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This paper contributes to the increasing literature of explaining wine prices by objective and sensorial factors, focusing on the retail sector of French wines sold in Belgian supermarkets. Our main findings are: (1) higher price are associated with higher quality wines, measured via ratings obtained from blind tastings, (2) organic wines attain higher prices than comparable non-organic wines, and (3), the alcohol volume is among the most important factors for explaining prices.

Keywords: wine pricing, hedonic regression, organic wines, chemical analysis

JEL classification codes: C21, D49, L11, Q12

Introduction

The literature on explaining wine prices is vast. One of the often considered research topics is whether the price reflects quality, or whether it is mainly driven by the reputation of the producer, see e.g. Benfratello et al (2009) for Italy, Cardebat and Figuet (2009) for Alsace, Beaujolais and Provence, Combris et al (1997) and Cardebat and Figuet (2004) for Bordeaux, Combris et al (2000) for Burgundy, Nishiyama (2023) for Chile, and Rebelo (2019) for Portugal. Among the factors used to assess the quality of a wine, one typically distinguishes between sensorial and objective attributes, both of which are important as shown e.g. by Thrane (2009) for French wines. Most studies concentrate on the premium segment, prone to investment by hedge funds, as for example Bocart and Hafner (2015) and Jones and Storchmann (2001). A concise review of the literature is given by Outreville et al (2020).

In this paper, we shed new light on the debate by considering the retail segment of French wines, sold in Belgian supermarkets, using a rich dataset including detailed information about the chemical components of the wine, and sensorial results from blind tastings. Our results show that there is a highly significant link between prices and quality.

Among the objective attributes, the most important one turns out to be alcohol volume. Organic wines are more expensive than comparable non-organic wines.

Data

The data is obtained from the Belgian consumer organization testachats via their annual wine guides that evaluate the quality of wines sold in Belgian supermarkets. We use the last four editions of this wine guide, from 2020 to 2023, and focus on the French wine regions Alsace, Bordeaux, Burgundy/Beaujolais, Languedoc, Loire, and Rhone, which gives us a total of 506 evaluated wines. The guide covers only the lower segment of the market with a maximum price of 15€ per bottle. Each wine is rated on a scale from 0 to 100. The rating takes into account a chemical analysis and the results of a blind tasting which consists of a global assessment of the wine and a verbal description of its properties in terms of colour, bouquet and taste. The final rating cannot be higher than the rating obtained from the blind tasting. It can be inferior if the rating of the chemical analysis is lower than the tasting grade, in which case the chemical analysis accounts for 40% and the blind tasting for 60% of the final rating. In particular, the chemical analysis includes the following measures:

ALC: measured alcohol volume (can differ from announced volume)

SUG: residual sugar in g/l

ACID: total acidity in g $C_4H_6O_6$ /l

ACIDVOL: volatile acidity in g HOAc/l

SO₂: sulphur dioxide in uncombined form, in mg/l

SO₂TOT: the total of SO₂ in combined and uncombined form, in mg/l

A wine is downgraded in the chemical analysis if: (1) the measured and announced alcohol volume differ by more than 0.5% vol. (2) ACID is outside the interval [4.3, 12.2] g/l, (3) ACIDVOL is higher than 0.75 g/l, (4) SO₂TOT is higher than the limit imposed

by the European Union (e.g. 150 mg/l for red wines having less than 5g/l residual sugar), or (5) SO₂ is lower than 5 mg/l for a red wine, and 10 mg/l for a white wine having less than 5g/l residual sugar. The precise weighting of these variables to obtain a score for the chemical analysis is not disclosed by the wine guide.

Results

Table 1 shows the results of a hedonic regression, where the price per bottle is regressed on its characteristics, including the rating obtained from the tasting and the chemical variables defined above. Because of the potential nonlinearity of the impact of ACID and SO₂ on prices and ratings, we added the squares to the linear terms, but only those of SO₂ turned out to be significant and kept in the model. We include dummy variables for red wines (0 for white wines), organic wines, and the regions except for one (Alsace) to avoid multicollinearity. Finally, we include dummies for the vintages 2016 to 2021. The uncovered vintages are 2015 with 14 bottles, and 2012 and 2014 with one bottle each. Note that for the dependent variable we use prices rather than the more common log prices, because our range of prices is quite small (3 to 15 euro), so that the results are very similar, but using prices directly allows us to express the marginal effects in monetary terms.

