Grape Supply and Implicit Prices for Wine Quality Attributes

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Abstract:

We analyze how grape supply may determine implicit prices for organic wine and regional denominations. We analyze three grape supply chains and the related wine quality they produce: cooperatives, own-growing and mixed-sourcing. Cooperatives have their grapes supplied by their member growers. Own-growers are making wine exclusively from their own-grown grapes. Mixed-sourcing describes wineries that use own-grown grapes and contract-grapes from independent growers. Cooperative producers face the challenge to raise grape and subsequent wine quality (e.g. setting appropriate incentives that induce their members to grow high quality grapes through vineyard management and grape pricing schemes). We analyze data on retail prices, wine quality evaluations, winery reputation indicators, organic production and regional denomination rules (DOC, IGT). Using a hedonic model, we show that wines from cooperatives may command a price (or reputation) premium relative to wines from private producers and we observe specialized grape supply chains with price premiums for DOC wine from cooperatives, IGT denominated wine from own-growing wineries and organic wine from mixed sourcing and own-growing producers. We confirm that cooperatives may gain a price premium in the market. Moreover, we show that the price premium for organic wine may depend on specialized grape supply chains.

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1. Introduction

Privately owned firms and cooperatives represent ownership forms that can be found concurrently in many markets throughout the world [Sexton and Lavoie, 2001; Hendrikse, 1998 and 2007]. Even in the U.S., cooperative enterprises are predominant in a number of industries including agriculture where they market as much as 1/3 of total production [Hansmann, 1996]. Also in Europe, large share of agricultural produce is marketed by farmer-owned cooperatives, but increasingly concerns are raised about their effectiveness and efficiency. In Europe, the common agricultural policy implies that production and marketing of these products must meet specific requirements (improved quality management and marketing conditions, production efficiency etc.) in order to comply with internal support regulations and to attain competitive positions within the European community as well as internationally.

Our empirical application examines the wine region of South Tyrol in Northern Italy where about 70% of the total wine production is produced by cooperatively owned wineries. In comparison, this is about twice as much as in Germany where only about 1/3 of the total production is processed by cooperatives [DRV, 2012]. In the theoretical and empirical literature, wine cooperatives have been identified as low quality producers (e.g. Pennerstorfer and Weiss, 2013). A possible explanation for this is free riding that leads to lower reputation for wine quality with consumers. Assuming similar wine winemaking and management abilities between different ownership forms, a cooperative's reputation for quality depends crucially on its individual growers supplying high quality grapes, which in turn determine wine quality further downstream. In contrast, private wineries controlling their own grape supply may face less uncertainty about quality and in turn gain a higher reputation with final consumers.

In South Tyrol, however, we observe that wine cooperatives apply by modern production conditions utilizing cutting-edge vineyard management systems which require that growers are cutting back on grape tonnage at certain predefined times during the growing season in order to limit yields, thus raising grape quality and in turn wine quality further downstream [Schamel and Schubert, 2016]. Therefore, one objective is to examine if local cooperatives are able to lower the uncertainty about grape quality relative to private wineries such that the hypothesized lower reputation for wine quality with consumers disappears. This leads to the important role of supply chain organization in producing a premium priced wine quality.

In this paper, we examine how cooperatively owned wineries perform relative to privately owned wineries regarding reputation for product quality. Wine quality and reputation crucially affect product prices and the economic performance of the winery. Using a hedonic model, we test the hypothesis whether wines from private producers receive a reputation premium relative to cooperatively produced wines. Moreover, we analyze three distinct grape supply chains and the quality of wines they can produce: cooperatives, own-growing and mixed-sourcing. Cooperatives have their grapes supplied by their member growers. Own-growers are smaller wineries that exclusively grow their own grapes. Mixed-sourcing describes wineries that use their own grapes and grapes from independent growers. In addition, we analyze implicit prices for organic wines as any of these grape supply chains is producing organically. Using an innovative data set, we examine the orientation towards specific grape supply chains and implicit prices related to denomination of origin rules (i.e. DOC vs. IGT) as well as organic production.

