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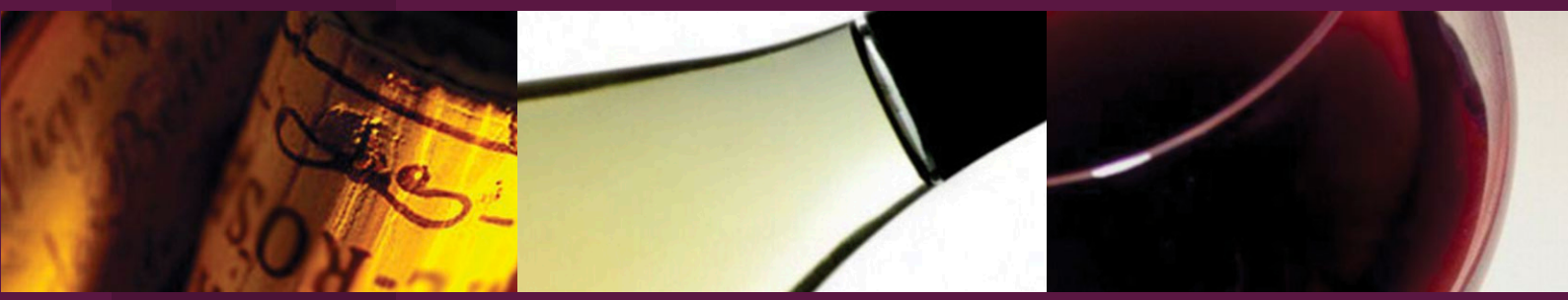

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The Influence of Alcohol Warning Labels on Consumers' Choices of Wine and Beer

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Abstract. This study aims to analyse the influence of alternative formats of health warnings on French and Italian Millennial consumers' choices of beer and wine. Two Discrete Choice Experiments were built for wine and beer and two Latent Class choice models were applied in order to verify the existence of different consumer profiles. Results show that young consumers' choices for wine and beer are influenced by framing, design and visibility of warnings. In both countries, the acceptance of warnings is higher for beer than for wine and in both cases consumers show higher utility for a logo on the front label: on the neck with a neutral message in the case of beer; on the front, without a message for wine. Latent Class choice models highlight the existence of different consumers' groups with different levels of warning influencing their choices. In order to apply policies conducting to health benefits, our results suggest the need to focus on young individuals to communicate the risks of alcohol abuse through targeted messages and, more generally, to make them aware of the potential negative effects of excessive consumption of both wine and beer.

Keywords: alcohol warning labels, wine, beer, Discrete Choice Experiment, Latent Class.

1. INTRODUCTION

Considering that the harmful use of alcohol is the third leading cause of mortality and morbidity of population globally (WHO, 2018), many public health and consumer associations are urging the implementation of mandatory health warning labels on alcoholic beverages. Several studies have highlighted that a large share of drinkers worldwide have an inac-

curate knowledge of the potential risks associated with alcohol consumption (Stockwell et al., 2016). The World Health Organization suggests that the presence of warning labels on alcohol containers could be considered an important first step in raising awareness and it could have a longer-term utility in helping to establish a social understanding of the harmful use of alcohol (WHO Europe, 2017; Eurocare, 2016). Indeed, labelling information is widely recognized as a means to constantly deliver a clear message to consumers at the point of purchase, or at the time of use, by promoting awareness, comprehension, and subsequent behavioural changes in line with the message content (Jarvis and Pettigrew, 2013).

However, alcohol warning labels (AWL) are currently used in 31 countries. They are often limited to the dangers of drinking when pregnant or drinking and driving, but the potential harm of excessive alcohol consumption could be extended to include other health conditions (WHO, 2010). Although Europe is the region with the highest per capita consumption of alcoholic beverages in the world, warning labels are still not required in the majority of Member States, and there are significant differences in national legislation among the countries that have introduced mandatory warnings (WHO Europe, 2017).

Much research has shown that support for health warnings on alcoholic beverages among consumers is high (Annunziata et al., 2019; Annunziata et al., 2016; Blackwell et al., 2018; Thomson et al., 2012; Greenfield et al., 2007), while other scholars have questioned the efficacy of alcohol warning labels in influencing drinking behaviour and concluded that evidence of their influence on changing behaviour is limited (e.g. Brennan et al., 2016; Coomber et al., 2015; 2018).

Instead of analysing the effectiveness of AWL in reducing abusive consumption behaviours, this paper aims to analyse the influence of alternative formats of AWL on Millennial consumers' choices of alcoholic beverages (wine and beer) by extending the results of a previous research carried out in Italy and France (Annunziata et al., 2019).

Specifically, this paper aims to verify 1) the influence of alternative formats of AWL on Millennial consumers stated choices of wine and beer; 2) the existence of different segments of consumers with different level of influence of AWL when choosing wine and beer.

To this purpose a Discrete Choice Experiment (DCE) and Latent Class choice models (LCM) were realized in Italy and France. The choice to analyse these two countries lies in their different regulations about AWL. Starting from 2007, mandatory warnings are imposed in France to inform consumers about the dangers associated with the consumption of alcoholic beverages during pregnancy, with a statement or a specific pictogram. In Italy a voluntary and unregulated approach exists, with the market offering bottles of alcoholic beverages with and without warnings and with a heterogeneity of warnings.

Table 1. Consumption of alcoholic beverages in France and Italy, million litres, 2010-2019.

	France		Italy	
	2010	2019	2010	2019
Wine	2,466	2,157	2,550	2,395
Beer	1,909	2,151	1,634	1,706
Spirits	395	367	158	138

Source: Euromonitor International (2020).

The decision to analyse Millennial generation consumers stems from the awareness that they are recognised as a particularly risky population segment, especially considering that heavy episodic drinking is constantly increasing among these individuals worldwide (Calafat et al., 2011). Furthermore, this generation represent a segment of growing interest for marketing researchers both in the wine and beer markets (Agnoli et al., 2011; de Magistris et al. 2011; Rivaroli et al. 2019). Compared with previous research, the originality of the current paper lies in the application of the choice experiment to two alcoholic beverages and the comparison of the outcomes.

Wine and beer were chosen as the objects of investigation of this study as: i) they are the most consumed alcoholic beverages in France and Italy (Table 1); ii) they are the most frequently consumed alcoholic beverages by Millennials in the two analysed countries (Euromonitor International, 2020; Agnoli et al., 2011); iii) wine is associated to tradition in both countries, while beer is more linked to Northern European consumption patterns (Agnoli et al., 2018), and this can give rise to differences in the acceptability of AWLs in these two alcoholic beverages, with relevant implications.

The paper is organised as follows: a brief overview of existing literature is presented in the first section; subsequently, a detailed description of the methodology and stimuli applied in the DCE is provided; then results from the DCE and Latent Class Analysis are presented and a discussion of the core implications is offered.

2. LITERATURE BACKGROUND

The current study builds on the growing research prompted by insights of behavioural economics and

the dual process theory (see, among others, Camerer and Loewenstein, 2004; Evans, 2008; Kahneman, 2011). Indeed, disentangling the relationship between conscious and unconscious elements in behaviour and decision-making, scholars have proved that consumers' choices are influenced by several contextual factors as social and environmental elements as well as cognitive shortcuts, emotions, and habits. Therefore, researchers have proposed to modify the choice architecture to alter individuals' behaviour for the good, i.e.: nudging people to do the right thing (Thaler and Sunstein, 2008). In particular, nudges are "any aspects of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler and Sunstein, 2008, p. 6). Based on this premises several policy makers have favourably embraced the use of gentle prompts and suggestions to increase healthier behaviours; also relying on high citizen support compared to other interventions - as taxes (Reisch et al., 2017). Recent evidences provided by cigarettes warnings suggests that labels that present health-aligned information may nudge behaviour that are in line with individuals' health goals, reducing consumption (e.g. Noar et al., 2016). Questions remains, however, around the possibility that similar label-based nudges can be effective also on alcoholic beverages.

Several studies suggest that AWLs may improve knowledge and attitudes regarding the harmful consequences of alcohol consumption among adults (Annunziata et al., 2017; Wigg and Stafford, 2016; Vallance et al., 2017), while little impact on changing drinking behaviour was found (Glock et al., 2013; Brown et al., 2016).

According to Al-Hamdani (2015) and Coomber et al. (2015), the limited impact of AWLs in changing behaviour is connected to the weak content of warnings and their poor visibility. In this regard, Agostinelli and Grube (2002) suggest that in order to improve the potential of warning labels in influencing behaviour, the key elements are label design and how well the information and messages on labels are targeted at their intended audience.

Indeed, several studies suggest that warning message framing, label design, format and visibility are crucial elements in determining health warning effectiveness and encouraging healthier behaviours (Blackwell et al., 2018; Al-Hamdani and Smith, 2017a; Knai et al., 2015; Krischler and Glock, 2015; Jarvis and Pettigrew, 2013).

Many studies found that pictorial health warnings are more effective than text-based warnings and enhance warning recognition (Hassan and Shiu, 2018; Kersbergen and Field, 2017; Wigg and Stafford, 2016). Al-Hamdani and Smith (2017a) suggest that combined text and image warnings have a stronger effect on alcohol consumers than the use of text only. Considering warning visibility, Kersbergen and Field (2017) reveal that increasing the visual salience by using graphic warnings as well as front-of-pack labelling might be more effective in attracting and maintaining consumers' attention. Al-Hamdani and Smith (2017b) found that plain packaging warning increases the likelihood for correct recognition.

In relation to the message framing, specific rather than general health warnings were rated as more effective, and led to greater risk perceptions (Miller et al., 2016; Pettigrew et al., 2014; Creyer et al., 2002). Jarvis and Pettigrew (2013) found that negatively framed messages had the highest utility whereas a positive message (about drinking and driving) could generate a boomerang effect. In addition, Blackwell and colleagues (2018) reported that participants of their study are more motivated to drink less after viewing negatively framed messages. Pettigrew et al. (2014) compared warnings with the wording 'increases risk' versus 'can cause' and found that the 'increases risk' wording was more convincing and more believable than the 'can cause' wording. Furthermore, Pettigrew et al. (2014) have examined the use of quantitative information in alcohol warnings and showed that quantitative messages performed poorly in terms of believability. Krischler and Glock (2015) showed that warning statements formulated as questions are more effective, especially among young adults, while Branco and Kaskutas (2001) found that warning labels that employ scare tactics can be perceived as overstating the risks and are not believable.

Annunziata et al. (2019) found that the level of visibility of the warnings currently carried by wine bottles in Italy and France is low and that consumers tend to prefer the "no warning option" attaching more utility to neutrally framed messages, even if some differences between Italian and French consumers exist.

Other researches highlighted that the extent to which the warning is read and elaborated by individuals is linked to the personal relevance of the message and individual motivation to actively respond, suggesting that tailored and targeted warning labels may be better received compared to generic ones (Hassan and Shiu 2018; Wogalter, 2006; Argo and Main, 2004).

In this regards other evidences revealed that targeted messages should be particularly useful among populations where there is great heterogeneity. The use of customised messages seems to be more effective than generic ones, especially considering individual alcohol-related beliefs, gender or age (Robertson et al. 2017;

Miller et al. 2016; Jarvis and Pettigrew, 2013; Creyer et al., 2002; Wright et al., 2008). With reference to the latter, Argo and Main (2004) argue that age correlates negatively with warning perception, in particular young adults tend to perceive themselves as invulnerable to the negative consequences of risky behaviours. Jarvis and Pettigrew (2013) found that the messages with the greatest utility differed across gender. Furthermore, concerning the drinking behaviour, Cryer et al. (2002) reported that drinking frequencies (i.e. binge or non-binge drinking) strongly affect the perception of different warnings on alcoholic beverages among students.

Jarvis and Pettigrew (2013) found that for those who report higher consumption of alcohol, negative health messages had the highest utility. Further, Miller and colleagues (2016) found that high-risk drinkers perceived the warning labels to be less effective in altering drinking behaviours than light-to-moderate drinkers.

Robertson and colleagues (2017) found that heavy drinkers are more sensitive to alcohol warnings related to concerns for self (e.g. liver damage) while lighter drinkers to warning related to potential risk for others (as violence).

Previous research has also found that the effectiveness of alcohol warning messages is influenced by different type of drink (e.g. wine, beer, vodka) (Thomson et al., 2012). In particular, messages matched with the type of drink were more relevant and acceptable to consumers, suggesting the need to further assess the interaction between the type of drink and the warning message but also to be cautious in generalising their results to other types of alcoholic beverages (Hassan and Shiu, 2018;Wright et al., 2008).

3. MATERIAL AND METHOD

3.1 Questionnaire and measurements

A consumer survey was conducted in order to reach the research objectives. Beyond the collecting data on socio-demographic characteristics, the questionnaire included information about alcohol consumption habits, selected from the Alcohol Usage Questionnaire (AUQ) developed by Mehrebian and Russell (1978) (Table 2). After assessing the level of attention paid to health warnings, the questionnaire asked about what effects health warnings have on respondents and their attitude towards alcohol, drawing from the readiness to change questionnaire developed by Kersbergen and Field (2017). Respondents were then asked to express their level of concern for some short and long-term side effects from alcohol consumption (Vecchio et al., 2017; Coomber et al., 2017).

3.2 Discrete Choice Experiments design

Respondents were also subject to two Discrete Choice Experiments (DCEs) (Louviere and Woodworth, 1983), depicting the hypothetical choice of a bottle of wine and beer. In order to avoid to sensitise respondents to warning contents, the DCEs were introduced to respondents before the section asking for the effects of health warnings.

The two DCEs include the same alternatives and attributes, selected considering the literature on health warnings and designed to test if consumer preference for wine and beer are influenced by the framing, design and visibility of different warnings (Table 3). Two non-mandatory warnings about a short- and a long-term effect of alcohol on health have been selected as alternatives of the designs, plus a no-warning alternative. The choice to select the risk of brain damage as the long-term effect and the risk from drinking and driving as the short-term effect was suggested by the literature (Jarvis and Pettigrew, 2013; Kaskutas and Greenfield, 1992; Coomber et al., 2017). These warnings have been graphically depicted on the label, and they could assume big size or small size and be placed on the neck or on the front label for beer, and on the front or the back label for wine, as in previous research (Al-Hamdani, and Smith, 2017b; Al-Hamdani, and Smith, 2015; Wigg and Stafford, 2016). Alcohol by volume is another attribute emerged as important in the literature (Jarvis and Pettigrew, 2013) and low, medium and high levels have been selected for beer according to general standards and for wine according to the specific grape variety involved in the hypothetical choice, Cabernet Sauvignon. The choice of this grape variety is given by the fact that it is the most widespread grape variety in Europe (Eurostat, 2017).

A textual message for the two selected warnings has also been included as an attribute of the DCEs, neutrally or negatively framed as in previous studies on the subject (Jarvis and Pettigrew, 2013; Krischler and Glock, 2015; Miller et al., 2016) or not included in the label (Table 4).

These alternatives, attributes and levels have been statistically combined in order to compose the experiment designs for this study. A full factorial design including each possible combination of the elements composing the design would have given rise to an enormous number of hypothetical choice situations. In order to show respondents with only a subset of possible choices, efficient fractional factorial designs were built with the software package Ngene (Rose and Bliemer, 2009; ChoiceMetrics, 2018). This class of designs aims to give rise to results generating parameter estimates with

Table 2. Collected data and measurement.

Topic	Variable	Measure	References
Socio-demographics	Gender	1 if male, 0 if female	
	Age	Continuous (from 18 to 40)	
	Years of education	Total years of education	
Alcohol consumption habits	Consumption frequency	from 1 (never) to 5 (every day)	Alcohol Usage Questionnaire (AUQ) (Mehrebian and Russell, 1978)
	Inebriation frequency in the last six months	from 1 (never) to 5 (more than 5 times)	
	Alcoholic beverages consumption in %	% of beer consumption	
		% of still wine consumption	
		% of sparkling wine consumption	
		% of spirits consumption	
		% of ready to drink consumption	
Attention towards labels and AW	Front label Back label Health warning	Scale from 1 to 5	Degree of attention towards information currently reported on front and back label (Mueller et al., 2010; Annunziata et al., 2016)
Discrete choice experiments for wine and beer			
Effects of health warnings	Decreased consumption	Multiple choice question, single answer 1 if is the case, 0 otherwise	
	Thought about decreasing consumption		
	Discussed with friends on risks		
	Thought about the risks		
	No effect		
Attitudes towards alcohol	Do not think to drink in excess	Likert scale from 1 to 5	Readiness to change questionnaire (Kersbergen and Field 2017)
	Like to drink and sometimes drink too much		
	Trying to drink less		
	Think that friends drink too much		
Concerns about the consequences of alcohol abuse	Lack of coordination and slower reflexes	Likert scale from 1 to 5	Concerns for long and short-term effects of alcohol intake (Vecchio et al., 2017; Coomber et al., 2017)
	Reduced concentration		
	Motor vehicle, bicycle and pedestrian accidents		
	Injuries associated with falls, accidents, violence		
	Alcohol poisoning		
	Harm to unborn babies		
	Obesity		
	Brain damage		
	Liver/Stomach problems		
	Heart and blood disease		

Table 3. Alternatives, attributes and levels of the DCEs.

Design components		Levels	
		Beer	Wine
Alternatives	Logo	1. Long-term health warning (Risk of brain damage)	
		2. Short-term health warning (Risk from drinking and driving)	
		3. No logo	
Attributes	I. Logo position	1. Neck	1. Back label
		2. Bottle	2. Front label
	II. Logo size	1. Big	
		2. Small	
	III. Alcohol by Volume	1. Low (3%vol.)	1. Low (11.5%vol.)
		2. Medium (5%vol.)	2. Medium (12.5%vol.)
		3. High (7%vol.)	3. High (13.5%vol.)
	IV. Message	1. Neutrally framed	
		2. Negatively framed	
		3. No warning message	

Figure 1. An example of choice task for wine and beer.

Table 4. Frame of the text messages associated with the warnings.

Message	Risk of brain damage	Risk from drinking and driving
Neutrally framed	Keep your brain healthy. Lower your alcohol intake	To be safe, do not drink and drive
Negatively framed	Every drink of alcohol harms your brain	Drunk driving kills

as small as possible standard errors. In order to reach this goal, they need to be fuelled by prior information on these parameters. 'Priors' to build two efficient designs were drawn from a pilot study involving 50 consumers from France and Italy and analysing their hypothetical choices of wine and beer. The efficient designs adopted in this study drove the allocation of alternatives, attributes and levels in the hypothetical choice scenarios of respondents and they were selected because they minimised the expected D-errors[1] (Ferrini and Scarpa, 2007; Scarpa and Rose, 2008; Sándor and Wedel, 2001). The final designs included 12 choice scenarios composed of three bottles each. In order to rationalise the response time to the questionnaire, three blocks of four choice scenarios were created adopting the blocking procedure. In this way, each respondent faced the choice of the preferred bottle of beer among four groups of three bottles and the choice of the preferred bottle of wine among four groups of three bottles each.

The choice scenarios were graphically represented to facilitate choice, adopting fictitious brands to avoid the conflicting impacts of knowledge and perceptions over real brands (Delmas and Lessem, 2017). For the beer choice task we applied only images of the front label (Fig. 1a), while for the wine choice task we used both

[1] The D-error is an aggregate measure drawn from the asymptotic variance-covariance (AVC) matrix of the variables in the design. It is estimated according to the following equation: D-error = [Det(Ω(β, xtj)]1/K]where Ω is the AVC matrix of the variables in the design (xtj), β is the vector of estimated coefficients, j is the alternative, t is the choice task and K is the number of estimated coefficients.

front and back labels (Fig.1b). In line with the habits of Millennials, the hypothesised consumption situation is a dinner with friends (Mueller and Charters, 2011).

3.3 Modelling approach

Data collected through the discrete choice experiment where analysed applying Multinomial Logit (MNL) models (McFadden, 1974) and Latent Class (LC) Choice Models (Greene and Hensher, 2003). MNL models assume that all respondents behave in the same way and present the same preferences, with a choice probability described as follows:

$$\Pr_{nit} = \frac{e^{V_{nit}}}{\sum_{j=1}^{J} e^{V_{njt}}} = \frac{e^{\beta' x_{nit}}}{\sum_{j=1}^{J} e^{\beta' x_{njt}}} \quad (1)$$

where n is the individual, who assesses for t times j alternatives and chooses alternative i. Following the random utility theory (Thurstore, 1927) V_{nit} is the part of the utility observed by the researcher, as discrete choice models assume that utility is a stochastic function, composed of a deterministic part, the function of the attributes of the good, and a stochastic part.

As reported in equation (1), the deterministic part of the utility can be written as:

$$V_{nit}=\beta' x_{nit} \quad (2)$$

where β is a vector of estimated coefficients and x_{nit} are the attributes of alternative i of the t choice which compose the utility of individual n (Train, 2009).

LC models create C latent classes grouping respondents with similar underlying preferences. Respondents are therefore assigned to a class up to a probability and given membership of a given class c, the probability of respondent n's sequence of choices y_n over the T choice occasions, is:

$$Pr(y_n|c, x_{nit}) = \prod_{t=1}^{T_n} \frac{e^{\beta'_c x_{nit}}}{e^{\beta'_c x_{njt}}} \text{ where } y_n=(i_{n1};i_{n2},\ldots,i_{nT_n}) \quad (3)$$

MNL models are applied in this study to analyse the influence of alternative formats of AWL on Millennial consumers stated choices of wine and beer. LC models were applied to identify different segments of consumers with different level of influence of AWL when choosing wine and beer.

Following the theory of Lancaster (1966), according to which the utility of a good is given by the attributes composing the good itself, in our models for the choice of wine and beer the utility of consumer n belonging to the latent class c can be explained as follows:

$$U_{njt|c}=\beta_{1|c} logo_{nit}+\beta_{2|c} size_{nit}+\beta_{3|c} position_{nit}+\beta_{4|c} message_{nit}+\beta_{5|c} ABV_{nit} \quad (4)$$

where *logo* is a nominal variable composed by three levels/logos (risk of brain damage, from drinking and driving and no logo); *size* is a binary variable assuming value 1 if the logo is big, 0 if it is small; *position* is a binary variable assuming value 1 if the logo is on the front label and 0 if it is on the back label/neck of the bottle; *message* is a binary variable assuming value 1 if the warning message is neutrally framed on the label, 0 if it is negatively framed and *ABV* is a continuous variable representing the three levels of alcohol by volume (low, medium and high) of the experimental design.

The emerged latent classes were characterised introducing socio-demographic and behavioural characteristics of respondents as covariates in the model. Data analysis was conducted using the software LatentGOLD (Vermunt and Magidson, 2013).

3.4 Data Collection

In line with other studies analysing wine and beer consumption and involving young respondents, the questionnaire was submitted online to a convenience sample of Millennials from France and Italy in 2018 (Vecchio, 2013; Szolnoki and Hoffmann, 2013). Respondents were recruited through social networks, blogs, forum and the word of mouth.

There is no common agreement among scholars defining the boundaries of Millennial generation. Some Authors consider this generation as born between 1981 and 1999 (Brosdahl and Carpenter, 2011; Bolton et al., 2013), others between 1980 and 2000 (Macky et al., 2008) or between 1978 and 2000 (Lancaster and Stillman, 2002; Thach and Olsen, 2006). In the present study individuals were screened to be born between 1978 and 2000 and to be of the legal age limit to drink alcoholic beverages at the time of the survey administration.

The final sample is composed of 659 individuals, 394 from Italy and 265 from France (Table 5). The sample is well balanced between male and female and is mostly composed of the younger segment of Generation Y. Half of the Italian part of the sample comes from the South, while half of the French sample comes from the Centre of France. As the French and the Italian education systems are different, a continuous variable was drawn explaining the years of education for each respondent

Table 5. Socio-demographic characteristics of the sample.

	Sample (N=659)		Italy (n=394)		France (n=265)	
	n	%	n	%	n	%
Gender						
Male	286	43.4	168	42.6	118	44.5
Female	369	56.0	226	57.4	143	54.0
Age class						
18-24 years old	397	60.2	195	49.5	202	76.2
25-31 years old	197	29.9	141	35.8	56	21.1
32-40 years old	65	9.9	58	14.7	7	2.6
Area of residence						
North	208	31.6	154	39.1	54	20.4
Centre	152	23.1	20	5.1	132	49.8
South	245	37.2	219	55.6	26	9.8
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Years of education	14.8	1.6	14.3	1.8	15.6	1.0

and highlighting a similar education level for the two segments.

