What's in a Name?
Information, Heterogeneity, and Quality in a Theory of Nested Names

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Abstract

Collective labels are widespread in food markets, either separated or nested with private brands, in this latter case then known as *nested names*. We propose a model to explain the rationale of nested names, with collective labels being effective in reaching unaware consumers, while individual brands helping firms in reaching expert consumers. We also incorporate the decision-making process within the group of producers joining collective labels, taking into account their heterogeneity in providing quality. Results show that nested names emerge when consumers become more aware about the label's quality information and when producers become more heterogeneous. Welfare tough may decrease when the group switches to nested names, as they reduce incentives to provide quality for less efficient producers. The results provide insights also to the historical and recent trends in food industries, such as within-label differentiation and label fragmentation, and their welfare implications.

JEL classification: D71, D83, L15, L66, Q13.

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1 Introduction

The coexistence of private brands and collective labels is common in agricultural and food markets. While agricultural producers and food firms can build their own brands (referred as individual brand-names, national brands, or firm-specific labels), they can also join collective labels (also referred as regional brands), such as Protected Designation of Origin (PDO) and Product of Geographical Indication (PGI) in the European geographical indication system (see, e.g., Menapace and Moschini, 2012). Moreover, it is also common for products such as wine and cheese to carry individual brands and collective labels simultaneously. Such a labeling strategy, known as "nested names", has received attention in recent empirical studies (see, e.g., Costanigro et al., 2010). In this article, we introduce an original model to investigate the choices of labeling strategies when firms can use both private (or individual) brands and regional (or collective) labels.

The evidence from empirical studies shows that consumers do have a preference for products carrying brand-names or collective labels compared to no quality signals. For example, Bonnet and Simioni (2001) and Hassan and Monier-Dilhan (2006) show that consumers are willing to pay a price premium for brand names. Deselnicu et al. (2013) find that collective labels, such as PDOs, can add value to food products. However, the willingness to pay for a PDO label depends on the product quality level: Loureiro and McCluskey (2006) show that for beef meat the PGI label is mostly valued by consumers for cuts of average quality. Similar evidence has been found in the US wine market (Costanigro et al., 2007). Comparing labeling strategies, brands can be more effective than a PDO label to increase consumers' willingness to pay (Deselnicu et al., 2013; Bonnet and Simioni, 2001). However, when nested names are concerned, Costanigro et al. (2010) argue that individual brands and collective labels can be complementary: the evidence in the wine sector shows that collective (or aggregate) names add price premia to expensive wines using firm-specific names.

Thus empirical evidence suggests that private brands and collective labels, used separately or nested, may have disparate impacts on consumers' quality perception. This of course raises several questions: What are the firm's best labeling strategies? How is the product quality decided under different labeling schemes? Are these firms' labeling strategies good or bad for economic welfare?

Despite the large number of empirical studies on the simultaneous use of different labels for food products, on the theoretical side there are only few studies that take into consideration this coexistence explicitly. Bonroy and Constantatos (2015), in reviewing the theoretical literature on labels highlight the role of labels for product differentiation and market segmentation. However, most of the models in this vein assume that labels convey full information or can perfectly inform consumers at some cost (see, e.g., Crespi and Marette, 2001; Fulton and Giannakas, 2004; Zago and Pick, 2004 among others). Bonroy and Constantatos (2008) consider the situation of an "imperfect" label, i.e., when the labeling information is not perceived by all consumers. They identify two types of labels: an easy-to-grasp label that can improve the information for unsophisticated consumers, and a sophisticated label that provides detailed information but is totally ignored by unsophisticated consumers. They derive the welfare impact of these labels under a two-quality duopoly structure. However, their model does not explain the coexistence of different labels, nor does it investigate the endogenous quality choices under different labeling patterns.

Another strand of literature studies the reputation effects of brands or labels for credence goods. While most work investigates individual and collective (or regional) reputations independently (see, e.g., Tadelis (1999), Mailath and Samuelson (2001), and Shapiro (1983) for firm individual reputations; Tirole (1996), Winfree and McCluskey (2005), and Fishman et al. (2014) for collective or regional reputations), very few works consider the coexistence of different labels. Costanigro et al. (2012) investigate the quality incentives of firms choosing nested names. They devise a model of a differential game that blends Shapiro (1983)'s model of private reputation and Winfree and McCluskey (2005)'s model of collective reputation. Using simulations, they find evidence consistent with Costanigro et al. (2010), i.e., private reputations become more valuable than collective ones the more expensive the product is. However, the model mainly focuses on the dual reputation effect of the nested names, without investigating the endogenous formation of other labeling schemes, e.g., the individual brand and collective label emerging separately. Therefore, they do not provide the welfare implications of different labeling schemes.

In this paper, we develop a model to analyze labeling strategies of producers within a region, taking into account their different impacts on consumers' perception about product quality and the effects on producers'quality investment incentives. Our analysis builds on the evidence of Costanigro et al. (2010; 2012) but adds some new contributions to the theoretical literature on labeling. Our first contribution is to capture the heterogeneity of consumers regarding the information they have or they can collect about the quality embodied in the labeling schemes. While some consumers are aware about the firm-specific brands, the general public tends to be unaware about the brand information. Instead, they are more likely to be informed by the collective label, which conveys the information of average quality in the region. This feature is in the spirit of Bonroy and Constantatos (2008) and is consistent with the findings of Costanigro et al. (2010; 2012). Furthermore, we show how the information heterogeneity may change the firm's choice of different labeling strategies and how such a change will affect the overall quality level and social welfare.

Our second contribution is to explain the recent trend of labeling scheme changes and the controversial issues on quality setting and labeling differentiation within the groups of producers adopting a collective label. As is further illustrated in Section 2, producers sharing a common regional label have different quality potentials and hence may have divergent interests concerning the quality rules within the collective label. Consequently, differentiation within the label may emerge, with some producers using nested names, while others holding to the collective label only. These trends and controversies are difficult to reconcile with existing models of quality labels. For example, most of the models in the labeling literature consider two types of producers, but once the label is introduced it usually leads to a market segmentation between high and low quality producers, where producers within each segment are homogeneous (Bonroy and Constantatos, 2015). In the reputation literature, on the other hand, the high-quality producers establish a collective label to separate from low quality firms and therefore there is no differentiation within the collective label group (Fishman et al., 2014).

To explain the emergence of the label differentiation, we explicitly model the decision-making process within the group of producers that chooses the labeling strategies and the associated quality standards. In particular, we allow heterogeneity within the group, and show how choices of quality standards and labeling strategies can be different according to

which type of producers has more saying in a group and to the available outside options. In particular, we will see how an increasing degree of heterogeneity may lead to different labeling choices and hence name patterns, i.e., from collective labels to nested names or separated labels.

In the next section we describe recent cases that illustrate the coexistence of different labeling schemes and some controversies that emerge when groups decide on the quality rules within the collective label. In section three, we introduce the model, highlighting the information structure underlying the possible name patterns. In section four, we determine the equilibrium name patterns that emerge and the associated welfare inpact. In section five, we discuss some alternative specifications of the model. In the final section, we discuss the policy implication and conclude.

2 Industry trends

The coexistence of private and regional labels is common in the wine industry, where well known firms typically use private brands together with regional brands, while other firms benefit mostly if not only from the PDO. This is the case, for instance, of Valpolicella, the second most important region for red wine production in Italy. Here, some of the major wine producers, with established brand names, have grouped into the "Famiglie dell'Amarone d'Arte". Being historically among those firms which have heavily invested in the Amarone production technology and established a worldwide reputation for their wines, they have recently argued vehemently against the *Consorzio per la tutela dei vini Valpolicella*, the body managing the PDO and to which all its wine producers belong to, because a significant part of Amarone production is taking place in valley vineyards.[1]

The valley production, though, was in contrast with the long established PDO's rules that allowed Amarone to be produced mainly in the classical hilly areas. The Consorzio di Tutela has recently suggested amending its own rules to explicitely allow the production of Amarone in plain vineyards as well (dell'Orefice, 2013). However, different firms, notably those grouped into the Famiglie dell'Amarone d'Arte, were against such modification, arguing that Amarone production should remain confined in the hilly areas, since quality is higher (Guerrini, 2013a).[2] Some of these firms also threatened to leave the PDO (Guerrini, 2013b). Anyway, in May 2013, the general assembly of producers, after an unanimous decision by the Board of Directors, confirmed by majority the possibility of producing Amarone in the valley areas.

[1]Firms in Valpolicella produce different types of red wines, but Amarone, the strongest and full bodied type, in the last decades has been fetching prices well above those for other red wines coming from the same area and grapes. Historically, Amarone was produced mostly in hilly areas, considered better suited to give higher quality grapes. Over the years, however, because of an increasing demand, Amarone wine production has been quietly extended to other production areas as well, in particular in the plain valleys, where yields are higher but quality possibly lower.

[2]S. Boscaini, owner of Masi, explained that "I'm not convinced that Valpolicella should be made outside the hills. The Classico region is historically one of small growers, but the rest is 90% co-ops, and they try to minimise the differences between the original area and the additional area. I'm not saying that they can't make great wine. But [increasing the size of the AOC] has been a disaster for Valpolicella, driving it down in quality" (Rand, 2013 : 38).

Similar to the Valpolicella's is the situation that has emerged in Oltrepò Pavese, where some of the major and well known producers have recently left the official Consorzio di Tutela: dissatisfied with the quality policies and its attempts to allow greater yields (thus lowering quality), they accuse it of being more in the interests of wine-bottlers than wine-makers (Morra, 2015, Scarci, 2015). There are also other instances in which groups in the past have splitted, often when some producers have left the original PDO controlled by supposedly too conservative or lower quality firms. Probably most famous is the case of Tuscany, where in the last decades the Chianti PDO has expanded, differentiated within (with the original sub-zone distinguishing it as "Chianti Classico") and even witnessed some exit by innovative producers, that left the Chianti PDO (and their required Sangiovese plus local varieties blend) to experiment blending with other international grapes, i.e., Cabernet, Merlot.[3] A more recent case is in the Rioja region, where one of the most well known producers left the PDO and others threatened to follow suit, because dissatisfied with the PDO's labeling rules (Mount, 2016).

We believe the Valpolicella and these other cases are emblematic of the situations we would like to represent with our model. Many producers share a regional label, which is recognized by consumers and the market, but they are of different quality potentials. Possible opportunities (or threats) require changes in the (quality) rules adopted by the group, but different producers may have divergent interests and so hold different positions on the matter. Some may be concerned that the prospected changes may lower the quality of the product (or its perception by consumers). To decide on the rule to adopt at the group's level, a collective decision-making mechanism is used, e.g., majority's rule. The producers (in the minority) not satisfied with the adopted decision, may consider distinguishing themselves within the collective brand or leaving the group altogether.

