THE ECONOMICS OF COLLECTIVE REPUTATION: MINIMUM QUALITY STANDARDS, VERTICAL DIFFERENTIATION AND OPTIMAL GROUP SIZE

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The economics of collective reputation: minimum quality standards, vertical differentiation and optimal group size

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Abstract

The literature on collective reputation is still in its infancy. Despite a number of valuable theoretical works studying the process of collective reputation building, due to data limitations there are no studies testing the determinants of group reputation. This work represents a first empirical step in this direction. Control variables range from the context in which firms operate to the quality standards set by the coalition, from the variables measuring the vertical and horizontal differentiation to the characteristics of the group. Our research provides empirical support in favor of the usefulness of compulsory and voluntary quality standards. Furthermore, it shows that the relationship between group size and collective reputation is non-linear: free entry may be not optimal since above a certain number of producers the group reputation declines due to free-riding problems.

1. Introduction

Over the last four decades, since Akerlof (1970) demonstrated that the presence of asymmetric information can lead to market failure, the literature has extensively investigated the determinants and the consequences of *firm* reputation[1]. However, and quite surprisingly given its importance for economic and non-economic transactions, the literature has not investigated much the mechanisms of *collective* (or group) reputation building.

A shared brand name, like for example geographical ones, can reduce information asymmetries especially when the scale of production is too small and individual firms fail to establish reputations on a stand alone basis. This has been the case for many products, especially connected to the agri-food sector where the property of land is often dispersed among many small farms[2]. Geographical names have been used since ancient times to identify high quality products like Greek olives, Parma ham, Danube salmon and Russian caviar. A sector where historically geographical appellations have played a crucial role is viticulture, with wines from Barolo, Bordeaux, Burgundy, Champagne, Chianti, Montalcino, and Rioja being the most famous examples.

Having a good collective reputation implies clear advantages. First, the use of a well-known group brand may enable (small) producers to reap the benefits of a reputation rent, without incurring all the costs that a company has to face when it has to establish the reputation of a commercial brand name.[3]

Second, collective reputation is important because in many markets there is a huge variety of products and abundance of information. Consumers willing to economize on the costs of ascertaining quality often rely on the reputation of firms or groups for their purchases (Andersson, 2002). When forming expectations consumers have to choose what sources of information to use and the extent of deepening to achieve (Costanigro et al., 2009). The first source of information is usually related to geographical brands, information on firm and bottle/year requiring a higher level of expertise.

Finally, some people attach value to the regional food traditions and are willing to pay a premium for it (Vogel, 1995) while others associate quality with the respect of a set of rules on safety, integrity, or conformity to

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[1] For a recent extensive survey see Bar-Isaac and Tadelis (2008).
[2] Caswell and Padberg (1992) analyze food labels as a possible solution to the imperfect information dilemma in food safety.
[3] As to the European wine sector, Bureau and Valceschini (2003, p. 3) claim that "the appellation of origin has proved successful in allowing even small producer groups to benefit from a well-established reputation".

industrial process, which requires the creation of agreed norms among a coalition of local producers.

However, creating a collective reputation might not always be possible since it requires a long lasting relationship among the members of the coalition of producers, as well as the identification of the group at each purchase (Fleckinger, 2007). These conditions may not be satisfied if the frequency of purchases is low, there is no traceability or the consumer has bounded memory.

The literature about collective reputation is still in its infancy. So far, the theoretical research has concentrated on modeling the process of collective reputation building while the empirical one on measuring the consequences of positive group reputation on clients' willingness to pay through the use of hedonic price models (e.g. Landon and Smith, 1998)[4].

Collective reputation is usually modeled as an aggregate of all the firms in the coalition (see Tirole, 1996 and Landon and Smith, 1998) or of its most famous members (Gergaud and Livat, 2004). In his seminal paper, Tirole (1996) made one of the first attempts of modeling group reputation as an aggregate of individual reputations, studying the joint dynamics of individual and collective reputations and deriving conditions to rebuild group reputations. In his work, group reputation is modeled as an aggregate of individual reputations and new members joining a group "inherit" the good or bad reputation of the coalition. Also in Gergaud and Livat (2004) individual and collective reputations influence each other, this latter work studying the joint dynamics.

