example: many consumers become aware of the existence of sulfites in the wine they consume, even if in most cases they will continue to consume it.[3]

The mandatory status fits well some types of labeling where the concept of quality is not well defined (*horizontal* labels). For instance, nutritional labels provide information about a bundle of characteristics that, taken separately, may be not meet unanimity in consumers'

[2] As reviewed in Bonroy and Constantatos (2014) the socially optimal level of the label's standard is typically higher than the profit maximizing one. By imposing mandatory labeling at the desired level, the regulator may preempt attempts for private labeling at a different level. Assume, for instance, that the regulator's optimal level of purity in order to characterize a product as GMO free is $x\%$, while the industry wishes the same label offered at a purity level $y < x$. If the ndustry introduces its label at $y\%$ while the regulator's label is mandarory, any firm producing between x and y must first carry the regulator's label of "containing GMO's", and then, be characterized as "low GMO percentage" by the private label. This would increase certification expenses while reducing the effectiveness of the private label, pushing most likely the latter out of use.

[3] Health hazard labels on cigarettes is another example of negative labeling. However, since for this good there is no high quality to be certified, the label is only a message carrier, and no certification cost is paid, the only cost for this label being the printing and package changing cost.

preferences; moreover, even when consumers are unanimous about any single attribute within a group, they may disagree in their evaluation of the group as a composite commodity.[4] However, mandatory labeling with respect to single attributes that command unanimous reaction by consumers–*vertical* labels, such as those referring to a product's content of Genetically Modified Organisms–is less obvious.

In this paper we try to provide a theory, both normative and positive, of mandatory labeling of quality. Our main tenor is that mandatory labeling is a means of redistributing the burden of certification costs from the high to the low quality producer. This redistribution may be necessary for the existence of the high-quality product, but in many instances may lead to the disappearance of the low-quality one. If the low-quality has positive value for consumers, redistribution can be performed only up to some extent. We determine the minimum (necessary) and the maximum limits within which a social-welfare increasing redistribution of certification costs can be performed, and show that the set between these two limits may in many cases not be empty. This implies that even when some redistribution of the certification cost is called for by normative arguments, the regulator has discretion over the final outcome, leaving the door open to political pressures. We model the latter in two ways. First as pure resistance to the percentage of certification cost transferred from the high- to the low-quality producer. Such resistance requires the use of real resources, and therefore the total bill to society for the introduction of the high quality product may be increasing to the percentage of cost that is redistributed. Second, we consider effort to affect the label's standard, as a means to reduce its cost.

Take GMO's as an example. Since both the GMO and the GMO-free products use the same facilities, there is an Identity Preservation (IP) cost necessary to keep the two products separate: after a quantity of GM product has passed through, the facilities must be cleaned, otherwise the purity of the GMO-free product is questionable. Who pays for IP? Under voluntary labeling it is the GMO-free producers that must assume that cost. Making labeling mandatory the regulator may hold the low quality producers liable for part or the entire amount of it. To

[4]For instance, "high energy" drinks contain ingredients that are desirable for an athletic dietary regime, but undesirable for a weight-loss regime. On the other hand, all consumers may agree in avoiding unsaturated fat and cholesterol, however the may not be unanimous in the importance they accord to each one. As a result, the ranking of two products, one containing less fat and the other less cholesterol, may differ from one consumer to another.

avoid misunderstanding, shifting the IP or certification cost to the low quality producers does not mean certifying the low quality, or cleaning the facilities after the GMO-free product has passed through. It is always the high quality that needs to be separated, certified, and have its identity preserved, and the cost of these operations remains unaffected no matter who pays for it. However, by making labeling mandatory, the regulator has a means to transfer some of these costs to the low quality producer. In the case of GMO's, mingling of the two products is unavoidable, thus making the 100% purity level for a GMO-free product unattainable: products are labeled according to whether they are above or below a certain purity level, arbitrarily decided by the labeling agency. The real cost of IP obviously depends on the standard's level. Since any gains from increased purity go to the high-quality, and assuming that mandatory labeling transfers at least part of the IP cost to the low quality, for any given percentages of redistribution, the high- and low-quality producers have, *ceteris paribus,* divergent incentives for setting the standard, thus also affecting the regulator's decision.[5]