4. RESULTS

4.1 Preferences for warning labels on wine and beer

Two MNL models were applied to understand different influences of AWL in the choice of wine and beer by Millennial respondents. Figure 2 shows that the most important elements driving consumer's choices for beer are a warning logo, alcohol by volume and warning message explaining the consequences of alcohol intake. Concerning wine, the presence and typology of warning logo is still the most important element, with a higher degree of importance than beer, and it is followed by the position of the logo and by the warning message. These results are in line with the study by Al-Hamdani (2014), highlighting the strong influence of pictorial health warnings on consumers.

For beer, positive utility is associated with the logo warning about the risks of drinking and driving, which is actually common on the bottles of beer both in Italy and France, depicting a focus on the short-term side effect of alcohol intake. A lower but still positive utility is registered if no logo is depicted on the label. Concerning wine, people associate positive utility to a bottle with no logo, and the logo about the consequences of alcohol on brain decreases consumer utility, as it does with beer (Table 6).

Unlike other studies (Pham et al., 2018; Al-Hamdani and Smith, 2017b), a clear preference does not emerge in consideration of the logo size for both alcoholic beverages. Concerning the position, consumers prefer a logo on the neck of the bottle for beer and on the front label for wine.

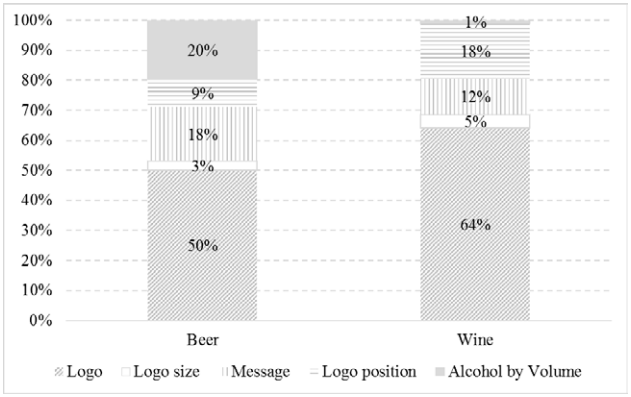

Figure 2. Attribute importance for beverages, full sample.

When it comes to choosing a bottle of beer, people prefer to be informed about the possible negative consequences of consumption, but with a neutrally framed message. When it comes to choosing wine, they prefer no warning message. In both cases a negatively framed message decreases consumers' utility, in line with studies by Al-Hamdani and Smith (2017a, 2017b).

The alcohol by volume indication results in a significant impact on consumers only for beer, and with a positive sign.

Two Latent Class choice models were run to analyse the hypothetical choices for both the alcoholic beverages and better explain these differences and understand consumers' preferences. The identification of latent classes aims to highlight differences in preferences and influences of health warning labels among young consumers. Despite being considered as a unique cohort, this generation is composed by a heterogeneous group of consumers, also in the light of the large age group that characterise it (Bucic et al., 2012; Agnoli et al., 2018). It becomes therefore important to identify these heterogeneities and characterise them according to their drinking behaviours and perceptions towards AWLs.

4.2 Latent class choice model for beer

The five-class solution was selected as the optimal to explain consumers' choices of beer, in line with the data fit criteria (Ferrini and Scarpa, 2007) (Table 7). After estimating the latent class model, socio-demographics and behavioural characteristics collected through the survey questionnaire have been included in the estima-

Table 6. Multinomial Logit estimation for choice of wine and beer, full sample.

	Beer					Wine				
	Coeff.		S.E.	Wald	*p*-value	Coeff.		S.E.	Wald	*p*-value
Logo										
Brain damage	-0.544	***	0.036	246.598	0.000	-0.693	***	0.039	339.748	0.000
No driving	0.318	***	0.030			0.050		0.033		
No logo	0.226	***	0.037			0.644	***	0.041		
Logo size										
Big vs Small	-0.054		0.054	0.996	0.320	-0.094		0.061	2.339	0.130
Message										
Negatively framed	-0.163	***	0.045	15.728	0.000	-0.141	***	0.046	10.376	0.006
Neutrally framed	0.144	***	0.043			0.031		0.048		
No message	0.019		0.041			0.109	***	0.046		
Logo position										
Label vs Neck	-0.159	***	0.054	8.622	0.003					
Front vs Back label						0.383	***	0.061	39.050	0.000
Alcohol by volume	0.085	***	0.013	45.827	0.000	-0.011		0.025	0.200	0.650
Goodness of fit										
Observations	2636					2636				
Cases	659					659				
Log likelihood	-2,689.476					-2,611.704				
R^2	0.073					0.1019				

* p<.10; **p<.05; ***p<.01.

Table 7. Data fit criteria for alternative Latent Class Models for beer choice.

	Log Likelihood	BIC	AIC	CAIC	N. Parameters	R^2
Multinomial Logit	-2689.4759	5424.387	5392.952	5431.387	7	0.073
2-Class	-2380.1775	4857.716	4790.355	4872.716	15	0.367
3-Class	-2311.849	4772.985	4669.698	4795.985	23	0.445
4-Class	-2266.5442	4734.301	4595.088	4765.301	31	0.517
5-Class	-2227.7592	4708.657	4533.518	4747.657	39	0.604
6-Class	-2206.0983	4717.261	4506.197	4764.261	47	0.642

tion as covariates (Table 8). This allowed the study to characterise classes also in the light of their alcohol consumption habits, effects of health warnings, attitudes towards alcohol and concerns about the consequences of alcohol abuse. This last aspect was included in the model as a single variable composed by the sum of the different items depicting individual's concerns about the consequences of alcohol abuse.

Latent class 1 (LC1) is composed of 28% of respondents and bases its choice on alcohol content, whose importance accounts for one third of the total utility. In particular, the utility of this LC increases with the increase of the alcohol by volume. The warning logo is the second most important attribute driving choice and consumers belonging to this class prefer a bottle of beer with no logo. Anyway, a bottle with a logo informing about the negative consequences of drinking and driving is positively perceived, differently from a logo informing about the negative effects of alcohol on brain. When a logo is present, they prefer it small and on the neck of the bottle. They prefer a bottle of beer with no warning message and negatively framed messages impact negatively on utility. This class particularly includes French male respondents, who do not consume alcoholic beverages very frequently, who declare that warnings about the negative consequences of alcohol on health have no impact on

Table 8. Estimates of Latent Class choice model for beer and class characterisation (n=659).

Latent class	LC1			LC2			LC3			LC4			LC5					
Latent class size	28%			24%			22%			19%			7%					
R^2	38%			7%			8%			14%			68%					
	AI	Coeff.	SE	AI	Coeff.	SE	AI	Coeff.	SE	AI	Coeff.	SE	AI	Coeff.	SE			
Logo	27%				51%				51%				39%				2%	
Brain damage		-0.919	***	0.124		-1.072	***	0.323		0.640	***	0.138		-3.980	***	1.346		-0.176		0.257
No driving		0.268	***	0.111		1.544	***	0.165		0.495	***	0.117		-1.779		1.197		0.149		0.228
No logo		0.651	***	0.119		-0.471	**	0.240		-1.135	***	0.169		5.759	***	2.299		0.027		0.326
Logo size	10%				11%				1%				9%				14%	
Big vs Small		-0.620	***	0.187		0.578	**	0.272		-0.035		0.116		2.314		1.677		2.171		1.652
Logo position	6%				10%				15%				12%				13%	
Label vs Neck		-0.372	**	0.186		0.502	**	0.296		-0.528	***	0.139		-3.065	*	1.719		-2.072		1.655
Message	24%				19%				20%				24%				9%	
Negatively framed		-0.793	***	0.169		0.422	*	0.254		-0.047		0.125		0.678		1.763		-0.933	***	0.355
Neutrally framed		0.166		0.124		0.126		0.166		0.379	***	0.122		-3.323		3.423		0.431		0.330
No message		0.628	***	0.135		-0.547		0.196		-0.331	***	0.111		2.645		1.845		0.502		0.343
Alcohol by volume	33%	0.484	***	0.056	9%	0.118	**	0.057	12%	0.108	*	0.056	15%	-0.950		0.746	62%	-2.423	*	1.442
Socio-demographics																				
Italian		-0.816	***	0.190		0.271		0.199		0.836	***	0.256		-0.534	***	0.186		0.244		0.295
Male		0.742	***	0.179		-0.122		0.190		-0.175		0.215		0.068		0.183		-0.514	*	0.302
Age		-0.031		0.023		0.012		0.022		0.050	***	0.022		-0.006		0.022		-0.026		0.034
Alcohol consumption habits																				
Consumption frequency		-0.268	***	0.129		0.351	***	0.133		0.225	*	0.117		-0.164		0.114		-0.144		0.196
Drunk frequency in the last 6 months		-0.128		0.081		0.555	***	0.089		-0.090		0.078		0.201	***	0.073		-0.538	***	0.168
Beer consumption vs other alcoholics		-0.004		0.005		0.014	***	0.006		0.004		0.005		-0.004		0.004		-0.010		0.007
Effects of health warnings																				
Discussed with friends on risks		-0.082		0.429		0.087		0.387		-0.210		0.421		0.827	**	0.398		-0.622		0.788
Decreased consumption		-0.690	*	0.397		-0.059		0.341		0.534	*	0.292		-0.582		0.455		0.797	*	0.409
No effect		0.921	***	0.170		-0.132		0.202		0.316	*	0.180		-0.733	***	0.308		-0.372		0.334
Thought about the risks		-0.234		0.230		0.320	*	0.192		-0.472	**	0.240		0.325		0.215		0.061		0.325
Thought about decreasing consumption		0.085		0.318		-0.216		0.335		-0.168		0.333		0.163		0.353		0.137		0.469
Attitudes towards alcohol																				
Do not think to drink in excess		-0.257	***	0.082		-0.148		0.093		-0.115		0.084		-0.008		0.084		0.527	***	0.167
Like to drink and sometimes drink too much		0.373	***	0.081		-0.318	***	0.097		-0.057		0.087		0.138	*	0.078		-0.137		0.129
Trying to drink less		-0.070		0.080		-0.091		0.088		-0.070		0.081		-0.159	*	0.082		0.390	***	0.102
Think that friends drink too much		-0.087		0.082		0.005		0.087		0.014		0.079		0.052		0.080		0.016		0.119
Concern about the consequences of alcohol abuse[a]		-0.030	***	0.011		0.043	***	0.013		0.000		0.010		-0.014		0.010		0.001		0.018

Note: LC=Latent Class; AI=Attribute Importance; SE=standard error; * p<.10; **p<.05; ***p<.01; a this variable is given by the sum of the items composing the topic.

their behaviour as they are not concerned about the consequences. Despite not consuming alcoholic beverages frequently, they admit to drinking too much sometimes.

LC2's utility is strongly driven by the warning logo. They prefer the warning logo related to risks of drinking and driving in big size on the front label of a bottle of beer. However, their utility is also positively driven by the alcohol content of a beer. No clear socio-demographic characterisation emerges for this class. They consume alcoholic beverages frequently, and beer is their favourite drink. In the last six months they have frequently felt drunk, but they do not think that they drink too much. They are concerned about the negative effects of alcohol abuse on health.

LC3, comprising 22% of respondents, is also strongly driven by the warning logo when choosing a bottle of beer and its utility is higher when there is a warning logo on the label. Respondents in this class prefer the warning about the negative effects of alcohol on brain and in a second instance on the negative consequences of drinking and driving. Their utility is positively influenced by a logo on the neck label and a neutrally framed warning message. This class is more likely to be composed of Italian respondents and respondents belonging to the higher age segment of the generation. This class particularly includes individuals that do not think about the risks when faced with a health warning.

Differently from LC2 and LC3, the utility of individuals associated to LC4 (19% of respondents) decreases when any kind of logo is included on the beer label, and when a logo is present, it is preferred on the neck label. This class more likely includes French people who state that they have had frequent episodes of drunkenness in the last six months. Warning labels have an effect on the behaviour of this class, including discussing with friends the risks of alcohol intake.

LC5 (7% of the sample) is strongly driven by the alcohol content and it prefers low-alcohol beers. The warning logo has little influence on its choice, and respondents from this class do not want to have a warning message negatively framed on the label. This class includes more women, people who do not tend to be involved in risky consumption behaviours and who tend to decrease consumption when they see a health warning label.

4.3 Latent class choice model for wine

A Latent Class analysis was applied also to analyse the wine choice of respondents and a four-class solution was selected as optimal according to the data fit criteria (Table 9).

LC.I (35% of the sample) is strongly driven by the logo when choosing wine and in particular any logo included on a wine label decreases their utility (Table 10). The logo about brain damage depresses the utility of individuals from this class more than the 'drinking and driving' one. Their utility is positively correlated with the alcohol content of a bottle of wine. French and male respondents are more likely to belong to this latent class. They do not consume alcoholic beverages frequently but when they drink, they tend to drink too much so that they feel drunk. This segment more probably includes respondents who declare to reduce consumption when they see the health warnings, but also some respondents for who these warnings have no effect or do not think about the risks. They are not concerned about the negative effects of alcohol on health.

LC.II (33% of the sample) is driven both by the logo and the warning message when choosing a bottle of wine. Individuals from this class prefer to see no logo, but if a logo is present they prefer the 'no driving' one as the logo on brain damage depresses their utility. They prefer a small logo, posted on the front label of the bottle. They prefer to have no warning message accompanying the logo on the label and a negatively framed message depresses their utility. The alcohol by volume of a bottle positively drives their choice. This class is more likely composed of female from the younger segment of the generation, who frequently consume alcoholic beverages even if they do not think to drink too much, and who declare that alcohol warnings have no effect on their behaviour as they are not concerned about the risks of alcohol abuse.

Table 9. Data fit criteria for alternative Latent Class Models for wine choice.

	Log Likelihood	BIC	AIC	CAIC	N. Parameters	R^2
Multinomial Logit	-2611.704	5268.844	5237.409	5275.844	7	0.102
2-Class	-2230.962	4559.286	4491.925	4574.286	15	0.434
3-Class	-2150.245	4449.777	4346.490	4472.777	23	0.532
4-Class	-2109.622	4420.456	4281.243	4451.456	31	0.584
5-Class	-2088.329	4429.797	4254.658	4468.797	39	0.616

Table 10. Estimates of Latent Class choice model for wine and class characterisation.

Latent class	LC.I			LC.II			LC.III			LC.IV					
Latent class size	35%			33%			19%			13%					
R^2	88%			17%			64%			32%					
	AI	Coeff.	SE	AI	Coeff.	SE	AI	Coeff.	SE	AI	Coeff.	SE			
Logo	50%				35%				49%				40%			
Brain damage		-3.058	***	0.983		-0.889	***	0.148		-0.248		0.217		1.059	***	0.237
No driving		-1.192	*	0.612		0.302	***	0.094		2.156	***	0.426		-0.580	***	0.239
No logo		4.249	***	1.465		0.587	***	0.127		-1.908	***	0.551		-0.479	**	0.241
Logo size	9%				11%				5%				7%			
Big vs Small		1.277		0.834		-0.465	***	0.180		0.448		0.274		-0.302		0.233
Logo position	1%				20%				3%				11%			
Label vs Neck		-0.082		0.573		0.867	***	0.180		0.209		0.220		0.447	*	0.257
Message	35%				25%				18%				19%			
Negatively framed		2.369		1.783		-0.568	***	0.135		0.211		0.227		0.360		0.230
Neutrally framed		0.379		1.748		0.103		0.100		0.650	***	0.257		-0.428		0.275
No message		-2.749		3.408		0.465	***	0.123		-0.861	***	0.299		0.069		0.187
Alcohol by volume	5%	0.372	*	0.220	8%	0.161	**	0.008	25%	-1.043	***	0.358	23%	-0.462	***	0.161
Socio-demographics																
Italian		-0.578	***	0.206		0.061		0.246		0.238		0.286		0.279		0.405
Male		0.347	**	0.172		-0.362	*	0.214		0.018		0.218		-0.003		0.283
Age		-0.016		0.019		-0.044	*	0.023		0.005	***	0.022		0.055	**	0.027
Alcohol consumption habits																
Consumption frequency		-0.241	**	0.115		0.230	*	0.138		0.334	***	0.140		-0.322		0.207
Drunk frequency in the last 6 months		0.222	***	0.081		0.142		0.101		-0.127		0.104		-0.237		0.162
Beer consumption vs other alcoholics		0.005		0.004		0.006		0.004		-0.003		0.006		-0.009		0.007
Effects of health warnings																
Discussed with friends on risks		-0.373		0.332		-0.344		0.433		0.023		0.384		0.693		0.469
Decreased consumption		0.629	***	0.282		-0.225		0.575		-0.398		0.443		-0.006		0.546
No effect		0.435	***	0.192		0.690	***	0.241		-0.197		0.264		-0.928	**	0.445
Thought about the risks		-0.450	***	0.198		0.050		0.232		0.200		0.205		0.200		0.239
Thought about decreasing consumption		-0.241		0.289		-0.172		0.371		0.372		0.307		0.041		0.396
Attitudes towards alcohol																
Do not think to drink in excess		0.104		0.068		0.142	*	0.082		-0.076		0.081		-0.170	*	0.101
Like to drink and sometimes drink too much		0.007		0.083		0.014		0.097		-0.114		0.115		0.093		0.161
Trying to drink less		0.085		0.068		0.032		0.086		-0.153		0.099		0.036		0.098
Think that friends drink too much		-0.025		0.069		-0.018		0.083		0.006		0.091		0.038		0.109
Concern about the consequences of alcohol abuse		-0.032	***	0.010		-0.034	***	0.012		0.005		0.013		0.060	***	0.017

Note: LC=Latent Class; AI=Attribute Importance; SE=standard error; * p<.10; **p<.05; ***p<.01 a this variable is given by the sum of the items composing the topic.

LC.III (19% of the sample) is driven by the logo and the alcohol content when choosing a bottle of wine. Differently from the previous two classes, individuals from this class prefer to see a warning logo on the wine label, and in particular the one connected to the risks of drinking and driving. Their utility increases also when a warning message accompanies the logo, when the message is neutrally framed. They choose wine based on low alcohol content. These individuals are more likely to belong to the older age segment of Millennials and be frequent consumers of alcoholic beverages.

LC.IV (13% of the sample) includes respondents who want to be warned about the negative consequences of alcohol on the brain when choosing a bottle of wine. They want the logo on the front label and low alcohol content for wine. The older segment of Millennials is more likely to belong to this latent class, who think about the risks when faced with a warning label and who are worried about the consequences of alcohol on health.

5. DISCUSSION

The introduction of health warnings on the label of alcoholic beverages is a topic of renewed interest in the field of consumer studies, due to the current debate on its mandatory or voluntary nature. Alcohol labelling issues are highly controversial due to the clash between different interests. On one side, there is the industry goal to increase sales volumes (and not costs) and on the other side, there is public interest in protecting consumers' health and right to be informed. Alcohol industry actors lobby for voluntary or self-regulatory initiatives and frame alcohol consumption issues as a part of their corporate social responsibility practices (McCambridge et al., 2018; Mialon and McCambridge, 2018). In this regards, it is useful to recall the fierce debate occurred among EU policy makers and the wine industry for the introduction of mandatory labelling of potentially allergenic substances in wine, including sulphites[2] . As well as the ongoing discussion related to the ingredients and nutritional labelling for alcoholic drinks for which the spirits and beer sectors signed in 2019 a Memorandum of Understanding[3].

With reference to health warnings, according to several research, current experience of voluntary alcohol warning in England (Petticrew et al., 2016), Australia (Coomber et al., 2018; O'Brien, 2019) and New Zealand (Tinawi et al., 2018) failed to inform individuals of health implications of alcohol consumption. If a self-regulatory approach prevails on mandatory standardised labelling, best practices for warning labels should be developed taking into account the results of the numerous studies that have analysed the impact of design and placement of health messages on alcohol labels; together with sector specific aspects.

In this scenario, the present study contributes to the literature by deepening the analysis of the influence of alternative formats of health warnings on French and Italian Millennial consumers' choices of beer and wine.

Overall, our results confirm that AWL effects on consumer choices of wine and beer are influenced by the alcoholic beverages considered suggesting the need to consider the interaction between the type of drink and the warning message (Thomson et al., 2012; Wright et al., 2008). Indeed, for beer a positive utility is associated with the option of logo warning on the risks of drinking and driving, while for wine consumers attach more utility to the 'no-warning option', confirming the results of previous study conducted in Italy and France (Annunziata et al., 2019).

This difference could be due to the fact that wine is still considered as a traditional product in both countries and it is not considered as transgressive, or linked to harmful and risky behaviours (Agnoli et al., 2018); on the contrary, wine is often touted for its potential health benefits (Higgins and Llanos, 2015). In this regard, several studies in Mediterranean countries reveal that wine consumption among Millennial consumers is decreasing for the shift in the preferences towards other products such as beer and spirits (Marinelli et al., 2014; De Magistris et al., 2011). In addition, specifically for wine, a range of studies has investigated the use of different information sources and indicated that in-store or in-restaurant sources are most valued (Atkin, Nowak, and Garcia, 2007; Atkin and Thach, 2012).

Considering the warning content, consumers attached a negative utility to the brain damage logo, for both beer and wine. This could be due to the fact that as shown by previous research young consumers are not very interested in potential long-term effects of alcohol (Annunziata et al., 2017; Annunziata et al., 2019; Jones and Parri, 2010; Jones and Parri, 2009). Indeed, these

[2] Regulation (EU) No. 579/2012 required mandatory labelling of a variety of allergenic substances in wine.

[3] Following the submission of the industry self-regulatory proposal on the provision of nutrition and ingredients listing from the European alcoholic beverages sectors, during the 2019 a series of bilateral dialogues with the sectors' representatives took place to encourage their commitment. As a consequence, representatives of the spirits and brewery industries signed the Memorandum of Understanding in which they commit over the coming years, to voluntary provide nutritional information and the list of ingredients for spirits and beer (even if in different manners).

consumers perceive themselves as not personally vulnerable to the long-term consequences of alcohol consumption at this point in their lives, attaching more importance to the short-term consequences of their decisions (Coomber et al., 2017).

Furthermore, the current study points out that the preference for the drinking and driving logo on beer could be linked to a strong public awareness of the problem of alcohol-related car accidents, but also to the fact that the beer industry is already involved in various public campaigns against drinking and driving[4].

The present results also confirm that framing, design and visibility of AWL affects consumers' choices of wine and beer and the impact varies in relation to alcoholic beverages considered. In particular, with reference to the warning visibility, consumers prefer to have a logo on the neck of the beer bottle; while for wine it should be on the front label. In relation to beer, our result is interesting considering that, according to recent research, most beer bottles already carry warning labels on the back (GfK, 2014). While, concerning wine, when warnings are available, they are usually located on the back label. Considering that Pabst et al. (2019) in a recent study reveal that the back label plays a minor role in the wine buying decision, according to our results, moving the logo on the front label could increases the warning visibility and effectiveness.

The size of the logo, according to current results, does not seem to be an influential attribute, contrarily to findings of other researchers (Pham et al., 2018; Al-Hamdani and Smith, 2017b). Concerning the message framing, results show that in the case of beer, consumers tend to choose a bottle with a neutrally framed message, while for wine they prefer the option without a message. However, negatively framed messages reduce consumers' utility for both alcoholic beverages, confirming that this type of message could have a stronger emotional impact on consumers choices (Al-Hamdani and Smith, 2017a; Al-Hamdani and Smith, 2017b). In this regard, Sillero-Rejon et al. (2018) found for beer that very stringent health warnings were judged to be more effective, leading to a greater motivation to reduce alcohol consumption, as well as greater avoidance and reactance.

Results from the LC models confirm the existence of different groups of young consumers whose choices are differently influenced by different AWL. According to previous research, our results show that these groups are characterised by different drinking behaviours and awareness of social and health risks related to alcohol consumption (Annunziata et al., 2017; Scholes-Balog et al., 2012).