Empirically, while there are some papers that analyze the impact of group reputation on individual reputation and/or prices[5], there is no work that so far has tested the determinants of the process of collective reputation building.

The target of our research is thus to provide first empirical evidence on (a large and comprehensive number of) determinants of collective reputation. The paper is organized as follows. Chapter 2 presents a brief review of the

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[4] Using data on Bordeaux wines the authors study the impact on price of quality and reputation, where the latter can be individual or collective. Results show that individual firm reputation matter more than actual quality and that collective reputation affects wine prices only if it is a good predictor of future quality.

[5] Due to the large availability of data from prestigious wine guides, some empirical papers dealing with (the consequences of) collective reputation refer to this sector. For studies analyzing (among other things also) the impact of collective reputation on wineries reputation or on wine prices see Landon and Smith (1998), Schamel and Anderson (2003), Castriota and Delmastro (2008), and Costanigro et al. (2009).

factors which are believed or have been shown to be relevant for the process of group reputation building. Chapter 3 explains how the dataset has been created and presents summary statistics. Chapter 4 presents econometric evidence. Chapter 5 concludes.

2. The determinants of collective reputation

When trying to investigate the elements driving the success of certain coalitions in terms of prestige, which is the aim of our research, two things have to be made clear. First of all, some of the variables affecting individual firm reputation, like age and size, should be important determinants of collective reputation as well given that some mechanisms of reputation building are expected to work in the same way at the individual and group level. Having said this, as a second remark, three main categories of determinants can be identified: (i) the characteristics of the coalition (ii) the quality standards set by the coalition and the variables influencing the effective behavior of the members; (iii) the context in which firms operate.

Starting from the first category, some of the considerations made by the literature about firm reputation can easily be applied to that of a group. Like for firms[6], the **age** of the coalition and of its brand is important since it takes time for the brand to get known among consumers. In Tirole (1996) stereotypes about the expected quality of a group are history dependent since collective reputation is a long term, path dependent process. Furthermore, collective reputation is long-lasting because new members inherit the reputation of the elders. Levin (2009) builds on Tirole (1996) and develops a dynamic model to explain persistence in collective reputations.

Size can be another driver, given that large coalitions have higher resources for marketing campaigns and a larger buyer base which, combined with word-of-mouth phenomena, make big coalitions more visible to the market (see Rob and Fishman, 2005 for a theoretical approach to individual firms). On the other hand, Kandori (1992), analysing the information transmission mechanisms through which self-interested community members sustain a rule in a context where agents care only about their own interests, shows the opposite pattern: the higher the number of community members, the less effective social norms. Informal sanctions can improve the behavior in infrequent trades: a simple action rule and local information transmission are shown to be sufficient to induce a mutually beneficial outcome.

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[6] See Melnik and Alm (2002) for an empirical application to firms.

In a similar vein, Fishman et al. (2008) argue that in absence of perfect monitoring the members of a community have an incentive to invest on the group reputation, but also an incentive to free ride which can lead to lower investments in quality, especially when the brand size increases: "if too many firms are admitted to the brand, the incentive to free ride necessarily overrides the reputation effect and reduces the incentive to invest, relative to stand alone firms. This is because once the brand is sufficiently large, the marginal contribution of an individual member's investment to the brand's visibility and reputation becomes negligible, in comparison to the payoff from free riding" (p. 4).

In line with the above intuition Castriota and Delmastro (2008) show that, everything else being equal, the reputation of wine cooperatives decreases with the number of associated members. Jin and Leslie (2009) provide additional empirical evidence of the existence of free riding problems when finding that franchised restaurants have lower hygiene standards with respect to chain affiliated ones, thereby taking advantage from (but also damaging) the chain quality.

The second group of determinants is represented by **minimum quality standards** (MQS) set by the coalitions themselves or by public authorities. Many professions are subject to occupational licensing and quality regulation, whose standards are sometimes set by the public authorities but often by the professional groups themselves. Some economists believe that entry regulation is meant to increase the producers' incomes at the expense of consumers, while others consider it as a solution to the asymmetric information problem between producers and consumers. In this latter view, introducing minimum standard requirements can increase clients' trust and lead to a Pareto-improvement, if the risk to meet an incompetent or fraudulent producer diminishes[7].