2. Literature Review

Few studies have analyzed the general relationship between a cooperative winery ownership structure and reputation for product quality. Since we have motivated the paper arguing that cooperatives face free rider problems in terms of assuring higher quality production, we limit our review of the existing literature to the case of cooperatives vs. private or investor owned firms (IOF) firms. Hoffmann [2005] argues that despite an extensive literature on endogenous quality choice, the effects of different ownership structures have been largely overlooked in the literature. He develops a game theoretical model to analyze cooperatives vs. IOFs in a duopoly with simultaneous quality choice and price competition. With fixed cost of quality, IOFs charge higher prices and generate larger consumer surpluses than cooperatives by marketing higher qualities. With variable cost of quality, cooperatives have a structural cost advantage, which is used to market larger quantities of higher quality product generating larger profits, larger consumer surplus and larger social welfare. Thus, firms can have a cost advantage due to ownership structure in addition to a quality advantage.

Pennerstorfer and Weiss [2013] study the impact of decentralized decision making on product quality and conclude that cooperative members have an incentive to overproduce and free ride on product quality and show that wines produced by Austrian cooperatives are of significantly lower quality. In their theory, quality provision depends on the size of the cooperative and on how quality is aggregated. Hanf and Schweickert [2014] analyze the conflict within wine cooperatives in Germany stemming from member orientation with a focus on quantity and customer (i.e. quality) orientation associated with a saturated and competitive market environment. Schamel [2015] examines German cooperatives and estimates that their wines suffer a reputation discount of about 10% relative to private wineries.

Product quality and reputation effects crucially affect product prices. In his seminal paper, Rosen [1974] posits that goods are valued for their utility-generating attributes. Consumers evaluate such attributes when making a purchasing decision. Competitive markets define implicit prices for these utility-generating attributes and the product price is the sum of implicit prices. Many studies have applied hedonic models to estimate implicit prices for product quality and reputation attributes of regional denomination attributes including wine [e.g. Schamel, 2007; San Martin et al., 2008; Oczkowski, 2016]. Economists have also used hedonic models to study price-quality and reputation effects related to cooperative wineries [e.g. Frick, 2004; Pennerstorfer and Weiss, 2013; Schamel, 2014 and 2015]. The literature on implicit prices related to organic wine production is mixed. Delmas and Grant (2014) show that eco-certification can lead to higher prices while the eco-label may not. Corsi and Strom (2013) find higher prices for organic qualities relative to conventional wine and that they modify the impact of other variables on price.

In this paper, we extend previous research studying the pros and cons of cooperatives in terms of reaping economies of scale, transaction costs, market power in relation to downstream buyers, farm service and input provider, or product quality performance [Bonus, 1996; Albaek and Schultz, 1998; Frick, 2004; Bogetoft, 2005]. In this paper, we emphasize product quality and reputation effects caused by vertical collaboration between growers, winemakers and marketers in a wine cooperative versus other organizational forms of the grape supply chain. Specifically, we add to this literature and analyze the impact of specific grape supply chains, organic production and denomination rules on the price-quality relationship of the resulting wines.

3. Data and Analysis

We analyze a data set of wines evaluated in the l'Espresso (I vini d'Italia) wine guide for South Tyrol. The data used in the estimation consists of 1265 wines from South Tyrol (377 from cooperative wineries, 888 from private wineries). A hedonic model is used to test if cooperatives or private wineries can obtain higher implicit prices for reputation of the wine quality they produce (Model 1) and to test the impact of grape supply chains, organic production and denomination of origin rules (Model 2). Specifically, we derive implicit prices for denomination of origin (DOC) rules and organic wine production, both of which are expected to have a positive impact on wine prices that consumers are willing to pay in the retail market.