Many more examples of labels can be found. In the US, eggs, poultry and beef products may carry USDA-administered labels, such as "Organic", and "No Hormones". The label by the international non-government organization Forest Stewardship Council guarantees consumers that the wood-made products they are using come from responsibly harvested and verified inputs. The European label EU Ecolabel is awarded according to high environmental and performance criteria set by the member states. Recently, the label Maître Restaurateur has been implemented in the French restaurant industry, guaranteeing that meals are prepared with fresh and regional ingredients. Controlled-origin labels guarantee that the production of certain products (wine, cheese, olive oil, and others) has taken place within a specific geographical area. As can be seen from the examples presented, the agro-food sector is one of the most heavily "label-bearing" sectors.

The market share of certified products has been constantly increasing : between 2000 and 2008, 234 new names have been registered in the European Union as protected designation of origin (PDO), or protected geographical indication (PGI), to reach a total of 779 registered names.[6]

[5]The *ceteris paribus* caveat aims to rule out other market considerations in setting the standard. In our analysis, both firms would not have an incentive to affect the standard if its cost were not to be redistributed between them.

[6]For a product name to be protected as a PDO, all stages of the production process must take place in the defined geographical area. For a PGI product, it is sufficient that only one stage of production takes place in the

Depending on the European country considered, these GI products account for between 1% and 5% of the turnover of the agro-food sector (London Economics, 2008). Organic products have similar participation in the total trade volume of their corresponding market in the European Union (European Commission, 2005); these market shares keep trending upwardly.

In many markets, the position of certified products is already well established. Over 50% of the Canadian productive forestland, and more than 15% of the respective U.S. one, are certified by some ecolabel on forest products (Forest Stewardship Council label, Sustainable Forestry Initiative label, etc.), and 99% of all wood used by the U.S. building industry is labeled (Yale Program on Forest Policy and Governance, 2008). Fair-trade bananas accounted for over 20 percent of banana sales in the United Kingdom, and for 40 percent in Switzerland in 2007 (FAO, 2009).[7]

The significant and always increasing presence of labelled products, especially in the agro-food sector, has attracted great interest on the implications and impact of labels from both, theoretical, and policy perspective. While the usefulness of labeling may seem obvious–after all, the presence of labels reduces information problems–theoretical analysis casted many doubts on the unconditional usefulness of introducing a label, making the answer less straightforward that it might initially appear. For a general review of labeling, see Bonroy and Constantatos (2014). Golan *et al.* (2001) presents a report of important issues related to labeling, followed by three case studies. Caswell and Anders (2011) introduces a labeling typology according to who owns the label, who performs the certification, and whether labeling is voluntary or mandatory, followed by an analysis of advantages and disadvantages of each identified type, as well as a description of situations where each type of labeling performs better. Teisl and Row (2005) argues that the effectiveness of eco-labeling programs depends on a) whether all firms are required to provide the information (mandatory vs voluntary), how detailed is the information presented to consumers, standardization of the information presented, and consumer's perception of the credibility of the source providing the information. More recently, Roe *et al.* (2014) focus on the question of mandatory vs voluntary labeling, pinning down the advantages and disadvantages of the two labeling forms. While very rich in observations and conclusions, the analysis in Roe

defined area.

[7] United Kingdom and Switzerland account for 61 percent, and 12 percent, respectively, of all fair-trade banana sales worldwide.

et al. (2014) remains informal.

The spectacular growing of interest in nutritional labels has sparked a large literature, reviewed in Drichoutis *et al.* (2006). This literature focuses on the determinants of label use, the debate on mandatory labeling, label formats preferred by consumers, and the effect of nutritional label use on purchase and dietary behavior. Kiesel *et al.* (2011) updates that review by presenting findings based on three types of data sources: consumer surveys, non-experimental data, and experimental data, distinguishing studies based on market level or natural experiments from laboratory experiments.