Rouviere and Souberyan (2008) show that free entry is not socially optimal due to the producers' incentive to free-ride on the collective reputation and, again, find that the introduction of minimum quality standards to correct this

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[7] A number of studies identify a positive effect of their introduction on quality (Leland, 1979), quality and price competition (Ronnen, 1991) and social welfare (Crampes and Hollander, 1995, Ecchia and Lambertini, 1997, Garella and Petrakis, 2008, and Saitone and Sexton, 2008). Rouviere and Souberyan (2008) follow Tirole (1996) and Gergaud and Livat (2004) in modeling the creation of collective reputation, but allow for entry in, or exit from, the group of good or bad producers whose size is given and fixed. In their study on collective reputation McQuade, Salant and Winfree (2008) find that in non-monopolistic markets the introduction of MQS would be welfare improving. On the contrary, a negative impact has been found by Shapiro (1983) on products supply, Bockstael (1984) on social welfare and producer returns, Maxwell (1998) on profitability of innovations, Scarpa (1998) on quality and profits, and Valletti (2000) on social welfare.

market failure is necessary to avoid good companies staying out of the market. This creates room for entry regulation. Indeed, under certain assumptions, Fleckinger (2007) shows that in an asymmetric information context entry regulation and minimum quality standards can be socially efficient.

However, imposing some minimum quality standards is useless if the members of the coalition do not respect the rules, which recalls the importance of the enforcement. In order to keep reputation, it is necessary a strong discipline which is maximized when it is sustained by the treat of exclusion from the group (Tirole, 1996), which in turn requires traceability (Winfree and McClucskey, 2005)[8] and frequent and effective controls[9].

This creates room for the last group of determinants: the **context** where a coalition of firms operates. Many studies on the determinants of growth have shown that initial GDP, the quality of infrastructures and of institutions, the level of corruption and criminality, cultural and political arrangements etc. influence a country's growth rate (see, among others, Abrams and Lewis, 1995) which is given by the performance of individual firms[10]. In particular, the level of trust and social capital, the traditions and the producers' intrinsic motivations are the results of decades or centuries of historic events which have shaped the mentality of a population, the level of enforcement of social norms, and thus might have a great impact on the quality of goods and consequently on reputation. In addition, in some sectors the so called "primitives", like the climate and the quality of land in agriculture, are fundamental in determining the quality of the final products.

3. Dataset and summary statistics

In order to test empirically the determinants of group reputation, we have created a database on the universe of Italian wine denominations in the year 2008. Indeed, our database refers to all 1,424 wine denominations that have

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[8] The authors show that, when collective reputation does not have firm traceability, firms will extract too much from the stock of reputation, selling low-quality products at high prices justified by the high past levels of quality.

[9] The principal-agent theories suggest that, if transaction costs are low, tighter monitoring will increase agent's work effort. However, when the relation between principal and agent is not only economic but also personal, then the effect of closer monitoring might be more than counterbalanced by the feeling of distrust which ends up reducing total effort (Frey, 1993). Furthermore, in a recent contribution Moav and Neeman (2009) find that the relationship between the precision of information about an agent's performance and his incentives to exert high effort is not monotonic.

[10] See Becchetti and Trovato (2002) for an empirical analysis of the determinants of firm growth using a large set of controls.

been so far (and since 1963) established in Italy. In particular, national decrees rule appellations of quality wines (i.e. DOCGs and DOCs)[11], and each appellation is arranged into denominations. In other words, national legislative decrees establish for each appellation, a number of denominations (from one up to 52) that may substantially differ one from another in terms of a relevant number of wine and group characteristics: i.e., the number of producers of each specific denomination, wine minimum quality standards so as horizontal and vertical characteristics (see infra).

