

## Vienna 2019 Abstract Submission

### Title

Modelling the Varying Relationship Between Quality and Price of Wine

### I want to submit an abstract for:

Conference Presentation

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### Keywords

alcohol content, Bayesian multilevel models, Czech Republic, extrinsic attributes, intrinsic attributes, residual sugar

### Research Question

What is the influence of various intrinsic and extrinsic attributes on the relationship between quality and price of wines?

### Methods

Mixed linear models are used where the price quality relationship can vary across category and country of origin. To investigate the robustness of the results Bayesian multilevel models are employed.

### Results

Results obtained from the robustness regression method show that wine prices depend on the alcohol content, residual sugar content, quality, type of wine, vintage and country of origin.

### Abstract

Motivation

This paper investigates the intrinsic and extrinsic determinants of wine prices. The data originates from the largest wine competition in the Czech Republic called Prague Wine Trophy including both domestic and imported wines. The determinants include expert sensory evaluation (100-point quality scale), alcohol content (abv), sugar content (grams per litre), categories measured (White wines, Red wines, Rosé, Sparkling wines, Sweet wines), vintage and country of origin. Quantile and multilevel models are used to examine the relationships. The empirical analysis is based on about 1200 observations. Mixed linear models are used where the price quality relationship can vary across category and country of origin (10 X 5 clusters). To investigate the robustness of the results Bayesian multilevel models are employed.

The paper contributes to the literature on the determinants of wine prices in different dimensions. First, the heterogeneity of the price-performance ratio of wines is examined in detail by using Bayesian multilevel models, where the ratio may vary according to wine category and country of origin. Secondly, we use a representative data set covering the universe of wines produced in or imported to the Czech Republic. Thirdly, we consider the alcohol content and the residual sugar, which was largely neglected in previous studies.

Czech Republic with its almost 18 thousand hectares of vineyards is dominated by Grüner Veltliner, Müller Thurgau, Riesling, Blaufränkisch and St. Laurent. In the terms of wine production Czech Republic is comparable with Croatia or Slovenia. Compared to these countries, however, Czech wine production has been growing continuously for the last five years at around 2 % per year. Czech Republic is a country that needs significant part of imports to meet its demand. Wines from Italy, Spain and Hungary are most imported wines nowadays (The Ministry of Agriculture of the Czech Republic, 2018).

Concentration on the residual sugar is of special importance in the Czech Republic since the sweetness of the harvested grapes has been rapidly increasing, and in vintage 2017 was 4.5 times higher than in vintage 1995 (The Ministry of Agriculture of the Czech Republic, 2018). Since the Czech Wine Law is adaptation of German Wine Law concentrated on the sweetness of the grapes harvested (Robinson, 2015), sweetness influence either the residual sugar in the wine or the alcohol content. Both of these intrinsic attributes are investigated in this study. Only sporadic studies employed the alcohol content (Brentari, Levaggi and Zuccolotto, 2011; Carew and Florkowski, 2010) and even less the content of residual sugar (Gál, 2017). In these studies, sugar content seems to be important in forming prices of the domestic production in Hungary as well as the alcohol content for the formation of the prices of Italian wines on Japanese market.

Numerous studies have investigated the quality of wines as the main determinant of the price (Combris, Lecocq and Visser, 1997), mostly manifested as an expert reviews and quality ratings (Friberg and Grönqvist, 2012; Oczkowski and Doucouliagos, 2015; Pennerstorfer and Weiss 2012; Schamel and Anderson, 2003). Wood (2003) improves the model with anticipation of the future auction prices of wines based on predictors known at the time of market release. The author finds production techniques and weather to be important predictors of auction wine prices.

#### Empirical model

The empirical model is motivated by the hedonic price model where prices of a product depend on its characteristics. To examine the determinants of wine prices, the hedonic pricing model is used. The theoretical basis is Lancaster's (1971) theory of consumer demand and the hedonic pricing model introduced by Rosen (1974). In the consumer demand model of Lancaster (1971), goods and services can be considered as bundles of attributes that consumers value. Rosen (1974) expands Lancaster's work by formulating market equilibrium conditions for the hedonic prices. The assumptions are perfect competition, absence of transaction costs, correct measurement of all attributes and choice of the right functional form. The model predicts that the result of all independent decisions of producers and consumers is an exact functional relationship between the price of the quality differentiated good and the properties embodied therein. Assuming no search and information costs, wine prices can be described depending on their characteristics. The key variable is the expert evaluations of wine quality. It is well known that wine quality is difficult to measure because it is subjective.