These few examples illustrate the diversity of situations with respect to the labels used by firms in the wine industry. Other evidence can be found in other food industries, e.g., cheese, meat, etc., so that the problems we investigate in this paper go beyond the wine examples we provide. In the next section, we develop a model that can tackle the different possibilities to highlight when these different cases may occur. We will then show how these choices depend on the level of heterogeneity among firms, as well as on consumers' knowlege about the product.

3 The model

To analyze the economics of nested names, we develop a model rich enough to allow for endogenous choices of quality and labeling strategies. Nevertheless, we use a simple framework that can still reveal the rationale and effects behind these strategies, including consumers' preferences and information, and the heterogeneity of firms in quality provision.

[3]These instances of "secession-with-experimentation" have led to the production of the so called "Super Tuscan" wines, that initially could be produced only outside the PDO rules as table wines, thus using individual brands and not the Chianti label. Eventually, some of the exited producers started a brand-new PDO, Bolgheri.

3.1 Basic setting

We consider an economy with a unit mass of risk neutral consumers, who face a unit mass of producers of a region. Each consumer purchases one unit of the product. The utility function is $U(s,p) = \theta s - p$ if the consumer purchase, and $U(s,p) = 0$ otherwise, where θ is the taste parameter, s denotes the quality of the product, and p its price. For simplicity, we assume that consumers are homogenous in their preference about the product with the same quality so that $\theta = 1$ for all consumers.[4]

Each producer provides at most one unit of product[5]. Producers however are *heterogeneous in quality provision*. There are two types of producers (denoted by H and L). A proportion β of producers (type H) can *intrinsically* provide high quality δ at zero cost. This is consistent with the geographical nature of many regional products, where some producers enjoy appropriate weather and soil conditions as compared to those located in other parts of the same region.[6] The other proportion $1-\beta$ of producers is of type L and can only provide quality s, with $s \in [s_0, \delta)$ and s_0 is the lowest quality in the market, which corresponds to the minimum quality standard level. The production cost is $\Phi(s)$, where $\Phi' > 0, \Phi'' > 0$. We assume $\Phi(s_0) = 0$ and $\Phi(\delta)$ is sufficiently high so that the L type producers can never reach the quality level of the H type. To this end, δ reflects the degree of heterogeneity of these two types of producers in their ability of quality provision. The higher is the δ, the more likely is that the quality of the L type differs from that of the H type.[7] With such a setting, the H type producers behave "mechanically" and commit to the high quality δ, whereas the L type producers behave opportunistically in choosing quality, affecting the overall quality level in the market.[8] In what follows, we focus on the quality choices for the L type producers.

We assume that producers are monopolists in the local market and can charge prices up to the consumers' willingness to pay. The monopolist assumption is frequently used in the

[4]We want to investigate the motivation of producers to adopt different labeling strategies. Under this assumption, we abstract from the traditional motive of developing different products to attract consumers with heterogeneous taste and focus on the strategic motive of producers to use different labels to balance the conflicting interests within a group.

[5]This simplification is standard in the literature on product quality (e.g., Tirole, 1988). As in most of the applied literature on food quality provision (see, e.g., Winfree and McCluskey, 2005), by assuming fixed output we ignore any issue related to competition in quantity and capacity and focus on the strategic effect of quality setting.

[6]This is also consistent with the same ideas of *terroir* and zonation that were embedded in the PDOs in the wine sector since their beginnings in the early 20th century, in France but also in other European countries.

[7]A more standard measure of the producers' heterogeneity is the cost difference between L and H. In our setting, the cost of producing quality δ for the two type is $\Phi(\delta)$ and zero, respectively. The cost difference is thus $\Phi(\delta)$, which increases monotonically with δ. We thus use δ to measure the efficiency difference between the two types.

[8]Such a setting is similar to the imitation approach in the reputation literature (see, for example, the survey of Bar-Isaac and Tadelis, 2008 and the seminal paper of Kreps and Wilson, 1982), with the good type being a "commitment" type and the bad type being a strategic type who tries to imitate the good ones in order to benefit from a high price premium. However, instead of investigating the individual incentive in building up reputations, we focus on the quality and labeling choices at a collective level, which have different information effects compared to the individual strategy of reputation building. We also assume absence of fraud (see, e.g., Di Fonzo and Russo, 2015, for an explicit treatment of it).

literature of individual reputation (e.g., Bar-Isaac and Tadelis, 2008) and collective reputation (e.g., Fishman et al., 2014 and Saak, 2012). Different from the reputation literature, we investigate producers' and consumers' behavior in a static setting and assume that trade occurs only one period. Such a setting, together with the information structure described below, enables us to focus on the producers' labeling strategies and the emerging name patterns, without being distracted from the signaling effect of price on quality (see, e.g., Bagwell and Riordan, 1991, Schnabel and Storchmann, 2010), the dynamic complexity of reputation effects (see, e.g., Winfree and McCluskey, 2005, Fishman et al., 2014) and the competition effect (see, e.g., Crespi and Marette, 2001, Lence et al., 2007, and Bonroy and Constantatos, 2015). In what follows, we first define the first-best (benchmark) situation when there is no information asymmetry between consumers and producers. We then introduce further assumptions about the information effect of different labels.

First best *Under perfect information, all consumers are perfectly informed about the product quality. The first-best quality level is defined as the quality of the L type producers which maximizes total social welfare* :

$$\max_s W(s) = \beta\delta + (1-\beta)(s_c - \Phi(s))$$

The first-order condition gives the first-best quality level s^*:

$$1 = \Phi'(s^*). \tag{1}$$

This standard result suggests that, in the first best, the marginal valuation of the low quality type is equal to her marginal production cost.

A more realistic situation is that products have a credence good nature and their attributes cannot be cheaply assessed by consumers. In this case, certification or labeling can be an efficient way to convey information of product attributes to consumers. However, consumers are often *heterogeneous* regarding the information they have (or can collect) about the quality embodied in the product and how they can benefit from labeling schemes. In the spirit of Costanigro et al. (2010) and Bonroy and Constantatos (2008), and consistently with experimental (see, e.g., Gustafson, 2015) and industry anecdotal evidence (see, e.g., LARVF, 2015), we assume two kinds of consumers: a proportion α of aware consumers who can identify the true quality of a product with individual names, and $1-\alpha$ of unaware ones who perceive only the average quality of a product. The existence and distribution of the two types of producers are common knowledge for both consumers. However, absent any label or brand, consumers have no information of the product and expect only the average quality of the market, i.e., $\bar{s}_0 = \beta\delta + (1-\beta)s_0$.

Our setting can also be interpreted in the perspective of search costs: aware consumers pay lower search costs than the general public, i.e., unaware consumers. Such a setting is closely related to search models, where informed consumers (who pay lower search costs) can easily spot the favorable products, whereas uninformed consumers choose based on the average product characteristics (see, e.g., Varian, 1980, Chan and Leland, 1982). While these papers mostly investigate the role of price to signal the product information, our focuses on the role of different labeling strategies to inform consumers with different search costs.

3.2 Labeling strategies and possible name patterns

We simply consider two kinds of labeling strategies: individual brands (denoted by "I") and collective labels ("C")[9]. The principles (i.e., assumptions) of these strategies are defined as follows:

Assumption 1 ***Individual brand (I)****, adopted by individual producers at cost f, can inform the aware consumers about the true quality of product but provides no information to the unaware consumers.*

This assumption captures the idea that the individual brand is enough to inform the knowledgeable consumers (α proportion) and hence, transform the good into an experience one. However, without another nested labels, unaware consumers (the $1-\alpha$ proportion) cannot recognize the specificity of the product and expect only the average quality of the market, i.e., $\bar{s}_0$. f captures costs associated with the development of the individual brand. Costs may arise because of advertising, promoting and other measures needed to inform consumers, for property rights enforcement, and/or to avoid counterfeiting.

Assumption 2 ***Collective Labels (C)****, developed by the group of producers in a region at no cost, can inform both aware and unaware consumers about the average quality of the group.*

This assumption captures the idea that collective label can reach more general public than the specific names. For instance, an unaware consumer cannot recognize the quality of a given Valpolicella producer alone, but she can infer the quality from the regional Valpolicella label, while aware ones can have a good knowledge of the different producers. In order to develop the collective label, costs due to certification, advertising, promotion, etc., arise and are shared among the producers in the regional group. We assume that the producer mass is large enough so that the cost born by each producer is negligible[10].

Given the assumption of labeling strategies, various name patterns may emerge in the market. We focus on three name patterns, resulting from the combination of labeling strategies: A uniform collective name adopted by all producers in the region (UC); nested names, with which the H type may develop their individual brands as well ($C+I$); and separate names, with which the L group producers adopt their own collective label and the H producers develop separately their individual brands (C_L, I). Consumers' perceptions about product's quality vary according to these labeling schemes, resulting in different incentive effects for quality provision. Based on the labeling principles stated above, Table 1 summarizes

[9] In practice, there may be other labeling forms. For example, a small group of producers may adopt a sub-group collective label, nested within a grand collective label. We discuss some of these cases in Section 6.2

[10] The model can be extended to a more general setting where the costs of informing consumers (search costs) vary with the proportion of aware consumers (α) and group's size (denote by z), i.e., $F(\alpha, z)$, with $F(\alpha, z) \in [0, f]$ and $F_\alpha > 0$ and $F_z \leq 0$. Our simple setting suggests that $F(\alpha, 0) = f$ for individual brand I and $F(\alpha, 1) = 0$ for collective brand C. Such a setting captures the idea that informing consumers is costly and enjoys some scale efficiency, i.e., the larger the group's size and the smaller is the cost born by an individual producer.

the possible name patterns, the associated labeling strategies and consumers' perception of these strategies.

UC If all producers adopt a uniform collective name (UC), in order to obtain the label the producers in the group have to agree upon a predetermined quality standard, defined in the code of practice. Denote by s_c, with $s_c \in [s_0, \delta)$, the level of the quality standard. The H type producers can trivially achieve the standard with their intrinsic quality level δ. However, the L type producers should comply with the standard s_c. Since the code of practice is open for the public, consumers know s_c. By Assumption 2, consumers perceive the average quality for the label $\bar{s}_c = \beta\delta + (1-\beta)s_c$. Notice that $\delta > \bar{s}_c > s_c$. Clearly, with the uniform label the L type producers benefit from positive spillovers because their products are commingled with the high quality products for both aware and unaware consumers. Moreover, if the quality standard is higher than the minimum level ($s_c > s_0$), the L type producers also benefit from the collective label, to the extent that it increases the average quality perception of consumers. High quality producers, on the other hand, will suffer from negative spillovers. However, they may benefit from joining a collective label because they can get access to markets with unaware consumers. We thus explain why producers of different qualities may join a common regional label, a situation where both types are together in a label without any other possibility to separate into the eyes of the consumers. Referring to our cases, it could be the situation of the Chianti PDO in the 70s, before the creation of the new PDO Chianti Classico and/or the establishment of individual brands.