2 Mandatory labeling

2.1 The rationale for mandatory labeling (normative arguments)

Consider a product that can be produced only at two exogenously given quality levels, high and low. Under full information there is a positive demand function $D_i(p_i)$, for each product type, $i = H, L$. Let the full information equilibrium prices be $\widetilde{p}_i$, the value of $\widetilde{p}_i$ depending on each market's structure, and assume that $p = \widetilde{p}_i$, both profits and consumer surplus are positive.[8] Assume that the market is served by two firms that have no choice over the quality of their product: firm H produces the high quality and firm L the low one. Under asymmetric information both firms are in the market but consumers ignore the presence of good units, therefore expecting any purchase they make to be of low quality with probability one. This implies that prior to certification, even if both qualities are present, it is as if there is only the low quality product, and the labeling cost corresponds to the necessary cost for introducing a new quality; assume the certification cost, F, to be fixed.[9] [10] The introduction of a new product (of same or different quality to the existing one) is socially desirable when the additional surplus

[8] When a market is competitive, positive profits reuqire increasing marginal cost.

[9] If the quality of each firm's product is subject to choice, under imperfect information both firms produce the low quality. The introduction of the high quality may eventually require other quality-upgrading costs, on top of the certification cost, the latter becoming in that case only part of the necessary cost for the introduction of the high quality.

[10] If under asymmetric information consumers are expecting an average quality, as in Zago and Pick (2006), labeling corresponds to the introduction of *two* new qualities instead of one, along with the simultaneous withdrawal of the expected quality under asymmetric information.

it creates outweighs any fixed costs F, related to its introduction, and the question is whether the market outcome complies to this rule.

The theory of industrial organization recognizes that a new product's introduction requires a fixed cost, socially valuable products may not be introduced. This is due to the "non appropriability of consumer surplus" (see Tirole 1989, pp xxx): even at a monopoly position, a firm can capture only a part of the net value its product creates, the remaining becoming consumer surplus. Hence, in some situations it is possible that:

$$\Delta\pi < F < \Delta\Pi + \Delta CS,$$

where $\Delta\pi$, $\Delta\Pi$, and ΔCS stand for the change in individual profit, total profit, and consumer surplus, respectively, from the introduction of the new product. The second inequality states that the good is socially desirable, but the first that it is privately unprofitable, and therefore will not be introduced. The problem is exacerbated if the consumption of high quality is also related to positive externalities, *i.e.,* the CS term captures itself *only part* of the social value created by the consumption of the high quality.[11]

The obvious prescription for the above problem is alleviation of the high quality producer by a part, or the entire amount of F, by shifting the burden to either the taxpayer, or the low-quality producer. The former implies direct subsidization of the high quality, while the latter can be obtained through a mandatory labeling scheme. Mandatory labeling requires the low-quality producer to pay at least part of the labeling cost, it is thus equivalent to a tax-cum-subsidy scheme which can be used in order either to enhance efficiency, and/or purely for redistribution. Since labeling requires the certification of only the high quality–in contrast to MQS where all products must be certified–any mandatory labeling scheme can only be operational if it provides the high quality producer with the incentive to submit its product for certification.[12]

[11] Economic theory suggests that market failure may in some cases imply "too many" instead of "too few" products n the market. The so-called "business stealing" effect, recognizes that $\Delta\pi > \Delta\Pi$, since part of the new product's profit is "stolen" from the profit of already existing products. It is thus possible to have $\Delta\Pi + \Delta CS < F < \Delta\pi$: despite the fact that the product's introduction is socially not worth (first inequality), the product is privately profitable and will be introduced (second inequality). In our context this translates to a tendency towards labeling abuse: due to private incentives, firms may seek to label their product in situations where the benefits from more information do not match the corresponding costs. In what follows we ignore this case.

[12] It is, of course, impossible to *force* the high quality alone to label its product, for it has always the option to forego the payment of F, selling its product as low quality, if more profitable. In Desquilbet and Bullock 2009, the group of non IP grains (normal grains in their terminology) is composed by GM grain and grain that "sprouts

By having the low quality subsidizing at least part of the high quality's certification cost F, a mandatory labeling scheme provides such incentive, through two channels: subsidization, and worsening of the profitability of the low-quality alternative. Since from this "stick and carrot" scheme the low-quality producer receives only the stick, the non appropriability of consumer surplus problem may appear now at the other end of the quality spectrum: the low quality product, while socially worth, may become privately unprofitable. Gruyere *et* al. argue that ...