Overall, the results reveal once more that consumer preferences diverge among beer and wine. Taking into account beer, two classes of consumers show a higher utility for the bottle with warning labels (LC2 and LC3, 46% of total sample), but at the same time these consumers hold significant differences in consumption patterns. While, LC2 included heavy beer drinkers, worried about the consequences of alcohol abuse and preferring the presence of warning on drinking and driving, LC3 included consumers with moderate consumption habits, who assign a positive utility to both warning logos but prefer the 'brain damage' warning. Considering socio-demographic variables, a higher number of older Millennials are included in this group. Conversely, LC1 and LC4 (47% of sample) are characterised by a higher concentration of consumers that do not want any warning logo on beer. In particular, LC1 (the most numerous) consumers are not worried about the consequences of alcohol abuse and strongly believe that health warnings have no effect. Men are the majority in this group.

Considering wine, a clear preference emerges towards a label without any warning. Specifically, the biggest groups LC.I and LC.II (which together represent 68% of sample) include consumers who are not worried of the consequences of alcohol abuse and consider health warnings ineffective.

Conversely, consumers in the other two classes (32% of respondents) that attach a positive utility to warnings on the label, are worried about the negative effects of alcohol, and consider health warnings as effective. Both groups have a high presence of older Millennials.

In brief, our results extend previous findings, highlighting that the older segment of Millennials with a moderate consumption behaviour tend to be influenced by the presence of AWL in their choices of alcoholic beverages, while this influence is weaker among younger Millennials (Creyer et al., 2002; Wright et al., 2008). Overall, Millennials are little concerned about the consequences of alcohol abuse and the only two groups that claim to be worried fall among those who prefer the bottle with the warning. Therefore, in line with other research (Comber et al., 2015), our results suggest that warnings can be a useful tool to spread more knowledge and awareness of the short- and long-term negative health and social effects of alcohol abuse.

5. CONCLUSION

This study analyses the influence of alternative formats of AWL on Millennials' beer and wine choices, in order to provide further insights to the current debate

[4] For a review of main educational campaign promoted by Worldwide Brewing Alliance see http://ec.europa.eu/health/ph_determinants/life_style/alcohol/Forum/docs/alcohol_lib6_en.pdf

on the introduction of health warnings on alcoholic beverages' labels. Despite it does not focus on the analysis of the effectiveness of health warnings policy in reducing abusive consumption behaviours, current results should be valuable for producers, providing practical indications on the influence of alternative formats of labels on young consumer choices.

In brief, findings highlight that the influence of AWL on the choice of wine and beer by Millennial consumers are driven by the type of alcoholic beverage and are affected by framing, design and visibility of warnings. In the two Mediterranean countries considered – Italy and France - the acceptance of warnings is higher for beer than for wine and in both cases consumers show an higher utility for a logo on the front label: on the neck with a neutral message in the case of beer; on the front, without a message for wine.

From a consumer behaviour point of view, the results confirm the existence of different segments of individuals in relation to their choices of alcoholic beverages with AWL, also characterised by different drinking behaviours and awareness of the social and health risks related to alcohol consumption. In particular, the older segment of Millennials with moderate consumption behaviour, a group which is to some extent worried about the negative effects of alcohol, chooses the bottle of beer with warning labels. The same is true, but with a lesser extent, when they chose a bottle of wine. The awareness of alcohol related health risks and the preference for bottles carrying warning labels is weaker among younger Millennials. Thus, in order to apply policies fostering health benefits, our results suggest the need to focus on young Millennials, effectively communicating the risks of alcohol abuse through targeted messages. In addition, and more generally, policies should increase young adults' awareness of the potential negative effects of excessive consumption of both wine and beer.

Some segments of Millennials declared that they are not affected at all by health warnings on the labels of wine and beer. This could be also a consequence of the excess of labelling information, in particular for wine, where labels are already very detailed, often including sensory descriptions and food pairings suggestions. In order to avoid overloading consumers with too many stimuli on the label, a valid alternative could be represented by providing detailed health related information online, using for example QR codes or specific links to websites that provide useful information about alcohol and drinking combining on-label and on-line information. Furthermore, companies should be stimulated to insert the website link in their general advertisements.

Moreover, considering that current results underline that Millennials, regardless of age, are not very concerned about the long–term consequences of alcohol abuse, more extensive education and information campaigns are needed aiming to inform young individuals about the potential negative consequences of alcohol intake, which go beyond the effects on driving and on pregnant women. This type of interventions can be more effective if combined with the use of warnings on the label, specifically rotating negative framed messages. Finally, considering that the awareness of alcohol-related health risks is weaker among younger Millennials and that they mainly drink alcoholic beverages during weekends in out-of-home contexts (Bazzani et al., 2020), new tools should be developed to provide information in this contexts, as posters in bars and stores, and advertisements; together with tools designed to explain how responsible drinking messages translates into actual drinks (such as the pocket-sized unit calculator introduced by UK drink-aware campaign).

The results of our analysis cannot be generalised as they are hardened by several limitations. First, the use of self-reported measurements is prone to generate social desirability bias; second the use of a convenience sample does not allow inferences on the populations of the two countries; third, the study analyses stated choices of respondents, which can be in line or not with actual choices when called to buy a bottle of wine (or beer) in everyday life. Lastly, the choice of the two countries (i.e.: Italy and France), where wine has an historical tradition of daily consumption, may limit the generalisation of results to other countries with different cultural backgrounds.

Based on these considerations, our analysis should be extended to other contexts with different drinking patterns and culture, like North European countries, and to other types of alcoholic beverages with a higher alcohol content, even more harmful and currently up surging among younger individuals. A laboratory experiment analysing actual choices of wine and beer with different AWL stimuli and monetary incentives for participants could partially bridge the lack of realism of discrete choice analysis.

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A Bad Year? Climate Variability and the Wine Industry in Chile

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Abstract. Short-term climate conditions may affect crop yields and vintage quality and, as a consequence, wine prices and vineyards' earnings. In this paper, we use a Computable General Equilibrium (CGE) model for Chile, which incorporates very detailed information about the value chain of the wine sector in the country. Using information for the 2015-2016 harvest, we calibrate climate variability shocks associated with a "bad year" for the wine industry in Chile, when premature rains occurred in important wine regions, reducing the area harvested and leading to wines with less concentrated flavors, particularly for reds. We model the climate shocks as a productivity change in the grape-producing sector (quantity effect). Moreover, we model quality effects as a shift in the foreign demand curve for Chilean wine. Given the specific economic environment in the model and the proposed simulation, it is possible to note the reduction of Chilean real GDP by about 0.067%. By decomposing this result, we verify that the quality effect has a slightly greater weight compared to the quantity effect.

JEL C68, Q13, Q54.

Keywords: climate variability, viticulture, wine, computable general equilibrium, Chile.

1. INTRODUCTION

Viticulture is particularly sensitive to climatic conditions. Climate is a factor that influences both the suitability of a region to ripen a specific variety of grapes and the resulting wine style (Jones, 2006). Short-term climate conditions may affect crop yields and vintage quality. As a consequence,

the latter conditions affect wine prices (Oczkowski, 2016) and vineyards' earnings (Ashenfelter and Storchmann, 2010), also compromising the reputation of a wine region. Climatic conditions and their effects on the quantity (yields) and quality of grapes produced will likely have important economic implications to the wine industry (Jones et al., 2005; Webb et al., 2008; Hannah et al., 2013; Mozell and Thach, 2014; van Leeuwen and Darriet, 2016; Ashenfelter and Storchmann, 2016).

While average climate conditions determine wine styles and varieties planted across the globe, different studies have shown that weather (short-term climatic conditions) define the characteristics of the vintages in the wine regions, with implications for wine prices and vineyard profitability (Jones and Storchmann, 2001; Schamel and Anderson, 2003; Haeger and Storchmann, 2006; Ramirez, 2008; Webb et al., 2008; Ashenfelter, 2010; Ashenfelter and Storchmann, 2010; Nunes and Loureiro, 2016; Oczkowski, 2016). Climate variability is one of the main environmental causes of losses to the agricultural sector, with lower crop yields or failure due mainly to drought, frost, hail, severe storms, and floods. Some of such driving climatic factors on the yield of wine grapes include temperature, solar radiation, and CO_2 concentration (Bindi et al., 1996).

Weather conditions that directly affect the cultivated and harvested area of wine grapes also affect the quality of the associated wine vintages (Nemani et al., 2001; Jones, 2004; Ramirez, 2008; Ashenfelter, 2010; Oczkowski, 2016). From a wider perspective, climate is part of the notion of "terroir", with which viticulture and the production of fine wines have a very close association (Jones et al., 2005). This concept involves matching wine grape varieties to particular combinations of climate, landscape and soils, within specific cultural contexts, to produce unique wines of particular styles (Seguin, 1986). On the one hand, climate change will alter these terroirs and potentially affect the quality of wine grapes produced (de Cortazar and Seguin, 2004) and, on the other hand, wine production and quality are chiefly influenced by site-specific factors, husbandry decisions, and short-term climate variability (Jones and Hellman, 2003).

The aforementioned empirical literature on the impact of climate on yield variability and quality of wine grape relies mainly on partial equilibrium reduced-form econometric estimations. There is a plethora of studies that successfully isolate the effects of climate events on a variety of outcomes related to the wine sector in different parts of the world. However, there are not many studies exploring the systemic economic impacts of climate shocks on the grape and the wine sectors. This wider view is essential in a context of an integrated approach of the production value chain of the wine sector. Backward and forward linkages affect, to different extents, local and external demand by the various economic agents. It is not different for the wine industry, in which sectoral linkages play an important role (Gillespie and Clarke, 2015).

In this paper, we will examine the wider impacts of the unfavorable weather conditions that prevailed in the 2015-2016 season in Chile, reducing the volume and the quality of the wine grapes. In what follows, we discuss in Section 2 the climatic conditions in Chile associated with higher quality vintages. As shown in Ashenfelter (2010) for Bordeaux wines, weather conditions are a good predictor of a "good year", explaining quality and prices of mature wines of a vintage. We then highlight in Section 3 some of the structural features of the Chilean wine-industry value chain embedded in our database. Section 4 describes our empirical strategy, and Section 5 discusses the main results. Concluding remarks follow.

2. WHAT MAKES A "GOOD YEAR" IN CHILE?

Geographically, Chile is composed of fifteen regions. Eighty nine percent of wine grape production is concentrated in the central zone of the country, from the V region of Valparaíso to the VII region of Maule (SAG, 2017). This area has a Mediterranean climate with well-defined seasons. This climate is characterized by a long-dry season with an average annual temperature of 14-15 degrees Celsius and an average accumulated rainfall of 400mm per year, ranging from 260 to 700mm. Temperatures and rainfall vary from the coast to the Andes mountains (west to east) and from north to south. Temperature decreases from north to south while rainfall increases (INE, 2016; Asociación Nacional de Ingenieros Agrónomos Enólogos de Chile, 2016).

A "good vintage year" in Chile, assuming it implies high productivity combined with high quality wine grapes, is similar to a good vintage year in places of comparable latitude. Wine grapes require hot, dry, rainless summers and cool winters. Berry development and ripening require a dry atmosphere, moderate temperatures (15-40 degrees Celsius) and plenty of sunshine (Patil et al., 1995). Among climate variables, air temperature is the most important factor affecting physiological behavior of the grape and chemical changes that occur during formation and maturity (Jackson 2000, and Carbonneau et al. 2007 cited by Montes et al. 2012).

The timing for the occurrence of high temperatures is also key as it can cause completely different effects in terms of grape quality and development. According to

Jones et al. (2005), the temperature during the growing season can affect grape quality and viability in several ways. For example, a number of days with temperatures above 10°C can initiate vegetative growth starting the growing season (Mullins et al., 1992). Also, during flowering and grape development, too high temperatures can cause: premature veraison (color change and beginning of sugar accumulation), high grape mortality, enzyme inactivation, and problems with flavor ripening (Mullins et al., 1992). However, during ripening, a high diurnal temperature range leads to synthesis of grape tannins, sugars, and flavors (Gladstones, 1992).

For the case of Chile, there is not much scientific information published as to what good and bad vintage years mean. The closest study is the one by Montes et al. (2012), who classify the viticultural potential for high-quality wine production considering the spatial differences across Central Chile, an area representing around 85% of all viticultural area in the country. This area is characterized by a Mediterranean climate with maximum temperatures ranging between 25 and 35 degrees Celsius during the growing season (September to March), and a total annual precipitation varying from 300 to 900 mm, concentrated in the cold season (June to August). Vineyards are typically irrigated and trained in vertical shoot-positioning system.

Montes et al. (2012) elaborate different climatic indices, which help describe the main features of Chilean climate based on monthly mean data of temperature, rainfall, and pan evaporation over 1990-2005 for 54 climatic stations. They estimate heat accumulation during the growing season, thermal regime during ripening, and the potential water balance at the end of the growth cycle. They find that the spatial differences in climatic potential in Chile are best described by heat accumulation and March thermal amplitude (the difference between maximum and minimum temperatures of March). While they determine a wide range of viticultural climatic groups in Chile, most of the weather stations (59%) were classified as having temperate warm and warm climates according to a heat accumulation index. These climates are thermally suitable for ripening of the main cultivated varieties in Chile, such as Cabernet Sauvignon or Merlot. However, they are detrimental for earliest cultivars, such as Sauvignon Blanc and Chardonnay in zones with high heat accumulation, possibly affecting their aromatic potential. This is consistent with the findings of Mills-Novoa et al. (2016) who suggest that viticultural suitability in the Maipo valley (located in Central Chile) may be limited in the future for producing high-quality grapes from cooler climate varieties.

Montes et al. (2012) also find that grape ripening is associated with low minimum night-time temperatures mostly around 8.5 and 10 degrees Celsius (consistent feature across all areas studied[1]); that proximity to the ocean has a strong influence; and that north to south orientation of climatic groups seems more relevant than east to west orientation.

Finally, they find a negative hydric balance during the warm season. This means there were almost no rainfall events during the growing season and fruit-ripening period, which, on the one hand, can reduce the development of some diseases but, on the other hand, can make the growing season highly dependent on irrigation in Central Chile.

In Chile, the harvest period goes from February to May depending on variety and location. Rainfall late in these months is detrimental for productivity as it promotes the rise of fungus. In general, cloudy weather, high humidity, low temperatures and rainfall during flowering and berry development are prone to spread diseases (Patil et al., 1995).

For anecdotal information of good and bad vintage years matching climate characteristics with wine tasting score ratings, Wine Spectator regional Vintage Charts provide yearly information that allows vintage comparison (Wine Spectator, 2020). These charts provide aggregate (average) characteristics of each vintage year and, in general, do not consider specific regions or varieties.

2.1. The 2015-2016 Season in Chile

The National Association of Oenologists 2016 Vintage Report classified the 2015-2016 season in Chile as complex due to climatic factors that affected wine grape health, ripening delay, and a productivity decrease of 30% on average. El Niño phenomenon greatly influenced climatic conditions presenting abnormally low rainfall during the 2015 winter and spring, and very intense rainfall starting on mid-April of 2016, around the middle of the vintage period. This rainfall episode and subsequent rainfall later in April exceeded a normal year and had a detrimental effect over grape health and productivity in Chile's central zone. Furthermore, a colder 2015 spring delayed budding, contributing to a ripening delay. These lower temperatures affected grape sugar content making it difficult to reach the 24 degrees Brix needed to produce a wine with 13 percent of alcohol by volume (Asociación Nacional de Ingenieros Agrónomos Enólogos de Chile, 2016). The most affected varie-

[1] This spatial consistency is uncommon in other wine-grape producing areas in the world.

ties were Carménère, Petit Syrah, Malbec, Cabernet Sauvignon, Cabernet Franc, and Merlot. However, for grapes harvested before mid-April (mainly white grapes and some red grapes), acidity and freshness were high, resulting in high quality grapes for varieties that benefit from these characteristics (Wines of Chile, 2016).

Consequently, due to the particular climatic conditions on the 2015-2016 season, many localities resulted with lower quality wine grapes affected by diseases and lower productivity, especially those areas with grapes harvested after mid-April (Asociación Nacional de Ingenieros Agrónomos Enólogos de Chile, 2016).

3. GRAPE AND WINE SECTORS IN CHILE

We use the 2014 input-output system published by the Chilean Central Bank as the basis to calibrate a computable general equilibrium (CGE) model. The model is very detailed in its sectoral disaggregation, identifying 111 different sectors and 179 goods and services. This database represents the structure of the Chilean economy in 2014, just before the climate variability shock we want to analyze.

The grape and the wine sectors are fully integrated in the model. In 2014, the grape-growing sector was responsible for 0.33% of national GDP and 1.04% of total exports. Table grape was its primary output (71.0% of total sectoral output), but the sector also produced wine grape (28.6%), and other products (0.4%). Most of the table grape's output was exported to other countries (85.5%), while the remaining part went to household consumption (11.8%), and a smaller share to other users (2.7%). Wine grapes were destined either to the wine production (90.7%) or to piscos and liquors production (9.3%).

From a cost perspective, intermediate inputs were responsible for 45.0% of total costs of grape production, with the remaining 55.0% allocated to payments to primary factors and production taxes. The sector paid 81.1% of total intermediate inputs costs to domestic suppliers, with the main items being support activities for agriculture (26.6% of total materials cost – only produced domestically); diesel (16.5% of total – 27.2% from domestic sources); and fertilizers and pesticides (15.6% of total – 75.3% domestic). Value added generated by the grape sector was relatively labor-intensive, with 53.7% of payments to primary factors accruing to labor, and 46.3% to capital.[2]

The wine sector contributed with 0.30% of Chilean GDP in 2014, and was responsible for 2.30% of national exports. In addition to the production of wine (98.5% of total output), there was a secondary production of piscos and liquors (1.5%). The wine production was mainly exported (73.7% of total output), with the remaining part almost fully destined to household consumption (23.9%) and to supply hotels and restaurants (2.4%); piscos and liquors were directed to domestic consumption by households (80.8%) with smaller shares sold to hotels and restaurants (6.8%) and abroad (6.6%), and the remaining share to the pisco sector.

The cost structure of the wine industry was divided into payments to intermediate inputs (69.0%) and to primary factors and production taxes (31.0%). The main input, wine grapes (21.2% of total intermediate input costs), was fully supplied by the domestic grape sector. Other relevant input costs included glass (11.8% of total – 98.2% from domestic sources); paperboard (10.6% of total – only produced domestically); and different professional services: other business services (8.9%), marketing services (5.6%) and personnel supply, cleaning, security and other support services (4.7%). Storage and deposit costs were also relevant (4.2%), as well as the use of other wood products (3.3% of total intermediate input costs – 80.5% from domestic sources) and imported other metal products (0.6%). Value added in the wine sector was capital-intensive, with 59.9% of payments to primary factors accruing to capital, and 40.1% to labor.

4. THE MODEL

We use a CGE model, calibrated for the Chilean economy, in order to evaluate the wider economic impacts of climate variability on the wine industry in the country. Our model's structure represents a variant of the well-documented ORANI-G model.[3] The Chilean version of the model identifies 111 sectors and 179 goods and services, one service used as margin (trade services), indirect, value added and production taxes, and five user groups (producers, investors, household, foreign sector and government).

The CGE model allows capturing economy-wide effects through an intricate plot of input-output relations. We calibrate the climate shocks defining two main channels to translate physical variables into economic inputs to the CGE models. Because we do not estimate econometrically the direct links between the climate scenario and the economic variables, we build narratives based on the expert literature to quantify the stylized exogenous scenarios to feed the CGE model.

[2] As a reference, overall labor share in the Chilean economy was 42.9% in the benchmark year.

[3] Dixon et al. (1982), and Horridge (2000).

The first channel – quantity channel – is derived from a decrease in productivity of the grape sector. We use information for the 2015-2016 grape harvest, which is usually associated with a bad year for the wine industry in Chile, since premature rains occurred in important wine regions, reducing the area harvested, and leading to wines with less concentrated flavors, particularly for reds, as perceived by consumers (Wine Spectator). According to data from the USDA Foreign Agricultural Service, grape production reduced by -10.59% in the period. The varieties Cabernet Sauvignon, Carménère and Petit Verdot in the Metropolitan Region of Santiago, O'Higgins and part of the Maule region were the most affected (see Figure 1). Weather conditions, characterized by heavy rains followed by high temperatures, was favorable for the development of Botrytis fungus that causes fruit rot. In addition, many fruits were still in the vines when heavy rains began, making the losses even more substantial (USDA, 2016). We model this channel of climate shocks as an exogenous productivity change (all input augmenting technical change) in the grape-producing sector (quantity effect), decreasing overall sectoral productivity by -10.59% so that, coeteris paribus, the model imposes an initial reduction in grape production similar to that observed.[4]

According to the model's analytical structure, the quantity channel can be decomposed into two different channels. First, a *price change channel*: as productivity declines, this represents, on one hand, increases in the prices of grapes (both table grapes and wine grapes), increasing production costs to the wine sector and raising the costs for domestic and foreign consumers, which lower both domestic and external demand. This creates room for decreasing firms' output – destined for both domestic and international markets – which requires less inputs and primary factors. Decreasing demand puts pressure on the factor markets for price decreases, with a concomitant expectation that the prices of domestic goods would decrease. Second, the reduction in overall productivity is also associated with an increase in the inputs and primary factors requirements per unit of output in the grape sector (*technical change channel*). This creates an upward pressure on input prices, wages and capital rentals, which are passed on in the form of higher prices.

The second channel – quality channel – is associated with an expert perception of a lower quality vintage

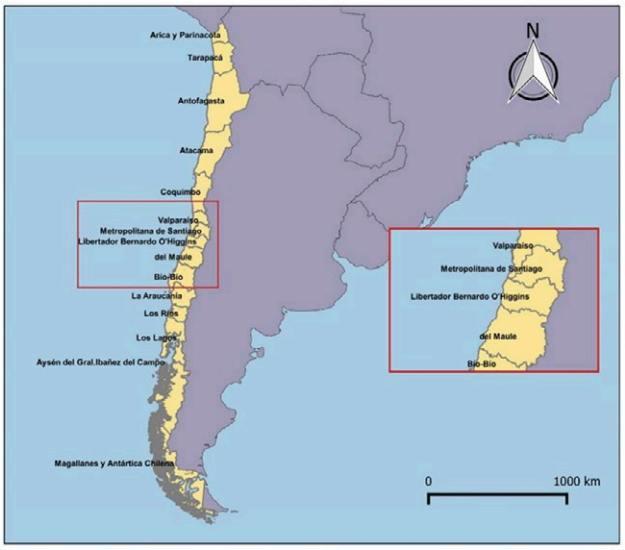

Figure 1. Regions Most Affected by Climate Variability.

of Chilean wines in 2016. The climatic adversity in 2015-2016 also brought about implications for the quality of the wines produced in Chile in 2016. Climate conditions in this "bad year" generated wines with slightly different characteristics from those more commonly found in Chilean wines (USDA, 2016). Table 1, drawn from the Wine Spectator magazine, shows the average vintage ratings for Chilean red wines for the period 2012 to 2016. It is possible to see that the rating for 2016 dropped five points in one year, passing from a score of 92, in 2015, to 87, in 2016.

Lower scores in vintage ratings may be associated with lower prices (premium). In a study by Schamel and

Table 1. Vintage Ratings – Chile: Reds (all regions).

Vintage	Score	Description
2016	87	Untimely rains in key regions such as Colchagua, Maipo and Casablanca cut yields and led to less concentrated flavors, particularly for reds
2015	92	A warm growing season and good harvest weather delivered powerful Cabernet Sauvignons and crisp, fruity Pinot Noirs; average quality for whites
2014	89	Spring frost cut crop; good quality fruit harvested; crisp reds, savory whites
2013	90	Cool vintage, delivering fresh, well-structured wines with good balance in terms of concentration and flavor
2012	91	Warm summer weather resulted in an early harvest, with clean, disease-free fruit and yields 15 percent above average; late-ripening Carmenère performed well

Source: Wine Spectator

[4] The "all input augmenting technical change" variables are sectoral-specific technological change variables, normally exogenous (values fixed outside the model). Suppose output were fixed, a shock of -10% to the component of such variable of the wine sector would mean that 10% more of all inputs were needed to produce the benchmark wine output. For technical details, please refer to Dixon et al. (1982), and Horridge (2000).