Nested names Under the nested name, the H types may develop their individual brand on top of the collective label ($C + I$). Aware consumers can thus identify the true quality of the products (which is s_c for the L type and δ for the H type) because of the branding strategy I. However, by the principle of individual brand I, the unaware consumers are still uninformed about the true quality of the H producers and perceive only the average quality of the collective label $\bar{s}_c$ for all types of products. Therefore, spillover effects arise only in the unaware market. This name pattern corresponds, for instance, to Valpolicella wines and to many other cases.

Separate names Under separate names, the L producers maintain or develop their own collective label without the participation of H producers, possibly because these latter have left the group. By assumption 2, the collective label perfectly informs both aware and unaware consumers about the L group's true quality (s_c), which is also the average quality of the group. However, the H producers develop their own individual brand (under C_L, I) without nesting it with any collective label. They may suffer from a negative spillover, to the extent that unaware consumers can only perceive their product as being commingled with those in the spot market, i.e., $\bar{s}_0$.[11] This corresponds to the case of Bolgheri for wine, when some good producers left the Chianti PDO (but before forming a new PDO on their own).

To sum up, the collective label allows producers to inform unaware consumers. Together with L types, the H quality producers may thus reach an important part of the market, of size $1-\alpha$, but suffer from negative spillover effects which depend on the proportion $1-\beta$

[11] By this means, we implicitly assume that unaware consumers, when purchasing the products with individual brands alone, are uninformed about the existence of the collective brands and hence cannot update their beliefs based on the quality of collective labels.

of L producers. While the L type producers always want a collective label to enjoy positive spillovers, H producers may choose to invest in individual brands to avoid negatives ones. Alternatively, they can join a uniform collective label - with or without individual brands - which enables reaching the unaware consumers. The spillover effects are thus higher with the uniform collective label, reduced with nested names, and further reduced in the unaware market (but coming from firms in the spot market for unaware consumers) with separated labels.

It should be noted that there may be other situations and resulting name patterns other than those listed in Table 1. For example, producers may adopt their own individual names in a world without collective labels, or they may have no incentives to adopt any labeling strategy if the labeling or branding costs are too high compared to expected benefits. Clearly, the L type producers have no incentive to adopt individual brands (I), which are costly and allow the aware consumers to identify their inferior quality. However, they may have incentives to group together and adopt collective labels. We assume that collective labels are efficient for the L producers compared to the case without labels.[12] On the other hand, the H type has the incentive to inform consumers about their high quality with different labeling strategies. We assume that individual branding is efficient for H producers compared to the case with no labels.[13] Moreover, we assume it is not possible for the H type producers to form their own collective label, either because of lack of coordination or because exclusion of the low type producers is not allowed under the collective labeling system (such as the GI system). With such a setting, we rule out the possibilities of individual branding by L producers, subgroup collective labeling by the H type producers, and no labeling for all producers. We thus remain with the three name patterns in Table 1: the collective name, nested names and separated names.

[12]This assumption suggests that even if L producers form a subgroup C_L and inform consumers about their average quality s_c, the profit is higher than what they gain in the spot market. Formally, providing that the producers are monopolist and charge up to consumers' willingness to pay, the profit they gain in the spot market is just $\underline{\pi} = \bar{s}_0$, while the profit of developing C_L is $\pi^{C_L} = s_c - \Phi(s_c)$. The efficiency assumption for collective labels thus implies that $\pi^{C_L} > \underline{\pi}$, which gives

$$\max_{s_c} s_c - \Phi(s_c) > \bar{s}_0.$$

[13]This assumption implies that the profit of H producers with labels is higher than what they gain in the spot market. Formally, providing that the producers are monopolist and charge up to consumers' willingness to pay, in the spot market they obtain a profit of $\underline{\pi} = \bar{s}_0$, while the profit of developing an individual brand is $\pi^I = \alpha\delta + (1-\alpha)\bar{s}_0 - f$. The efficiency assumption for the individual label suggests that $\pi^I > \underline{\pi_H}$, that is, the labeling cost is small enough or the intrinsic quality for the H type is high enough, i.e.,

$$\delta > \delta_0 \equiv \frac{f}{\alpha(1-\beta)} + s_0.$$

Since the collective and sub-collective labels cost less than the individual brands, they are more efficient labels for H producers.

3.3 The game

We start from an institutional structure where all producers belong to a grand coalition in the region and a regional name is available for the coalition, [14] Producers have to coordinate on the labeling strategies and decide the quality standard associated with the labels. The decision process follows a three-stage game:

- In stage 1, the producers' coalition decides the labeling scheme, under which quality investments will be undertaken.
- In stage 2, the coalition designs the code of practice, which defines the quality standard s_c for the group members. Given the labeling scheme and the quality standard, producers decide whether to stay in the coalition.
- In stage 3, each producer decides the price to be charged to consumers. Consumers decide whether or not to buy from the producer.

Stage 1 and 2 of the game involve collective decisions, which require coordination among different producers within the coalition. The heterogeneity among producers suggests that they will have divergent interests about the labeling strategies and the associated labeling schemes. The question arises on how they make the labeling decisions and balance the divergent interests of different types. To deal with this question, we assume a simple *majority rule*: if L type producers are in the majority (i.e., $\beta < \frac{1}{2}$), the labeling scheme and quality standard (s_c) are designed in the interest of the L group. This is not the only possible choice, but it captures the main features of the situations we are trying to model while keeping our model tractable. We will discuss other possibilities in section 6.1. In the following section, we develop formally the analysis for the case we consider the most interesting, i.e., where the majority of producers is the opportunistic type, i.e., the L type.

The stage 3 of the game involves individual pricing decisions. Table 1 shows that consumers - heterogeneous in their awareness of quality - also face products of different qualities in different labeling schemes. In addition, the willingness to pay of aware and unaware consumers are different for the product with the same label. Question arises on whether a monopolist producer can discriminate consumers and charge different prices according to their willingness to pay.

In some cases, like for instance when retailing channels are different, or when markets are geographically separated, perfect discrimination is possible. For example, the Chinese market for Bordeaux wine becomes attractive not only because of the potential size of the market, but also because of the hugely overpriced bottles afforded by Chinese consumers (Thompson, 2015). In many other situations, however, it may be difficult or impossible to charge different prices and prevent consumers' arbitrage. In the following, we start with a simple case where each monopolist producer can perfectly discriminate the aware and unaware consumers. In section 5, we discuss how the results change when price discrimination is not possible.

[14] This is a scenario consistent with the existing GI labeling system in the EU, in which for many products there exist a uniform group. Alternative scenarios may be settings in which no collective labels yet exist, e.g., because of the lack of well defined property rights, like in developing countries, and the "quality standard" is thus equal to the minimum level; or when no alternatives to the uniform collective are allowed by the law, like for instance in the US Marketing Orders. We astray also from problems of sequential joining by heterogeneous producers (as argued in Carter, 2015). We leave these alternative scenarios for future work.

Table 1: Name patterns, labeling strategies and quality perception

Name patterns	Labeling Strategies	Aware (α)	Unaware ($1-\alpha$)	Spillover Effects	Examples
Collective name (UC)	L: Collective H: Collective	$\bar{s}_c$ $\bar{s}_c$		(+) from H in whole mkt (−) from L in whole mkt	Old days' Chianti & Valpolicella
Nested names ($C+I$)	L: Collective H: Coll.+Indiv.	s_c δ	$\bar{s}_c$ $\bar{s}_c$	(+) from H in unaware mkt (−) from L in unaware mkt	Valpolicella & many others
Separated names (C_L, I)	L: Collective H: Individual	s_c δ	s_c $\bar{s}_0$	No spillover (−) in unaware spot mkt	Chianti vs. Super-Tuscans

s_c: Quality standard/ code of practice which depends on the labeling scheme.
$\bar{s}_c = \beta\delta + (1-\beta)s_c$: Average quality of the region.
s_0: Minimum quality standard.
$\bar{s}_0 = \beta\delta + (1-\beta)s_0$: Average quality of the spot market.

4 Equilibrium name patterns under perfect price discrimination

In this section, we investigate the equilibrium labeling strategies and reveal the economic rationale for different name patterns. We show how the equilibrium name pattern may vary with the producer and consumer heterogeneities. Furthermore, we derive the welfare effects of the equilibrium labeling strategies and show how a particular name pattern may be welfare deteriorating or welfare enhancing.

In stage 3, under perfect price discrimination, each producer can charge the price up to the consumers' willingness to pay, which is, in our setting, the consumers' perceived quality level, as described in Table 1. We assume that quantity is "separable", i.e., producers can segment their unit production to the targeted markets. For instance, under the nested name ("$C+I$"), producer H can sell α unit at price δ to aware consumers, while $1-\alpha$ unit at $\bar{s}_c$ to unaware ones. Thus, we can derive the expected profit for each producer, which depends on the level of quality chosen and on the labeling scheme.

Back to the quality setting stage, the L majority rule suggests that the L type producers choose the quality level s_c in the possible labeling scheme to maximize their own expected profit, taking into account the H type producers' outside options. We assume that the H type producers cannot coordinate effectively to deviate collectively. Thus, in each possible labeling scheme, we check for *unilateral deviation* of the H type producer.[15]

4.1 Quality standards under different name patterns

In this subsection, we investigate the decision of the quality standard in a case-by-case fashion. The possible labeling schemes are summarized in the second column of Table 1. We denote by i ($i \in \{L, H\}$) the type of the producers and j, $j \in \{$"UC", "$C+I$", "C_L, I"$\}$, the labeling scheme. The L majority rule suggests that the L group producers decide the quality standard s_c to maximize $\pi_L^j(s_c)$, taking into account producers H's outside option, i.e., that they have no incentive to deviate from the labeling scheme j.

Regarding the outside option, by the assumption of unilateral deviation any H producer can only deviate to develop her own individual brand, either by nesting it with the collective label ("$C+I$") or by separating herself altogether from the collective label ("C_L, I"). If H remains nested within the grand coalition, her high quality product is commingled with the collective label quality s_c for the unaware consumers, whereas if H separates from the coalition, the unaware consumers only see her quality mixed with the low quality s_0 in the spot market. Since $s_c \geq s_0$, deviating to the nested labeling scheme "$C+I$" yields a higher payoff to H producers. In the following analysis, we use $\pi_H^{C+I}(s_c)$ to capture the H producer's outside option.