The results show that the highest significance level is attained by ALC, suggesting that controlling for other characteristics, a 1% higher alcohol volume increases the price by 1.32 €. The rating obtained from the tasting and chemical analysis is also highly significant, with an expected increase of 6 eurocents when the rating increases by one point. The vintage dummies are significantly negative which might be explained mainly by the age effect, i.e. older wines being more expensive. To a minor extent, it might also be a quality effect as these vintages are compared mainly with the exceptional 2015 vintage, although 2016 and 2018 were exceptional, too. Organic wines attain significantly

higher prices, which confirms the results of Corsi and Strom (2013). Of the chemical variables, only SO₂ turned out to be significant with a negative impact on prices over the range of observed values of SO₂, while the impact of SO₂TOT is positive. The latter effect needs to be seen jointly with SO₂ as these variables are highly correlated. Finally, Burgundy wines are relatively more expensive than wines from other regions.

To see whether there is an endogeneity issue with the ratings variable, we perform a second regression of ratings on the exogenous variables, see the results in Table 2. The fitted values of this regression are then used as instruments in the first regression, replacing the observed ratings. The corresponding Durbin-Wu-Hausman test yields a p-value of 0.258, thus not rejecting the null hypothesis of no endogeneity. This corroborates the reliability of the OLS estimates of the first regression. It is remarkable from the results in Table 2 that organic wines, although attaining higher prices, tend to be less appreciated in the tastings, although this effect is significant only at a 20% level.

We furthermore conduct a quantile regression to see whether the discovered effects differ between wines at the lower and upper ends of the scale, the results are reported in Table 3. The rating effect turns out to be stronger for the median and the 25% and 75% quartiles than for the 10% and 90% levels. A similar conclusion can be drawn for the organic wine dummy, which is positive and significant for the median and the two quartiles, but insignificant at the two outer levels. The effect of alcohol volume on prices is strongest for the lower quantiles and the median, while it is insignificant at the 90% level. The effect of the chemical variables is relatively stable across quantiles, or insignificant. For example, the effect of SO₂ is significantly negative at all levels, while ACID is insignificant except at the 90% level.

Conclusions

Our results show that the main determinants of the prices of French wines in the retail segment are the alcohol volume, the rating, the vintage year, and an organic wine label. As the rating is composed of sensorial variables obtained at blind tastings, and a chemical analysis of the wine, we take it as a proxy for quality. Thus, our results suggest a strong link between prices and quality. Organic wines tend to be more expensive than comparable non-organic wines.. Future research may extend the analysis, for example by including other countries that are also covered by the wine guides of testachats. By further extending the analysis over a longer time horizon, one might also use the hedonic regression framework to construct a price index for the retail segment.

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Table 1. Regression of wine prices on explanatory variables, explained in the text.

	Estimate	StdError	t value	Pr(> t)	
Constant	-12.7681	3.190389	-4.002	7.26E-05	***
Red	-0.76823	0.458083	-1.677	0.09418	.
Rating	0.065298	0.013496	4.838	1.76E-06	***
Y2016	-1.33843	0.750012	-1.785	0.074962	.
Y2017	-2.05254	0.722695	-2.84	0.0047	**
Y2018	-1.97616	0.682567	-2.895	0.003961	**
Y2019	-3.20439	0.703333	-4.556	6.61E-06	***
Y2020	-3.13397	0.718885	-4.359	1.59E-05	***
Y2021	-2.63164	0.799577	-3.291	0.00107	**
Organic	1.29672	0.363013	3.572	0.00039	***
Bordeaux	-0.43941	0.604989	-0.726	0.467995	
Loire	1.857074	0.58557	3.171	0.001613	**
Rhone	-1.21239	0.6539	-1.854	0.064334	.
Languedoc	-1.4889	0.567181	-2.625	0.008937	**
Burgundy	2.462442	0.645734	3.813	0.000155	***
ALC	1.323593	0.189965	6.968	1.06E-11	***
SUG	-0.017	0.047715	-0.356	0.721829	
ACID	0.240574	0.212304	1.133	0.257708	
ACIDVOL	2.346617	1.215464	1.931	0.054112	.
S02	-0.19103	0.051807	-3.687	0.000252	***
S02sq	0.002584	0.001282	2.015	0.044435	*
S02TOT	0.022867	0.00682	3.353	0.000863	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.451 on 484 degrees of freedom
Multiple R-squared: 0.377, Adjusted R-squared: 0.3499
F-statistic: 13.95 on 21 and 484 DF, p-value: < 2.2e-16