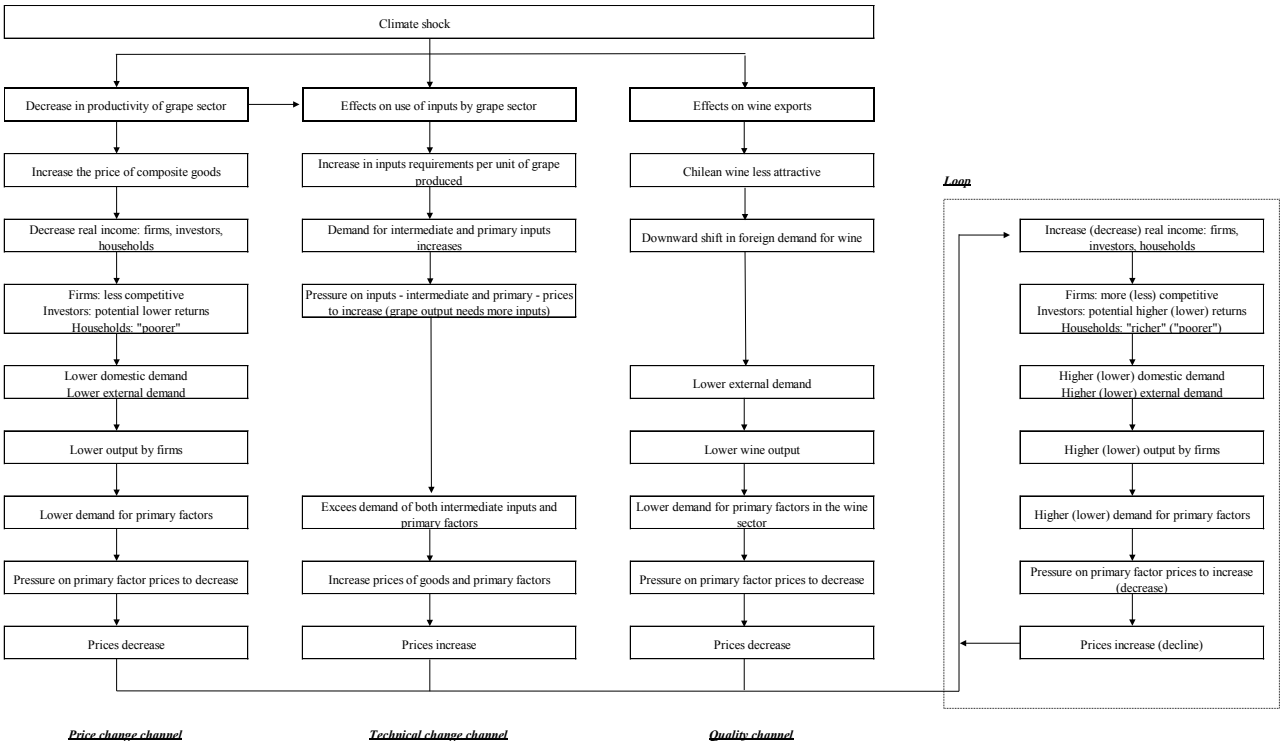

Figure 2. Causal Relations Underlying the Simulation Results.

Anderson (2003), the authors estimated hedonic price functions for premium wine from Australia and New Zealand, differentiating implicit prices for sensory quality ratings over the vintages: the parameters for vintage rating were all significant and stable over time. The price premium was 3.1% on average and varied between 2.3% and 4.1% for one-point increase in the vintage rating for the 1992-2000 vintages.

Thus, given these two pieces of information, and considering the strong exposure of Chilean wines to international markets (almost ¾ of the output are exported), we model the quality channel as a downward parallel shift in the downward-sloping constant-elasticity export demand curve for Chilean wine in the model. In the specification of the model, foreign demands (exports) for domestic good *i* depend on the percentage changes in a price, and two shift variables which allow for vertical and horizontal movements in the demand curves. The price variable, which influences export demands, is the purchaser's price in foreign countries, which includes the relevant taxes and margins. The parameter controls the sensitivity of export demand to price changes. Formally:

$$(export_i\text{-}fq_i^{(export)})=\eta_i(p_i^{(export)}\text{-}phi\text{-}fp_i^{(export)}),\ i\in G$$

Where $G=\{1,\ldots,g\}$, g is the number of goods in the economy; $export_i$ is foreign demand for domestic good i, $p_i^{(export)}$ is the purchasers' price in domestic currency of exported good i; phi is the nominal exchange rate; $fp_i^{(export)}$ and $fq_i^{(export)}$ are, respectively, quantity and price shift variables in foreign demand curves for national exports.

We parameterize the size of the shock on $fp_i^{(export)}$ by applying Schamel and Anderson's estimates to a five-point decrease in the vintage rating in 2016. Given the average price premium of 3.1% per point increase in the vintage-rating, we computed the compounded effect of a five-point difference, leading to an approximate -14.16% price reduction associated with the same benchmark level of foreign demand for Chilean wine.[5] Given the structure of the model, lower international demand for Chilean wines puts less pressure on prices through the decrease in export activity.[6]

Figure 2 summarizes the transmission mechanisms associated with first-order and second-order effects in the adjustment process underlying the model's aggregate results in the context of the major channels through which the shocks operate. Second-order prices changes

[5] Formula: (100*((1/(1.031^5))-1))

[6] The relative strength of this channel is directly related to the magnitude of the short-run export demand elasticity (for Chilean wines), .

go in both directions – decrease and increase. The net effect is determined by the relative strength of the countervailing forces.

5. RESULTS

To measure the wider impacts of the prevailing climatic conditions that affected grape and wine production in Chile in 2016, we run the model under a short-run macro-adjustment closure.[7] On the supply-side, we make the capital stock, technology, and the real wage exogenous. With the real wage given, the model can determine aggregate employment. With employment, technology and capital determined, the model can determine aggregate output (GDP). On the demand side, aggregate investment, and other demands (and inventories) are fixed. We allow (i) government consumption to move with tax revenue, and (ii) household consumption to move with factor income. With GDP determined from the supply side and domestic absorption (household consumption, investment, government consumption and inventories) defined as previously indicated, the trade balance must act as an endogenous 'swing' variable to satisfy the GDP identity. That is, if as a result of our shock GDP increases/decreases relative to domestic absorption, the trade balance must move toward surplus/deficit.

Table 2 presents the simulation results for GDP and its components. It breaks down changes in real GDP into the contributions of the main expenditure-side components, also decomposing the total impacts associated with the quantity and the quality channels. This enables us to verify how much of the change in real expenditure-side GDP is due, say, to a change in exports, associated with each channel. Table 2 also breaks down changes in real GDP from the income side, presenting the contributions to GDP due to primary factor usage, indirect taxes, and technical change. The combined effects of lower grape output and lower quality wine would lead to a reduction of Chilean real GDP by -0.067%, with similar contributions associated with the quantity channel (-0.031%) and the quality channel (-0.036%). Overall, a decrease in exports (negative impact on GDP of -0.052%), followed by a reduction in household consumption (-0.028%) made the main contributions to the aggregate GDP result. In the case of exports, lower productivity in the grape-producing sector (quantity channel) increases the price of both exported table grapes and domestically consumed wine grapes, in the latter case indirectly affecting prices of wine exports. As for the quality channel, the shift in export demand for Chilean wines directly impacts export volumes. Thus, exports results go in the same direction in both channels.

Table 2. Decomposition of the Impacts on Chilean GDP (% contribution).

	Total	*Subtotal*	
		Quantity	*Quality*
Real GDP from expenditure side	***-0.067***	*-0.031*	*-0.036*
Aggregate real investment expendiutre	0.000	0.000	0.000
Real houselhold consumption	-0.028	0.027	-0.055
Export volume	-0.052	-0.035	-0.017
Aggregate real government demands	-0.001	0.001	-0.001
Import volume	0.014	-0.024	0.037
Real GDP from income side	***-0.067***	*-0.031*	*-0.036*
Use of capital	0.000	0.000	0.000
Use of labor	-0.006	0.021	-0.028
Indirect taxes	-0.004	0.004	-0.009
Technical change	-0.057	-0.057	0.000

In the case of real household consumption, nonetheless, the results for its contributions to GDP, associated with the quantity and the quality channels, go in different directions. According to our model, with fixed capital stocks, the supply elasticity can be approximated by the expression that reflects its close connection with the elasticity of substitution between capital and labor, the shares of labor and capital in primary factor costs, and the share of primary factors in total costs. In other words, for given values of the substitution elasticity, supply is more elastic as either the labor/capital ratio is higher, or the share of materials in total cost is higher (Dixon et al., 1982). As seen in section 3, the grape sector is characterized as a labor-intensive sector. Within the quality channel, the technical change channel dominates primary factors market outcomes, generating higher labor absorption (positive impact on income-side GDP of 0.021%), and an increase in household consumption (positive impact on expenditure-side GDP of 0.027%). This creates an upward pressure on input prices, wages and capital rentals, which are passed on in the form of higher prices, as can be seen at the bottom estimates of Table 3.[8]

While the net effect of the quantity channel leads to real factor income increase, the outcome associated with the quality channel goes in the opposite direction, resulting in a decrease in household consumption. The initial decrease in economic activity associated with the foreign demand shift is accompanied by an overall reduction in employment and lower capital rentals, in a context of fixed capital stocks. Given that we set real

[7] The closure is adapted from the standard short run closure described in Horridge (2000).

[8] Table 3 also presents results for factor payments (including prices and use), GDP components and price indices.

Table 3. Impacts on Selected Macroeconomic Variables (in percentage change).

	Total	Subtotal	
		Quantity	Quality
Aggregate primary factor payments	**-0.143**	0.233	-0.376
Aggregate payments to capital	**-0.164**	0.224	-0.388
Aggregate payments to labor	**-0.115**	0.246	-0.361
Index of factor cost (excludes tech change)	**-0.136**	0.209	-0.345
Average capital rental	**-0.164**	0.224	-0.388
Average nominal wage	**-0.099**	0.190	-0.288
Aggregate primary factor use (excludes tech change)	**-0.007**	0.024	-0.031
Aggregate capital stock, rental weights	**0.000**	0.000	0.000
Aggregate employment, wage bill weights	**-0.017**	0.056	-0.073
Real GDP from expenditure side	**-0.067**	-0.031	-0.036
Aggregate real investment expendiutre	**0.000**	0.000	0.000
Real household consumption	**-0.044**	0.043	-0.088
Export volume index	**-0.159**	-0.107	-0.052
Aggregate real government demands	**-0.006**	0.005	-0.011
Import volume index, CIF weights	**-0.043**	0.075	-0.119
Average real wage	**0.000**	0.000	0.000
Real devaluation	**0.071**	-0.261	0.332
Consumer price index	**-0.099**	0.190	-0.288
Exports price index, local currency	**0.045**	0.269	-0.223
Government price index	**-0.099**	0.179	-0.277

Table 4. Impacts on Household Consumption, Exports and Output of Selected Products (in percentage change).

	Household consumption			Exports			Output		
	Total	Quantity	Quality	Total	Quantity	Quality	Total	Quantity	Quality
Wine grapes	**0.000**	0.000	0.000	**0.000**	0.000	0.000	**-3.194**	-0.751	-2.443
Table grapes	**-4.932**	-4.717	-0.215	**-6.308**	-6.289	-0.019	**-5.789**	-5.749	-0.040
Piscos and liquors	**-0.450**	-0.414	-0.036	**-0.329**	-0.514	0.186	**-0.793**	-0.951	0.157
Wine	**0.129**	-1.017	1.145	**-4.788**	-0.644	-4.143	**-3.951**	-0.822	-3.130
Total in Chile	**-0.044**	0.043	-0.088	**-0.159**	-0.107	-0.052	**-0.048**	-0.012	-0.035

wages exogenously, imperfect substitutability between labor and capital helps explaining the stronger effect on capital costs.

One last comment on the macroeconomic results presented in Tables 2 and 3 relates to balance of trade effects. Real devaluation, defined as the ratio between the CIF import price index in local currency and the GDP deflator, shows how foreign prices move compared to local prices. In this formulation, the overall impact on this variable, 0.071%, combines two different opposing forces. While the reduction in the productivity of the grape sector leads to overall higher domestic prices (-0.261%), promoting import penetration, the lower demand for Chilean wine changes relative prices in favor of less expensive domestic goods (0.322%), which, together with an overall lower activity level, help decreasing import demand. Accordingly, for exports, the vintage effect on real devaluation makes Chilean products more attractive to foreigners, partially offsetting the effect of the decrease in wine exports.

Table 4 highlights the importance of the impacts on the main products of the grape sector (wine and table grapes) and the wine sector (piscos and liquors, and wine) for the simulation results, revisiting some of the macroeconomic effects previously described. It captures the relevance of forward linkages in the wine industry value chain, revealing features of each product's sales structures, as described in section 3. We focus on two main final users, namely households and exports. The reduction in the consumption of table grapes by households (-4.932%) and foreigners (-6.308%), its two main markets, is mainly associated with the rise in prices due to productivity changes. As a result, total output drops by -5.789%, a decrease mostly due to the quantity channel. Wine grapes, which supply exclusively to the wine sector, perceive an output decrease of -3.194%; roughly ¼ of this change due to the productivity effect in the grape sector and ¾ due to backward linkages associated with the vintage effect that affects wine exports.

The wine output, on its turn, decrease by -3.951%, with most of this outcome associated with the quality effect (-3.130%). Interestingly, despite a sharp reduction in sales to foreign markets (-4.788%), domestic sales to households increase 0.129%. The higher domestic consumption (1.145%), led by lower relative prices due to the shrinkage of sales to foreigners, offsets the negative local sales to final consumers when climate shocks harm yields of grape crops (-1.017%), raising local wine prices as domestic wine grapes, the main input of the wine industry, become more expensive. Piscos and liquor output decreases to a lesser extent (-0.793%). However, we see a shift of production of the wine sector from wine to piscos and liquors, as the former becomes less "attractive". This might be a path to follow as a potential adaptation measure given that there is an increase in exports due to quality (which in annulated by the quantity effect), which might be pursued to face a bad climate in a year.[9] Therefore, the vineyard can substitute wine production by spirits production in order to face the fall in the wine demand by household and international consumer. At the micro-level, this might be a strategy for those producers of grape that can be used in pisco and liquor production, which are at the north part of the grape zone cultivation.

Finally, we have also calculated the impacts on sectoral output of the climate variability scenario that affected grape harvests in Chile. Figure 3 highlights those sectors that achieved the top and bottom performance. Sectors are ranked by the total effects. Backward and forward linkages play an important role in the picture that emerges.

[9] The specification of the sectoral composition of production is derived from the firm's maximization of revenue from all commodity outputs, subject to a constant elasticity of transformation (CET) production function. The model allows for secondary production, i.e. each sector can produce a mixture of all commodities. Given the CET specification, the output mix of each sector varies with the relative prices.

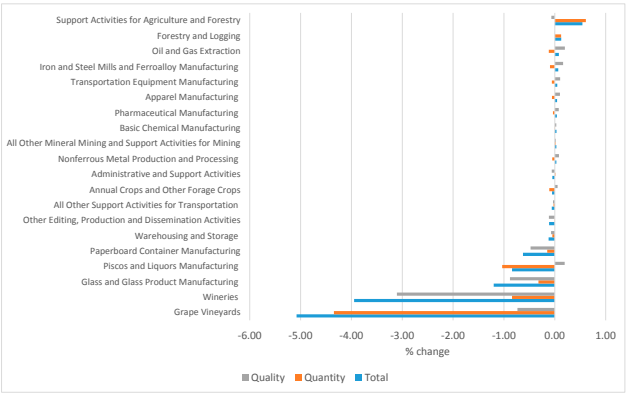

Figure 3. Impacts on Sectoral Activity (in percentage change).

According to Figure 3, in addition to the two sectors directly affected by the quantity and quality channels (grape vineyards and wineries), the sectors (indirectly) most affected by climate anomalies that hit grape yields are those related to the wine industry value chain.

To better understand the sectoral results of the model, a brief analysis of the structure of the economy can be done (Haddad, 2009). A close inspection on the benchmark data is necessary, conducted primarily on the relationships in the input-output database. Understanding of disaggregated results may be achieved through econometric regressions on key structural coefficients. How important is the existing economic structure in explaining the sectoral results associated with climate anomalies in Chile? Do backward and forward linkages matter? To answer these questions, following Dixon et al. (2007), we regress the model results (sectoral activity level) against selected structural coefficients of the model, suggested by the previous discussion. The OLS regressions are shown in Table 5 and aim only at revealing some of the influence of the benchmark structure on the results, considering a regression for the overall results, and two regressions for the subtotals (quantity and quality decompositions). The selected structural indicators explain more than 90 percent of the variation across sectors in the CGE model results. Given the nature of our experiment, we included sectoral dummies for the grape and wine sectors, in attempt to isolate the sector-specific shocks in each analysis. Sectors that present higher decreases in their output tend to have an overall higher share of their sales to the wine sector, suffering from the effects in the production value chain. Also, sectors that face stronger negative effects tend to concentrate their sales to Chilean households. Thus, the extent to which climate anomalies faced by the grape-producing sector affect sectoral economic activity is conditioned by the

Table 5. Structural Analysis of Sectoral Activity Results.*

Dependent Variable: ACT_SECT

Variables	*Total*	*Subtotal*	
		Quantity	*Quality*
WINE_SH	-4.205***	-1.006**	-3.199***
	(0.301)	(0.432)	(0.132)
HH_SH	-0.089***		-0.048***
	(0.032)		(0.018)
D_GRAPE	-4.143***	-4.064***	
	(0.118)	(0.174)	
D_WINE	-3.945***		-3.145***
	(0.098)		(0.054)
EXP_SH		-0.121**	0.051**
		(0.058)	(0.022)
MAT_SH		-0.121	
		(0.076)	
Constant	0.023*	0.073	0.012
	(0.013)	(0.045)	(0.008)
Observations	111	111	111
R-squared	0.977	0.899	0.975

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: *ACT_SECT = percentage change in sectoral activity level; WINE_SH = share of total sales to the wine sector; HH_SH = share of total sales to households; D_GRAPE = dummy for the grape sector; D_WINE = dummy for the wine sector; EXP_SH = share of total sales to exports; MAT_SH = share of materials in total costs.\

structural characteristics of the productive system and macroeconomic outcomes.

5.1. Sensitivity Analysis

In CGE modeling, one possible way to overcome the scarcity of estimates of key parameters is to simulate results based on different qualitative sets of values for the behavioral parameters and structural coefficients (Haddad, 2009). Through the judgment of the modeler, a range of alternative combinations reflecting differential structural hypotheses for the regional economies can be used to achieve a range of results for a policy simulation. This method, called qualitative or structural sensitivity analysis, provides a "confidence interval" to policy makers, and incorporates an extra component to the model's results, which contributes to increased robustness through the use of possible structural scenarios. As data deficiency has always been a big concern in CGE modeling, one that will not be overcome in the near future, this method tries to adjust the model for possible parameter misspecification. If the modeler knows enough about the func-

Table 6. Sensitivity Analysis Results: Export Demand Elasticity for Wine.

	Benchmark			*2x*			*5x*		
	Total	*Quantity*	*Quality*	*Total*	*Quantity*	*Quality*	*Total*	*Quantity*	*Quality*
Household consumption									
Wine grapes	**0.000**	0.000	0.000	**0.000**	0.000	0.000	**0.000**	0.000	0.000
Table grapes	**-4.932**	-4.717	-0.215	**-5.099**	-4.736	-0.363	**-5.398**	-4.770	-0.628
Piscos and liquors	**-0.450**	-0.414	-0.036	**-0.472**	-0.415	-0.057	**-0.503**	-0.416	-0.088
Wine	**0.129**	-1.017	1.145	**1.060**	-0.901	1.961	**2.784**	-0.687	3.471
Exports									
Wine grapes	**0.000**	0.000	0.000	**0.000**	0.000	0.000	**0.000**	0.000	0.000
Table grapes	**-6.308**	-6.289	-0.019	**-6.330**	-6.294	-0.035	**-6.374**	-6.304	-0.070
Piscos and liquors	**-0.329**	-0.514	0.186	**-0.175**	-0.491	0.316	**0.104**	-0.448	0.551
Wine	**-4.788**	-0.644	-4.143	**-8.182**	-1.102	-7.080	**-14.429**	-1.946	-12.483
Output									
Wine grapes	**-3.194**	-0.751	-2.443	**-5.197**	-1.023	-4.174	**-8.881**	-1.524	-7.357
Table grapes	**-5.789**	-5.749	-0.040	**-5.826**	-5.755	-0.071	**-5.897**	-5.768	-0.129
Piscos and liquors	**-0.793**	-0.951	0.157	**-0.656**	-0.927	0.271	**-0.397**	-0.883	0.486
Wine	**-3.951**	-0.822	-3.130	**-6.517**	-1.171	-5.346	**-11.236**	-1.813	-9.423
Macroeconomic aggregates									
Real GDP from expenditure side	**-0.067**	-0.031	-0.036	**-0.096**	-0.035	-0.061	**-0.147**	-0.042	-0.104
Aggregate real investment expendiutre	**0.000**	0.000	0.000	**0.000**	0.000	0.000	**0.000**	0.000	0.000
Real houselhold consumption	**-0.044**	0.043	-0.088	**-0.114**	0.033	-0.147	**-0.236**	0.016	-0.251
Export volume index	**-0.159**	-0.107	-0.052	**-0.201**	-0.112	-0.089	**-0.277**	-0.122	-0.155
Aggregate real government demands	**-0.006**	0.005	-0.011	**-0.015**	0.003	-0.018	**-0.029**	0.001	-0.030
Import volume index, CIF weights	**-0.043**	0.075	-0.119	**-0.138**	0.062	-0.200	**-0.305**	0.038	-0.343
Aggregate employment, wage bill weights	**-0.017**	0.056	-0.073	**-0.075**	0.047	-0.122	**-0.176**	0.032	-0.209

tioning of the particular economy, the model achieves a greater degree of accuracy when such procedure is adopted.

Qualitative sensitivity analysis is carried out in this sub-section in order to grasp a better understanding on the role played by the export demand elasticity for wine. Such parameter determines the strength of the responsiveness of the Chilean wine industry to price changes. Given the lack of specific estimates for Chilean wine[10], it was calibrated with the short-run value 0.33, based on estimates for agro-industrial products. Given the uncertainty about its value, we run sensitivity analysis for this parameter, choosing alternative values up to twice and five times higher. Table 6 summarizes the sensitivity of results for macroeconomic aggregates and selected products. Overall, they point to a stronger dominance of the quality effect, as the value of the parameter goes up. They also point to the magnification of the main results, reinforcing their direction.

6. CONCLUDING REMARKS

In this paper we have computed estimates of the economy-wide impacts of the special weather conditions that prevailed in Chile and affected grape harvests in the country, also affecting the quality of the wine produced. We have used a national CGE model calibrated for the Chilean economy. We evaluated two main transmission channels of the climate variability shocks to the economy, namely a quantity channel originated in the grape vineyards, and a quality channel accruing to the wineries. The general equilibrium approach adopted in this work allowed a broader understanding of potential responses of the wine industry in Chile to a specific climate scenario taking into account its whole value chain. It helped telling a story that takes into account the grape and wine sectors embedded in a national economic system.

The results revealed the relevance of backward and forward linkages to understand the systemic effects. Revisiting the main results of the paper, a quick back-of-the-envelope calculation using the estimates of the impacts on sectoral economic activity and structural coefficients computing sectoral shares in GDP shows that for each 1.00 Chilean Peso (CLP) of reduction in the combined sectoral GDP of the grape and wine sectors,

[10] Muhammad et al. (2013) report a price demand elasticity for Chinese wine imports from Chile equal to -1.104.

there is an additional 1.39 CLP reduction in other sectors' GDP.[11]

The results are not without limitations. In our simulation-based approach, results depend heavily on the analytical, functional and numerical structures of the model. The usual issue of model pre-selection (Blaug, 1992), with its advantages and disadvantages for the purpose of this exercise, applies here. Moreover, in spite of taking a general equilibrium approach to understand the economic effects in the Chilean economy, the narratives we built to quantify the exogenous scenarios to feed the CGE model preclude how weather conditions may have affected other crops. Thus, in our attempt to isolate the main mechanisms that link physical (climate) shocks to economic shocks, we have focused our attention on those directly associated with the key players of the wine industry. As usual, additional research is needed to help providing further evidence to evaluate these issues more completely.