The l'Espresso wine guide lists a range of applicable retail prices per bottle from which we use the lower bound for estimation purposes. The price information used for the estimation is submitted prior to the quality evaluation (i.e. the point rating by the expert tasters). Thus, it does not reflect any direct effects due to a favorable quality rating. Experts rate the wines according to a 20-point scale in half-point steps. The guide also provides a star rating (between zero and 3) for a winery's distinctiveness, which can be regarded as a proxy for its reputation for wine quality. Wine age at the time of evaluation ranged from 1-13 years. The wine guide differentiates wine color, sweet or desert wines, DOC and IGT designated wines, organic wines, wine variety and special expert recommendations (e.g. value for money or best regional buys).

The data on the structure of the grape supply chain was obtained from the local chamber of commerce, which is administering the denomination of origin rules. We analyze three grape supply chains and the related quality of wines that they produce. Cooperative wineries (Coop) have their grapes supplied by their member growers. Own-growers (Own) are smaller wineries that exclusively grow their own grapes. Mixed-sourcing (Mixed) describes wineries that use their own grapes as well as a substantial amount of grapes that they buy from independent contract growers.

The following variables are used in our model: cooperative wine, red vs. white wines, sweet wines, IGT vs. DOC designated wines, organic wines and special recommendations are regular dummy variables while wine variety is a categorical dummy. As dependent variable, we use the logarithm of the lower price bound log(price). We employ a log-linear function in our regression and estimate the following equation (Model 1):

$$\begin{aligned} log(price) = \alpha_0 &+ \alpha_1 log(points) + \alpha_2 log(Bottles) + \beta_1 Coop + \beta_2 Mixed + \beta_3 IGT + \beta_4 Bio \\ &+ \gamma_1 Age + \gamma_2 Stars + \gamma_3 Red + \gamma_4 Sweet + \gamma_{5j} Variety + \\ &+ \eta_1 ValueRec + \eta_2 BuyRec + \varepsilon \end{aligned} \quad (1)$$

Log(price) is the logarithm of the wine price, log(points) is the logarithm of the l'Espresso points (sensory wine quality evaluation) and log(Bottles) is the logarithm of the production quantity (number of bottles produced) and ε is the error term with a zero mean and uniform variance. Coop is dummy variable indicating a cooperative wine. IGT is dummy variable indicating an IGT denominated wine. Bio is a dummy variable indication organically produced wine. Age is the age of the wine at the time of its sensory evaluation. Stars is an expert evaluation of the producer reputation for quality ranging from zero to three stars including ½ stars. Red and Sweet indicate a red wine and sweet wine respectively. Variety is a categorical dummy differentiating seven wine varieties or types (Lagrein, Schavia, Gewürztraminer, Pinot Noir, Sauvignon Blanc, Riesling and Spumante). ValueRec and BuyRec are both dummy variables denoting expert recommendations for especially valuable and best-buy wines.

The regression equation for model (1) stated above includes the following parameters (Greek letters) and their interpretation:

- α_1 elasticity of wine quality w.r.t. price
- α_2 elasticity of output w.r.t. price (scarcity effect)
- β_1 implicit price (collective reputation) of cooperative wineries
- β_2 implicit price (collective reputation) for mixed sourcing wineries
- β_3 implicit price (collective reputation) for IGT denominated wines
- β_4 implicit price (collective reputation) for organic wines
- γ_1 implicit price for wine age (age in years at the time of evaluation)
- γ_2 implicit price for star ranking (producer reputation for quality effect)
- γ_3 implicit price for a red vs. a white wine (red wine premium)
- γ_4 implicit price for a sweet or dessert wine (sweet wine premium)
- γ_{5j} implicit price for wine varieties (varietal premium)
- η_1 implicit price for a value recommendation
- η_2 implicit price for a best buy recommendation.

Given its log-linear functional form, estimating the equation above yields price premiums and discounts relative to the contribution of the base category (non-sweet white DOC wine not bio-labeled and no distinct variety for the region). Finally, we tested both models and/or the residuals for normality (Jarque-Bera-Test) and heteroskedasticity (White-Test) and do not find any significant problems in the data. We also employed RESET tests, which rejected other functional forms. Based on our literature review, we formulate the following three hypotheses:

Hypothesis 1: Cooperative wines receive a price discount relative to other grape supply chains.
Hypothesis 2: IGT denominated wines fetch a reputation discount versus DOC wines.
Hypothesis 3: Organic wine commands a price premium versus conventional wine.