In order to maintain both products in the market, the regulator may perform redistribution only within the limits imposed by the self-selection constraint for the high quality, and the participation constraint for the low quality. Let π_i, $i = H, L$, represent the corresponding profits under certification of the high quality, π are the (equal for both firms) profits when the high quality refuses to certify its product, and t be the percentage of F paid by the low quality. The self selection constraint for the high quality is:

$$\pi_H - (1-t)F \geq \pi \Leftrightarrow t \geq \underline{t} \equiv (\pi + F - \pi_H)/F.$$

The low-quality participation constraint is:

$$\pi_L - tF \geq 0 \Leftrightarrow t \leq \bar{t} \equiv \pi_L/F.$$

Note that when $F \leq \pi_L$, the low quality stays in the market even if it is held liable for the entire amount of F. When $0 < \underline{t} < \bar{t} < 1$, the regulator is constrained to choose a $t \in \left[\underline{t}, \bar{t}\right]$, otherwise one of the two qualities will be lost.

2.2 The choice of t: Positive analysis

from non-GM seed, but producers take no steps to prevent its possible commingling with GM grain."

Certification of the low instead of the high quality also fails because its producer may always self-report the true quality of its product, while the high quality producer cannot be held liable for falsely reporting low quality. Hence, only units originating from firms that do not self-report as low quality producers must be tested and certified. Hence, even if it is the low quality that carries the label (negative label) the certification cost is related to the high quality.

The above argument applies only to the costs related to identifying the two qualities. When labeling involves other costs, such as message-communicating costs (*e.g.,* the cost of printing the information on the package) the situation changes, since now the low quality can be held liable for not complying with the regulation. The result in Crespi and Marrette *xxx* that from an efficiency point of view, labeling must imposed on the product with the smaller market share, must be understood as applying on message-communicating and other particular costs of labeling, and not on the certification costs necessary to identify the high quality.

What does determine the exact value of t? The normative analysis narrows the interval within which t is likely to be found, but says little about its exact value. Obviously, such situation opens up the way for costly lobbying activities targeting the value of t. We assume that each quality is produced by many identical firms, and the terms H-, and L-firm refer to the representative firm of each type.[13] The lobbying game is played by two rival central agencies, each representing the interests of the corresponding producers. This agency is a *supra* firm structure, controlling all lobbying activities and aiming to maximize the representative firm's profit, net of lobbying expenses. The agency can impose its decisions on lobbying expenses on individual firms, but differs from a cartel directing board in that it has no saying on their quantity or price decisions. Since each lobbying agency has the same objective as the typical firm it represent, we continue describing the lobbying game as played between the representative H- and L-firms.

We model the situation as a three-stage game. At the first stage each firm sets a target value t_i, $i = H, L$. At the second stage, each firm incurs lobbying expenditures, $C_i = c_i F$, $i = H, L$, in order to promote the adoption of its target. At the end of the second stage a draw determines whether it is t_H or t_L that is finallly adopted by the government. After observing the result of the draw, the high quality firm(s) decides whether to certify its product and the low quality firm whether to stay in the market.[14] At the third stage firms compete and earn their profits.

Starting backwards, consider that the "market game" (3rd stage) has been played and resulted in some the following payoffs, according to the firms' previous decisions on entry and certification. These payoffs are operating profits as functions of primary demand and cost variables, as well as of market structure and the type of competition (Cournot, or Bertrand). These (gross of certification cost) profits are assumed to obey the following ranking:

$$\widetilde{\pi} > \pi_H > \pi > \pi_L,$$

where: π_i, $i = H, L$, represent the corresponding profits under certification of the high quality, π are the (equal for both firms) profits when the high quality refuses to certify its product, and $\widetilde{\pi}$ is the profit of the high quality when the low quality does not participate in the market. In

[13] The situation does not change if we consider a single or a few firms within each group.

[14] We assume that production costs are not affeted by quality, therefore a high qualtiy firm can never excluded from the market. Even if it decides to forego certification, it can always sell its product as low quality, and make the same profit as a low-quality producer.

order to avoid examining trivial cases, we assume that

$$\pi_H - F \leq \pi \quad \text{and} \quad \pi_L - F \leq 0.$$

The first (second) inequality rules out the case where the high (low) quality can afford the entire certification cost, *i.e.,* we assume that $\underline{t} \leq 0 \leq 1 \leq \bar{t}$.