As a final comment, we recognize there is an ongoing discussion about the definition of terroir and, even more, there is a discussion about the existence of the concept of terroir (Pszczólkowski, 2014, Vaudour, 2002). Broadly, there are two definitions of terroir: one that does not incorporate human intervention (management and perception), and another definition that besides soil, climate, and variety combination, considers vineyard management and perception (tasting). Besides the discussion about the definition of terroir, Bramley and Hamilton (2007) show that terroir is spatially variable at the within-vineyard scale using precision viticulture techniques.

Considering this last fact and the definition by Seguin (1986) presented in the introduction section of this article, in order to include terroir in the model we would need detailed information of variety-soil-climate combinations together with vineyard management at the local level. To the best of our knowledge, this information is very limited in Chile (and very far from what is known in the old world about their terroirs). Nonetheless, from a methodological perspective, it would be feasible to specify the model for specific wine regions – as information becomes available. For example, according to the discussion in Section 2, we can conclude that valleys that produce reds such as Maipo and Colchagua were affected negatively by the 2015-2016 season climatic conditions, however, valleys like Casablanca, specialized in white wines may have benefited. In spite of data constraints, future research efforts in modeling the Chilean economy in an integrated manner should move towards multirregional modeling frameworks.

[11] We have compared the GDP effects (-0.067%) to the combined contributions of the grape and the wine sectors to this outcome, by multiplying their respective shares in GDP (0.33% and 0.30%) to the simulated impact on their activity levels (-5.062% and -3.800%, respectively).

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Sparkling Wine International Market Structure and Competitiveness

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Abstract. This paper aims to analyse the Sparkling Wine international market structure and competitiveness, focusing on the 2004–2018 period. It used the data regarding exports and imports of sparkling wine available in the International Trade Centre's Trade Map database. The method used to examine sparkling wine's international market structure and competitiveness consisted of calculation of: (i) Revealed Comparative Advantage (RCA); (ii) Relative Position in the Market (RPM); (iii) Hirschman-Herfindahl Index (HHI); and (iv) Net Export Index (NEI). The paper analyses the growth of the sparkling wine trade worldwide. It demonstrated that France had the greatest relative position in the market, followed by Italy and Spain. This same sequence was found in the revealed comparative advantage, highlighting the increased Italian export level. A high export market structure concentration was also shown. On the other hand, there was an unconcentrated import market structure, and, according to the NEI, it was possible to identify three groups composed of actors who were stable in terms of: i) exports based on domestic production (France, Italy and Spain); ii) trade, reflecting re-export (Singapore and the Netherlands); iii) imports, with strong domestic consumption (Germany, the United Kingdom, the United States of America, Australia, and Belgium).

Keywords: wine competitiveness, market structure, sparkling wine, HHI, revealed comparative advantage.

1. INTRODUCTION

Sparkling wine, which is known as a celebratory beverage, and also as a lifestyle symbol, has a strong symbolic function (Velikova et al., 2016). The earliest mentions of sparkling wine production date back to 1531 at the Saint-Hilaire monastery in the South of France (Stevenson, 2003).

The most famous, prestigious, expensive, and highest ranked sparkling wines come from Champagne (Epstein, 2011; Rokka, 2017). The products of that area carry the denomination of origin, and are named as Champagne. Sekt, cava, crémant, and prosecco are familiar terms used to describe the different sparkling wines from outside the Champagne region, and these are becoming better known in the world. Furthermore, their consumption has been trending upwards due to the strong influence of Western culture,

reflecting luxury fads (Epstein, 2011), the trend toward indulgence, and to differentiate the chosen wine in order to enhance the experience (Hannin et al., 2010; Mariani, Pomarici and Boatto, 2012).

The wine industry is a multibillion-dollar business engaged in world trade. In 2018, sparkling wine export figures rose to more than US$ 7 billion worldwide (ITC, 2020). France maintains its leadership in sparkling wine exports as a result of its specialisation in winemaking and attention to *terroir* (Zhao, 2005; Demossier, 2011). However, recent studies reveal changing dynamics in the sparkling wine market, whether due to new entrants (Basso, 2019), new consumers and new consumer behaviour (Castellini and Samoggia, 2018; Velikova et al., 2016; Lerro et al., 2020), or strategies for maintaining established markets (Rossetto and Gastaldello, 2018), resulting in a complex situation described, for example, by Pomarici (2016).

In addition, since the beginning of the 21st century, the sparkling wine trade has been growing and its structure has been undergoing changes due the new competitive market scenario (Mariani et al., 2012). However, just a few studies analyse the international wine market in a sectioned manner in countries (Anderson, 2018; Beluhova-Uzunova and Roychev, 2018; Corsi, Marinelli and Sottini, 2013) or sets of countries (Fleming, Mounter, Grant, Griffith and Villano, 2014; Lombardi, Dal Bianco, Freda, Caracciolo and Cembalo, 2016), and no study deals with international sparkling wines market. Thus, this paper fills that lack of studies by analyse the sparkling wine market regarding its: (1) international competitiveness; and (2) international market structure.

2. THEORETICAL BACKGROUND AND METHOD

Competitiveness can be examined in multiple ways. This paper follows Latruffe's (2010) idea, where competitiveness is defined by the capacity to face competition and be successful. Comparison is inherent in this view, which can be between different units (such as different countries) in a specific factor or the same unit (the same country) with its respective factor in a different period of time.

Competitiveness can be determined by three different levels: microeconomic (firm), mesoeconomic (sector) and macroeconomic (nation), as seen in Drescher and Maurer (1999) and Bojnec and Fertö (2009). This paper considers the mesoanalytical level involving sparkling wine.

According to Horn (1985), the mesoanalytical level can be measured with different indicators. Trade theory suggests that the nation's competitiveness should be defined by comparative advantage. The comparative advantage theory reveals that trade flows are a result of the relative cost differences among trading partners, suggesting that countries are competitive in the sectors in which they have greater efficiency (Horn, 1985; Bojnec and Fertö, 2009).

To determine the competitiveness of the international sparkling wine market we used the Revealed Comparative Advantage (RCA) initially developed by Balassa (1965), and later modified by Vollrath (1991) to avoid duplicate registers. This was applied in the wine sector by Anderson (2018), Maté Balogh and Jàmbor (2017), Beluhova-Uzunova and Roycheva (2017), Van Rooyen et al. (2010) and Crescimanno and Galati (2014). The index is sustained by exports, revealing the relation between the nation's exported product to its total export flow, and the world's export performance for the same product, in the same period, as follows:

$$\mathrm{RCA}=\left(\frac{X_{ip}^{t}/X_{tp}^{t}}{X_{im}^{t}/X_{tm}^{t}}\right)$$

where:
RCA = revealed comparative advantage
X_{ip}^{t} = exports of product *i* from the country in period *t*
X_{tp}^{t} = exports from the country in period *t*
X_{im}^{t} = exports of product *i* across the world in period *t*
X_{tm}^{t} = exports across the world in period *t*

The higher the final value is, the higher the nation's revealed comparative advantage, whereas the lower the final value, the higher the disadvantage (Vollrath, 1991; Bojnec and Fertö, 2009; Fleming et al., 2014).

In addition to the RCA, the Relative Position in the Market (RPM) is also used, which determines the nation's position in the international trade of a specific product (Thomé and Soares, 2015). It is revealed by calculating the relationship between the nation's trade balance for a specific product and the total global trade for the same product (Thomé and Soares, 2015; Lafay et al., 1999), as follows:

$$\mathrm{RP}M_{i}^{t} = 100x\ \frac{X_{i}^{t}-M_{i}^{t}}{W_{i}^{t}}$$

$\mathrm{RP}M_{i}^{t}$ = relative position in the market
X_{i}^{t} = exports of product *i* from the country in period *t*
M_{i}^{t} = imports of product *i* into the country in period *t*
W_{i}^{t} = global trade (exports plus imports) of product *i* in period *t*

The RPM follows the same pattern as the RCA, which means that the higher the final value is, the greater its market position.

Beyond the RCA and RPM indexes, the Industrial Organisation is a useful framework to understand how market structure influences performance, as shown by Iwasaki et al. (2008), Mariani, et al. (2012) and Thomé and Soares (2015).

The structure-conduct-performance (SCP) paradigm advocates a direct link between market structure and the degree of competition (Bain, 1951). According to the SCP, greater market concentration allows those holding bigger market shares to exploit market power to obtain greater profits (Bain, 1951; Iwasaki et al., 2008).

As seen in Scherer and Rosss (1990), market concentration is the union of the largest market shares in a given sector, and, according to Correia, Gouveia and Martins (2019), this same consideration is applicable to the international wine business.

A high market concentration occurs when few competitors hold a significant share of it, while a large majority of players operate in the rest of the market. In contrast, low market concentration occurs when there is a large number of competitors in similar conditions (Thomé and Medeiros, 2016).

Market concentration is an important aspect of the market structure. Where companies are located affects their performance by reflecting the country's competitive position (Thomé, Medeiros and Hearn, 2017), thus, market concentration can be seen as a relevant performance indicator (Thomé and Soares, 2015).

As seen in Iwasaki et al. (2008), concentration measures should be based on the international market share of each country. They can be expressed in different ways and need to consider the inequality of international market shares and the number of countries (competitors). According to the U. S. Department of Justice and Federal Trade Commission, Horizontal Merger Guidelines (2010), the value of HHI varies between zero, indicating a monopolistic position, to ten thousand, indicating pure monopoly. Otherwise, an index value lower than 1,500 indicates that the industry or market is unconcentrated; for values between 1,500 and 2,500, the market is moderately concentrated; and for HHI with a value above 2,500, the market is highly concentrated. Among the possible equations used to express market concentration, Iwasaki et al. (2008) highlighted the Hirschman-Herfindahl Index (HHI):

$$\mathrm{HHI} = \sum_{i=1}^{n} S_i^2$$

where:
HHI = Herfindahl-Hirschman Index
S_i^2 = market share squared
n = total countries in the sector

Furthermore, another helpful index that allows understanding of competitive conduct in international trade is the net export index (NEI). The NEI refers to the product's import/export flow (Banterle and Carresi, 2007; Pascucci, 2018). This index not only helps in the debate on sparkling wine re-exportation emphasised by Pomarici (2016), but also shows the countries that use this strategy and at which level. According to Mariani et al. (2012, p. 33), re-exportation is the act of "exporting from one country wine previously imported", which takes into account the country's trade balance for product *i*, due to the total trade for the same product. Based on Banterle and Carresi (2007) and Thomé and Soares (2015), it is calculated as:

$$\mathrm{NEI}_i^t = \frac{X_i^t - M_i^t}{W_i^t}$$

where:
NEI_i^t = the net export index
X_i^t = exports of product *i* from the country in period *t*
M_i^t = imports of product *i* into the country in period *t*
W_i^t = the trade (exports plus imports) of product *i* of the country in period *t*

The index fluctuates between -1 (when the country only imports the product) to 1 (when the country only exports the product). When its result reaches 0, the country both exports and imports.

The data for this paper were extracted from the International Trade Centre (ITC) database, from 2004 to 2018 for product 220410: Sparkling wine of fresh grapes. The ITC is a subsidiary organisation of the World Trade Organisation (WTO) and the United Nations (UN), with the purpose to provide trade reports and technical assistance for developing countries (ITC 2020).

3. RESULTS AND DISCUSSION

This study identifies the major international players in the sparkling wine sector, verifying and describing their evolution in the annual growth transactions. The identification was measured in thousands of US Dollars, as follows.

3.1 Importers

In the results of the ten main importers, according to the data presented in Figure 1, it is possible to see that, although all the countries were affected by the 2009 financial crisis, the total amount of sparkling wine imports increased over the period analysed.

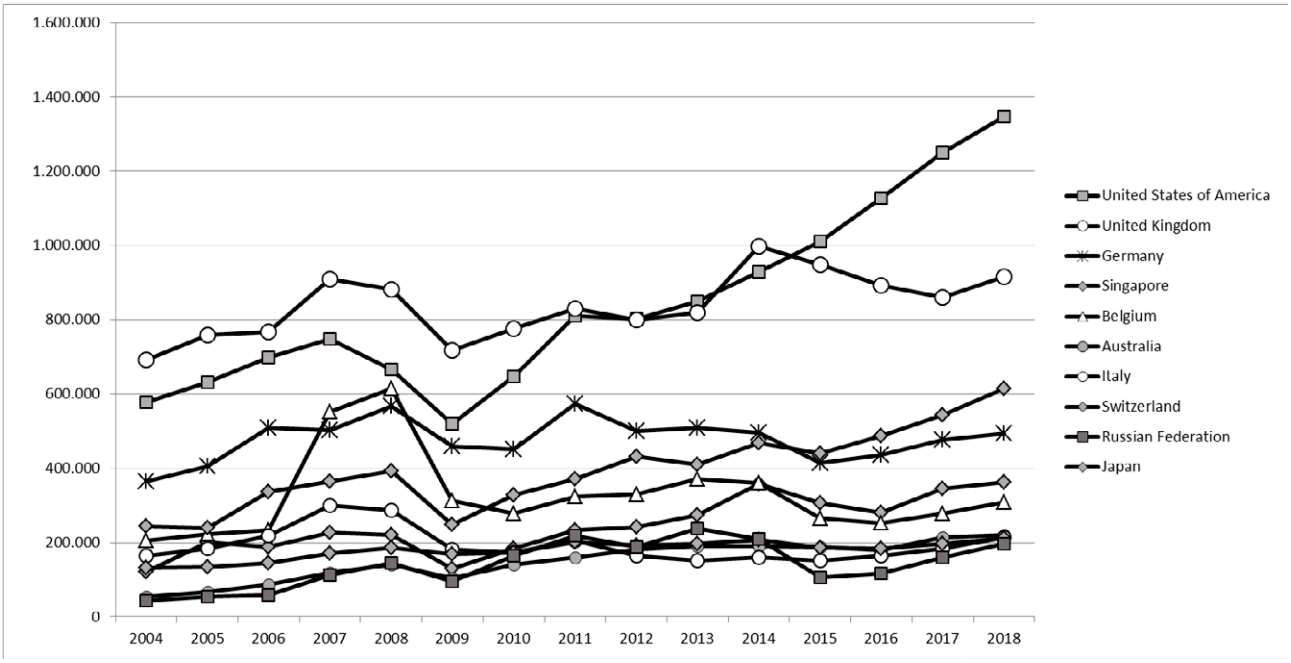

Figure 1. Top 10 importers (US$) of sparkling wine, 2004-2018. Source: Our own calculations based on ITC data.

The USA is the world's largest importer of sparkling wine, followed by the UK. Prior to 2014, the UK had led, but the two countries changed position, and, ever since, the USA has remained in first place. Its imports have grown continuously, and its annual average growth rate was 8.83% during the period under analysis, as presented in Table 1.

Like the UK and the USA, albeit presenting smaller values, Germany, Japan, Singapore and Belgium have also changed their positions over the period. It is also noteworthy that Singapore (13.36%) and Japan (10.14%) were third and fourth respectively in terms of annual average growth rate.

The Russian Federation, experienced its highest average annual growth (23.06%), mainly due to increasing imports of Italian sparkling wine, as described by Crescimanno and Galati (2014). This was followed by Australia, which had increased its imports due to a drop in domestic sales of national sparkling wine (see Verdonk et al., 2017), thus presenting an average annual growth of 20.38%.

Table 1. Annual average growth (US$) of the Top 10 sparkling wine importers.

	2004	2018	Difference	Annual average growth (%)
USA	578,649	1,348,136	769,487	8.83
UK	691,460	916,638	225,178	2.17
Japan	244,031	615,558	371,527	10.14
Germany	364,751	493,531	128,780	2.35
Singapore	120,879	363,299	242,420	13.36
Belgium	205,837	308,859	103,022	3.33
Australia	54,394	220,742	166,348	20.38
Italy	163,920	213,777	49,857	2.02
Switzerland	132,138	211,441	79,303	4.00
Russian Federation	43,907	195,843	151,936	23.06

Source: Our own calculations based on ITC data.

3.2 Exporters

The results show France as the greatest sparkling wine exporter, as seen in Figure 2. Its exports were outstanding when compared to other exporters. Throughout the period analysed, France held the largest portion of this market. Such stability can be explained by the fact that French wines attract and fascinate consumers in a way that wines from no other country do (Phillips, 2016), and their management of quality and production, combined with their promotion and distribution techniques, have placed France in the foreign market as a producer of high quality wines (Corsi et al., 2013).

The second and third places were shared by Italy and Spain. For Spain, the data showed stability, while

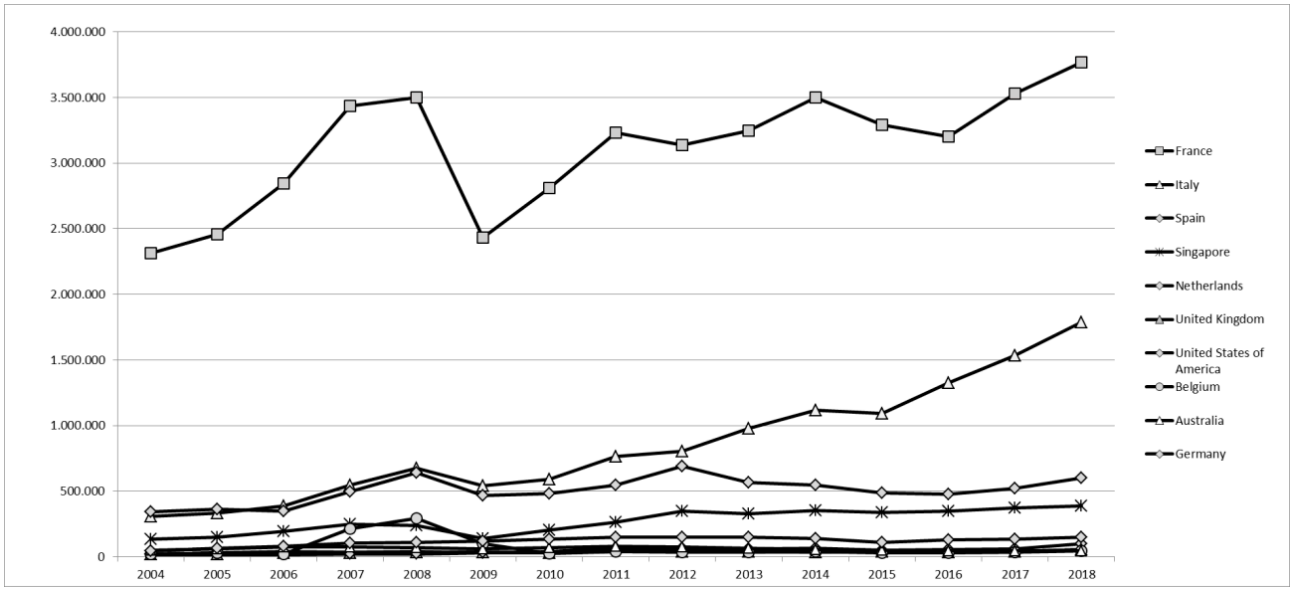

Figure 2. Top 10 exporters (US$) for sparkling wine, 2004–2018. Source: Our own calculations based on ITC data.

Italian sparkling wine exports presented a constant increase that had begun in 2005, thus remaining as the second biggest exporter.

The 2009 financial crisis affected Italy more mildly than France, causing Italian exports to fall less than the French ones. In 2011, after just 3 years, it can be seen that Italy managed to exceed its 2008 figure, and has since continued to grow steadily. France, despite remaining in first place throughout the entire analysis, only managed to surpass its 2008 exports nine years later, that is, in 2017.

It is important to note that, after the crisis, consumers' purchasing power became limited, making them opt for more affordable sparkling wines (Lero et al., 2019), but they also maintained their ties of tradition and territory (Corsi et al., 2013), which contributed to the growth of Italian and Spanish exports.

As seen in Table 2, among the largest exporters of sparkling wine, Italy enjoyed the highest average annual growth (32%) during the timeline, which was explained by Crescimanno and Galati (2014), revealing that the country knew how to take advantage of the opportunities that had arisen with the change in the international wine market. Thus, it expanded exports due to its capacity to meet a diversified demand that required high-quality wines.

Among the four largest exporters of sparkling wine, Singapore showed growth in its exports in the first four years, but it was surpassed by Belgium in 2008. In 2009, Singapore recovered, reaching fourth place, and, since then, it has kept growing steadily, while Belgian exports have remained constant, lower than Singapore's.

Table 2. Annual average growth (US$) for the Top 10 sparkling wine exporters.

	2004	2018	Difference	Annual average growth (%)
France	2,313,905	3,767,259	1,453,354	4.18
Italy	306,052	1,786,570	1,480,518	32.00
Spain	344,511	599,128	254,617	4.92
Singapore	134,019	387,163	253,144	12.59
Germany	43,356	146,955	103,599	15.92
Netherlands	21,666	97,948	76,282	23.47
UK	17,632	54,561	36,929	13.96
USA	13,629	52,712	39,083	19.11
Belgium	19,093	45,629	26,536	9.26
Australia	47,948	43,155	-4,793	-0.66

Source: Our own calculations based on ITC data.

The Netherlands, the USA, the UK and Germany also presented high annual average growth. The Netherlands was outstanding, with an annual average growth of 23.47%. On the other hand, Australia presented a decrease of almost 1% per year.

3.3 Market share and concentration of imports

As seen in Table 3, imports of sparkling wines are unconcentrated. The USA, the UK and Japan are the importers holding the three largest market shares.

Table 3. Market share and the HHI for the imports of sparkling wine.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
USA	18.2	17.6	17	14.3	11.9	12.6	14.1	14.9	14.8	14.8	14.7	17.9	19.5	19.5	19.1
UK	21.8	21.1	18.7	17.4	15.7	17.5	17	15.3	14.7	14.3	15.8	16.8	15.4	13.4	13
Japan	7.7	6.7	8.2	7	7	6	7.2	6.8	8	7.1	7.4	7.8	8.4	8.5	8.7
Germany	11.5	11.3	12.4	9.6	10.6	11.6	9.9	11	9.2	8.9	7.9	7.3	7.5	7.4	7.1
Singapore	3.8	5.6	4.6	4.3	3.9	3.1	4	4.3	4.5	4.8	5.7	5.4	4.8	5.4	5.1
Belgium	6.5	6.2	5.7	10.5	10.9	7.6	6.1	6	6.1	6.5	5.7	4.7	4.4	4.3	4.4
Australia	1.7	1.9	2.1	2.3	2.5	2.5	3.1	2.9	3.4	3.3	3	3.3	3.1	3.3	3.1
Italy	5.2	5.1	5.3	5.7	5.1	4.4	3.8	3.8	3	2.6	2.5	2.7	2.9	2.9	3
Switzerland	4.2	3.7	3.5	3.3	3.3	4.1	3.8	3.7	3.6	3.5	3.3	3.3	3.2	3.1	3
Russia	1.4	1.5	1.4	2.2	2.6	2.3	3.6	4	3.5	4.2	3.3	1.9	2	2.5	2.8
HHI	1,218	1,159	1,077	962	867	883	868	854	815	793	813	925	948	899	873

Source: Our own calculations based on ITC data.

Besides these, Singapore, Australia and the Russian Federation showed considerable growth.

The USA and the UK switched their positions over the years. The UK initially held a market share of 21.8 points while the USA held 18.2. Since 2015, the UK showed a reduction in market share, while the USA increased steadily.

Japan and Germany also showed fluctuations in their market shares. Japanese market shares fluctuated until 2013, when a period of slow continuous growth began, resulting from consumption habit changes. The people began to view wine as a daily drink, and became increasingly curious about higher quality wines (Corsi et al., 2013), which generated an increase in sparkling wine consumption, especially among women (Rod and Beal, 2014). Germany, despite presenting a constant fall, starting with 11.5 points in 2004 and experiencing fluctuations between 2006 and 2011, continued to be a strong importer, due to having sparkling wine as an occasional celebratory beverage (Dressler, 2018). According to Szolnoki and Hoffmann (2014), it was one of the few countries in the world that had very diversified structured distribution channels, offering a wide variety of purchase points for the German sparkling wine consumer.

Singapore, Australia, and the Russian Federation have experienced remarkable growth. Singapore's market share started at 3.8 points in 2004 and closed at the end of the analysis with 5.1 points. Australia started with 1.7 points and finished at 3.1. Notably, the Russian Federation doubled its market share, which went from 1.4 points in 2004 to 2.8 in 2018.