To test hypothesis 1, we expect a significantly negative coefficient β_1, which would indicate a negative collective reputation for wines produced by cooperatives. For hypothesis 2, we expect a negative, but significant coefficient β_3, indicating a negative collective reputation for IGT denominated wines. For hypothesis 3, β_4 is expected to be positive and significant.

Based on the results of Model 1, we estimate a second model to include information about grape supply, organic production and DOC vs. IGT denominated wines in order to test possible interaction effects. In particular, we are interested in the role of the grape supply in organic production and applied denominations. We proceed by first presenting the results of Model 1.

4. Estimation Results

The results for Model 1 are presented in Table 1. In our discussion, we focus on the variables that are specifically linked to the three hypotheses proposed (i.e. Coop, IGT, BIO and Mixed). Thus, we do not discuss in detail the estimated parameters and their associated implicit prices related to the control variables, included in the model for completeness of the analysis.

Our estimation reveals a significantly positive coefficient for cooperative reputation. The estimate (0.132) indicates that South Tyrol cooperatives receive a collective price premium of about 13% relative to their local own-growing competitors. This is even more remarkable given the fact that the model corrects for a wineries' quality reputation through the "Stars" variable. Thus, we cannot confirm hypothesis 1. Wines coming from cooperatives producers in South Tyrol receive a reputation premium relative to their own-growing competitors. In addition, also mixed sourcing wineries receive a collective price premium equal to about 5% relative to own-growing wineries. This result confirms our observation: cooperatives in South Tyrol are able to lower the uncertainty about grape quality relative to privately owned wineries, in particular through yield management in the vineyard, such that the hypothesized price difference disappears. This also holds for mixed-sourcing wineries that buy a substantial amount of grapes from independent contract growers.

Insert Table 1 about here. Estimation Results for Model 1

Turning to hypothesis 2, we observe a significant price premium for IGT denominated wine that is about 11% relative to DOC. Thus, we also cannot confirm hypothesis 2 and IGT denominated wines seem to fetch a price premium over DOC denominated wines, which raises the question on the effectiveness of the local DOC rules in guaranteeing quality that also translates into a price premium in the marketplace. Lastly, there is no significant implicit price for certified organic wine from South Tyrol, supporting the mixed evidence from the existing literature on implicit prices for organic wines [Delmas and Grant, 2014]. Hence, hypothesis 3 cannot be confirmed either.

Briefly commenting on some of the remaining coefficient, we find that wine quality is highly elastic with respect to price (a 1% increase in the quality rating leads to a 2.7% price increase). The star rating for a wineries' quality reputation is also significant and yields a 7% price increase for another star being awarded. The remaining results on the control variables listed in Table 1 are mostly in line with other studies. For example, the premium for red wine is about 18% and the premium for sweet wine about 24%.

An innovation of this paper relates to the role of grape supply chains, organic production and denomination rules for the price-quality relationship of the resulting wines. We estimate a second model testing possible interaction effects of grape supply, organic production and DOC vs. IGT denominations. Cooperatives in South Tyrol are producing very limited quantities of organic wine and almost exclusively DOC denominated wine. Hence, relevant interaction terms between supply chain organization, organic production and applied denomination of origin rules are as follows:

- *DOC x Coop* or DOC classified wine produced by cooperatives
- *Bio x Mixed* or organic wine produced by mixed sourcing wineries
- *IGT x Own* or IGT classified wine produced by own-growing wineries
- *Bio x Own* or organic wine produced by own-growing wineries