Table 2. Regression of ratings on exogenous variables

	Estimate	Std. Error	t value	Pr(> t)	
Constant	61.931636	10.358854	5.979	4.37e-09	***
Red	-3.521892	1.532862	-2.298	0.0220	*
Y2016	-2.592334	2.520601	-1.028	0.3042	
Y2017	-5.460369	2.418770	-2.257	0.0244	*
Y2018	-4.175836	2.288594	-1.825	0.0687	.
Y2019	-3.190084	2.361865	-1.351	0.1774	
Y2020	-1.163486	2.418047	-0.481	0.6306	
Y2021	-1.771423	2.688903	-0.659	0.5103	
Organic	-1.566287	1.219251	-1.285	0.1995	
Bordeaux	2.091190	2.033217	1.029	0.3042	
Loire	-1.451852	1.968995	-0.737	0.4613	
Rhone	1.659923	2.198699	0.755	0.4506	
Languedoc	0.404316	1.908144	0.212	0.8323	
Burgundy	-2.242869	2.170127	-1.034	0.3019	
ALC	1.308835	0.636350	2.057	0.0402	*
SUG	0.278879	0.160033	1.743	0.0820	.
ACID	-0.595979	0.713766	-0.835	0.4041	
ACIDVOL	-0.001428	4.089322	0.000	0.9997	
S02	0.894527	0.169502	5.277	1.98e-07	***
s02sq	-0.017832	0.004237	-4.208	3.07e-05	***
S02TOT	-0.142910	0.022009	-6.493	2.08e-10	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 8.246 on 485 degrees of freedom
Multiple R-squared: 0.2232, Adjusted R-squared: 0.1912
F-statistic: 6.969 on 20 and 485 DF, p-value: < 2.2e-16

Table 3. Quantile regression for prices at different levels $p=0.1, 0.25, 0.5, 0.75, 0.9$.

p	0.1	0.25	0.5	0.75	0.9
Constant	0.4176	-4.2787	-2.0236	9.2394.	20.3978*
Red	-0.5527	-0.2595	0.0645	0.4690.	0.2348
Rating	0.0083	0.0282*	0.0220*	0.0313*	0.0112.
Y2016	-0.3862	0.0241	-0.0112	0.3201	-0.1703
Y2017	-0.1694	0.0939	-0.2199	-0.6415	-0.0917
Y2018	-0.8767	-0.2034	0.2192	0.0785	-0.1424
Y2019	-1.5465*	-1.1814**	-1.0402.	-0.8577	-0.3051
Y2020	-1.4772*	-1.0054.	-1.1963*	-1.8387*	-1.3117*
Y2021	0.4270	1.7671*	1.4130.	0.6520	0.5568
Organic	0.5474.	0.6249*	0.9959**	0.6701*	-0.3836
Bordeaux	1.6669	0.3343	0.0822	-0.5170	-2.0132*
Loire	1.7854.	0.7651	1.1282.	0.7404	-0.6847
Rhone	1.8687.	0.1434	-0.0152	-0.3947	-1.9853.
Languedoc	0.4429	-1.2020	-0.3736	-1.8113	-4.2009*
Burgundy	2.2561*	1.8199	1.5322.	0.1340	-1.6738.
ALC	0.6442.	0.7200**	0.7202**	0.0452.	0.0021
SUG	0.0170	0.0239	0.0167	-0.0660	-0.1884.
ACID	-0.2737	0.4540	0.3285	0.2330	-0.6163.
ACIDVOL	0.7662	2.2621	1.4899	1.5633	0.0866
S02	-0.0700*	-0.0897**	-0.0732*	-0.0576*	-0.0325.
S02sq	0.0000	0.0016	0.0007	0.0008	0.0006
S02TOT	0.0374**	0.0211.	0.0166*	0.0081	-0.0100

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1