Uniform Collective label (UC) If the L majority chooses within a uniform collective label, the price is charged at the consumers' average willingness to pay, which is $\bar{s}_c$ for both

[15] This assumption is reasonable when small-size producers are scattered and hence less likely to coordinate for a collective deviation.

aware and unaware consumers. The problem is written as:

$$\max_{s_c} \quad \pi_L^{UC}(s_c) = \bar{s}_c - \Phi(s_c) \tag{2}$$

$$s.t. \quad \pi_H^{UC}(s_c) = \bar{s}_c \geq \pi_H^{C+I}(s_c) \equiv \alpha\delta + (1-\alpha)\bar{s}_c - f \tag{3}$$

$$\bar{s}_c = \beta\delta + (1-\beta)s_c$$

Condition (3) is the participation constraint for the H producer, suggesting that the quality standard should be set at such a level that H has no incentive to develop its own individual brand. The choice of quality standard depends on whether the participation constraint is binding, as can be shown in the following lemma.

Lemma 1 *Under the uniform collective labeling scheme, the L majority chooses the quality standard s^U, which solves $(1-\beta) = \Phi'(s_c)$, if and only if the following inequality holds*

$$\delta < \hat{\delta} \equiv \frac{f}{\alpha(1-\beta)} + s^U. \tag{4}$$

Otherwise, the standard is set at $\hat{s}^U(\delta, \alpha, \beta) \equiv \delta - \frac{f}{\alpha(1-\beta)}$, which is higher than s^U.

The lemma is easily derived from the problem (2), where condition (4) is directly from the participation constraint (3), taking into account that the quality standard is set at s^U. When the outside option is a profitable alternative for the H type, then the quality standard in the UC group will be "distorted" upward to induce the H to remain in the group ($\hat{s}^U > s^U$). In the following analysis, we first assume that condition (4) is not binding so that the equilibrium quality standard is s^U. We compare this case with other labeling schemes and derive the equilibrium labeling scheme for the range of parameters defined in condition (4). In subsection 4.3, we investigate the case where condition (4) is binding and derive the equilibrium labeling scheme for the full range of parameters.

Nested names ($C+I$) If the L majority chooses the collective label, while allowing the H producers to develop their individual brands, the participation constraint for the H type producers is trivially satisfied, because the H producer cannot deviate to a better situation. The problem can be written as

$$\max_{s_c} \pi_L^{C+I}(s_c) = \alpha s_c + (1-\alpha)\bar{s}_c - \Phi(s_c) \tag{5}$$

We denote by s^N the equilibrium quality level. s^N solves

$$(1 - \beta + \alpha\beta) = \Phi'(s_c) \tag{6}$$

Separate names (C_L, I) If the L group forms its own collective label without the H producers, the true quality s_c is revealed to both aware and unaware consumers. The problem

for the L group is now[16]:

$$\max_{s_c} \pi_L^{C_L,I}(s_c) = s_c - \Phi(s_c), \tag{7}$$

The equilibrium quality choice for the group of L producers is defined by $1 = \Phi'(s_c)$, which corresponds to the full information benchmark case. In other words, with separation there are no spillover effects and the quality chosen by the L group producers achieves the first best level, s^*.

4.2 Choice of labeling scheme

Back to the stage 1 of the game, the choice of the equilibrium labeling scheme depends on the comparison of the profits for type L producers under the different possible labeling schemes. Proposition 1 summarizes the results.

Proposition 1 *Based on the L majority rule, if $\delta < \hat{\delta}$ (constraint (4) is not binding), we have*

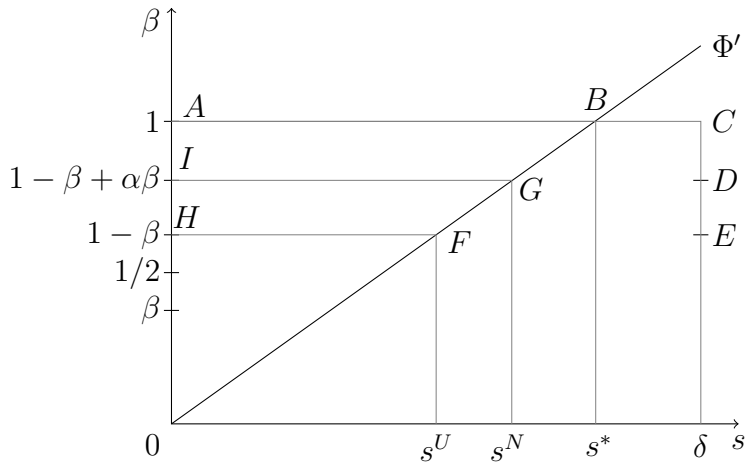
- $s^U < s^N < s^*$. *The quality standard is the lowest under the uniform label and the highest under the separate names.*
- $\pi_L^{UC} > \pi_L^N > \pi_L^*$. *The L group will choose the Uniform Collective label.*

The proof and intuition of proposition 1 can be illustrated in Figure 1. The vertical axis plots the marginal benefits of investing on quality for the L type under different name patterns, while the horizontal axis represents the quality choice. Without the participation constraint, the equilibrium is determined by equalizing the marginal benefit and the marginal cost, which represents an increasing function of quality ($\Phi' > 0$ and $\Phi'' > 0$). (**AZ: given the linear mg cost, should we have $\Phi'' \geq 0$ instead?**) From the analysis of quality choice in section 4.1 (i.e., problems (2), (5) and (7)), the marginal benefit under the uniform, nested and separate names are respectively $1-\beta$, $1-\beta+\alpha\beta$ and 1, suggesting that the quality choices are $s^U < s^N < s^*$.

Clearly, the L producers enjoy a full spillover under the uniform collective label (UC). They can free-ride on the high quality of the H type in both the aware and unaware market, and hence have the lowest incentives to invest in quality. The total profit of the L type producer is depicted by the area $0ACEF$: $0HF$ is the profit generated from the L type's own quality effort, while the larger revenue rectangle $ACEH$ stems from free-riding on the H type ($\beta\delta$). Under the nested labeling scheme, though, the L producers can free-ride on the H type only in the unaware market (with size $1-\alpha$). Hence, they have to rely more on their own effort in providing quality compared to the case of uniform label. Their profit is then given by the area $0ACDG$, of which the free-riding profit shrinks to $(1-\alpha)\beta\delta$, i.e., the

[16]We implicitly assume that there is no participation constraint if the H type producers are not in the group of the L producers. If the collective label cannot exclude the eligible producers in the region, the separating labeling scheme will be constrained by the type H's participation constraint, i.e., $\pi_H^{C_L,I} \geq \pi_H^{C+I}(s_c)$. However, adding such a constraint will not change the equilibrium outcome. As is shown in section 4.3, the separate labeling results in the lowest profit for the L group producers. Taking into account the participation constraint of H producers, the profit of the L group producers is even lower, making the separate labeling scheme irrelevant for the equilibrium analysis that follows.

Figure 1: Quality standard and L type's profit under different labeling schemes



area $ACDI$. Last, under separate names, there are no spillover effects because both aware and unaware consumers can distinguish the true quality of the L type producers. The profit is given by the area $0AB$, irrelevant for the high quality level δ. Straightforwardly, the L group benefits the most from the uniform label than other labeling schemes.

4.3 Constrained problem and equilibrium name pattern

In this subsection, we investigate the case when the parameters of interest range out of constraint (4). In this case, Lemma 1 suggests that the quality standard is set at $\hat{s}^U(\delta, \alpha, \beta) \equiv \delta - \frac{f}{\alpha(1-\beta)} > s^U$. In other words, the L majority has to "distort" the quality standard above the unconstrained level s^U, in order to ensure that the H producers stay inside the group, when the uniform collective label is chosen. The increment of the standard level depends on the producer heterogeneity in quality provision and on consumers' information heterogeneity. Investigating the parameters affecting $\hat{s}^U$, we have:

Lemma 2 *Under the L majority rule, a uniform collective label is implemented with a higher quality standard when the H type's intrinsic quality level (δ) is higher, the proportion of aware consumers (α) is larger or the population of L type producers ($1-\beta$) is larger, that is*

$$\frac{\partial \hat{s}^U}{\partial \delta} > 0, \frac{\partial \hat{s}^U}{\partial \alpha} > 0 \text{ and } \frac{\partial \hat{s}^U}{\partial \beta} < 0.$$

The intuition directly hinges on the comparison between H's profit under the uniform collective label and the outside option when switching to the individual brands. When the quality provided by the H producers (δ) is high, the heterogeneity in quality provision becomes large and hence the divergence in interests under the uniform collective label becomes intense. The H producers will then find it attractive to develop their individual brands to inform the aware consumers. Therefore, a higher level of quality standard for L producers is required to reduce the quality heterogeneity and hence increase the gain of H inside the

uniform collective group. Similarly, the larger the proportion of aware consumers, the more appealing for H producer to deviate to the individual branding, and hence the higher is the quality standard that the L majority should set in order to reduce the heterogeneity with H producers. On the other hand, if the proportion of L group $(1-\beta)$ is large, H will suffer much more negative spillovers from joining the mixed group with uniform label compared to the individual label. To compensate H producers, the standard should then be distorted more upward.

The uniform collective label is preferred by the L majority according to proposition 1. However, the more distorted are the quality choices the higher the cost to improve quality by the L types, making the uniform collective label strategy less likely to be chosen in equilibrium. Indeed, if condition (4) is binding, the higher the L majority raises the quality standard, the less the profit the L producer will gain with the uniform collective label. On the other hand, the profits that the L producers gain under the nested names (π_L^N), or with separate names (π_L^*), are not affected by the participation constraint. As $\pi_L^N > \pi_L^*$, the equilibrium labeling scheme hinges on the comparison of the L producer's profit under nested names (π_L^N) and under the constrained uniform labeling case ($\pi_L^{UC}(\hat{s}^U(\delta,\alpha,\beta))$). Proposition 2 shows the results.