Hence, the estimated second regression equation looks as follows (Model 2):

$$\begin{aligned} log(price) = \alpha_0 \; & + \alpha_1 log(points) + \alpha_2 log(Bottles) \\ & + \beta_1 DOC\ x\ Coop + \beta_2 BIO\ x\ Mixed + \beta_3 IGT\ x\ Own + \beta_4 Bio\ x\ Own + \beta_5 Bio + \beta_6 Own \\ & + \gamma_1 Age + \gamma_2 Stars + \gamma_3 Red + \gamma_4 Sweet + \gamma_{5j} Variety + \\ & + \eta_1 ValueRec + \eta_2 BuyRec + \varepsilon \end{aligned} \quad (2)$$

Table 2 only lists the significant results for Model 2 omitting insignificant variables and interaction terms. The estimated coefficients indicate that cooperative DOC wines receive a significant price premium of about 9% relative to their local competitors using mixed sourcing or own-grown grapes. Cooperatives are deeply rooted in the local economy. Therefore, it is not surprising that they are specializing in DOC denominated wine for which they receive a significant price premium.

Insert Table 2 about here. Estimation Results for Model 2

Organic wine from mixed sourcing wineries fetches a price premium of about 40% relative to wines from other supply chains while organic wine from own-growing wineries just receives a premium of 12%, leaving the dummy for certified organic wine (from cooperatives) at a significant discount of 17%. Own-growing wineries receive a premium of about 18% for their IGT denominated wines, leaving a significant price discount of about 5% for their DOC wines. Note that although not reported in Table 2, we observe no significance for other interaction terms including mixed sourcing wineries producing DOC and cooperatives producing IGT wines.

The remaining results on the control variables for Model 2 do not change significantly and are mostly in line with the results of Model 1. The estimated coefficients for Model 2 confirm that in South Tyrol cooperatives compete successfully focusing on DOC wines while their local competitors, using different grape supply chains, have a price advantage in producing organic or IGT denominated wines.

In discussing these results, it is interesting to emphasize that different grape supply chains in South Tyrol get a price premium for their wines. This relates in particular to organic wine. In Model 1, we did not differentiate specific supply chains for organic wine and thus reported no significant price effect for organic wine. Once we include the detailed information, we can see that mixed sourcing wineries receive a price premium for their organic wines that is more than three times larger than own-growing wineries, while cooperatives sell their organic wine at a significant discount.

It seems that own-growing wineries produce according to IGT classifications from their higher quality grapes and to their market own-brand, while leaving their lower quality grapes for DOC denominated wines. Similarly, mixed sourcing wineries seem to focus on organic production, while their DOC wines are insignificant relative to other producers. We argue that our results confirm a strategic orientation of wineries in South Tyrol. Cooperatives get a collective price premium for their DOC wine, own-growing wineries a price premium for their IGT wines emphasizing branding while mixed source wineries receive a large price premium for organic production.

5. Discussion and Conclusion

In this paper, we provide empirical evidence illustrating how cooperatives compete with private wineries regarding quality reputation. A cooperative's reputation for quality wine production depends crucially on the quality variation of its grape supply from individual growers. Thus, wine quality may be more uncertain further downstream. In contrast, own-growing are characterized by a high degree of control within the production chain and thus may face less uncertainty about wine quality further downstream. This also holds for mixed sourcing wineries who may control quality through specific provisions with their contract growers. The resulting price premiums (reputation effects) of these different grape supply chains on market prices are analyzed in this paper.

Our results indicate that cooperative wineries in South Tyrol manage to organize their production decisions such that they are able to compete with privately owned wineries in terms of quality reputation. The relative competitive strength of cooperatives in terms of DOC wine production implies that own-growing wineries focus on IGT denominations for which they are able to command a price premium.

Some very interesting results stemming from their grape supply are derived for organic wines. Without differentiating grape supply, we could not report a significant price effect for organic wine. Introducing detailed interaction effects of organic production coming from different producer groups changed this result as follows. Mixed sourcing wineries fetch a price premium for their organic wine relative to wines from other supply chains while own-growing wineries receive a much smaller premium and cooperatives a discount for their organic wines.