The price equation is specified as follows:

$$P_i = \ln(\dots)$$

where  $i$  denotes the individual wine samples and  $\ln()$  denotes the natural logarithm.  $P$  denotes the actual price in CZK. Alcohol measure the alcohol content. Quality measures the quality in points. Sugar measure the sugar content. Category are the different wine categories measured as a set of dummy variables (White wines, Red wines, Rosé, Sparkling wines, Sweet wines) with white wines as the reference category. Vintage denotes a set of dummy variables of measuring the Vintage in years. Countryoforigin denotes the origin of the wine with domestic origin as the reference category. As the sample of wines reflect the situation on the wine market in the Czech Republic, some of countries are summed up since these wines are not plentifully represented. Finally,  $c$  is the constant term and is the error term.

The price equation can be estimated by OLS or by the robust regression method which is less sensitive to influential observations and outliers. However, both OLS and robust regression method only allow for estimation of the mean effects for average wine. Quantile regression models make it possible to study whether the relationship between prices and its determinants differs between low- and high-priced wine brands (conditional on other factors). Note that quantile regressions are also robust to outliers or influential observations in the dependent variable. In addition, Bayesian multilevel models are used where the relationship between wine prices and points can vary across combinations of type of wine and country of origin.

### Empirical results

Results obtained from the robustness regression method show that wine prices depend on the alcohol content, residual sugar content, quality, type of wine, vintage and country of origin. Wine prices are significantly increase with the alcohol content and the quality ranking. Interestingly, sugar is not significant, thus residual sugar is not included in the final specification because the coefficient is not significant at any conventional levels (t-value of 0.24). Sweet wine can achieve 35 per cent higher prices than white wines. The price premium of sparkling wines is 16 per cent than for the reference category. Wine prices continuously increase with the age of the wine. Wines of US American origin achieve the highest prices followed by Italian wines. The price premium is 70 and 50 per cent higher than Czech wines. Quantile regression show that the sign and the significance of the characteristics do not differ much at the different parts of the conditional contribution of wine prices. Unreported results show a wide heterogeneity of the price quality relationship with the points coefficient varying between 2 and 5.5. Further contribution of the study is the presence of wines from Czech Republic, Slovak Republic and Austria which were not extensively studied with the exception of Austrian wines in the study conducted by Amrusch and Wirl (2013).

Table 1: Regression estimates of the determinants of wine prices  
Robust regression method Quantile 0.25 Quantile 0.50 Quantile 0.75  
coeff t coeff t coeff t coeff t