The results for HHI, throughout the timeline analysed, revealed that the market structure remained unconcentrated. In 2004, the index was 1,218, and, in 2018, it was 873, i.e., a total deconcentration of approximately 30%.

3.4 Market share and concentration of exports

Unlike imports, sparkling wine exports were concentrated. Analysing Table 4, it can be seen that the three largest exporters were France, Italy and Spain, totalling about 83% of the sparkling wine exportation in 2018. It is also noted that Singapore, Germany, the Netherlands, the USA and Australia showed significant changes.

France was the largest exporter of sparkling wine and remained stable in first place throughout the entire period. Its market share was the only one that exceeded the average of 50 points, confirming its greater capacity to create added value in international markets, a fact also identified in Lombardi et al. (2016).

With an emphasis on the evolution of the Italian sparkling wine market shares, it can be noted that they almost tripled, starting at 9.1 points and ending at 24.4 in 2018. The results show that, although the Italy figure grew, France underwent a significant decrease. Thus, it means that Italy increased its market share substantially based on France's decrease. Other countries, like Spain, had a lower increase or decrease in exportation.

The HHI for exports showed an equal decrease in imports, reducing by about 30%. In 2004, it was 4,930 and in 2018 it was 3,342, indicating that, despite the reduction in its concentration, the sparkling wine export market remained highly concentrated.

3.5 Relative position in the market

Table 5 contains the RPM (Lafay et al., 1999) calculations for the 10 largest world exporters of sparkling wine. Analysing Table 5, it is possible to identify two players that held significant market positions, above 10 points, as follows:

Table 4. Market participation and the HHI for the exports of sparkling wine.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
France	68.7	67.4	68.4	63.6	59.3	58.5	60.4	58.1	54.7	55.3	55.6	56.9	53.8	53.5	51.4
Italy	9.1	9.1	9.3	10.2	11.4	13	12.6	13.7	14	16.6	17.9	18.9	22.3	23.1	24.4
Spain	10.2	9.9	8.4	9.2	10.9	11.3	10.4	9.8	12.1	9.6	8.7	8.4	7.9	7.8	8.2
Singapore	3.9	4	4.7	4.6	4	3.4	4.4	4.8	6	5.6	5.6	5.8	5.8	5.6	5.3
Germany	1.3	1.7	1.9	1.9	2	3	2.8	2.8	2.6	2.5	2.3	1.9	2.1	2	2
Netherlands	0.6	0.9	1	0.7	0.7	0.7	0.9	1.1	1.1	1	1	0.8	0.9	0.9	1.3
UK	0.5	0.6	0.7	0.6	0.6	0.8	0.6	1.4	0.7	0.7	0.6	0.7	0.6	0.6	0.7
USA	0.4	0.4	0.3	0.4	0.4	0.7	0.6	0.7	0.7	0.8	0.6	0.6	0.6	0.6	0.7
Belgium	0.6	0.8	0.5	4	5	2.3	0.5	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.6
Australia	1.4	1.6	1.7	1.4	1.2	1.4	1.5	1.4	1.3	1.1	0.9	0.8	0.8	0.7	0.6
HHI	4,930	4,753	4,869	4,282	3,813	3,754	3,947	3,695	3,385	3,468	3,531	3,708	3,499	3,500	3,342

Source: Our own calculations based on ITC data.

Table 5. Relative position in the market, 2004-2018.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
France	34.84	33.42	33.91	31.82	29.79	28.31	29.97	28.9	27.65	27.49	27.26	28.18	26.6	26.3	25.39
Italy	2.17	2.04	2.06	2.34	3.35	4.33	4.49	5.07	5.73	7.11	7.61	8.22	9.86	10.31	10.92
Spain	4.55	4.06	3.23	2.87	3.67	4.55	4.3	4.07	5.5	4.17	3.57	3.35	3.18	3.13	3.28
Singapore	0.2	-0.73	0.08	0.21	0.16	0.13	0.21	0.29	0.92	0.44	-0.05	0.26	0.57	0.18	0.16
Germany	-4.91	-4.74	-5.22	-3.77	-4.25	-4.3	-3.44	-4.07	-3.13	-3.1	-2.83	-2.65	-2.64	-2.62	-2.42
Netherlands	-0.56	-0.04	-0.66	-0.87	-0.85	-0.76	-0.56	-0.56	-0.45	-0.39	-0.5	-0.43	-0.35	-0.32	-0.22
UK	-10.3	-10.19	-8.92	-8.27	-7.35	-8.28	-8.1	-6.82	-6.8	-6.71	-7.66	-7.95	-7.33	-6.26	-5.99
USA	-8.64	-8.53	-8.29	-6.85	-5.59	-5.94	-6.68	-7.01	-6.81	-6.92	-7.08	-8.53	-9.3	-9.26	-9
Belgium	-2.85	-2.67	-2.57	-3.16	-2.79	-2.62	-2.75	-2.57	-2.64	-2.9	-2.56	-2.06	-1.87	-1.86	-1.82
Australia	-0.09	-0.11	-0.18	-0.42	-0.6	-0.53	-0.76	-0.73	-0.96	-1.08	-1.08	-1.22	-1.45	-1.3	-1.23

Source: Our own calculations based on ITC data.

- France: from the analysis, it is possible to observe a fall of 9.45 points in French RPM. The highest mark was in the first year (2004) with 34.84 points, and, since then, the French figures have been decreasing continuously.
- Italy: showed steady growth, starting the analysis with 2.17 points and ending with 10.92. It had the biggest observed growth among the 10 largest exporters.

Despite having experienced periods of instability, Spain sometimes surpassed Italy's marks, and, because of its lower level of specialisation (see Mariani et al., 2012), it did not follow the Italian growth, remaining in the third-largest relative market position.

3.6 Revealed Comparative Advantage

Table 6 presents the RCA (Vollrath 1991) for the 10 largest world exporters of sparkling wine. France had the highest values for the revealed comparative advantage, starting at 15.11 points, and, despite fluctuations, it showed a slight growth over the years, ending at 17.43 points.

Italy showed the largest increase in its revealed comparative advantage. At the beginning of the analysis, it presented 2.33 points and, over the years, it showed continuous growth, without fluctuations, ending at 8.64 points. Thus, Italy tripled its revealed comparative advantage from 2004 to 2018.

Spain started the analysis with marks higher than those of Italy, but, throughout the years, however, Italian values underwent continuous growth. Spain did not have the same flow, thus, since 2013, Italy remained con-

Table 6. Revealed Comparative Advantage, 2004-2018.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
France	15.11	16.05	17.07	16.31	15.92	15.57	17.81	17.95	18.02	18.3	18.6	18.9	17.5	17.8	17.4
Italy	2.33	2.52	2.67	2.8	3.37	3.95	4.27	4.74	5.13	6.06	6.38	6.79	7.12	8.05	8.64
Spain	5.09	5.3	4.9	5.2	6.21	6.23	6.36	5.95	7.75	5.83	5.17	4.96	4.51	4.29	4.78
Singapore	1.82	1.81	2.04	2.12	1.89	1.53	1.87	2.07	2.66	2.49	2.56	2.66	2.74	2.61	2.47
Germany	0.12	1.81	0.19	0.19	0.2	0.03	0.03	0.03	0.34	0.32	0.12	0.23	0.25	0.24	0.25
Netherlands	0.18	0.25	0.29	0.19	0.2	0.2	0.26	0.38	0.36	0.33	0.34	0.31	0.33	0.31	0.44
UK	0.13	0.15	0.18	0.17	0.19	0.27	0.21	0.49	0.26	0.24	0.2	0.23	0.21	0.24	0.29
USA	0.04	0.04	0.03	0.04	0.04	0.07	0.07	0.08	0.08	0.09	0.07	0.06	0.06	0.06	0.08
Belgium	0.16	0.24	0.15	1.27	1.68	0.77	0.19	0.27	0.25	0.21	0.24	0.2	0.21	0.2	0.25
Australia	1.49	1.57	1.69	1.34	1.02	1.14	1.07	0.95	0.9	0.81	0.65	0.71	0.65	0.5	0.44

Source: Our own calculations based on ITC data.

Table 7. Net Export Index for the main sparkling wine exporters.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
France	0.96	0.96	0.97	0.96	0.96	0.92	0.96	0.96	0.96	0.96	0.95	0.95	0.94	0.94	0.94
Italy	0.3	0.28	0.28	0.29	0.4	0.49	0.54	0.57	0.66	0.73	0.74	0.75	0.77	0.78	0.78
Spain	0.76	0.69	0.62	0.44	0.49	0.67	0.69	0.69	0.79	0.75	0.69	0.65	0.64	0.64	0.65
Singapore	0.05	-0.15	0.01	0.04	0.04	0.04	0.05	0.06	0.17	0.08	-0.01	0.04	0.1	0.03	0.03
Germany	-0.78	-0.73	-0.73	-0.66	-0.69	-0.59	-0.54	-0.59	-0.53	-0.55	-0.55	-0.58	-0.54	-0.56	-0.53
Netherlands	-0.45	-0.34	-0.4	-0.56	-0.54	-0.51	-0.39	-0.33	-0.28	-0.27	-0.32	-0.33	-0.27	-0.26	-0.14
UK	-0.95	-0.94	-0.92	-0.93	-0.92	-0.91	-0.93	-0.82	-0.9	-0.9	-0.93	-0.92	-0.92	-0.9	-0.88
USA	-0.95	-0.95	-0.96	-0.94	-0.93	-0.89	-0.91	-0.9	-0.89	-0.89	-0.91	-0.93	-0.93	-0.93	-0.92
Belgium	-0.83	-0.76	-0.83	-0.43	-0.35	-0.52	-0.83	-0.77	-0.8	-0.83	-0.8	-0.8	-0.77	-0.78	-0.74
Australia	-0.06	-0.06	-0.09	-0.23	-0.32	-0.27	-0.33	-0.33	-0.41	-0.49	-0.55	-0.59	-0.59	-0.65	-0.67

Source: Our own calculations based on ITC data.

stant above the mark of 6 points, while Spain dropped from 5.09 points in 2004 to 4.78 in 2018.

Singapore's growth was relatively stable during the course of time. It is noticed, however, that, in 2005 and 2009, the country had its biggest falls, below the initial mark of 1.82 points. The highest mark was registered in 2017 at 2.74 points. On the other hand, Australia showed different behaviour from other significant countries. Despite starting in a position similar to Singapore, with 1.49 points, and showing growth in 2005 and 2006, it started, in 2007, to undergo a period of instability and decline, as it increased its sales volume to the detriment of quality (Corsi et al., 2013), ending with 0.44 points in 2018.

3.7 Net Export Index

The Net Export Index – NEI allows a better understanding of the commercial characteristics of the nations under this sparkling wine analysis. The NEI fluctuates between -1 (where the nation only imports the product) and 1 (where the nation only exports the product). When the index reaches 0, the nation both imports and exports the product (Banterle and Carraresi, 2007). Table 7 contains the NEI values for the main sparkling wine exporters.

The results presented in Table 7 reveal that some countries' positions as producers or consumers were well established. However, the results also confirm Mariani et al. (2012) and Pomarici (2016), which shows that re-exportation is a common action in the sparkling wine sector, specifically:

- France: Strong tendency to export. Features: fluctuates between its lowest mark, 0.92 points, and its highest mark, 0.97; the results indicated France as the world's largest exporter of sparkling wines.
- Italy: Shows growth in exporting, registering an overall increase of 0.48 points. The lowest registered marks were in 2005 and 2006, at 0.28 points. Since

2007, Italian marks show steady growth.

- Spain: Its net export index presented a stable line in export score.
- USA: Stable and consistent importer, the lowest marks were registered in 2009, 2012 and 2013 at -0.89, and the highest mark registered was -0.96 in 2006.
- UK: Like the USA, the UK is a stable consistent importer, fluctuating between -0.95 and -0.82.
- Singapore: Shows small fluctuation. The biggest imports mark was registered in 2005 at -0.15 points, and, in terms of exports, it was registered in 2012 at 0.17 points. Due to the proximity to the mark of 0, it can be inferred that Singapore was a re-exporter. As an important transportation hub, sparkling wines from the main producing countries passed through Singapore before heading to southwest Asia and Japan (Rod and Beal, 2014).
- Australia: The country's figures showed that, in the first year of the analysis, it was classified as a re-exporter. However, during the period, it is noted that the Australian NEI moved from 0 to -1. In 2018, the Australian NEI was -0.67, classifying Australia as a sparkling wine importer. Despite being a large importer, mainly of French Champagne (Culbert et al., 2016), Australia presented a continuous contraction of its commercial specialisation (Galati et al., 2017). Domestic sales of Australian sparkling wine fell due to increased international competition and unfavourable exchange rates. Thus, it was concluded there was an increase in the volume of imported wine (Fleming et al., 2014; Verdonk et al., 2017).

4. CONCLUSIONS

This paper analysed the sparkling wine industry in terms of its competitiveness and international market structure. France was the largest exporter of sparkling wines in the world. The marks of its main competitors (Italy and Spain, respectively 23.1% and 7.8% of the market share in 2018) were far lower than those of France (51.4% of the market share in 2018). On the other hand, the USA (19.5% of the market share in 2018) and the UK (13.4% of the market share in 2018) were the principal importers.

Regarding the HHI, the all the results are lower than 1,500, revealing that the sparkling wine import market was unconcentrated. Thus, when comparing the number of competitors that have the largest market shares, it can be said that the sparkling wine import market was more balanced than the export market. The HHI for exports showed that it remained a very concentrated market, despite the general drop of 1,588 points in its concentration. It could be inferred that the sparkling wine export market consisted of a highly concentrated market, and that the largest share of this concentration lay in a single main competitor. While for exports France had the largest share, for imports we could observe four main importers: the USA, the UK, Japan, and Singapore.

The RCA showed that the countries with the greatest comparative advantage in the international sparkling wine market were: France (17.4), Italy (8.64) and Spain (4.78), and the relative market position reveals that these were the most significant countries in the international sparkling market, which Benoît et al. (2019) called the Old World wine market.

The NEI revealed, among leading exporters, three groups of actors who are: i) stable in terms of exports based on domestic production (France, Italy and Spain) with general number above 0.5; ii) stable in trade, reflecting re-export (Singapore and the Netherlands) with general numbers between -0.4 and 0.1; iii) stable in imports, with strong domestic consumption (Germany, the UK, the USA, Australia, and Belgium) with general numbers below -0.5.

Trade based measures of competitiveness provide a realistic indicator of underlying competitiveness, but are a limitation for the period analysed, in this case 2004 to 2018. For future studies, two main goals are suggested regarding: i) the reasons why the comparative advantages in sparkling wine are changing in France and Italy, ii) the relation between old and new countries in the sparkling wine markets. For instance, does the New World sustain the Old World, and if so, why?.

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The Role of Context Definition in Choice Experiments: a Methodological Proposal Based on Customized Scenarios

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Abstract. One of the most critical points for the validity of Discrete Choice Experiments lies in their capability to render the experiment as close to actual market conditions as possible. In particular, when dealing with products characterized by a large number of attributes, the construction of the experiment poses the issue of how to express the choice question providing sufficient information. Our study verifies the role of scenario definition in choice experiments and proposes a methodology to build customized scenarios by eliciting responses from interviewees on the main choice criteria, which makes it possible to render the conditions of the experiment more realistic. This methodology is applied to the case study of wine and is introduced by a systematic review of the Discrete Choice Experiments conducted on wine. The findings show that customized scenarios result in different preference estimates compared to the conventional approach. In particular, we found a significant decline in the importance of the price attribute, which could be attributed to a better definition of the product being evaluated. Moreover, the methodology is capable of gathering information on the decision-making process that would otherwise remain unobserved and that can be used for a better segmentation analysis.

JEL: D12, Q13.

Keywords: choice-based conjoint, choice modeling, experimental design.

1. INTRODUCTION

The market potentials of new product attributes were assessed by means of various methodological approaches including discrete choice experiments (DCEs), which are the most widely used stated preference method in the literature of applied economics and marketing (Hensher, 2010; Lancsar and Louviere, 2008; Louviere et al., 2000). This methodology consists of an attribute-based measure of benefit and is built on the hypothesis that any product can be described by its attributes and be assessed via the levels of the attributes themselves (Ryan, 2004).

The DCEs are conducted by means of interviews that seek to reproduce a choice situation as close as possible to that of a real purchasing decision (Ben-Akiva et al., 2019). The interviewee is presented with several product alternatives that differ by the different levels of the attributes considered. The choice of these attributes and levels is a crucial point in carrying out the DCE. This issue becomes particularly important when dealing with complex products (such as wine, beer, motor vehicles, and property), the valuation of which is subject to a large number of stimuli. In fact, while considering many elements of value to describe the products can, on one hand, render the experiment more realistic, on the other hand, a large number of attributes and levels makes the experimental design difficult to manage (Hoyos, 2010), increases the variance of the error term, and entails a cognitive effort for the respondent that can become an error of evaluation (Arentze et al., 2003; Caussade et al., 2005). Moreover, it is also fundamental to not omit the attributes that are important for the majority of consumers, so as to avoid overestimating the importance of the attributes included in the choice task (Boncinelli et al., 2017; Casini et al., 2009; Corduas et al., 2013), and to avoid respondents making inferences about omitted attributes without the researcher being able to have information about them (Lancsar and Louviere, 2008). In this regard, Ben-Akiva et al. (2019) point out that the presentation of incomplete product profiles in the DCEs is a widespread issue among scholars. The same authors claim that the resulting fill-in problem puts the interviewees in the condition of making unrealistic and heterogeneous assumptions about missing attributes.

Many studies have tackled this issue defining in greater detail the context of reference where the actual choice is made. In this manner, the attributes considered important, but that are not included in the experiment, are described in context by the researcher, and therefore represent a scenario shared by all choices and all respondents. This solution presents some difficulties, however. In fact, when dealing with complex products, an excessively detailed description of the scenario can lead to high rates of no-choice, as excessively specific products are proposed that may not prove interesting to many consumers. Furthermore, scenarios with too many details would lead to creating an experiment that would be valid only for specific cases, and therefore, incapable of assuming a general value.

In order to make the experiment as realistic as possible, Ben-Akiva et al. (2019) recommend building it so as to maintain the same complexity of the real market in defining the products, possibly also incorporating the filtering heuristics in the choice of the product. Indeed, as pointed out by Swait and Adamowicz (2001), in a real market where goods comprise many attributes, consumers often adopt filtering heuristics that consists of screening out products that fail to pass thresholds on selected attributes.

In view of making a contribution to these issues, our study proposes a methodology to build the choice experiment in which defining the scenario is based on what each interviewee states about the attributes and levels considered for the choice of the product being analyzed, according to a procedure analogous to that of filtering heuristics. It is thereby possible to obtain a choice scenario tailored to respondents' behavior. In literature, the studies that have attempted to adapt the experiment to the respondents have modified the attributes of the choice sets, applying the Adaptive Choice Experiments or Menu Choice methodologies (Contini et al., 2019; Liechty et al., 2001; Toubia et al., 2004; Yu et al., 2011). In the ambit of environmental economics, the personalization of the experiment concerned the status-quo option (see, as example, Ahtiainen et al., 2015). To our knowledge, however, there are no studies that have worked on personalizing the choice scenario, which makes our proposal the first contribution in this sense.

The article illustrates this proposal of methodology applied to the case study of wine. The choice of wine derives from the consideration that it is a complex product whose preferences depend on an abundance of extrinsic and intrinsic attributes (Charters and Pettigrew, 2007; Contini et al., 2015; Oczkowski and Doucouliagos 2015; Schmit et al., 2013). The literature review presented in the following section illustrates the way these attributes were used in building the choice experiments on wine.

In our DCE, besides the attributes used in the choice sets, the scenario was described leaving the interviewees free to choose the attributes they felt were most important from among the principal attributes of literature. Using a mixed logit model, the results of this approach are compared with those obtained by applying the conventional methodology in which the researcher chooses a priori the elements to define the scenario. Moreover, the information collected on the choice criteria of the interviewees can be utilized for further analyses on consumer behavior. In our case, for example, this information was used to obtain a more meaningful segmentation by a latent class analysis. In the discussions section, a critical analysis is performed on the methodology and several suggestions are made for a further development of studies.

2. LITERATURE REVIEW

We conducted a systematic review of the articles published on the study of wine preferences from 1998 to 2019 by applying DCEs. Relevant articles were identified and gathered from two scientific article databases (Scopus, Web of Science) and a web search engine (Google Scholar) by means of using the following keywords: "choice experiment" AND "wine", "choice modeling" AND "wine", "discrete choice" AND "wine". We selected only articles published in journals indexed in WOS and Scopus, excluding conference proceedings.

We found a total of 35 studies. The various attributes that appeared in the selected articles were reclassified in the following 15 categories: "alcohol content"; "awards" includes awards and mentions in guidebooks; "brand" includes the indication of the producer, bottler, and brand notoriety; "format" includes characteristics like bottle capacity and shape; "functional properties" concerns the presence of information on health benefits; "price"; "production methods" conveys information on the production process, including various certifications of an environmental nature, such as organic; "promotion" states whether a discount is offered; "protected geographical indication" includes the geographic indications of different countries and regions like, for example, the DOCGs in Italy or the AOCs in France; "region of production"; "sulfites" i.e. the absence of added sulfites; "taste", such as, for example, fruity, sweet, tannic, and full-flavored; "typology" includes the typologies red/white, still/sparkling, the grape variety, and the name that identifies the wines, such as, for example, Chianti or Champagne; "winery distinctiveness" includes information about the producer, such as company history, label graphics, and company web site; "consumption advice" includes advice to enhance the consumption experience by means of pairings with particular dishes, and indications on the best modalities for enjoying the wine, such as, for example, the serving temperature.

In addition to these elements, we also examined the "occasion", which is to say the special or usual situation of consumption, at home or with friends, insomuch as the preference for the attributes evaluated in the DCEs also depends on the situational variables connected with the social and physical environment in which the wine is consumed (Boncinelli et al., 2019).

The experiments reviewed utilized the aforesaid categories either to describe the choice context, which is to say the scenario defined by the researcher and shared by all of the choice sets, or as attributes that characterize the alternatives in the choice set. The different use in the choice experiment is synthetically illustrated in Table 1, where "C" means that the element is used in describing the context, and "A" indicates that the attribute describes the choice option.

In addition to price, the review shows that the category most utilized in the literature is wine "typology", which is found in experiments both as a choice attribute (17 articles) and as a context (13 articles). To be more exact, the information on color and style (still or sparkling) is used in defining the context, while the information on grape variety or wine name are among the choice set attributes.

Next in line for frequency of use is the "region of production" (21 articles), which was always used in the DCEs as a choice attribute. Conversely, the "format" was almost always considered as a context variable (18 times out of 19). "Brand", "designation of origin", "production methods", "alcohol content", "taste", "winery distinctiveness", "acknowledgements", and "consumption advice" are less studied in the literature and are mostly treated as choice attributes. In particular, to date, no studies have used awards and the evaluation in specialized guidebooks as a context, which is to say that none have formulated a DCE in which the preference for award-winning wines is evaluated. Finally, only a limited number of studies have used choice attributes like absence of added sulfites (2 articles), nutraceutical characteristics (2 articles), and offer of discounts (2 articles). Defining the "occasion" is used as a context variable and is found in 22 articles out of 35. This description shows that almost all of the 15 categories of attributes considered are found in a consistent number of studies, thus confirming that the choice process of wine takes numerous attributes into account. The difficulty of implementing DCEs with all of the important attributes, however, has led researchers to select only a few attributes in making the experiments, inevitably reducing the realistic nature of the choice. In particular, in building the choice sets, an average of 4 categories are employed (each of which almost always represented by a single attribute), while the definition of the scenario involves, on the average, 1-2 categories more.

Our study proposes to surpass these limits by defining a methodology to create the DCE that makes it possible to take account of most of the attributes of the complex product that are considered important, guaranteeing sufficient effectiveness in developing the experiment.

3. METHODOLOGY

This section opens with a presentation of the procedure applied in our experiment; it then presents the

Table 1. Factors used in the choice experiments on wine classified as context elements (C) or as choice attributes (A).