While this paper develops an interesting case of how differences in terms of grape supply may affect implicit prices for organic wine and regional denominations of origin, it remains to be seen if this can also be observed in other regions. While the case of successful South Tyrolian cooperatives is very interesting, it may rather be the exception than the rule as suggested by the results from other regions reported in the literature and cited above. However, the result related to organic wines from different producer types (related to grape supply) is interesting and new. While many studies have reported insignificant or negative price effects for organic wine, it may just depend on how well their grapes are sourced.

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Table 1.

Estimated Model (1): Dependent Variable is log(price)[1]

Variable	Coefficient	Std. Err.	t-Stat.	Prob.
Constant	-4.466	0.451	-9.899	0
Log(Points)	2.700	0.158	17.039	0
Log(Bottles)	-0.079	0.009	-8.851	0
Coop	0.132	0.019	6.950	0
Mixed	0.048	0.019	2.498	0.013
IGT	0.107	0.034	3.158	0.002
BIO	0.041	0.036	1.158	0.247
Age	0.106	0.009	12.161	0
Stars	0.073	0.010	7.374	0
Red Wine	0.178	0.030	5.905	0
Sweet Wine	0.240	0.040	6.016	0
Lagrein	-0.050	0.034	-1.466	0.143
Schiava	-0.280	0.039	-7.206	0
Gewürztraminer	0.235	0.023	10.017	0
Pinot Nero	0.049	0.041	1.200	0.230
Sauvignon Blanc	0.100	0.021	4.704	0
Riesling	0.111	0.026	4.286	0
Spumante	0.128	0.070	1.823	0.069
Buy Rec	-0.212	0.029	-7.391	0
Value Rec	-0.360	0.018	-19.478	0

R-squared	0.662	Mean dependent var.	2.663
Adjusted R-squared	0.657	S.D. dependent var.	0.417
S.E. of regression	0.244	Akaike info criterion	0.033
Sum squared residual	74.156	Schwarz criterion	0.114
Log likelihood	-0.772	Hannan-Quinn criterion	0.063
F-statistic	128.616	Durbin-Watson statistic	1.503
Prob(F-statistic)	0	Wald F-statistic	157.344
Prob(Wald F-statistic)	0		

[1] White heteroskedasticity-consistent standard errors & covariance

Table 2.

Estimated Model (2): Dependent Variable is log(price)[1]

Variable	Coefficient	Std. Err.	t-Stat.	Prob.
Constant	-4.213	0.449	-9.388	0
Log(Points)	2.611	0.157	16.577	0
Log(Bottles)	-0.077	0.009	-8.672	0
DOC x Coop	0.089	0.019	4.721	0
Bio x Mixed	0.397	0.057	6.934	0
IGT x Own	0.184	0.044	4.190	0
Bio x Own	0.118	0.041	2.904	0.004
Organic	-0.171	0.020	-8.476	0
Own	-0.048	0.019	-2.523	0.012
Age	0.113	0.009	13.283	0
Stars	0.070	0.010	7.178	0
Red Wine	0.198	0.026	7.687	0
Sweet Wine	0.241	0.040	5.960	0
Lagrein	-0.062	0.030	-2.051	0.041
Schiava	-0.293	0.036	-8.237	0
Gewürztraminer	0.247	0.024	10.356	0
Pinot Nero	0.111	0.021	5.155	0
Sauvignon Blanc	0.126	0.027	4.716	0
Riesling	0.073	0.031	2.352	0.019
Spumante	0.066	0.032	2.070	0.039
Buy Rec	-0.206	0.027	-7.567	0
Value Rec	-0.351	0.019	-18.801	0

R-squared	0.670	Mean dependent var	2.663
Adjusted R-squared	0.665	S.D. dependent var	0.417
S.E. of regression	0.241	Akaike info criterion	0.012
Sum squared residual	72.403	Schwarz criterion	0.102
Log likelihood	14.359	Hannan-Quinn criter.	0.046
F-statistic	120.426	Durbin-Watson stat	1.534
Prob(F-statistic)	0	Wald F-statistic	184.608
Prob(Wald F-statistic)	0		

[1] White heteroskedasticity-consistent standard errors & covariance