In addition, their reputation can vary considerably, as shown by the scores attached by prestigious wine guides. For instance, Asti Spumante and Moscato d'Asti are the two denominations that belong to the same appellation (DOGC Asti) but substantially differ in terms of group size (in 2006, the number of producers was 4,784 for Asti Spumante and 519 for Moscato d'Asti), wine type (the former is a dry or sweet sparkling wine, while the latter is a sweet low alcoholic wine), minimum quality standards (the minimum wine alcoholic content is 5,5° for the former and 8,5° for the latter), and international reputation (Asti Spumante scores 1-2 stars in the Hugh Johnson's wine guide, while Moscato d'Asti reaches 2-3 stars[12]).[13]

As to the explanatory and dependent variables of wine denominations (see Table 1 for a detailed description), information is from National decrees (issued from 1963 to 2008) that discipline all **technical aspects of wine denominations**. In particular, for each denomination they provide specific rules over: the list of provinces and sub-zones where the wine can be produced, the horizontal characteristics of the wine, and the *quality standards* to be achieved (both agronomical and oenological phases of wine production). As to these latter, criteria include: species to be planted and minimum percentages of vines which must be used (see compulsory wine in Table 1); maximum number of plants and grapes per hectare (grapes yields); maximum ratio between wine obtained and grapes used (grapes/wine); minimum wine alcohol content, minimum wine total acidity, and wine ageing practices.

Moreover, the decree may establish the introduction, within the same denomination, of further types of wine, where quality standards are set more severely on a voluntary basis (*vertical differentiation*) with respect to technical aspects such as: the selection of vineyards (classico and sottozona),

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[11] At the end of the year 2008, there existed 36 DOCGs and 317 DOCs.

[12] Hugh Johnson's wine guide assigns, when present, from 1 to 4 stars to each denomination, where intervals (e.g. 1-2, 2-4) are also possible.

[13] Note that from above considerations it derives that an analysis on wine appellations would be not only inefficient (because it won't use all available information) but it would also be incorrect, since most of above mentioned determinants of collective reputation are fixed at a denomination level.

the agronomical procedures (passito, late harvest, and vin santo), and the oenological standards (superior for alcoholic content, and riserva for wine ageing). As to the spectrum of *horizontal differentiation* of a wine denomination, control variables include: the color (white, rose or red) and type (dry, slightly sweet, sweet, novello, sparkling, and spumante).

Second, we added information on the **general characteristics of the wine denomination**, drawing again upon national decrees (for the variables DOCG and age) and on data from the Italian Chambers of Commerce (for the number of producers of each wine denomination in year 2006).

Finally, we completed the information set by collecting data on average socio-economic indicators for the province(s) of production of each wine denomination that capture the following **context** aspects: domestic demand structure (GDP per capita), local entrepreneurial ability (index of entrepreneurship), geographical externalities (index of economic infrastructures), trust climate (crimes per 100,000 inhabitants), and the importance of natural endowment (value of vineyards).

As to the dependent variable, we measure group reputation by relying on scores assigned by the Hugh Johnson's wine guide. Indeed, in markets characterized by strong asymmetric information rating agencies have emerged as a market response to market failure. Nowadays, guides play exactly this role in the wine market and influence substantially both consumer and investor decisions (Ali et al., 2008). We chose Hugh Johnson's wine book, which is published yearly since 1977, because is the most diffused and acclaimed international guide that rates wine denominations. Ratings are expressed in number of stars, from 1 to 4. Of course not all denominations reach an international standing (indeed only half -723 out of 1,424- of all Italian wine denominations are present in the guide). Thus, we assigned 0 to wine denominations with no international reputation.

Table 2 reports descriptive statistics. Collective reputation ranges from 0 to 3.5 stars, with average of 1.03 and standard deviation of 1.09. The average age of the denominations is 24 years, ranging from 42 for the oldest to 1 for the youngest. Minimum quality standards vary significantly according to the coalition's willingness to increase the average product quality. Also the characteristics of the coalition (like the number of producers, the total quantity and average production per winery) and the socio-economic indicators for the provinces of interest are subject to radical differences among the denominations.

By the law, DOCG denominations must have higher minimum quality standards than DOC wines which, on average, translate into better quality

and higher reputation. Table 3 shows the number of denominations and the share of DOCG over the sub-sample by reputation level: there is a clear positive correlation between score value and percentage of quality wines.