log Alcohol Content	0.60 ***	4.98	0.53 ***	2.39	0.54 ***	2.78	0.68 ***	2.97
log Points	4.24 ***	11.42	3.72 ***	7.42	4.29 ***	8.16	4.10 ***	7.96
Red Wines (ref. cat. white wines)	-0.02	-0.80	-0.05	-1.37	-0.01	-0.41	0.00	-0.10
Rosé	-0.05	-0.85	-0.05	-1.02	-0.08 *	-1.86	-0.02	-0.25
Sparkling Wines	0.16 ***	2.86	0.20 ***	3.93	0.16 **	2.47	0.07	0.82
Sweet Wines	0.37 ***	6.11	0.27 **	2.11	0.33 **	2.18	0.59 ***	3.63
2009 (ref cat. 1998 to 2008)	-0.05	-0.72	-0.08	-0.65	-0.03	-0.17	0.09	0.54
2010	-0.22 ***	-3.07	-0.25 **	-1.98	-0.24 *	-1.92	-0.27 *	-1.86
2011	-0.29 ***	-4.72	-0.33 ***	-4.13	-0.34 ***	-3.91	-0.30 **	-2.42
2012	-0.35 ***	-5.87	-0.40 ***	-5.00	-0.37 ***	-4.38	-0.37 ***	-2.96
2013	-0.59 ***	-9.84	-0.59 ***	-8.24	-0.63 ***	-7.32	-0.63 ***	-5.09
2014	-0.71 ***	-10.89	-0.70 ***	-9.15	-0.69 ***	-8.19	-0.76 ***	-5.90
Non-vintage	-0.47 ***	-4.99	-0.83 ***	-5.27	-0.39 *	-1.72	-0.17	-0.89
ARG (ref cat. CZE)	0.22 ***	2.69	0.23 **	2.34	0.20 *	1.77	0.22 **	2.26
AUS & NZE	0.16 **	2.04	-0.06	-0.33	0.23	1.47	0.40 **	2.21
CHI	-0.05	-0.76	-0.03	-0.27	-0.08	-0.81	-0.06	-0.62
FRA	0.33 ***	9.42	0.29 ***	6.70	0.32 ***	6.77	0.39 ***	5.21
GER	0.31 ***	5.86	0.32 ***	4.55	0.30 ***	4.97	0.31 ***	4.52
ITA	0.47 ***	12.53	0.48 ***	7.31	0.46 ***	11.09	0.50 ***	11.32
AUT	0.40 ***	8.06	0.46 ***	5.32	0.45 ***	11.68	0.37 ***	5.24
OTH	0.12 **	2.21	0.14 **	2.22	0.13	1.63	0.16	1.36
SLO	0.13 ***	3.03	0.16 ***	3.84	0.10 **	2.04	0.11 ***	2.59
ESP	0.09	1.41	0.16 **	2.35	0.14 **	2.10	0.11	0.97
USA	0.68 ***	10.26	0.77 ***	11.84	0.70 ***	10.16	0.61 ***	5.90
Constant	-14.38 ***	-8.56	-12.1 ***	-5.01	-14.5 ***	-6.06	-13.74 ***	-5.80
Pseudo R2	0.29	0.35	0.39					
# of obs	1222	1222	1222	1222				

Notes: The dependent variable is the logarithm of the wine prices. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level. Country of origin abbreviations: CZE - Czech Republic, ARG - Argentina, AUS & NZE - Australia and New Zealand, CHI - Chile, FRA - France, GER - Germany, ITA - Italia, AUT - Austria, OTH - Other countries, SLO -

Slovak Republic, ESP – Spain

#### References

- Amrusch, P., & Wirl, F. (2013). Does the environment matter on the wine market: an analysis of the wine market in Austria. *Ecosystems and Sustainable Development IX*. doi:10.2495/eco130181
- Brentari, E., Levaggi, R., & Zuccolotto, P. (2011). Pricing strategies for Italian red wine. *Food Quality and Preference*, 22(8), 725–732. doi:10.1016/j.foodqual.2011.06.001
- Carew, R., & Florkowski, W. J. (2010). The Importance of Geographic Wine Appellations: Hedonic Pricing of Burgundy Wines in the British Columbia Wine Market. *Canadian Journal of Agricultural Economics/Revue Canadienne D'agroeconomie*, 58(1), 93–108. doi:10.1111/j.1744-7976.2009.01160.x
- Combris, P., Lecocq, S., & Visser, M. (1997). Estimation of a hedonic price equation for Bordeaux wine: does quality matter?. *The Economic Journal*, 107(441), 390–402.
- Friberg, R., & Grönqvist, E. (2012). Do expert reviews affect the demand for wine?. *American Economic Journal: Applied Economics*, 4(1), 193–211.
- Gál, P. (2017). How intrinsic values influence wines prices. *BIO Web of Conferences*, 9, 03020. doi:10.1051/bioconf/20170903020
- Lancaster, K. (1971). *Consumer Demand: A New Approach*. New York, Columbia University Press.
- Oczkowski, E., & Doucouliagos, H. (2015). Wine prices and quality ratings: A meta-regression analysis. *American Journal of Agricultural Economics*, 97(1), 103–121.
- Pennerstorfer, D., & Weiss, C. R. (2012). Product quality in the agri-food chain: do cooperatives offer high-quality wine?. *European Review of Agricultural Economics*, 40(1), 143–162.
- Robinson, J. (2015). *The Oxford companion to wine*. Vyd. 4. New York: Oxford University Press. ISBN 0198705387.
- Rosen, S. (1974). Hedonic prices and implicit markets: product differentiation in pure competition. *Journal of political economy*, 82(1), 34–55.
- Schamel, G., & Anderson, K. (2003). Wine quality and varietal, regional and winery reputations: hedonic prices for Australia and New Zealand. *Economic Record*, 79(246), 357–369.
- The Ministry of Agriculture of the Czech Republic (2018). *Situational and Forward-looking Reports of Grapevine and Wine*. Praha: The Ministry of Agriculture. ISBN: 978-80-7434-471-8.
- Wood, D. (2003). What Determines the Future Value of an Icon Wine? New Evidence from Australia. *Oenometrics IX Conference*, Budapest, 22–24 May 2003 (pp. 1–25).