The exposition can be simplified if we normalize the above payoff functions with respect to the certification cost F, setting $\widetilde{\pi} = \widetilde{\gamma}F$, $\pi_H = \gamma_H F$, $\pi = \gamma F$, and $\pi_L = \gamma_L F$; hereafter we adopt these normalized terms, and re-write our previous assumptions as

$$\begin{aligned} \widetilde{\gamma} &> \gamma_H > \gamma > \gamma_L, \\ \widetilde{\gamma} - \gamma &< 1, \\ \gamma_L &< 1. \end{aligned} \tag{1}$$

At the second stage both firms (agencies) decide their optimal amount of lobbying expenses. Lobbying expenses affect the probability the the draw's outcome is the share rule of the certification cost proposed by the high quality agency, that probability being given by the following function

$$\varrho\left(c_H, c_L; t_H, t_L\right) = \frac{c_H\left(1 - t_H\right)}{c_H\left(1 - t_H\right) + b c_L t_L}, \tag{2}$$

where $b \geq 0$ represents the relative efficiency of the low-quality lobbying expenses relative to that of the corresponding expenses of its rival. This term summarizes both, differences in organizational efficiency, as well as social *a priori* favor or dislike towards each of the two qualities. For instance, GMO producers may rely on a better performing agency, which pushes b upwards, but at the same time society may show more "sympathy" towards non-OGM producers, attributing to traditional farming the preservation of some important societal values. When $b > (<) 1$, the overall prior is in favor of the low (high) quality producers. The function $\varrho\left(\cdot\right)$ is constructed as to reflect that each firm's necessary expense in order to target a given value of ϱ increases with the "ambition" of the sharing rule that firm has proposed at the first stage of the game. In other words, as t_H increases (t_L decreases) the high (low) quality agency needs higher amounts of lobbying expenses in order to reach a given probability of succes ϱ (or $1 - \varrho$).

Assume first that t_H, t_L are such that, together with the exogenous parameters of the model (γ's and c's) guarantee that in equilibrium the high quality certifies its product and the low quality stays in the market. The lobbying decision of the high quality is taken as to

$$\begin{aligned} \max_{c_H} \widehat{\pi}_H^{S3} &= \varrho(\cdot)\left[\gamma_H - (1-t_H)\right] + (1-\varrho(\cdot))\left[\gamma_H - (1-t_L)\right] - c_H \\ &= \gamma_H - \left[\varrho(\cdot)(1-t_H) + (1-\varrho(\cdot))(1-t_L) + c_H\right]. \end{aligned} \tag{3}$$

Since γ_H is a market outcome not affected by changes in the fixed cost of each firm, maximization of $\widehat{\pi}_H^S$ corresponds to minimizing the sum of the expected share of the expected share of the certification cost plus the lobbying cost (the term in square brackets on the RHS of the above). The resulting reaction function of the high quality is

$$\begin{aligned} c_H^{rfS}(c_L; t_H, t_L) &= \frac{bc_L(t_H-1)t_L + (t_H-1)\sqrt{bc_L(t_H-1)t_L(t_L-t_H)}}{(t_H-1)^2} \\ &= \frac{\sqrt{bc_L(t_H-1)t_L(t_L-t_H)}\left[1+\sqrt{bc_L(t_H-1)t_L(t_L-t_H)}\right]}{t_H-1}. \end{aligned} \tag{4}$$

The corresponding problem of the low quality firm is

$$\begin{aligned} \max_{c_L} \widehat{\pi}_L^{S3} &= \varrho(\cdot)\left[\gamma_L - t_H\right] + (1-\varrho(\cdot))\left[\gamma_L - t_L\right] - c_L \\ &= \gamma_L - \left[\varrho(\cdot)t_H + (1-\varrho(\cdot))t_L + c_L\right], \end{aligned} \tag{5}$$

yielding the following the reaction function:

$$\begin{aligned} c_L^{rfS}(c_H; t_H, t_L) &= \frac{\sqrt{-b^3c_H(t_H-1)t_L^3(t_H-t_L)} + bc_H(t_H-1)t_L}{b^2t_L^2} \\ &= \frac{\sqrt{c_H(t_H-1)}\left[\sqrt{c_H(t_H-1)} - \sqrt{t_H-t_L}\right]}{bt_L}. \end{aligned} \tag{6}$$