Proposition 2 *Under L majority rule and perfect price discrimination, the L producer group trades-off between the uniform collective label and the nested names. There exists $\delta^{NU}(\alpha,\beta)$, which solves $\pi_L^{UC}(\hat{s}^U(\delta,\alpha,\beta)) = \pi_L^N$ for δ, such that $\delta^{NU}(\alpha,\beta) > \hat{\delta}(\alpha,\beta)$ and*

- *if $\delta > \delta^{NU}(\alpha,\beta)$, the nested names are chosen with standard s^N ($s^N < \hat{s}^U$);*
- *if $\delta^{NU}(\alpha,\beta) > \delta > \hat{\delta}(\alpha,\beta)$, uniform collective label is adopted with the standard $\hat{s}^U > s^U$;*
- *if $\delta < \hat{\delta}(\alpha,\beta)$, uniform collective label is adopted with the standard $s^U = \hat{s}^U < s^N$.*

Proof The last item is straightforward according to proposition 1. The proof of the first two items depends on the comparison of $\pi_L^{UC}(\hat{s}^U)$ and π_L^N, which are derived as follows

$$\begin{aligned} \pi_L^{UC}(\hat{s}^U) &= \beta\delta + (1-\beta)\hat{s}^U - \Phi(\hat{s}^U), \text{ with } \hat{s}^U \equiv \delta - \frac{f}{\alpha(1-\beta)} \\ \pi_L^N &= (1-\alpha)\beta\delta + (1-\beta+\alpha\beta)s^N - \Phi(s^N). \end{aligned}$$

It can be easily checked that $\frac{\partial^2 \pi_L^{UC}(\hat{s}^U)}{\partial \delta^2} = -\Phi'' < 0$ and $\frac{\partial \pi_L^N}{\partial \delta} = (1-\alpha)\beta > 0$. Thus $\pi_L^{UC}(\hat{s}^U)$ is continuous and concave in δ, while π_L^N is increasing with δ. Moreover, when $\delta = \hat{\delta}$, $\hat{s}^U = s^U < s^N$ and hence $\pi_L^{UC}(\hat{s}^U) = \pi_L^{UC}(s^U) > \pi_L^N$. On the other hand, when δ increases from $\hat{\delta}$, then $\hat{s}^U$ increases accordingly. It can be shown that when $\delta = \tilde{\delta} \equiv s^N + \frac{f}{\alpha(1-\beta+\alpha\beta)}$, the revenue part of $\pi_L^{UC}(\hat{s}^U)$ and π_L^N are the same and $\hat{s}^U > s^N$, so that the cost part of $\pi_L^{UC}(\hat{s}^U)$ is larger. Hence $\pi_L^{UC}(\hat{s}^U) < \pi_L^N$ when $\delta = s^N + \frac{f}{\alpha(1-\beta+\alpha\beta)})$. By continuity, there exists $\delta^{NU} \in (\hat{\delta}, \tilde{\delta})$, which solves $\pi_L^{UC}(\hat{s}^U) = \pi_L^N$ such that if $\delta > (<)\delta^{NU}$, $\pi_L^{UC}(\hat{s}^U) < (>)\pi_L^N$. Q.E.D.

The intuition of the proposition is straightforward. Uniform collective labeling, without any constraint, enables the L type producers to enjoy the maximum spillovers from the

H producers. However, when the heterogeneity within the group becomes larger, the L majority needs to balance the interests of H producers as well. The L majority, to deal with more divergent interests, can raise the quality standard to reduce the heterogeneity under the uniform collective label, or allow the H type producers to differentiate with individual brands (nested labels). The L majority faces a trade-off between pursuing the maximum spillover from H and imposing a costly high quality standard. When the heterogeneity is relatively small, the first approach is more profitable for the L majority because a small increase in quality standard is enough to keep the H in the uniform label and thus benefit from positive spillovers. The quality standard can be higher than the nested case $\hat{s}^U > s^N$ because the benefit from full spillovers enables the L type to afford a higher quality cost. When the heterogeneity becomes too large, however, the nested label is a better approach because it requires a lower quality standard, while still allowing the L group to (partially) benefit from the spillover from the H producers in the market of unaware consumers.

Proposition 2 suggests that the equilibrium labeling strategies may present various name patterns, depending on the range of parameters. In addition to the producer heterogeneity (δ), the degree of awareness (captured by α in the model) is also essential for the choice of labeling strategies. Figure 2 plots the equilibrium labeling schemes in the $\alpha - \delta$ space. The figure suggests that larger degree of heterogeneity (δ) and consumer awareness (α) will induce the choice of nested name labels. When consumers become more aware about the product quality, the outside option for the H producers becomes more attractive, making it more difficult for the opportunistic producers to retain them under the uniform label. This is especially true when the producer heterogeneity is too large to balance the interests of H producers. Given that quality is costly (for L) the opportunistic type L lets the H type go and so nested names emerge. To this extent, more awareness on consumers' side and larger heterogeneity on producers' side induce the producer group to adopt nested labeling strategies, which differentiate the H type from the L majority.

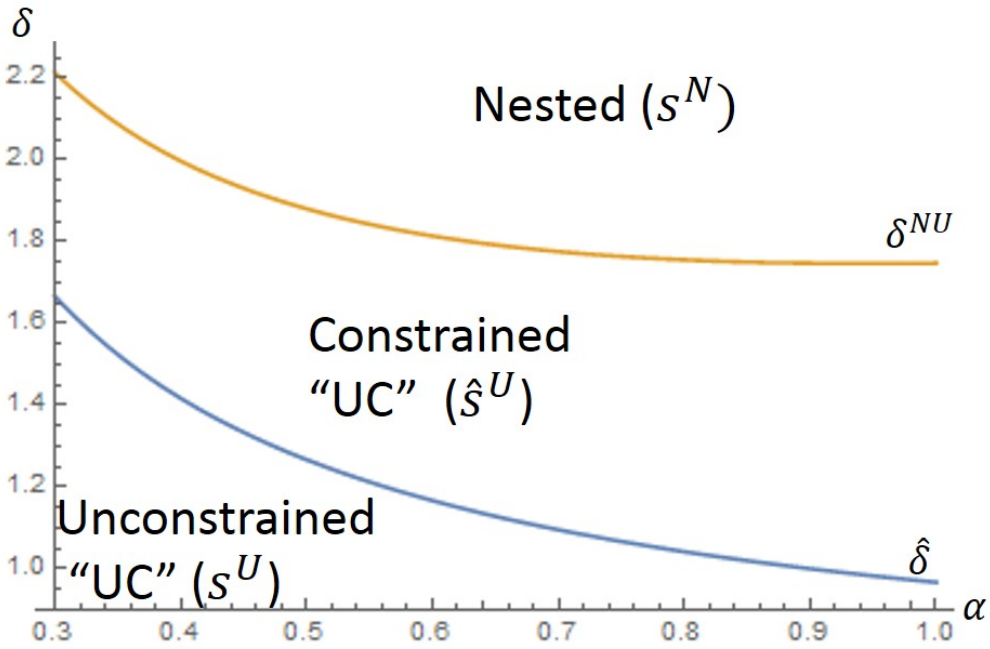
Our analysis provides thus new insights on the rationale of labeling differentiation. The literature often argues that producers differentiate their quality (or variety) to attract consumers with different tastes (see, e.g., Bonroy and Constantatos, 2015) and/or to soften competition in homogeneous product market. In our model, which abstracts from consumers' taste heterogeneity and product competition, the motivation of labeling differentiation stems from the desire of the producer group to balance their divergent interests within the group. Indeed, both the L type and H type producers benefit from nested names. By allowing the H producers to develop the individual brands together with the collective label, the L producers can still enjoy the positive spillover of high quality from H producers, while the H producers can reach out unaware consumers with a relatively higher preceived average quality. However, such a labeling differentiation may be welfare deteriorating, as we will show in the next section.

4.4 Welfare analysis

In this subsection, we investigate the welfare effects of the equilibrium labeling strategies. In the presence of different labeling strategies, the social welfare is defined as

$$W^i(s_c) = \beta(\delta - f\mathbf{1}_{\{\text{“}C+I\text{”},\text{“}C_L,I\text{”}\}}) + (1-\beta)(s_c - \Phi(s_c)).$$

Figure 2: Equilibrium labeling schemes



where $\mathbf{1}_i = 1$ if the labeling involves the scheme i, otherwise it takes zero value. Given the labeling costs f, the optimal standard level is still at s^*, which can be implemented under the separate labeling schemes (C_L, I) according to Section 4.1. However, Proposition 2 suggests that this labeling scheme is not present in equilibrium. Instead, the only candidate equilibrium is the uniform collective label (UC) or the nested name label $(C+I)$. Comparing their welfare effects, we have:

Proposition 3 *The choice of the L majority can be welfare deteriorating or welfare enhancing. There exists* δ^W*, which solves* $W^{UC}(\hat{s}^U(\delta, \alpha, \beta)) = W^{C+I}(s^N)$*, such that* $\delta^W < \delta^{NU}$ *and*[17]*:*

- *if* $\delta < \delta^W$ *, L chooses "UC", entailing a lower welfare than the nested label, i.e.,* $W^{UC} < W^{C+I}$*.*
- *if* $\delta^W \leq \delta < \delta^{NU}$ *, L chooses "UC", resulting in a higher welfare level than the nested labels, i.e.,* $W^{UC} > W^{C+I}$*.*
- *if* $\delta \geq \delta^{NU}$ *, then L chooses "C + I", entailing a lower welfare than the uniform labels, i.e.,* $W^{C+I} < W^{UC}$*.*

[17]It should be noticed that δ^W, as well as other thresholds, e.g., δ^{NU}, are all functions of other parameters, e.g., α, β and f. For ease of presentation, we remove the arguments in these functions.

Proof Since the welfare is maximized at s^*, any $s_c < s^*$ entails a distortion in welfare, and the smaller s_c the lower the welfare, i.e., $\frac{dW^i(s_c)}{ds_c} < 0$ for $s_c < s^*$. (**AZ: Shouldn't we have** $\frac{dW^i(s_c)}{ds_c} > 0$ **instead?**) Therefore, whether a labeling scheme is welfare enhancing depends on whether the scheme results in a higher quality standard.[18] Proposition 2 suggests that when δ increases, the quality standard increases from s^U to $\hat{s}^U$ and then changes to s^N if $\delta > \delta^{NU}$. Clearly when $\delta \leq \hat{\delta}$, the UC labeling scheme entails the lowest welfare since $s^U < s^N$. When δ increases from $\hat{\delta}$, welfare increases accordingly. At δ^{NU}, $\pi_L^{UC}(\hat{s}^U) = \pi_L^N$, which can be rearranged as $\pi_L^{UC}(\hat{s}^U) - \pi_L^{UC}(s^N) = \alpha\beta(\delta - s^N) > 0$. Since $\frac{d\pi_L^{UC}(s)}{ds} < 0$ for any $s > s^U$, directly we have $\hat{s}^U > s^N$, and hence $W^{UC} > W^{C+I}$ when $\delta = \delta^{NU}$. By continuity, there exists $\delta^W \in (\hat{\delta}, \delta^{NU})$, which equalizes welfare under the two labeling schemes, such that if $\delta > (<)\delta^W$, $W^{UC} > (<)W^{C+I}$. Q.E.D.

The proposition is intuitive. Uniform collective label, without any constraint, leads to the lowest incentive for L to provide quality and hence the lowest welfare level compared to the other labeling schemes. When the heterogeneity within the group becomes larger, the L majority increases the quality standard to accommodate for the outside option constraint for the H producers. This increases the overall quality level, and hence welfare raises accordingly. However, when the heterogeneity becomes too large, the L majority loses the incentive to raise quality standard to retain the H producers inside the group. Instead, nested label is chosen with a relatively low quality standard, leading to a lower welfare compared to the constrained uniform label.