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# **Modelling the Varying Relationship Between Quality and Price of Wine**

**Jiří Zelený, Martin Falk, Michal Lošťák**

## **Extended Abstract**

**Keywords:** alcohol content, Bayesian multilevel models, Czech Republic, extrinsic attributes, intrinsic attributes, residual sugar

**Research Question:** What is the influence of various intrinsic and extrinsic attributes on the relationship between quality and price of wines?

### **Motivation**

This paper investigates the intrinsic and extrinsic determinants of wine prices. The data originates from the largest wine competition in the Czech Republic called Prague Wine Trophy including both domestic and imported wines. The determinants include expert sensory evaluation (100-point quality scale), alcohol content (abv), sugar content (grams per litre), categories measured (White wines, Red wines, Rosé, Sparkling wines, Sweet wines), vintage and country of origin. Quantile and multilevel models are used to examine the relationships. The empirical analysis is based on about 1200 observations. Mixed linear models are used where the price quality relationship can vary across category and country of origin (10 X 5 clusters). To investigate the robustness of the results Bayesian multilevel models are employed.

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The price equation is specified as follows:

$$\ln P_{ijt} = c + \alpha_1 \ln(\text{Alcohol})_i + \alpha_2 \ln(\text{Quality})_i + \alpha_3 \ln(\text{Sugar})_i + \sum_{C=1}^4 \beta_C \text{Category}_i + \sum_{V=1}^7 \beta_V \text{Vintage}_i + \sum_{C=1}^{11} \beta_C \text{countryoforigin}_i + \varepsilon_i$$

where  $i$  denotes the individual wine samples and  $\ln()$  denotes the natural logarithm.  $P$  denotes the actual price in CZK. Alcohol measure the alcohol content. Quality measures the quality in points. Sugar measure the sugar content. Category are the different wine categories measured

as a set of dummy variables (White wines, Red wines, Rosé, Sparkling wines, Sweet wines) with white wines as the reference category. Vintage denotes a set of dummy variables of measuring the Vintage in years. Countryoforigin denotes the origin of the wine with domestic origin as the reference category. As the sample of wines reflect the situation on the wine market in the Czech Republic, some of countries are summed up since these wines are not plentifully represented. Finally,  $c$  is the constant term and  $\varepsilon$  is the error term.

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*Table 1: Regression estimates of the determinants of wine prices*