Solving the two reaction-functions system yields the second stage equilibrium value of each firm's lobbying expenses, for any given pair of proposed share rules:

$$c_H^{S2} = c_L^{S2} = c^{S2} = \frac{b(1-t_H)(t_H-t_L)t_L}{(1+bt_L-t_H)^2}. \tag{7}$$

The resulting equilibrium probability of t_H being adopted is

$$\varrho^{SS} = \frac{1 - t_H}{1 + bt_L - t_H}. \tag{8}$$

Finally, the second-stage maximized profits of the two firms are

$$\widehat{\pi}_H^{S2}(t_H, t_L) = \frac{bt_L(bt_L + 2)\alpha + \gamma_H - 1 + (3 - 2bt_L\alpha - 2\gamma_H)t_H + (\gamma_H - 3)t_H^2 + t_H^3}{(1 + bt_L - t_H)^2} \tag{9}$$

with $\alpha = \gamma_H + t_L - 1$

and

$$\widehat{\pi}_L^{S2}(t_H, t_L) = \frac{(1 - t_H)^2(\gamma_L - t_H) + 2b(1 - t_H)(\gamma_L - t_H)t_L + b^2\gamma_L t_L^2 - b^2 t_L^3}{(1 + bt_L - t_H)^2} \tag{10}$$

At the first stage of the game the agency H makes a share offer t_H in order to maximize its expected profit $\widehat{\pi}_H^{S2}(t_H, t_L)$, which yields the reaction function:

$$t_H^{rfS} = 1 + \frac{\sqrt{bt_L}}{2}\left(3 - \sqrt{9bt_L - 8t_L + 8}\right), \tag{11}$$

and similarly, the agency L makes an offer t_H in order to maximize its expected profit $\widehat{\pi}_L^{S2}(t_H, t_L)$, yields the reaction function:

$$t_L^{rfS} = \frac{\sqrt{(1 - t_H)[(8b - 9)t_H + 9]} - 3(1 - t_H)}{2b} \tag{12}$$

The equilibrium offers are

$$t_H^S = \frac{1}{3} + \frac{2}{3\left(\sqrt{b} + 1\right)},\ t_L^S = \frac{2}{3\left(\sqrt{b} + 1\right)}. \tag{13}$$

When $b = 1$, so the two firms' expenses have the same productivity in terms of lobbying (the process is unbiased), the offers are symmetric with $t_H^S = 2/3$, and $t_L^S = 1/3$. Substituting the equilibrium offers from (13) into (7) and into (8) we obtain the equilibrium lobbying effort and

the resulting probability of t_H's success:

$$c_H^S = c_L^S = \frac{\sqrt{b}}{3\left(1+\sqrt{b}\right)^2}, \quad \varrho^S = \frac{1}{1+\sqrt{b}}.$$

The above shows that the eventually wasteful lobbying expenses are minimized when the process is unbiased, *i.e.,* when $b = 1$. Finally, the expected share of the certification cost is

$$\widehat{t}^S = \varrho^S t_H^S + \left(1-\varrho^S\right) t_L^S = \frac{1}{1+\sqrt{b}}.$$

When $b = 1$, the solution is symmetric and the expected share is $1/2$. The above solution holds as long as in equilibrium both, the low quality stays in the market, and the high quality certifies, whether the outcome of the draw is t_H^S or t_L^S. Since, however, these decisions are made, not upon $\widehat{t}^S$, but upon the observation of the actual value of t, we need to also examine potential corner solutions.

2.3 Blockaded entry of the low quality

3 Conclusions

Mandatory labeling is a means of transferring part of the certification burden from the high to the low quality producer. This redistribution may be necessary when the high quality is threatened, and works by providing stick and carrot to the high quality: not only its certification cost is reduced but the option of avoiding certification by pretending to sell low quality becomes unattractive. However, the redistribution of the certification cost can only be performed within limits, otherwise the low quality may be driven out of the market. When redistribution is feasible, firms may spend lobbying expenses to shift an as big as possible part of the certification cost to their rival. This results in a symmetric equilibrium with positive expenses, that are completely wasteful: firms are trapped in a prisoner's dilemma situation.

We currently work in two directions. The first is to determine the lobbying outcome under asymmetric conditions, and the second, to relate also the amount of the certification cost F to lobbying, since firms may act by trying to affect the label's standard.

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