Author(s)/ Date	Occasion	Wine Attributes													
		Alcohol content	Awards	Brand	Consumption advice	Format	Functional properties	Price	Production methods	Promotion	Protected geographical indication	Region of production	Sulfites	Taste	Typology[a]	Winery distinctiveness
Boncinelli et al. (2019)	C			A		C		A	A		A				C	
Escobar et al. (2018)	C				A	C		A				A			A	
Palma et al. (2018)		A			A	C		A		A				C	A	A
Scozzafava et al. (2018)	C					C		A							A	
Delmas and Lessem (2017)	C			A				A	A			A			C	
Ghvanidze et al. (2017)	C	A					A	A	A						C	
Huang et al. (2017)	C			A				A							C	
Williamson et al. (2017)								A				A		A	C	A
Palma et al. (2016)	C			A				A							A	
Scozzafava et al. (2016)	C					C		A							A	
Troiano et al. (2016)						C		A	A		A	A				A
Williamson et al. (2016)	C	C	A	C		C		A				A			A	A
Gassler (2015)	C		A					A	A	A		A		A	C	A
Costanigro et al. (2014)			A					A	A				A		C	
Lontsi et al. (2014)			A					A	A							
Stasi et al. (2014)		A				C		A	A				A			
Xu and Zeng (2014)	C			A	A			A				A			C	
Cicia et al. (2013)								A				A			C	
Mueller and Remaud (2013)	C	A	A	A				A	A		A			A	A	A
Kallas et al. (2013)	C		A					A				A			A	
Sáenz-Navajas et al. (2013)			A	A	A	C		A			A	A		A		A
Thiene et al. (2013)				A		C		A			A				A	
Corsi et al. (2012)	C		A		A	C		A				A		A	A	
Kallas et al. (2012)	C		A					A				A			A	
Zhllima et al. (2012)				C				A				A		A	A	
Jarvis et al. (2010)	C		A	A		C		A				A			C	
Mueller et al. (2010a)	C			A		A		A				A			C	A
Mueller et al. (2010b)	C	C		C	A	C		A	A			C		A	A	A
Mueller et al. (2010c)	C	A		A	A	C		A				A		A	A	C
Barreiro-Hurlé et al. (2008)					A	C	A	A	A			A			C	
Hertzberg and Malorgio (2008)	C			A		C		A			A				A	
Alimova et al. (2007)			A		A			A				A				
Lockshin et al. (2006)	C			A		C		A				A		A	C	
Mtimet and Albisu (2006)	C				A	C		A			A				A	
Perrouty et al. (2006)				A				A				A			A	

Notes: [a] Typology includes the type of wine (red/white, still/sparkling), the grape variety, and the names of the wines used (e.g. Chianti, Brunello di Montalcino).

econometric model employed, and ends with a description of the sample.

3.1. Experimental procedure

Our experiment was conducted in January 2018 by administering an on-line questionnaire to a sample of 600 Italian wine consumers. A company specialized in market research (Toluna Inc.) handled recruiting participants and collecting data. In particular, the experiment consisted of a DCE divided into two treatments. Following a between-subject approach, each respondent was randomly assigned to only one of the treatments. In this manner, two subsamples of 300 respondents each were formed.

We called the first treatment "limited information". It is tantamount to a conventional unlabeled DCE in which the description of the scenario conveys the information that the experiment concerned a 0.75-liter bottle of red wine for an occasion of everyday home consumption. In the second treatment, which we called "full information", every single respondent received the same information as the first treatment, plus a description of the scenario that was more detailed and consistent with his purchasing habits. The description of the scenario was based on questions asked prior to the choice experiment.

The procedure of the second treatment can be divided into 3 steps. In the first step, respondents were asked to select, from a list we drew up based on the literature review, the criteria that they normally use in choosing wine. The criteria they could select from were: the wine's region of origin, the grape variety, the brand, alcohol content, and mention in guidebooks. In the second step, for each criterion selected, the participant was asked to select their preferred option from a dropdown menu containing the principal possible alternatives (Table 2). For example, if the interviewee indicated grape variety as a choice criterion, then he was asked to select the one he habitually preferred from a list of 20 grape varieties. In the third step, the respondents participated in a DCE where the choice scenario was defined on the basis of the information collected in phases 1 and 2. In other words, the respondents received a choice scenario "personalized" to their purchasing habits. In this manner, we were able to work around the problem that each respondent could make inferences about the attributes important for them but not included in the choice experiment and that the researcher could therefore not survey.

By way of example, the respondent who selected Tuscan wines produced from the Sangiovese grape variety and with an alcohol content of 13° performed the choice experiment reported in Fig. 1.

Table 2. Information to form the choice scenario.

Criteria	Available Options
Origin	Abruzzo, Basilicata, Calabria, Campania, Emilia Romagna, Friuli-Venezia Giulia, Lazio, Liguria, Lombardy, Marche, Piedmont, Apulia, Sardinia, Sicily, Tuscany, Trentino Alto Adige, Umbria, Valle d'Aosta, Veneto, International wine.
Grape variety	Aglianico, Barbera, Bardolino, Bonarda, Cabernet, Cabernet Sauvignon, Cannonau, Corvina, Dolcetto, Gutturnio, Lambrusco, Merlot, Montepulciano, Morellino, Negroamaro, Nero D'Avola, Primitivo, Sangiovese, Syrah, Teroldego, Other
Brand	Well-known, Unknown
Alcohol content	Less than 12%, 12%, 13%, 14%, 15%, more than 15%
Mention in guidebooks	Mentioned, Not mentioned

Figure 1. Example of a choice experiment.

Imagine you need to purchase a 0.75-litre bottle of red wine from Tuscany, made from the Sangiovese grape variety and with an alcohol content of 13% for everyday consumption (which is to say not tied to special occasions). In each choice set, from among the alternatives proposed, choose the one you would purchase. In the event that none of the alternatives is to your liking, you can select the no-choice option

The attributes included in the choice tasks, identical for the two treatments, number 4 (Table 3). The first attribute concerns the organic production method with two levels: conventional (the product does not have an organic certification) and organic (the product carries the European logo concerning organic certification). The second attribute concerns sulfites with two levels: contains sulfites, no sulfites added. The third attribute considered concerns the geographical indications (GI). The levels of GI are those regulated by the Italian classification system of GI wine (Italian Law 238/2016). The levels utilized for the GIs are: DOCG (Designation of

Table 3. Attributes and levels in the choice experiment.

Attributes	Levels
Organic claim	Organic, none
No sulfites added	No sulfites added, contains sulfites
Geographical indications	DOCG, DOC, IGT, none
Price	€2, €6, €10, €14

Controlled and Guaranteed Origin), DOC (Designation of Controlled Origin), and IGT (Typical Geographical Indication). The DOCG wines are subjected to stricter regulations than the DOC wines. The DOC wines instead respect stricter regulations than the IGT wines. Finally, the fourth attribute is price with 4 levels: € 2, € 6, € 10, € 14.

Each respondent was required to answer 8 choice questions, indicating in each choice task their preferred wine between two product alternatives that differed by attribute levels. Each choice task also included a no-buy option. The experimental design was done by means of the Ngene software version 1.1.2, applying an orthogonal fractional design.

3.2. Econometric model

DCEs have their theoretical foundations in Lancaster's consumer theory (1966), which postulates that the utility deriving from the consumption of a certain good is a function of the same good's characteristics. We can therefore model the product's utility in function of the attributes included in the choice tasks and handle the information collected with the DCE by means of a mixed logit model (Train, 2009) that takes account of the unobserved heterogeneity across the sample.

The utility function of the individual i obtained from the choice alternative j in the choice task t is as follows:

$$U_{ijt} = ASC + \alpha PRICE_{ijt} + \boldsymbol{\beta}'_i \mathbf{x}_{ijt} + \varepsilon_{ijt} \quad (1)$$

where *ASC* is an alternative-specific constant that represents the no-buy option; α is the marginal utility of the price; PRICE represents the price levels offered to the respondent to purchase a bottle of wine; $\boldsymbol{\beta}_i$ is the vector of utility parameters for participant *i*; $\mathbf{x}_{ijt}$ is the vector of the wine's attributes and their levels with respect to alternative *j*, individual *i* and choice task *t*. Finally, ε_{ijt} is an unobserved random term. In the specification of our model, PRICE and ASC have been estimated as fixed coefficients, while the coefficients of the other attributes (organic certification, sulfites, and GI) have been assumed as independently distributed following a normal distribution. Therefore, in addition to the median effect, for each attribute, a standard deviation was estimated for each of the random components. The model has been estimated by STATA 15.1. We used the mixed logit model to compare the results of our approach with those obtained by applying the conventional methodology in which the researcher chooses a priori the elements to define the scenario.

We then created a latent class model (LCM) in order to provide an example of how the information obtained with our proposed procedure can be used to obtain a more meaningful segmentation. The LCM represents the semi-parametric version of a mixed model inasmuch as heterogeneity has a discrete distribution with C mass points, where C represents the number of classes with which the model is estimated (Greene and Hensher, 2003; Hynes and Greene, 2016). The LCM considers that every single individual belongs to a specific latent class c, where c = 1, ..., C; where all of the individuals belonging to that class have homogeneous preferences but are heterogeneous with respect to the individuals belonging to other classes. We can therefore write that following Greene and Hensher (2003), the probability that individual *i* in the choice task *t* chooses the alternative *j* among the *J* alternatives is:

$$P_{ijt} = \sum_{c=1}^{C} \pi_{ic} \frac{\exp(\boldsymbol{\beta}'_c \mathbf{x}_{ijt})}{\sum_{j=1}^{J} \exp(\boldsymbol{\beta}'_c \mathbf{x}_{ijt})} \quad (2)$$

where β_c is the vector of utility parameters of class *c*. The model estimates the parameters of the attributes for each class, as well as the probability of each individual π_{ic} to belong to a specific class *c*. This process too, can be modeled as a multinomial logit (Greene and Hensher, 2003; Ouma et al., 2007; Wu et al., 2019):

$$\pi_{ic} = \frac{\exp(\mathbf{z}_i' \boldsymbol{\gamma}_c)}{\sum_{c=1}^{C} \exp(\mathbf{z}_i' \boldsymbol{\gamma}_c)} \quad (3)$$

where $\mathbf{z}_i$ is the vector of the respondent's observed individual characteristics and γ_c is the parameter vector for consumers in class *c*. In our case, $\mathbf{z}_i$ represents the criteria that respondents stated they normally use in choosing wine, which is to say the information collected in the first step of the experimental procedure with the full information group.

Table 4. Sample composition (%).

	Limited information scenario	Full information scenario	Prob.>Chi²
Gender			
Male	48.67	49.00	
Female	51.33	51.00	0.93
Age			
18–34 years	24.00	23.00	
35–54 years	35.67	36.33	
55–80 years	40.33	40.67	0.95
Education			
Primary education	7.67	7.67	
Secondary education	49.67	55.00	
Tertiary education	42.67	37.33	0.06
Geographical area			
Northern Italy	46.67	47.00	0.99
Central Italy	18.33	18.00	
Southern Italy and Islands	35.00	35.00	

3.3. The sample

Six hundred Italian respondents filled in the questionnaire, 300 for each treatment. All participants were screened to ensure they were over 18 years of age and had consumed wine in the previous months. The overall sample consists of approximately 48% men and 52% women. The different age categories are well represented and most of the respondents have a secondary education. However, the consumers with a university degree are slightly over-represented. The two sub-samples have the same socio-demographic make-up as shown by the Chi-squared test (Table 4).

4. RESULTS

This section presents the choice criteria selected in the first step of the experiment, the results of the mixed logit models and the latent class analysis.

4.1. Choice criteria

Table 5 reports the frequencies with which respondents chose criteria in the course of the first step of the experiment. The information most used is origin, indicated by 77% of the respondents, followed by brand, selected by approximately 69% of the interviewees. Guidebooks are utilized by just over one-fifth of the sample and represent the criterion used less frequently.

Table 5. Frequencies with which the respondents chose criteria in the course of the first step of the experiment.

Attributes	Relative frequency (%)
Origin	77.00
Brand	69.33
Alcohol content	50.00
Grape variety	49.67
Mention in guidebooks	21.67

As interviewees were given the possibility to choose one or more criteria, an overall 30 combinations were chosen, the first 10 of which represent 73% of all of the respondents (Fig. 2). The combination of origin and brand is the most numerous, and is utilized by almost 14% of respondents. The successive combinations add to these two criteria, alcohol content and grape variety.

The group of respondents that utilizes all 5 criteria (8.7%) is quite consistent, while the groups that use a single criterion are few. Among these, the most conspicuous is in fact the group that only considers origin, which represents only 4% of respondents.

The results of this first explorative analysis confirm that the choice of wine is very complex, that there are large differences between consumers, and that defining the product in creating the choice experiment can therefore be critical.

4.2. Likelihood ratio tests for pooled models

To test whether the coefficients between the two models are equal, we used the likelihood ratio (LR) test. The LR test is calculated as:

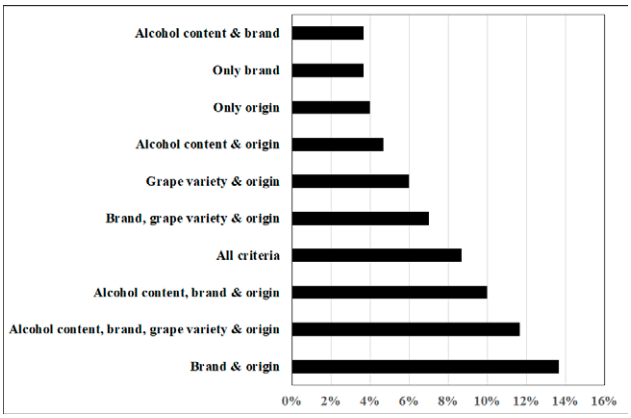

Figure 2. Frequencies concerning the first 10 combinations of the habitual choice criteria.

Table 6. Results of the log-likelihood ratio tests.

	Preference Space Model	WTP Space Model
Log likelihood limited information scenario	-2011.78	-1969.72
Log likelihood full information scenario	-2040.38	-1969.69
Log likelihood pooled model	-4065.40	-3951.07
LR test statistics	26.49	23.31
Degrees of freedom	12	13
p-value	0.009	0.039

$$LR = -2(LL_{pooled} - (LL_{lim\_info} + LL_{fullinfo})) \quad (4)$$

where LL_{lim_info} is the log-likelihood of the model applied to the sub-sample with limited information, $LL_{fullinfo}$ is that of the model for the group that received the treatment with full information, while LL_{pooled} is the log-likelihood pertaining to the pooled model. The LR test has a Chi squared distribution with a number of degrees of freedom equal to the difference of the number of parameters. Table 6 reports the results of the LR test calculated both with a model specified in the utility space and with a model specified in the WTP space. The latter model serves to make sure that the results are the same in both of the specifications and to take into account the scale heterogeneity between the two sub-samples. For both of the models, the LR statistics do not significantly exceed the critical values. Based on this outcome, we can affirm that the results between the two sub-samples are different.

4.3. Parameter estimates

Table 7 reports the results of the mixed logit models for the limited information scenario, the full information scenario, and the pooled model.

In both scenarios, the parameters of the attributes are 99% significant and bear the expected signs. With the exception of that of the IGT with limited information, the coefficients associated with the standard deviations are also all significant, which indicates a substantial heterogeneity in consumer preferences with respect to the attributes considered in the model. Specifically, the coefficient of the no-buy option is negative in both models, which indicates that the consumers receive a greater utility from choosing at least one of the options presented compared to the no-choice option. As expected, the coefficient of price is negative for both of the scenarios, indicating that the increase in price corresponds to a decrease in consumer utility. For this parameter, the magnitude is substantially different in the two scenarios, -0.10 for the limited information scenario compared to -0.05 for the full information scenario, indicating the lesser role of the price attribute in the utility function in the latter case.

Table 7. Results of the mixed logit models.

Attributes	Limited Information Scenario			Full Information Scenario		
	Coef.		95% C.I.	Coef.		95% C.I.
Random parameters in utility functions						
Organic	0.41	***	(0.11; 0.71)	0.37	***	(0.09; 0.65)
No sulfites added	1.79	***	(2.02; 1.55)	1.73	***	(1.98; 1.48)
IGT	0.77	***	(0.47; 1.06)	0.92	***	(0.62; 1.22)
DOC	0.94	***	(0.6; 1.27)	0.93	***	(0.61; 1.25)
DOCG	0.68	***	(0.43; 0.93)	0.73	***	(0.49; 0.98)
Non-random parameters in utility functions						
Price	-0.10	***	(-0.13; -0.08)	-0.05	***	(-0.08; -0.03)
No-buy	-1.36	***	(-1.71; -1.01)	-0.96	***	(-1.29; -0.62)
Standard deviation						
Organic	0.94	***	(0.74; 1.13)	0.46	***	(0.19; 0.74)
No sulfites added	1.20	***	(0.96; 1.43)	1.42	***	(1.17; 1.67)
IGT	-0.12		(-1.04; 0.79)	0.66	***	(0.29; 1.03)
DOC	0.94	***	(0.64; 1.24)	0.53	***	(0.15; 0.91)
DOCG	-0.85	***	(0.53; 1.17)	0.91	***	(0.61; 1.21)
Observations			7,200			7,200
BIC			4130.14			4187.35
AIC			4047.55			4104.77

Notes: Asterisks indicate the following significance levels: *= 10%; **= 5%; ***= 1%.; Coef. = Coefficient; C.I. = Confidence interval.

The parameters of the other attributes' levels all prove to be positive in both of the scenarios, thus indicating that the consumers prefer wines without added sulfites, with geographical indication, and organic. In particular, the absence of added sulfites is the parameter with the greatest magnitude and thus constitutes the characteristic that on a par with other conditions confers greater utility to wine.

From the analysis of the confidence intervals, we can also note that the two models substantially differ only by the parameter of price. Indeed, as we have already pointed out, the coefficient of price for the full information scenario is about half that of the limited information scenario, and the confidence intervals in the two models do not overlap.

To further verify the determinants of the differences between the two sub-samples, a new model was performed on the pooled sample, inserting variables of

Table 8. Results of the mixed logit model with treatment interactions.

Attributes	Coefficient		*z*-value
Random parameters in utility functions			
Organic	0.39	***	2.65
No sulfites added	1.80	***	15.62
IGT	0.80	***	5.37
DOC	0.92	***	5.51
DOCG	0.67	***	5.25
Non-random parameters in utility functions			
Price	-0.10	***	-9.35
No-buy	-1.33	***	-7.50
Treatment*Price	0.04	***	3.00
Treatment*No-buy	0.33		1.37
Treatment*Organic	0.01		0.06
Treatment* No sulfites added	0.07		0.48
Treatment*IGT	0.07		0.36
Treatment*DOC	0.05		0.20
Treatment*DOCG	0.07		0.41
Standard Deviation			
Organic	0.75	***	9.47
No sulfites added	1.32	***	15.19
IGT	-0.42	**	-2.00
DOC	0.77	***	6.72
DOCG	0.89	***	7.98

Notes: Asterisks indicate the following significance levels: *= 10%; **= 5%; ***= 1%.

interaction between the treatment (full information) and the attributes specified in equation 1. The results of this different specification indicate that all of the interaction variables are not statistically significant except for the interaction variable between treatment and price (Table 8). This confirms that the full information treatment affects the parameter of price, determining a significant reduction of its importance.

Notably, the interaction between the no-buy option and treatment is also not significant, which indicates that the treatment has not affected the no-choice rate during the choice experiment. Providing the respondent with a more definite scenario by means of the proposed methodology therefore does not modify the no-choice rate.

In order to test whether the treatment also had an effect on the willingness to pay, we applied a Poe (2005) test. The results reported in table 9 show that the willingness to pay of the two sub-samples differ by the attributes No sulfites added, IGT and DOCG. The difference for the willingness to pay for the DOC attribute is significant only for 10%, while the willingness to pay for the organic certification does not differ in the two treatments.

Table 9. WTP values (€ per bottle) across Treatments and Hypotheses Tests.

	Limited Information Scenario	Full Information Scenario	p-values
Organic	4.09	7.25	0.199
No sulfites added	-17.37	-33.18	0.001
IGT	7.42	17.78	0.010
DOC	9.22	18.22	0.054
DOCG	6.66	14.01	0.021

We estimated p-values using the Poe (2005) test with 1,000 Krinsky and Robb (1986) bootstrapped WTP estimates.

4.4. Latent class results

The segmentation analysis was conducted by means of a LCM with a specification of the model with respect to the same utility function as that of equation 1 and utilizing the choice criteria of each respondent as class membership variables. We have chosen the 5-class model based on the Bayesian Information Criterion (BIC), which shows an inversion between the models with 5 and 6 classes (Table 10).

The results of the LCM (Table 11) show a marked heterogeneity in consumer preferences indicated by the strong differences between classes as per significance, magnitude, and sign of the utility function parameters.

For example, the price coefficient is negative and significant for classes 1 and 3, positive and significant for classes 4 and 5, and not significantly different from zero for class 2. Organic certification is instead significant only for class 5, where it represents one of the attributes with the greatest positive impact on consumer utility. The absence of added sulfites is perhaps the most homogeneous parameter among the classes; it is indeed always significant with a positive sign even when it presents a

Table 10. Fit measures for latent class models with different numbers of classes.

Model	LL	BIC	AIC	Npar
2-Class model	-1857.609	3829.226	3755.217	20
3-Class model	-1781.949	3752.013	3629.898	33
4-Class model	-1717.814	3697.849	3527.629	46
5-Class model	-1668.261	3672.849	3454.522	59
6-Class model	-1640.347	3691.126	3424.694	72
7-Class model	-1619.769	3724.075	3409.537	85

Notes: LL = Log-likelihood; BIC = Bayesian Information Criterion; AIC = Akaike Information Criterion; Npar = Number of parameters.

Table 11. Latent class model results.

Attributes	Class 1	Class 2	Class 3	Class 4	Class 5
Utility Function Coefficients					
Price	-0.11 ***	-0.04	-0.45 ***	0.19 ***	0.18 ***
No-buy	-3.85 ***	-3.06*	-1.96 ***	0.23	4.04 ***
Organic	1.14	0.96	-0.58	-0.25	2.91 ***
No sulfites added	0.33 **	4.65 **	1.46 ***	0.50 ***	4.74 ***
IGT	0.76	1.74	1.67 ***	0.96 **	2.28 ***
DOC	1.88	2.24	1.44 ***	0.79 *	3.03 ***
DOCG	1.15 ***	4.45	1.19 **	0.38	0.98 **
Class Membership Coefficients					
Constant		-1.34 **	0.44	-1.71 **	-0.29
Origin		1.34 **	0.32	1.22 **	0.15
Grape Variety		0.07	-0.30	-0.56	-0.06
Brand		0.34	-0.24	0.31	0.02
Alcohol content		-0.40	-0.66	0.31	-0.66
Mention in Guidebooks		0.56	-1.43 **	0.92	-0.76
Class Size	25%	23%	22%	17%	13%

Notes: Asterisks indicate the following significance levels: *= 10%; **= 5%; ***= 1%.

conspicuous variability of magnitude, passing from 0.33 for class 1 to 4.74 for class 5. The GI parameters always have a positive sign, but are not always significant. For example, they are all significant for classes 3 and 5, while for class 2, no indication of origin is significant. Class 1, which has the most consistent class size, has a significant preference only for DOCG wines, the top-tier certification.

The coefficients of class membership indicate the role of the different criteria in determining the probability of belonging to each class with respect to class 1. The Wald test of joint difference of parameters between classes indicates that the main predictors among the classes are origin (Wald = 9.77; p-value = 0.044) and mention in guidebooks (Wald = 16.75; p-value = 0.0022). In particular, the probability of belonging to class 2 and 4 (40% of respondents) depends significantly on the choice of origin. While respondents belonging to class 3 are consumers who, more than those of other classes, are more likely to disregard the judgement of guidebooks as a choice criteria of wine. The coefficients concerning alcohol content, grape variety, and brand are instead not statistically significant.

5. CONCLUSIONS

DCEs are a widely utilized methodology to evaluate the market potentials of new attributes of products. One of the main challenges in applying them is represented by the capability to reproduce the decision-making context in the most realistic manner possible (Ben-Akiva et al., 2019). This issue is particularly important when dealing with complex products. Their evaluation necessitates considering a great number of stimuli, and also involves a filtering heuristic, progressively screening out products that fail to pass thresholds on a selected attribute.