	Robust regression									
	method		Quantile 0.25		Quantile 0.50		Quantile 0.75			
	coeff	t	coeff	t	coeff	t	coeff	t	t	
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Rosé	-0.05	-0.85	-0.05	-1.02	-0.08 *	-1.86	-0.02	-0.25		
Sparkling Wines	0.16 ***	2.86	0.20 ***	3.93	0.16 **	2.47	0.07	0.82		
Sweet Wines	0.37 ***	6.11	0.27 **	2.11	0.33 **	2.18	0.59 ***	3.63		
2009 (ref cat. 1998 to 2008)	-0.05	-0.72	-0.08	-0.65	-0.03	-0.17	0.09	0.54		
2010	-0.22 ***	-3.07	-0.25 **	-1.98	-0.24 *	-1.92	-0.27 *	-1.86		
2011	-0.29 ***	-4.72	-0.33 ***	-4.13	-0.34 ***	-3.91	-0.30 **	-2.42		
2012	-0.35 ***	-5.87	-0.40 ***	-5.00	-0.37 ***	-4.38	-0.37 ***	-2.96		
2013	-0.59 ***	-9.84	-0.59 ***	-8.24	-0.63 ***	-7.32	-0.63 ***	-5.09		
2014	-0.71 ***	-10.89	-0.70 ***	-9.15	-0.69 ***	-8.19	-0.76 ***	-5.90		
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ITA	0.47 ***	12.53	0.48 ***	7.31	0.46 ***	11.09	0.50 ***	11.32		
AUT	0.40 ***	8.06	0.46 ***	5.32	0.45 ***	11.68	0.37 ***	5.24		
OTH	0.12 **	2.21	0.14 **	2.22	0.13	1.63	0.16	1.36		
SLO	0.13 ***	3.03	0.16 ***	3.84	0.10 **	2.04	0.11 ***	2.59		
ESP	0.09	1.41	0.16 **	2.35	0.14 **	2.10	0.11	0.97		
USA	0.68 ***	10.26	0.77 ***	11.84	0.70 ***	10.16	0.61 ***	5.90		
Constant	-14.38 ***	-8.56	-12.1 ***	-5.01	-14.5 ***	-6.06	-13.74 ***	-5.80		
Pseudo R2			0.29		0.35		0.39			
# of obs		1222		1222		1222		1222		

Notes: The dependent variable is the logarithm of the wine prices. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level. Country of origin abbreviations: CZE – Czech Republic, ARG – Argentina, AUS & NZE – Australia and New Zealand, CHI – Chile, FRA – France, GER – Germany, ITA – Italia, AUT – Austria, OTH – Other countries, SLO – Slovak Republic, ESP – Spain

## References

Amrusch, P., & Wirl, F. (2013). Does the environment matter on the wine market: an analysis of the wine market in Austria. *Ecosystems and Sustainable Development IX*. doi:10.2495/eco130181

Brentari, E., Levaggi, R., & Zuccolotto, P. (2011). Pricing strategies for Italian red wine. *Food Quality and Preference*, 22(8), 725–732. doi:10.1016/j.foodqual.2011.06.001

Carew, R., & Florkowski, W. J. (2010). The Importance of Geographic Wine Appellations: Hedonic Pricing of Burgundy Wines in the British Columbia Wine Market. *Canadian Journal of Agricultural Economics/Revue Canadienne D'agroeconomie*, 58(1), 93–108. doi:10.1111/j.1744-7976.2009.01160.x

Combris, P., Lecocq, S., & Visser, M. (1997). Estimation of a hedonic price equation for Bordeaux wine: does quality matter?. *The Economic Journal*, 107(441), 390-402.

Friberg, R., & Grönqvist, E. (2012). Do expert reviews affect the demand for wine?. *American Economic Journal: Applied Economics*, 4(1), 193-211.

Gál, P. (2017). How intrinsic values influence wines prices. *BIO Web of Conferences*, 9, 03020. doi:10.1051/bioconf/20170903020

Lancaster, K. (1971). *Consumer Demand: A New Approach*. New York, Columbia University Press.

Oczkowski, E., & Doucouliagos, H. (2015). Wine prices and quality ratings: A meta-regression analysis. *American Journal of Agricultural Economics*, 97(1), 103-121.

Pennerstorfer, D., & Weiss, C. R. (2012). Product quality in the agri-food chain: do cooperatives offer high-quality wine?. *European Review of Agricultural Economics*, 40(1), 143-162.

Robinson, J. (2015). *The Oxford companion to wine*. Vyd. 4. New York: Oxford University Press. ISBN 0198705387.

Rosen, S. (1974). Hedonic prices and implicit markets: product differentiation in pure competition. *Journal of political economy*, 82(1), 34-55.

Schamel, G., & Anderson, K. (2003). Wine quality and varietal, regional and winery reputations: hedonic prices for Australia and New Zealand. *Economic Record*, 79(246), 357-369.

The Ministry of Agriculture of the Czech Republic (2018). *Situational and Forward-looking Reports of Grapevine and Wine*. Praha: The Ministry of Agriculture. ISBN: 978-80-7434-471-8.

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