Again, we plot the welfare effects in $\delta - \alpha$ space. Figure 3 suggests that larger degree of heterogeneity (δ) and consumer awareness (α) may induce the choice of a nested name label, which results in lower welfare levels compared to the uniform collective label. Only when the parameters of interest are at intermediate levels, can the social welfare be improved, due to a "superior" quality of the collective label. This superior quality may be even higher than the social optimal level, leading to an excess supply of quality by the L group producers.[19]

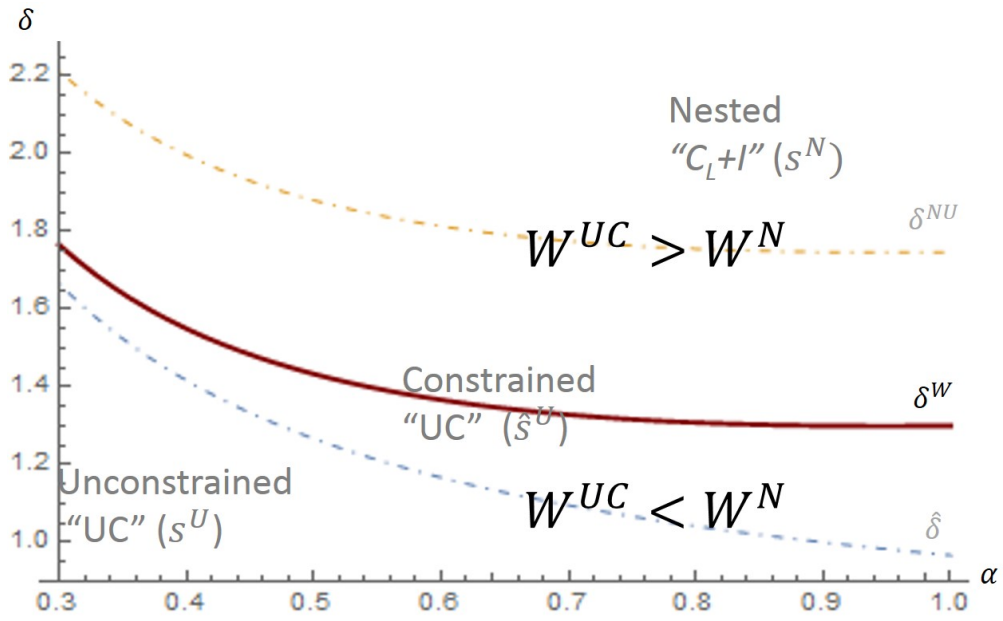
Our results provide two interesting insights. First, nested name enables H producers to differentiate themselves from low quality products. However, this strategy does not always welfare-dominate a uniform collective label. Indeed, in our setting, the incentive of quality provision for the opportunistic producers depends on two mechanisms. On one hand, this incentive is reduced by the spillover effect of the collective label. To that extent, the nested label has lower spillover effects than the uniform label and hence it gives higher incentives for quality provision to the opportunistic producers. On the other hand, the incentive to increase quality arises also from the desire to retain high quality producers inside the group under a uniform label. When this latter mechanism plays a dominate role, uniform collective label becomes a welfare enhancing strategy with a higher average quality.

Second, the increase of consumers' awareness (i.e., increasing α) will change the labeling choice, which may lead to a lower quality provision and hence a welfare decrease. This result differs from the standard literature on quality and information, which suggests that the more the information to consumers the higher the quality incentives for producers (see, e.g., chapter 2 in Tirole, 1988 and Bagwell and Riordan, 1991). Without analyzing the labeling

[18]The labeling cost f is also a welfare loss compared to the first-best case. However, if f is at a small level, the welfare comparison still hinges on the comparison of standards.

[19]It can be shown that if $\delta^W < \delta < \delta^{NU}$ and f is small, then $\hat{s}^U(\delta, \alpha, \beta) > s^*$.

Figure 3: Welfare of the equilibrium labeling schemes



effect, the standard literature suggests that the presence of aware consumers benefits of a positive externality the unaware consumers by inducing producers to provide high quality. However, when a collective label is the tool, our results suggest that the presence of aware consumers may exert a negative externality over the unaware consumers by altering the labeling choice of opportunistic producers. The incentives to raise quality standard under the uniform label disappear, leading to the nested label and its lower quality level.

5 Equilibrium name patterns without price discrimination

In many cases, producers cannot price-discriminate. In our setting, without the quantity decision that affects prices and without additional information based on which producer can screen consumers, the only possible pricing policy is a uniform price for all consumers. As before, we assume that all labeling strategies are efficient for the H type producers compared to the strategy without labeling and the collective label is efficient for the L type producers but not available for the H type. By this means, the possible name patterns are those seen before, and consumers' perception about the product quality is the same as summarized in table 1. However, without price discrimination, producers cannot always set prices up to the consumers' maximum willingness to pay.

Whenever the willingness to pay of the aware and unaware consumers are different, producers face a trade-off: charging a higher price, but losing consumer who are willing to pay less; or charging a lower price, and being able to serve the whole market. For instance,

under the nested name, the H types trade-off between targeting only the aware consumers at a high price δ using individual brands (receiving a profit $\alpha\delta - f$), or targeting the entire market at a lower price ($\bar{s}_c$) up to the unaware consumers' willingness to pay. On the other hand, the L producers trade-off between targeting only the unaware consumers $(1-\alpha)$ at an average price $\bar{s}_c$; or targeting the entire market at a lower price based on the true quality s_c.[20]

Consistently with the last section 4, we assume the L group of producers is the majority and makes decisions for the entire coalition. Table 2 derives the quality standards under different name patterns and compares the results with the case of perfect price discrimination (see the online Appendix A.1 for detailed analysis).

Table 2: Quality standards with or without price discrimination (PD)

Name patterns	s_c	**No PD**	**Perfect PD**
Uniform collective names	s^U :	$1-\beta = \Phi'$	$1-\beta = \Phi'$
	$\hat{s}^U \equiv$	$\frac{(\alpha-\beta)\delta - f}{(1-\beta)}$	$\delta - \frac{f}{\alpha(1-\beta)}$
Nested	s^N :	$1-\beta = \Phi'$	$1-\beta+\alpha\beta = \Phi'$
Separate	s^* :	$1 = \Phi'$	$1 = \Phi'$
Comparison		$s^N = s^U < \hat{s}^U < s^*$	$s^U < s^N < s^*$

According to Table 2, without price discrimination the L majority will choose the same quality standard under the (unconstrained) uniform collective name and the separate name as in the case of perfect discrimination. This is because consumers, both aware and unaware, are equally informed by the collective label when not nested with individual names, and hence there is no need to discriminate consumers under uniform name and separate names. Price discrimination will have an effect in the case of constrained UC or with nested names.

In the case of constrained UC, the L majority has to distort the quality standard upwards to prevent the H types from deviating to the nested individual branding $(C+I)$. However, without the possibility of perfect discrimination, the outside option for the H type is less attractive because producer H will not serve the unaware consumers, but target only the aware ones with a higher price δ. Indeed, the outside option is only $\alpha\delta - f$, i.e., short of $(1-\alpha)\bar{s}_c$ compared to outside option under PD (see condition (3)). Therefore, it is less likely that the L majority will have to distort upwards the quality standard to keep H inside the group. Moreover, it can be easily shown that the quality standard is lower without PD, i.e., $\hat{s}^{U(NoPD)} < \hat{s}^{U(PD)}$, suggesting that a smaller increase in the quality standard is now enough to keep the H type inside the group.

In the case of nested names, it is evident from Table 2 that quality incentives are the same as in the unconstrained "UC" case, but lower than with perfect PD, i.e., $s^{N(NoPD)} = s^U < s^{N(PD)}$. This is because without PD the L producers target only the unaware market at the full spillover price $\bar{s}_c$. In other words, they can still fully free-ride on the H type, but on a smaller market, that is in $(1-\alpha)$ instead of 1 like in the case of "UC". Moreover,

[20]Note that any price in $(s_c, \bar{s}_c)$ or outside the range cannot be an equilibrium price, because L can always deviate to s_c or $\bar{s}_c$ and gain a higher profit. The same reasoning holds for the H producer.

without the supply provided to aware consumers - those who can identify their true quality - the L producers have also lower incentives to improve the quality than in the case with PD. All in all, the spillover effects and the loss of market effect result in the lowest quality incentives for the L producers under the nested name than with any other name pattern.

To sum up, without PD the L majority may still have to distort quality choices upwards to keep the H type inside the group. However, this is less likely to happen and to a lower extent compared to the case with PD. Moreover, profits with nested names are lower not only because of the demand loss in the aware market, but also because of the ensuing lower quality level. Therefore, looking at the equilibrium choices by the L majority in stage 1, nested names are less attractive without PD, making it possible for the separate names to be chosen in equilibrium. Proposition 4 states these results more rigorously.

Proposition 4 *Under L majority rule and no price discrimination, the separate name C_L, I may be chosen in equilibrium. There exists δ^{NS}, which solves $\pi_L^N = \pi_L^*$, and δ^{SU}, which solves $\pi_L^{UC}(\hat{s}^U) = \pi_L^*$ for δ, such that*

- *if $\delta^{SU} < \delta^{NS}$ and $\delta^{SU} < \delta < \delta^{NS}$, the separate name is chosen with standard s^*.*
- *otherwise, the equilibrium follows the same patterns as stated in Proposition 2.*

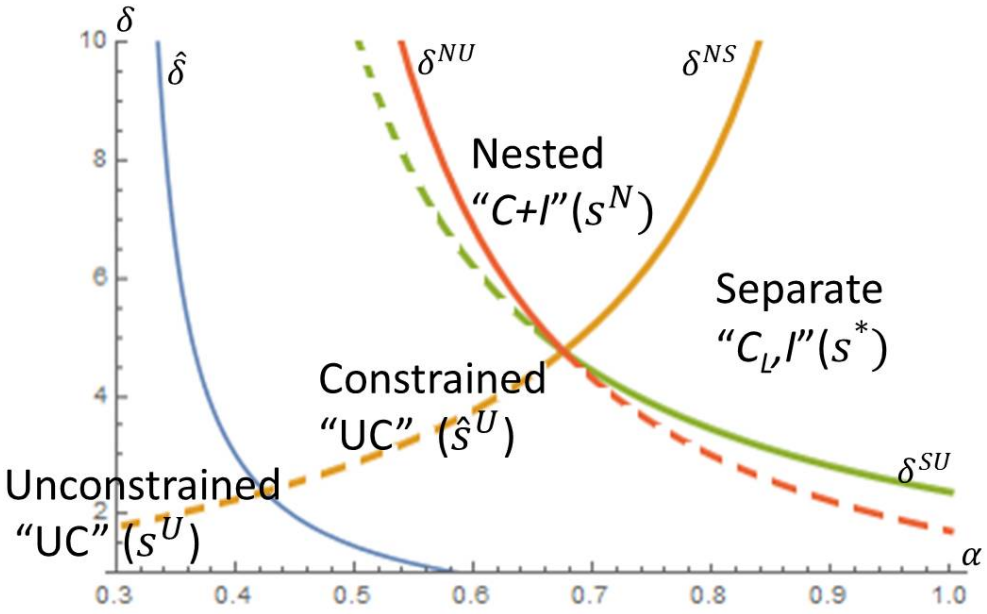
Proof See Appendix A.2.