4. Econometric analysis

4.1 Main results

Before describing the econometric analysis, it is important to underline that most of control variables used in our study are exogenous. Age is clearly exogenous, as well as the minimum quality standards and the variables capturing vertical and horizontal differentiation, which cannot be influenced by the reputation of the denomination. A similar line of reasoning holds for the socio-economic context of the provinces where the denominations have been created.

The only two potentially endogenous variables are DOCG and the size of the coalition. In fact, the DOCG level is awarded to wines with outstanding superior characteristics which over time have gained prestige. However, the legal procedure to obtain a DOCG is long, complex, uncertain and requires a lot off lobbying activity. As a result, DOCs are usually upgraded to DOCG with a considerable and unpredictable delay from the date of application.

As to the size of a coalition, it might be the cause of group reputation since size is associated with visibility, but also its consequence if an increasing collective reputation attracts a growing number of firms willing to benefit from the accumulated asset. In order to attenuate this second potential endogeneity problem we use two years lagged data for the number of producers (year 2006), while all the other variables refer to the year 2008. In addition, we first run econometric estimates without including the number of producers, and only then we include also this variable into the econometric models.[14]

Given the discrete nature of the dependent variable the econometric methodology relies on ordered Logit regressions with robust standard errors. The sample used is the universe of all 1,424 denominations, whose reputation is regressed on the variables listed in Table 1. Therefore, the structure of the equations will be the following:

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[14] Note that the introduction in the estimates of this variable causes also a reduction of the number of observations from 1,424 to 1,391. This is because some denominations have been created from 2006 onwards, and thus we do not have data on the number of producers.

$$HJ_i = \beta_0 + \beta_1 DEN\_CARACT_i + \beta_2 MQS._i + \beta_3 VERT\_DIFF_i + \beta_4 CONTEXT_i +$$
$$+ \beta_5 HORIZ\_DIFF_i + \varepsilon i$$

where *HJ* is the reputation in the Hugh Johnson wine guide, the subscript *i* refers to the denomination. Table 4 shows three models. In the first we control for the characteristics of the denomination, the socio-economic variables at the province level and horizontal differentiation. Without including as controls the compulsory (MQS) and the voluntary additional (vertical differentiation) quality standards, the dummy variable for the DOCG level turns out to exert a strong positive effect. On average, DOCG denominations have higher minimum quality standards and consequently are more prestigious than DOC ones.

In line with theoretical predictions age has a strong positive effect: everything else being equal, older denominations have built over time their reputation. Socio-economic variables go in the expected direction with GDP per capita, number of enterprises per 100 inhabitants, index of level of infrastructures and average value of vineyards having a positive effect on reputation. Variables capturing horizontal differentiation are not expected to play any role, unless they reflect the personal taste of the evaluator or the quality of the national products relative to that of foreign ones. As expected, in our estimates coefficients are only weakly significant (results of single variables are omitted for reasons of space and available upon request).[15]

In the second regression we insert as an additional control the minimum quality standards required by the law to produce wines belonging to a certain denomination. All quality standards are significant at 5% level, except for wine alcoholic content which is significant at 10% level. This finding provides a solid empirical ground to those theoretical works identifying a positive, rather than negative, link between minimum quality standards on one hand and quality and (group) reputation on the other. The size of the coefficient of the dummy variable DOCG decreases significantly but is still significant at 5% level. Minimum quality standards are aimed at increasing the average product quality and thereby capture a big part of the positive effect of the DOCG label.

The third regression repeats the exercise by adding the voluntary quality standards aimed at providing additional vertical differentiation. Main results hold, the size and significance of the DOCG dummy variable decreasing even more. Sottozona, late harvest and riserva display a positive influence on the

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[15] At the bottom of Tables 4 and 6 we report joint tests for significance of coefficients (Chi-squared Wald tests) of horizontal differentiation variables which range from 1 to 10% according to the specification adopted.

reputation of the coalition. The result of superiore (significant and negative) may seem surprising, even though, contrary to common (and legislative!) beliefs, the alcoholic content of a wine does not imply higher quality *per se* (this result is further confirmed by the MQS variable Wine alcoholic content which is not significant).