Proposition 4 suggests that separate names emerge when the producer heterogeneity δ is in a intermediate range. Out of this range, the equilibrium names follow the same pattern as in the case with PD: when producer heterogeneity is low, a uniform collective name is adopted to provide the L majority maximum spillover profits; when producer heterogeneity is high, nested names are chosen to relax the conflicting interests among producers. However, when producer heterogeneity is at an intermediate range, a uniform name cannot be an equilibrium because the L producers cannot sustain a highly distorted quality level when trying to keep the H producers inside the group. Nor can it be the nested names, because the L producers without PD have to quit the market of aware consumers and the spillover in the unaware market is not enough to cover this demand loss. In this case, separate names become a viable equilibrium because they allow the L producers to serve all consumers, avoiding also the conflicts within the group.

The result is clearer if we plot the equilibrium name patterns in the $\delta - \alpha$ space in Figure 4. Compared with Figure 2 in the case under PD, without PD separate names may be chosen in equilibrium instead of nested names. This is especially true when the proportion of aware consumers (α) is large and when the producer heterogeneity (δ) is around intermediate values. Indeed, when deciding the labeling schemes, the L majority trades off between choosing the nested name to enjoy a (smaller size) spillover in the unaware market but quitting the aware market, or choosing the separate name to cover both markets but without any spillover.

When aware consumers are predominant and producer heterogeneity is not so high, the loss of aware consumers outweighs the spillover benefits, leading to the emergence of separate names in equilibrium. Because of the differences in emerging equilibria, the welfare effects of the equilibrium name patterns without PD will be different as well, as stated in the next proposition.

Figure 4: Equilibrium labeling schemes with no price discrimination



Proposition 5 *Without price discrimination, the choice of the L majority can be welfare deteriorating or welfare enhancing. Comparing the three name patterns,*

- *the nested name always leads to the lowest welfare;*
- *whenever the separate name is chosen in equilibrium, it leads to the highest welfare;*
- *whenever the uniform name is chosen in equilibrium, it leads to the highest welfare.*

Proof: See Appendix A.3.

Proposition 5 suggests that without PD, the emergence of nested name is always welfare deteriorating, while that of separate and uniform names is welfare enhancing. Nested names without PD entail indeed two quality-reducing distortions: the free-riding for L in the unaware market - common to the case with perfect PD - but also the demand loss that follows from quitting the aware market. On the other hand, both the uniform label and the separate names suffers only one quality-distortion: the uniform case faces the free-riding, the separate names the demand loss of the unaware market left by H. Last, notice that, as the Appendix A.3 explains in more details, whenever the uniform label or the separate names emerge (given parameter values), they provide the highest welfare level.

6 Discussion and robustness checks

In this section, we discuss the generality of our results, and show how they may change under different decision rules and in the presence of different sub-labeling schemes.

6.1 Decision rules

So far we have investigated the producers' labeling incentives when the L type producers are the majority and make the decision for the grand coalition. The L majority rule is obviously a simplification of the decision process inside the coalition. Depending on the distribution of the producers, their political power or their ability in bargaining, there may exist other decision rules, which will affect the equilibrium labeling schemes and the resulting name patterns.[21]

If most producers in the area are H types ($\beta > \frac{1}{2}$) and make the decision for the coalition, they are strictly better off by forming their own group (C_H) and setting the quality standard up to $s_c = \delta$. They would prevent the low quality producers from free-riding on the high quality label. In the meantime, they could perfectly inform both aware and unaware consumers about their true quality δ. When these structures are chosen, the H majority is indifferent about the quality standard s_c. Such a situation though is less common in practice.

A more complex situation is when the decisions inside the coalition depend on the political power of producers with different interests. Our results will be affected if the group of H producers has a larger political power, because the decision will be biased towards their interests. However, so long as the L producers have the dominant power, our results will not change qualitatively.

For example, the decision on the quality standard s_c under a labeling scheme j ($j \in \{\text{“}UC\text{”}, \text{“}C+I\text{”}, \text{“}C_L, I\text{”}\}$) can be stated in the following problem:

$$\begin{aligned} \max_{s_c} \quad & \Gamma(\beta)\pi_H^j(s_c) + (1-\Gamma(\beta))\pi_L^j(s_c) \\ s.t. \quad & \pi_L^j(s_c) \geq \bar{s}_0 \quad \text{and } \pi_H^j(s_c) \geq \pi_H^{C+I}(s_c) \end{aligned}$$

where $\Gamma(\beta)$ stands for the relative political power of the H group of producers. Under the rule of one-member-one-vote, $\Gamma(\beta) = \beta$; under the majority rule, $\Gamma(\beta) = \begin{cases} 1 & \text{if } \beta > \frac{1}{2}, \\ 0 & \text{otherwise.} \end{cases}$ So long as $\Gamma(\beta)$ is small enough, the decision will be biased to the interest of the L producers and all our results will hold qualitatively.

6.2 Subgroup collective labeling

Our model can easily be extended to the case of sub-group collective label(s) nested within the grand collective label, i.e., $C + C_H$. There are some instances in which this option has been adopted. For example, Valpolicella allows the distinction between the classical and the (later) enlarged production areas within the same PDO. One possible solution to reconcile divergent interests inside a label indeed may be to better recognize (and reflect into the labels) the quality potential of different zones, possibly allowing for different rules or quality standards in different sub-areas.

The most sophisticated regional brand of all is probably Burgundy, which structure is an example of extreme differentiation within a PDO, since it represents in fact a qualitative

[21] While these aspects go beyond the focus of our paper, we would like to acknowledge the literature on the effects of different voting systems, also applied to agricultural organizations such as Marketing Orders (see, e.g., Plakias and Goodhue, 2015) or water user associations (see, e.g., Zaporozhets, 2015).

classification of the about 1000 land plots (the *climats*) available in the region. Accommodating quality differences may decrease conflicts within the collective brand and enable the emergence of the quality potential of different sub-areas. This is why the Burgundy system has been imitated elsewhere in the world. One example is the Barolo PDO in Piemonte and its *menzioni geografiche aggiuntive*, that is the possibility to add the village and the sub-village (cru) to the Barolo name (Rinaldi, 2012). Another example is the existence of the US' sub-American Viticultural Areas (AVAs),[22] which can be seen as a further application of the Burgundy's principles.

The analysis of these sub-labels nested within a collective label however is similar to the case of the nested individual brands seen earlier. Indeed, if the L majority chooses the collective label, while enabling the H producers to adopt a sub-collective label, the L group still enjoys positive spillovers from the H group in the unaware market. It thus gains the same profit as in the "$C+I$" case, obtaining the same quality choices for both nested names. In other words, the profit levels and the welfare effects of the two different nested policies are equivalent.[23]

7 Concluding remarks

We present a model to investigate nested names and the coexistence of different labels. Our collective label informs unaware consumers about the average quality of the firms joining it, while individual brands are effective in informing more knowledgeable consumers about the true quality of a product. Within groups, producers are heterogeneous in their potential for quality, and when they decide on the quality standards they have to use some democratic decision-making process.

Different equilibria may emerge, according to the distribution of producer's types, their degree of heterogeneity, and to the relative prevalence of unaware consumers. When low quality producers control the collective label, they may prefer a uniform collective label because they benefit the most from the efforts of high quality producers. These latter, on the other hand, may still find it profitable to join forces with lower quality producers because with the collective label they can reach the unaware consumers and indirectly induce the low quality producers to adopt a stricter quality standard. When producers' heterogeneity increases, however, the uniform label is less profitable for high quality producers, who may then prefer to establish individual brands as well or create a sub-label within the group. Moreover, when producers cannot price discriminate, with high heterogeneity nested names are an equilibrium strategy, while with intermediate heterogeneity it may be profitable to "take separate routes", i.e., to use individual brands and avoid joining a common label.

We show how information and heterogeneity may explain the firms labeling strategies, and how such strategies can affect the overall quality level and economic welfare. Nested names - though useful to reconcile divergent interests inside the collective label - may in some cases lead to lower quality and welfare levels than the uniform collective label. On the other

[22] In the US, AVAs are wine-producing areas, locally or nationally known, with well defined boundaries, and with distinctive features in terms of climate and soils.

[23] The only difference comes from the establishment costs of the sub-label versus the individual brand. A detailed analysis is available from the authors upon request.

hand separate names, which emerge only when firms face consumers that can arbitrage, lead to the highest quality and welfare levels. These results explain some of the issues relevant in many food industries and the evidence we document, in particular the coexistence of private and collective labels, the differentiation within collective labels, and the label fragmentation and proliferation. Linking our results to historical and recent trends in food industries, we suggest what welfare impact a labeling change may have: while label fragmentation may lead to a higher welfare by inducing higher quality incentives for producers, within-label differentiation may be welfare detrimental, to the extent that it reduces them. Moreover, we explain that nested names, i.e., the "combination of private and public incentives" are not necessarily "inherently prone to intra-regional controversies" (Costanigro et al., 2012: 262) but may instead result from increasing producer heterogeneity and/or consumers' awareness about wine quality.

While our motivating cases come mostly from the wine industry in the EU, our model and results can be related to other industries, e.g., cheese, cured meats, vegetables, etc. and countries as well. From the industry's point of view, the decision to use a more or less differentiated label, and all the promoting activities that go with it, may simply depend on the destination market. For new and/or distant markets, where presumably the unaware component of consumers is significant, a more uniform label may be an effective tool. In closer (i.e., national) or knowledgeable markets, where consumers have a good understanding of the products of a region, then a more differentiated label or nested names may find a better use.

Things are less obvious for policy-making. In the standard literature, the more informed are the consumers, the higher the incentives for producers to provide quality. However, in our model we show that one needs to consider both the presence of aware and unaware consumers and the available pricing policies. When producers can discriminate between aware and unaware consumers, the presence of aware consumers may alter the label chosen by opportunistic producers, who may choose nested names instead of increasing quality to retain high-qality producers within a collective name. When the share of aware consumers is sufficiently high, the negative externality they generate can more than offset the positive effect of nested names, that otherwise can reduce the free riding by low quality producers. In this case, there may be room for public intervention, since the economy would be better-off with a collective name.

However, when producers cannot price discriminate, there is no rationale for public intervention if producers choose uniform collective names, even when the producers' heterogeneity is high. Policy-makers should also let high quality producers choose separate collective names, if they find it in their interest. But policy makers should be cautious again about nested names. Without price discrimination, a uniform collective name always welfare dominates nested names, because there is no longer an incentive for low quality producers to increase quality with nested names, as they can now only target the unaware market.