Table 5 shows joint tests for significance of coefficients (Chi-squared Wald tests) for the five groups of variables considered in Model 3 of Table 4. The null hypothesis that the coefficients are jointly equal to zero is rejected at 1% level for the first four groups. In line with previous findings, the coefficients of the variables measuring horizontal differentiation are weaker and therefore jointly different from zero only at 5% level.

4.2 Optimal group size

In Table 6 we focus on the role exerted by the size of the coalition, measured by the number of its members. In Model 4 we extend Model 3 by using the number of producers as additional control: this latter variable turns out to have a strong positive effect. Model 5 considers also the square of the number of producers to check for a possible non-linear relationship. The relation is indeed concave, the significance of the coefficient of the number of producers rising significantly when also its square is included.

Figure 1 reports a graphical simulation of the relationship between the number of firms in a coalition and the reputation of the denomination itself[16]. The reputation of the denomination benefits from the size of the coalition because of higher visibility and market power, and increases until a peak at around 3,400 producers. However, after this peak the effect of group size on collective reputation is negative due to free-riding problems.

In both regressions the effect of belonging to a DOCG vanishes. This is a good piece of news, meaning that, after controlling for all factors, the reputation of the denomination depends on all the other objective characteristics considered in the analysis, and not on an institutional signal. A significant coefficient attached to the DOCG dummy variable would mean either that the evaluator got influenced by the institutional signal or that there are some unobserved components we cannot control for.

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[16] The simulation has been performed by estimating Model 5 with OLS.

5. Conclusions

While the literature on firm reputation is huge, that on collective reputation is still scarce. Existing theoretical works analyze mainly the process of collective reputation building, while empirical papers focus on the consequences of collective reputation (especially on the price the seller is able to charge), with a number of applications to the wine market given the abundance of available data.

However, so far no empirical work has analyzed the determinants of group reputation. We do so by studying the determinants of collective reputation in the Italian wine market, our database being composed by the *universe* of wine denominations in the year 2008. Our dependent variable is the international reputation of wine denominations. We control for a number of potential variables ranging from the general characteristics of the group of producers to the compulsory minimum quality standards set by the coalition, from the additional voluntary quality standards capturing vertical differentiation to the context in which firms operate, to the variables measuring horizontal differentiation.

The economic literature has associated the introduction of minimum quality standards with both negative (entry barrier to new firms) and positive (higher average product quality) effects on social welfare, quality and reputation. Our findings provide evidence in favor of the positive effects of MQS on group reputation. Similar results hold for the adoption of voluntary additional quality standards. In markets with strong asymmetric information, free entry may end up being sub-optimal since the relation between number of producers in the coalition and group reputation is concave. At the beginning, when the scale of production is small, a growing number of members ensure higher visibility, but after a peak the collective reputation declines since the incentive to free ride prevails.

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Table 1: Description of the dependent and explanatory variables

Variable	Source	Description
Reputation		
HJ's coll. reputation	HJ's wine book	Number of stars awarded to the denomination, from 1 to 4, while 0 means absence of reputation
General characteristics of the denomination		
DOCG	National decrees	DV equal to 1 if the denomination is a DOCG
Age	National decrees	Age of the denomination (in years) since it was first awarded a DOC
Producers	Chambers of Commerce/Federdoc	Nr. of wineries producing the denomination
Minimum quality standards (compulsory)		
Compulsory vines	National decrees	Minimum percentage of all compulsory vines
Grapes yields	National decrees	Maximum quintals of grapes per hectare
Grapes/wine	National decrees	Maximum conversation ratio grapes used in wine obtained
Wine alcoholic content	National decrees	Minimum wine alcoholic content (in %)
Wine total acidity	National decrees	Minimum total acidity (grams per liter)
Wine ageing	National decrees	Minimum ageing (in months)
Additional voluntary quality standards (vertical differentiation)		
Classico	National decrees	DV equal to 1 if the wine is from a historical restricted area within the limits of the denomination
Sottozona	National decrees	DV equal to 1 if the wine belongs to defined restricted area of the denomination
Passito	National decrees	DV equal to 1 if the wine is strong, mostly sweet, from grapes dried
Late harvest	National decrees	DV equal to 1 if the wine is a late harvest
Vin Santo	National decrees	DV equal to 1 if the wine is strong and sweet, from "passito" grapes, using traditional methods
Superiore	National decrees	DV equal to 1 if the wine is with more ageing and 0.5-1% more alcohol
Riserva	National decrees	DV equal to 1 if the wine is aged for statutory period, usually in casks or barrels
Context		
GDP per capita	Unioncamere	GDP per capita in the provinces of production of the denomination
Entreprises	Unioncamere	Enterprises (per 100 inhabitants) in the provinces of production of the denomination
Infrastructures	Unioncamere	Infrastructures index (Italy=100) in the provinces of production of the denomination
Crimes	Unioncamere	Crimes (per 100,000 inhabitants) in the provinces of production of the denomination
Value of vineyards	INEA	Average value of vineyards (per ha) in the provinces of production of the denomination
Horizontal controls		
White	National decrees	DV equal to 1 if the wine is white
Rose	National decrees	DV equal to 1 if the wine is rose
Red	National decrees	DV equal to 1 if the wine is red
Dry	National decrees	DV equal to 1 if the wine is dry
Slightly sweet	National decrees	DV equal to 1 if the wine is slightly sweet (i.e. *amabile or abboccato*)
Sweet	National decrees	DV equal to 1 if the wine is sweet
Novello	National decrees	DV equal to 1 if the wine is early vintage with carbonic fermentation
Sparkling	National decrees	DV equal to 1 if the wine is sparkling (i.e. *frizzante*)
Spumante	National decrees	DV equal to 1 if the wine is sparkling and is produced with Charmant-Martinotti or Champenoise (in Italy metodo classico) methods

Table 2: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
HJ's collective reputation (stars)	1,424	1.03	1.09	0	3.5
DOCG	1,424	0.04	0.19	0	1
Age (years)	1,424	24.10	12.71	1	42
Producers	1,391	117	369	0	6,592
Compulsory vines (%)	1,424	82.73	13.61	25	100
Grapes yields (q. per ha)	1,424	112.54	21.29	40	200
Grapes/wine (%)	1,424	68.60	5.75	25	75
Wine alcoholic content (°)	1,424	11.46	1.13	9	18
Wine total acidity (gr. per l.)	1,424	4.67	0.41	3	6.5
Wine ageing (months)	1,424	2.32	7.94	0	96
Classico	1,424	0.02	0.15	0	1
Sottozona	1,424	0.13	0.34	0	1
Passito	1,424	0.13	0.34	0	1
Late harvest	1,424	0.04	0.20	0	1
Vin Santo	1,424	0.04	0.20	0	1
Superiore	1,424	0.14	0.34	0	1
Riserva	1,424	0.31	0.46	0	1
GDP per capita	1,424	25,099	6,473	9,182	35,619
Enterprises (per 100 inh.)	1,424	9.38	1.24	6.00	12.00
Infrastructures (index)	1,424	100	63	24	449
Crimes (per 100,000 inh.)	1,424	2,931	1,066	1,075	6,546
Value of vineyards (per ha)	1,424	39.97	39.26	9.00	186.00
White	1,424	0.49	0.50	0	1
Rose	1,424	0.010	0.099	0	1
Red	1,424	0.50	0.50	0	1
Dry	1,424	0.94	0.24	0	1
Slightly sweet	1,424	0.13	0.34	0	1
Sweet	1,424	0.18	0.39	0	1
Novello	1,424	0.07	0.25	0	1
Sparkling	1,424	0.13	0.33	0	1
Spumante	1,424	0.14	0.35	0	1

Table 3: Reputation by score value

Reputation	N	DOCG	DOCG/N
0	701	4	0.50%
1	52	0	0%
1.5	169	3	1.70%
2	283	17	6%
2.5	129	16	12.40%
3	84	7	8.30%
3.5	6	4	66.70%
4	-	-	-

Note: Hugh Johnson provides either values (e.g. 2 stars) or ranges (e.g. 2-4 stars), in which case the reported score is the average of the two values.