Our model is quite general but takes some simplifying assumptions. We assume that the collective labels (either the uniform or the sub-regional) are effective in conveying information. Like many other contributions in the literature, we consider a static game, with no room for signaling or reputation. We consider firms (consumers) that produce (consume) only one unit of output and may decide on the quality level to produce (consume). We consider firms of the same size. We do not consider explicitely the coalition formation of

the high-quality types in the minority. We avoid also competition among producers and/or collective labels and the explicit consideration of choosing the quantity as well. All these assumptions may be amended, possibly leading to different results and policy implications. We believe these questions deserve further investigation, that we leave for future work.

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A Appendix: No price discrimination

Without price discrimination (PD), the H producers trade off between targeting only the aware consumers with individual brand (gaining $\alpha\delta - f$) or full commingling with the other producers in the market (gaining $\bar{s}_c$ in the grand coalition with L producers or $\bar{s}_0$ in the spot market). We assume $\alpha\delta - f > \bar{s}_0$ so that individual branding is efficient. It should be mentioned that, whenever individual branding is chosen - either with or without the nested name ($C + I$ or C_L, I) - the H producers gain the same profit without price discrimination.

$$\pi_H^{C+I} = \pi_H^{C_L,I} = \alpha\delta - f.$$

This profit is the outside option for the H producers when facing the decisions of the L majority. To derive the equilibrium, we investigate the pricing and quality decision by the L majority group in a case-by-case fashion.

A.1 Quality standard in possible labeling schemes

The willingness to pay of the aware and unaware consumers are summarized in Table 1, based on which, we can derive the possible prices and profits in each labeling schemes.

UC Under the uniform collective label, the L majority targets both aware and unaware consumers with an uniform price $\bar{s}_c$. The problem is:

$$\begin{aligned} \max_{s_c} \quad & \pi_L^{UC}(s_c) = \beta\delta + (1-\beta)s_c - \Phi(s_c) \\ s.t. \quad & \pi_H^{UC}(s_c) = \bar{s}_c \geq \alpha\delta - f \end{aligned}$$

Compared with perfect discrimination case in condition (4) , the outside option is less attractive without PD, making it easier to sustain the uniform collective label. The equilibrium standard is shown in the following Lemma:

Lemma 3 *Without PD, the quality standard under the uniform collective label is the same as that with PD ($s^U : 1 - \beta = \Phi'$) if and only if the following inequality holds*

$$\delta < \hat{\delta} \equiv \frac{f + (1-\beta)s^U}{(\alpha - \beta)}. \tag{8}$$

Otherwise, the standard is set at $\hat{s}^U(\delta, \alpha, \beta) \equiv \frac{(\alpha-\beta)\delta - f}{(1-\beta)}$, which is higher than s^U.

Comparing condition (8) with condition (4) in the case of PD, it can be easily shown that the right-hand side is larger without PD and the constrained standard level is smaller. Therefore, without PD, it is less likely that the L majority upward "distorts" the quality standard to keep the H producers in the coalition. Moreover, if the outside option becomes attractive for the H producers, the standard is raised at a lower level compared to the case with PD.

Nested names If the L majority allows H producers to develop individual brands ($C+I$), the L producers trade off between charging a lower price s_c for all consumers and targeting only the unaware consumers with price $\bar{s}_c$. The former pricing strategy is equivalent to L producers being on their own, thus without any spillover from H producers. We leave the analysis for the separate name case and focus on the latter pricing strategy. When targeting only the unaware consumers, we follow Tirole (1988, p. 107) assuming that the producer only provides $(1-\alpha)$ quantity in the market and that production costs are linear in quantity. The problem is written as[24]

$$\begin{aligned} \max_{s_c} \pi_L^{C+I}(s_c) &= (1-\alpha)(\bar{s}_c - \Phi(s_c)) \\ &= (1-\alpha)\left(\beta\delta + (1-\beta)s_c - \Phi(s_c)\right) \end{aligned} \tag{9}$$

Solving the problem, the solution is the same as that in the unconstrained "UC" case s^N : $(1-\beta) = \Phi'$. Moreover, comparing it with the PD case (where the left-hand side of the analogous FOC is $1-\beta+\alpha\beta$), it is straightforward to see that s^N is smaller, resulting in a lower profit π_L^N in the case without PD.

Separate names By forming a collective label of only L types, the true quality s_c (which is also the average quality) is revealed to both aware and unaware consumers. The problem for the L majority is the same as in (7) in the case with PD. Thus we obtain the same quality level s^* which solves $1 = \Phi'$ and the same profit for the L producers π_L^*, which corresponds to the full information case.

A.2 Choice of the labeling scheme–Proof of proposition 4

Again, the equilibrium labeling scheme depends on the comparision of profits for the L producers. Notice that if the constraint (8) is not binding, the profit under the uniform collective label $\pi_L^{UC}(s^U)$ is the same with or without PD and so is the profit under the separate name π_L^*. However, the profit gained in the nested name π_L^N is lower in the case without PD than with PD, which is smaller than $\pi_L^{UC}(s^U)$. Therefore, the L majority will choose the uniform collective label, which gives the highest profits under all possible name patterns $\pi_L^{UC}(s^U) > \pi_L^*$ and $\pi_L^{UC}(s^U) > \pi_L^N$.

If the constraint (8) does not hold, i.e., $\delta \geq \hat{\delta}$, the L majority has to "distort" the quality standard upward to $\hat{s}^U$, which reduces the profit for the L producers under the uniform collective label $\pi_L^{UC}(\hat{s}^U)$. When the profits become low enough, the L majority may switch to other labeling strategies, which gives a higher profit. Notice that $\pi_L^N =$

[24] A more rigorous statement of the problem for the $C+I$ case is

$$\begin{aligned} \max_{s_c} \quad & \pi_L^{C+I}(s_c) = \max\{(1-\alpha)\left(\bar{s}_c - \Phi(s_c)\right), s_c - \Phi(s_c)\} \\ s.t. \quad & \pi_H^{C+I}(s_c) = \max\{\alpha\delta - f, \bar{s_c} - f\} \geq \bar{s}_c \\ & \pi_L^{C+I}(s_c) \geq \bar{s}_0 \end{aligned}$$

Providing that $\delta > \delta^{NS}$, which solves $\pi_L^N = \pi_L^*$, the problem degenerates to (9), suggesting that in the $C+I$ case, the L producers target only the unaware consumers at price $\bar{s}_c$ and the H producers target only the aware consumers at price δ.

$(1-\alpha)\pi_L^{UC}(s^U) = (1-\alpha)(\beta\delta + (1-\beta)s^U - \Phi(s^U)$ is increasing with δ and $\pi_L^* = s^* - \Phi(s^*)$ is independent of δ. Moreover, it can be easily checked that when $\delta = s^U + \frac{\pi_L^* - \pi_L^{C_L,I}(s^U)}{\beta}$, $\pi_L^N < \pi_L^*$; when $\delta = s^* + \frac{\alpha}{(1-\alpha)\beta}\pi_L^*$, $\pi_L^N > \pi_L^*$. Thus, there exists a threshold δ^{NS}, with $\delta^{NS} \in (s^U + \frac{\pi_L^* - \pi_L^{C_L,I}(s^U)}{\beta}, s^* + \frac{\alpha}{(1-\alpha)\beta}\pi_L^*)$, solving $\pi_L^N = \pi_L^*$ for δ, such that if $\delta > (<)\delta^{NS}$, $\pi_L^N > (<)\pi_L^*$ and the nested (separate) name becomes a candidate equilibrium.

If $\delta > \delta^{NS}$, the equilibrium hinges on the comparison of $\pi_L^{UC}(\hat{s}^U)$ and π_L^N, which follows the same argument as stated in Proposition 2. If $\delta < \delta^{NS}$, the equilibrium depends on the comparison of $\pi_L^{UC}(\hat{s}^U)$ and π_L^*. Analogous to the above analysis, there exists a threshold δ^{SU}, which solves $\pi_L^{UC}(\hat{s}^U) = \pi_L^*$ for δ, such that if $\delta > (<)\delta^{SU}$, $\pi_L^{UC}(\hat{s}^U) < (>)\pi_L^*$ and the L majority will choose the separate name (uniform collective label). Combining all of this, we have Proposition 4.

A.3 Welfare effect–Proof of Proposition 5

We compare the welfare of the three name patterns: "UC", "$C+I$" and "C_L, I". The welfare functions are derived as follows:

$$\begin{aligned} W^{UC} &= \beta\delta + (1-\beta)(s - \Phi(s)) \text{ where } s = s^U \text{ or } \hat{s}^U; \\ W^{C+I} &= \beta(\alpha\delta - f) + (1-\beta)(1-\alpha)\left(s^N - \Phi(s^N)\right); \\ W^{C_L,I} &= \beta(\alpha\delta - f) + (1-\beta)\left(s^* - \Phi(s^*)\right). \end{aligned}$$

Providing that $s^N < s^U < s^*$ and $s^U < \hat{s}^U$, it is straightforward that $W^{C+I} < W^{UC}$ and $W^{C+I} < W^{C_L,I}$. Thus, the nested name in the case without PD results the lowest welfare among all the three name patterns.

However, the comparison of the welfare under "UC" and "C_L, I" is less clear. On the one hand, the quality incentive is lower under "UC" than under "C_L, I", suggesting a lower welfare with the uniform name compared to the separate name. On the other hand, without PD, separate name also entails inefficiency because the high quality producers do not serve the unaware market and because the cost of developing individual brands (note that $\pi_H^{C_L,I} = \alpha\delta - f$), whereas such inefficiency is not present in the case of the uniform collective name. The question is whether these names patterns are welfare enhancing when they are chosen in equilibrium.

Notice that the welfare functions of a name pattern i can also be rewritten as

$$W^i = \beta\pi_H^i + (1-\beta)\pi_L^i$$

where $\pi_L^{C_L,I} = \pi_L^*$. From Proposition 4 and the proof in section A.2, when the separate name is chosen in equilibrium, $\delta > \delta^{SU}$. In this case, $\pi_L^{UC} < \pi_L^{C_L,I}$. Meanwhile, "UC" is constrained and hence, the H producers gain the outside option profit $\alpha\delta - f$, which is the same profit as they can obtain in "C_L, I". Thus we have $\pi_H^{UC} = \pi_H^{C_L,I}$, leading to $W^{UC} < W^{C_L,I}$. When the uniform name is chosen in equilibrium, $\delta < \delta^{SU}$. In this case, $\pi_L^{UC} > \pi_L^{C_L,I}$. Meanwhile, the H producers gain no less than the outside option profit:$\pi_H^{UC} \geq \pi_H^{C_L,I}$. Thus we have $W^{UC} > W^{C_L,I}$, thus proving proposition 5.