Table 4: Ordered Logit regressions

Regressors	Model 1		Model 2		Model 3	
	Coef.	**z**	**Coef.**	**z**	**Coef.**	**z**
DOCG	1.57	5.11	0.80	2.47	0.75	2.06
Age	0.09	16.32	0.10	17.10	0.10	16.05
Compulsory vines			0.02	3.92	0.03	4.94
Grapes yields			-0.02	-6.41	-0.02	-4.79
Grapes/wine			-0.06	-2.83	-0.04	-1.89
Wine alcoholic content			-0.17	-1.73	-0.13	-1.37
Wine total acidity			-1.23	-7.01	-1.09	-6.26
Wine ageing			0.05	4.38	0.04	4.06
Classico					0.35	0.81
Sottozona					0.53	2.98
Passito					0.74	1.62
Late harvest					0.94	2.41
Vin santo					0.78	1.44
Superiore					-0.27	-2.03
Riserva					0.34	2.41
GDP per capita/1000	0.07	6.33	0.05	3.74	0.05	3.74
Entreprises/1000	0.10	1.90	0.06	1.10	0.05	0.86
Infrastructures/100	0.45	3.06	0.52	3.68	0.60	3.92
Crimes (per 100 inh.)	-0.09	-1.52	-0.11	-1.74	-0.17	-2.40
Value of vineyards/100	0.39	3.26	0.51	3.22	0.24	1.41
Horizontal differentiation (Wald test: Prob>Chi2)*	0.0000		0.0914		0.0309	
N	1,424		1,424		1,424	
Pseudo R2	0.17		0.22		0.23	

Note: Results are from ordered Logit regressions with robust standard errors. The last regressors have been scaled in order to reduce the number of zeros of the coefficients.
* Joint tests for significance of coefficients (Chi-squared Wald tests).

Table 5: Joint test for significance of coefficients (Wald tests)

Category of reputation determinants	Chi 2 test	Degr. of fr.	Prob.>Chi 2
General characteristics of the denomination	268.93	2	0.0000
Minimum quality standards (compulsory)	106.4	6	0.0000
Addit. voluntary quality standards (vertical diff.)	35.52	7	0.0000
Context	42.85	5	0.0000
Horizontal differentiation	15.42	7	0.0309

Note: Tests refer to coefficients in Model 3 of Table 4.

Table 6: Ordered Logit regressions, with nr. of producers

Regressors	Model 4		Model 5	
	Coef.	z	Coef.	z
DOCG	0.51	1.27	0.44	1.14
Age	0.09	15.04	0.09	14.69
Producers / 1000	*0.66*	*3.58*	*1.55*	*5.29*
(Producers / 1000) squared			*-0.24*	*-3.00*
Compulsory vines	0.03	4.73	0.03	4.66
Grapes yields	-0.02	-5.18	-0.02	-5.30
Grapes/wine	-0.04	-1.74	-0.04	-1.69
Wine alcoholic content	-0.14	-1.41	-0.13	-1.35
Wine total acidity	-1.06	-6.07	-1.05	-6.07
Wine ageing	0.05	4.13	0.05	4.16
Classico	0.15	0.34	-0.02	-0.05
Sottozona	0.65	3.6	0.71	3.92
Passito	0.82	1.8	0.83	1.87
Late harvest	0.90	2.32	0.86	2.23
Vin santo	0.74	1.37	0.75	1.40
Superiore	-0.37	-2.72	-0.44	-3.20
Riserva	0.36	2.51	0.38	2.64
GDP per capita/1000	0.06	4.3	0.06	4.41
Entreprises/1000	0.00	0.01	-0.01	-0.20
Infrastructures/100	0.55	3.64	0.55	3.59
Crimes (per 100 inh.)	-0.21	-2.95	-0.21	-2.97
Value of vineyards/100	0.16	0.91	0.09	0.54
Horizontal differentiation (Wald test: Prob>Chi2)*	0.0088		0.0017	
N	1,391		1,391	
Pseudo R2	0.23		0.23	

Notes: Results are from ordered Logit regressions with robust standard errors. The last regressors have been scaled in order to reduce the number of zeros of the coefficients. The Chi 2 test for the joint hypothesis that Producers/1000 and [(Producers/1000) squared] are jointly equal to zero provides value 40.38, with P-value equal to 0.0000.
* Joint tests for significance of coefficients (Chi-squared Wald tests).

Fig.1: Nr. of producers and collective reputation