In the literature, creating DCEs for complex products has frequently implied the use of a large number of attributes and levels in the experimental design without, however, always succeeding in adequately reproducing the actual choice situation. Moreover, the use of a large number of attributes and levels entails important criticalities in terms of experimental design complexity and the difficulty of interviewees to reply. An enhancement of the realistic nature of the experiment can also be obtained by means of a better definition of the context in which the choice is made, but in this case, excessive detail can determine the undesired effect of a high no-reply rate, considering the fact that the product described in this manner might not prove interesting to a sufficient number of consumers.

The solution proposed here confronts this problem by means of a methodology of building the choice experiment that takes into account the actual behavior of the consumer in choosing wine. For this product, as for others with similar characteristics of complexity, the final choice derives from a filtering heuristic of the many alternative products available on the market (Swait and Adamowitcz, 2001). For example, first we choose the

color, then the grape variety, then we consider the price, and so on until we complete the range of attributes that each consumer considers important. In attempting to make the choice experiment as realistic as possible, we therefore developed a procedure to define the scenario of reference which includes all the attributes that each interviewee considers important in their decision-making process. In greater detail, in the first phase, the respondents were asked what attributes were important for them in choosing wine. Then for each attribute selected, the main alternatives were proposed, and they were asked to select the one they preferred. The mix of options indicated in this manner was then used to define the choice scenario of each interviewee. It was thereby possible to obtain a more realistic choice situation, maintain the design within acceptable limits of complexity, and also observe the specific characteristics of the product that each interviewee referred to in his choice. The capability to identify the specific preferences that the decision-making process of wine develops along constitutes an important improvement compared to traditional procedures. Furthermore, we found significant differences in the choice criteria for wine, as far as the nature and number of attributes to consider are concerned.

Applying the procedure of tailoring the scenario of reference to the individual respondent has shown that defining the choice scenario is not neutral with respect to the choices elicited in the experiment. In fact, our approach has shown preference estimates that are significantly different from those of the conventional approach, as pointed out by the LR test. These differences proved substantial for the parameter of price, indicating that a better description of wine in the scenario of reference gave rise to a reduction in the importance of the price attribute, which can plausibly be explained by the fact that the consumer is less uncertain about the definition of the two alternatives of wine to evaluate. Our outcomes are coherent with general economic theory and with earlier consumer studies which indicate that price sensitivity is a function of available information. In this regard, Alba et al. (1997) find that having more information on quality attributes reduces price sensitivity, while Nagle and Müller (2017) suggest that consumers show lower price sensitivity when they perceive specific quality features of the product. These results call for further research on the role that the specification of the choice scenario has on preference estimates. In fact, in various case studies, an issue might arise on how detailed the product definition should be, and the adopted solution might not be neutral with respect to the results, especially in terms of WTP.

Furthermore, our results point out that the use of the "region of origin" and "mention in guidebooks" criteria, in particular, contribute to defining specific segments of consumers.

It is worth mentioning that the information acquired through the methodology proposed is greater than the information used in this paper. The numerousness of the choice options utilized by respondents, however, was such that given the size of the sample, it did not permit more in-depth segmentation analyses.

The type of approach utilized does not allow us to identify econometric indicators that define whether the procedure we propose has greater statistical properties than the traditional procedure. From the practical point of view, however, the possibility to avail ourselves of individual information on the choice criteria and on the preferred options for each choice criterion represents an important element for a better understanding of the decision-making process, and can also be used for further segmentation analyses, as proposed in the article.

In conclusion, this article represents a first contribution to achieving a more realistic decision- making context by improving the choice scenario definition in DCEs. Overall, the proposed solution offers various advantages over the traditional approaches, even though its application in different contexts and on different products could certainly make for further improvements in the phase of eliciting preferences.

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The Impact of Country of Origin on Brand Equity: An Analysis of The Wine Sector

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Abstract. The purpose of this study is to explore the country of origin´s effects on brand equity dimensions. This research selected wine as the product category and data were collected from Portuguese and Canadian consumers. Our conceptual framework incorporates the influence of country of origin on brand equity dimensions, composed by brand loyalty, brand associations, brand awareness and perceived quality, as well as the brand equity subsequent effect on purchase intention. The hypotheses were tested using Partial Least Squares Structural Equation Modelling (PLS-SEM). The results of the Portuguese sample indicate that the country of origin affects positively all the brand equity dimensions. The Canadian sample results show that country of origin affects brand loyalty and perceived quality, but there is no significant effect on brand associations and brand awareness dimensions.

Keywords: country of origin, brand equity, wine sector, loyalty, awareness, brand associations, perceived quality.

1. INTRODUCTION

Consumers' concerns during the purchasing process comprise, not only product quality and price, but also other factors such as, the product's country of origin. The home country effect is a persistent concern in international marketing (Koschate-Fischer et al., 2012). Countries recognized as good producers in a product category generally leverage the acceptance of their products compared to countries less recognized in that product category (Yasin et al., 2007).

Country of origin can act as an indicator of quality, exerting an important impact on consumer's purchase intention (Lin and Chen, 2006) and consequently, on the consumer's perception of brand equity (Rezvani et al., 2012). This study intends to analyze the impact of country of origin on brand

equity, placing the focus of the analysis on the Portuguese and Canadian markets.

Different types of conceptual categorizations have been developed to classify wine producing countries, but the classification that separates the geography of the wine industry into two "worlds", has been widely applied (Rodrigues et al., 2020). According to this taxonomy, Portugal is classified as an "old world" wine producing country, while Canada is a "new world" wine producing country (Johnson and Robinson, 2013). Remaud and Couderc (2006) consider that "old world" wine producing countries have historically emphasized the origin of grapes and promoted their specified regions' designations, while "new world" has mainly concentrated on supporting labeling through strong proprietary brands and grape variety. The wine producer country classification "old world" vs. "new world" can be combined with the categorization into "traditional producer" vs. "non-traditional producer" (Thorpe, 2009). While the categories "old world" vs. "new world" consider the country's history as a wine producer, the classification "traditional producer" vs. "non-traditional producer" refers to the country's relevance in world wine exports. Therefore, a non-traditional exporter indicates a country with a reduced presence as an exporter in the international wine market. According to these categorizations, the differences between the two countries under investigation are evident, since while Portugal is classified as an old world traditional producing wine country, Canada is considered as a new world non traditional producing wine country (Rodrigues et al., 2020).

Portugal is the eleventh major wine producer in the world, with a total volume of wine production of approximately 6.1 million hectoliters (OIV, 2019). Between 2014 and 2018, Portuguese wine production increased 29% in volume. Portugal is the fourth major per capita wine consumer in the world, with a per capita consumption of 51.3 liters in 2018, and the eleventh major wine consumption market in the world, reaching a total of 5.5 million hectoliters in that year (OIV, 2019). Moreover, Portugal is the ninth world top exporter of wine, exporting around three million hectoliters of wine in 2019 (Statista, 2020). The export volumes of Portuguese wines have been relatively stable from 2011 to 2019. Additionally, ProWein business report (ProWein, 2018) considered Portugal as one of the wine origins with stronger demand from international marketers.

Canada has a wine consumption per capita of 16.9 liters (Statista, 2020). The per capita wine consumption in the Canadian market increased 14.2% between 2010 and 2018. The wine consumption in the Canadian market has been showing a growing trend over the past few years, with an increase of 32.7% between 2011 and 2019, in terms of sales. In 2019, Canadian wine sales reached approximately 2.28 billion Canadian dollars, while imported wine sales achieved a total of 5.18 billion Canadian dollars. Canada is the twelfth major wine consumption market in the world, reaching a total of 4.9 million hectoliters in 2018 (OIV, 2019). Moreover, Canada is the sixth world top importer of wine, with approximately a total of 4.2 million hectoliters (OIV, 2019). Between 2014 and 2018, Canadian wine imports demonstrated a growth of 10% in volume. In the ProWein business report (ProWein, 2018), Canada was considered one of the wine markets more attractive and with lower risk for wine producers.

Based on a sample of Portuguese and Canadian consumers, the current study intends to investigate the influence of the wine's country of origin on the different brand equity dimensions and purchase intention. The next section contains the literature review, followed by hypotheses development. Next, the methodology and results sections are presented. This study is concluded with the discussion, managerial implications, and suggestions for future research.

2. LITERATURE REVIEW

2.1. Country of origin

Country of origin can be defined as the country to which the consumer associates a product or brand as its source, regardless of where the product is produced (Herz and Diamantopolous, 2013). The country of origin's effect is mentioned by several authors (e.g. Sauer et al., 1991; Suh et al., 2015) as the influence exerted on consumer evaluation of a product or service, depending on the stereotypes formed in relation to the country of origin.

Country of origin can be considered as a product attribute (Cordell, 1992; Hong et al., 1989). Consumers often develop stereotypes about the products of a particular country and their respective attributes (Yasin et al., 2007). The greater the contact and knowledge about a country or its products, the more objective can be the consumer's perception regarding the country of origin effect (Lee and Lee, 2009). Country of origin may function as an indicator of product quality or as an appeal to references that consumers may have developed regarding products of a particular origin (Insch and Floreck, 2009). Consequently, a positive image of the country can be used to highlight the relationship between the product and its origin. Furthermore, a corporate brand's country of origin can influence the reputation signals' effectiveness (Cowan and Guzman, 2020).

The influence of country of origin on consumers' product evaluations can occur on three levels, namely, cognitive, affective and normative (Martinez-Carrasco, Brugarolas and Martinez-Poveda, 2005). Regarding the cognitive perspective, country of origin can be used as a signal for quality attributes. The affective level is activated by emotional benefits related to national pride and social status. The normative perspective is associated with personal and social norms that consumers possess related to the country of origin. For instance, the purchase of national products can be perceived as the correct way of conduct to support the national economy.

In the wine sector, communication of its origin is mandatory, both in Canada (Food and Drugs Act, 1985 and Consumer Packaging and Labeling Act, 1985) and in the European Union (Protected Designation of Origin, 2011), thus increasing the relevance of the country of origin's effect in this product category (Thøgersen et al., 2017).

The positive impact of the country of origin occurs in many industries. However, previous research has defended that country of origin effects may differ between product categories (Trinh, Corsi, and Lockshin, 2019). For instance, country of origin seems to exert weaker effects for low-involvement products, such as wheat, potatoes, or butter (Magnusson, Haas, and Zhao, 2008). On the contrary, country of origin effects tend to be stronger for high-involvement products, such as wine, since consumers invest more effort into collecting information about those products (Li, Leung, Wyer, 1993).

Country of origin is used as crucial element in promotion campaigns in the wine industry (Trinh et al., 2019). Previous studies have shown that the country of origin of wines can have important implications for both export and marketing activities of the wine industry. For instance, Rodrigues et al. (2020) have shown that the country of origin of wines is extremely relevant to the wine traders' mental representation. Tzimitra-Kalogianni et al. (1999) concluded that the wine origin is one of the most relevant wine attributes in the Greek market, together with label, aroma, taste, and clarity. Keown and Casey (1995) evidenced that country of origin is the most relevant criterion for wine selection in Northern Ireland. Steiner (2000) highlighted the importance of origin in the selection of French wines in the UK wine market. Therefore, in the wine industry, country of origin can be considered a crucial element in the consumers' wine choice.

2.2. Ethnocentrism

The concept of ethnocentrism has been mentioned in international business for about half a century (Michailova et al., 2017). Ethnocentrism can be defined as: "a view of things in which one's own group is the center of everything. Each group nourishes its own pride and vanity, boasts itself superior, exalts its own divinities, and looks with contempt on outsiders" (Sumner, 1906: 13).

Ethnocentric consumer trends affect the emotional dimension related to the process of buying foreign products and creates the assumption that this choice somehow threatens domestic industry and national security (Herche, 1992). Thus, ethnocentric consumers believe that buying foreign-produced products is morally wrong and does not contribute to the local economy (El Banna et al., 2018), therefore opting to buy domestic products and disregarding foreign products. With increasing globalization, the concept of ethnocentrism becomes relevant for understanding the moral concern resulting from the consumption of domestic versus foreign goods (Siamagka et al., 2015).

In the wine industry, consumer ethnocentrism has been considered as being capable to influence both the perceived quality and the purchase intentions of regional wines (García-Gallego, Chamorro-Mera, and García-Galán, 2015). These results confirm that communication campaigns that promote a wine region's image are valuable, not only as an external promotion tool, but also as an encouragement for domestic consumption, particularly by consumers with stronger ethnocentrism levels.

Martinez-Carrasco et al. (2005) found that consumer ethnocentrism creates strong preferences for local wines. Therefore, consumer ethnocentrism can act as a crucial consumption motivation during the process of wine selection. Ethnocentrism creates in the individual a sense of identity and stimulates the understanding that national symbols and values are objects of attachment and pride (Le Vine and Campbell, 1972), motivating the purchase of domestic products and creating a negative attitude towards foreign products (Verlegh and Steenkamp, 1999).

Nowadays, consumers' choices encounter a large range of domestic and foreign products. Ethnocentric tendencies constitute one of the factors that influence the purchase decision between domestic and foreign products. In the wine industry, consumer ethnocentrism can exert a strong and positive influence on attitudes related to domestic wine purchase (Tomić Maksan, Kovačić, and Cerjak, 2019).

2.3. Brand equity

Brand equity can be defined as a "set of brand assets and liabilities linked to a brand, its name and symbol, that add to or subtract from the value provided by a prod-

uct or service to a firm and/or to that firm's customers" (Aaker, 1991: 27). Consequently, brand equity translates the value of a product, a service, or a corporate brand (Kim, Choe, and Petrick, 2018). A brand is considered to benefit from a positive customer-based brand equity effect when consumers respond more favorably to an element of the brand marketing mix, compared to their responses to a similar marketing mix element from an unnamed or a fictitiously named version of the product or service (Keller, 1993). Brand equity is of critical importance since it conditions customer lifetime value and leverages financial market outcomes (Heitmann, et al. 2020).

The assets and liabilities that generate brand equity can be grouped into the following dimensions: brand loyalty, brand awareness, perceived quality, brand associations and other proprietary brand assets (Aaker, 1991). These dimensions of brand equity have long been of crucial interest to business managers, marketing, and consumer behavior researchers (Chen, Su, and Lin, 2011; Kim et al., 2018). In the following sections, the main antecedents of customer-based brand equity (brand loyalty, brand awareness, perceived quality, brand associations) are explained in more detail.

2.4. Brand loyalty

Brand loyalty is often the core of brand equity (Aaker, 1991), as consumer loyalty reinforces the brand over competitors. This relationship is strengthened as brand loyalty acts as a barrier to entry for new competitors, since the cost of attracting new customers is higher than retaining existing consumers.

Brand loyalty is not a unanimous concept in the literature, but two key approaches to behavioral loyalty and attitudinal loyalty are highlighted (Roustasekehravani et al., 2015). Behavioral loyalty is based on consumer behavior. Thus, the consumer who systematically buys the same brand is considered loyal. The subjectivity and complexity of explaining why the behavior occurs, is pointed out as the main disadvantage of this approach, since the company is objectively unaware of the factors that determine the consumer's brand loyalty (Odin et al., 2001). On the other hand, attitudinal loyalty delimits and identifies the determining factors of loyal consumer attitudes. Therefore, research focuses on the consumer's psychological commitment to purchase, without necessarily considering whether the purchase takes place. Premium price can be perceived as a basic indicator of brand loyalty, as it indicates that consumers are willing to pay an extra percentage for that brand, although other brands with similar characteristics may be available at a lower price (Aaker, 1991).

2.5. Brand awareness

Brand awareness can be defined as the ability of consumers to recognize or recall that a brand belongs to a particular product category (Romaniuk et al., 2017). Brand awareness is strongly related to the strength of a brand's presence in the minds of consumers, resulting in their ability to identify the brand under various market conditions (Świtała et al., 2018). For Aaker (1991), brand awareness is created by repeatedly and memorably exposing brand elements such as the name, slogan, logo, or packaging to consumers. This exposure contributes to establish brand roots in consumers' memory and to strengthen brands' links with the product category.

The strengthening of brand awareness paves the way for a victorious brand, due to the distinction from other brands present in the market (Ahmed et al., 2017). For example, Constellation, one of the largest wine companies in the world, invests heavily in the acquisition of wine brands to create and increase brand awareness (Atkin et al., 2017). This strategy recognizes the important role that brand awareness plays in the distinction between products and in the consequent purchase, therefore consumers can buy a bottle of wine by the brand name, even when they have little knowledge about that particular wine (Foroudi, 2018).

2.6. Brand associations

Brand associations relate a memory to a brand (Aaker, 1991). Associations are starting points for buying decisions, as consumers rely on them to retain information emanating from brand actions, to generate a buying reaction and to create positive behaviors, allowing openness for brand diversification into other types of products. Thus, companies try to associate their brand with a certain attribute, recognized by the consumer, to make it difficult for new brands to enter the market (Akkucuk et al., 2016).

Brand associations are important for both businesses and consumers, as brand associations influence brand differentiation, brand positioning, brand extension, consumer information processing, consumer behavior, purchase intention and consumer satisfaction (Bawa and Saha, 2016).

2.7. Perceived quality

Perceived quality is the consumer's subjective assessment of the excellence or generic superiority of a product (Zeithaml, 1988). The degree of perceived quality increases with the long-term brand relationship experi-

ence, as through this, consumers recognize brand differentiation and superiority. Perceived quality is subjective since it depends on the perception and discernment of the consumer involved.

Saleem et al. (2015) characterize perceived quality as a psychological assessment of the product based on consumer perceptions. This assessment is based on product characteristics, whether intrinsic or extrinsic. The intrinsic attributes, which are related to the product itself, may be the aroma, the palate, or the color, in the case of wine. Extrinsic characteristics are related to properties that are not physically part of the product, such as packaging or region of origin (Sáenz-Navajas et al., 2016). The intrinsic determinants of wine quality are the most important for brand value creation, however, they are also the most difficult to control. Thus, the combined valuation of both characteristics is predominant (Danner et al., 2016).

Perceived quality is a particularly important factor in the wine product category, as consumers perceptions are quite heterogeneous and strongly influenced by their level of specialization or knowledge (Sáenz-Navajas et al., 2016). Therefore, perceived quality can be understood as a brand value proposition, which makes consumers endogenous to value creation (Liu et al., 2017).

3. HYPOTHESES

The country of origin can affect the purchase behavior (Dmitrovic, Vida, and Reardon, 2009). Consumers form multiple stereotyped national images regarding a product's country of origin (Ahmed and d'Astous, 2007; Laroche et al., 2005), and these perceptions influence their purchase behavior (García-Gallego, et al., 2015; Papadopoulos, and Heslop, 2002; Pharr, 2005). A country of origin with a strong presence generally has a positive impact on purchase intention, as it acts as an indicator of product quality (Aichner et al., 2017). Therefore, when a wine is thought to be originating from a country with high standards, a long tradition and or with strong wines brands, it will be considered superior and more appealing compared to a similar wine from a country not recognized as a wine producer. Certain brands adopt names that refer to nationalities recognized by the product category, in order to leverage their product based on the effect of the country of origin, such as the French brewer Brasserie Fischer that launched its tequila flavored beer by adopting a name, Desperados, and a Mexican image. Based on the effect of Portugal as a country of origin in the wine sector, the following hypotheses are proposed:

H_{1a}: The country of origin Portugal relates positively with purchase intention for Portuguese consumers.

H_{1b}: The country of origin Portugal relates positively with purchase intention for Canadian consumers.

Brand equity has a positive and important impact on the preference for a brand. Hoeffler et al. (2003) suggest that strong brands get a greater preference from consumers because with a certain level of product knowledge, consumers buy the brands with the highest value (Aaker, 1991). Brand equity is reflected in the preference for the brand, and thus we can infer that the preference for the brand is reflected in purchase intention (Bougenvile and Ruswanti, 2017). Thus, the following hypotheses are proposed:

H_{2a}: Brand equity relates positively with purchase intention for Portuguese consumers.

H_{2b}: Brand equity relates positively with purchase intention for Canadian consumers.

Consumers' national identities have been showing a growing impact on their consumption behavior (Dmitrovic et al, 2009; Quellet, 2007). Stronger competitive rivalries in domestic markets may stimulate nationalistic purposes in consumers' purchasing motivations (Shankarmahesh, 2006). Since consumers judge products taking into account the country with which they are associated, consumers may reveal, in specific conditions, a preference for a domestical alternative (Granzin and Olsen, 1998). Ethnocentric consumers tend to believe that it is unpatriotic to purchase foreign products and to consider national manufactured products as being superior (Shimp and Sharma, 1987). Consequently, consumer ethnocentrism strongly influences the construction of consumer attitudes towards domestic and foreign products (Kim and Pysarchik, 2000). In the current study, the ethnocentrism of Portuguese and Canadian consumers and their relationship with "Portugal" country of origin effect was analyzed, assuming that the greater the degree of Portuguese consumers' ethnocentrism, more favorable will be the associations that they will create in relation to their own country of origin. In turn, it is considered that the greater the degree of ethnocentrism of Canadian consumers the less favorable their associations will be in relation to the country of origin Portugal. Therefore, the following hypotheses are proposed:

H_{3a}: Portuguese consumers' ethnocentrism relates positively with the country of origin Portugal.

H_{3b}: Canadian consumers' ethnocentrism relates negatively with the country of origin Portugal.

The country of origin can provide to consumers important quality connotations, consequently affecting the perceived quality of a product (Klein, Ettenson, and Morris, 1998; Verlegh and Steenkamp, 1999). The coun-

try image influences consumers' product evaluations (Lee, Lee, and Lee, 2013), regarding attributes such as the product quality and reliability (Laroche et al., 2005). Consequently, consumers make use of product-country images as a cue for inferring product quality (Haubl and Elrod 1999; Verlegh, Steenkamp, and Meulenberg, 2005). Consumers tend to have favorable perceptions regarding brand quality when the brand is known to come from a country strongly associated with a certain product category (Elliot and Cameron, 1994). Thus, it is expected that associations to a country, well recognized in a product category, are transferred to the perceived quality of brands originated from that country. Hence, the following hypotheses are proposed:

H_{4a}: The country of origin Portugal relates positively with perceived quality for Portuguese consumers.

H_{4b}: The country of origin Portugal relates positively with perceived quality for Canadian consumers.

Country of origin can generate and emphasize secondary associations to a given brand, through connections to places, people, and moments (Pappu et al., 2006). Since associations to a country of origin are considered as secondary associations to the brand (Keller, 1993), it is assumed that the country of origin influences brand associations. Thus:

H_{5a}: The country of origin Portugal relates positively with brand associations for Portuguese consumers.

H_{5b}: The country of origin Portugal relates positively with brand associations for Canadian consumers.

Consumers are known to associate the brand with its country of origin. Previous studies confirm a strong relationship between country of origin and brand awareness (Sanyal et al., 2011). In this sense, the awareness of a wine-producing country is transferred to wines from that country, thus influencing the consumer. Therefore, brands from the same country share a common base of awareness related to the country of origin (Pappu et al, 2007). Hence, the following hypotheses are proposed:

H_{6a}: The country of origin Portugal relates positively with brand awareness for Portuguese consumers.

H_{6b}: The country of origin Portugal relates positively with brand awareness for Canadian consumers.

Country of origin can affect brand loyalty through its positive image and consumer familiarity with the country's products (Septyanti and Hananto, 2017). In parallel, Paswan et al. (2003) verified that consumers tend to be loyal to a country, just as they are loyal to brands. Therefore, consumer satisfaction with products from a particular country can influence consumer loyalty to that country's brands (Pappu et al., 2007). Thus:

H_{7a}: The country of origin Portugal relates positively with brand loyalty for Portuguese consumers.

H_{7b}: The country of origin Portugal relates positively with brand loyalty for Canadian consumers.

Perceived quality can increase brand preference and induce consumers to choose a brand over another (Liu et al., 2017). Aaker (1991) also identifies perceived quality as a distinctive factor that offers the consumer a reason to buy or not a certain product. In this way, a growth in perceived quality can translate into an increase in brand equity. Therefore, the following hypotheses are proposed:

H_{8a}: Perceived quality relates positively with brand equity for Portuguese consumers.

H_{8b}: Perceived quality relates positively with brand equity for Canadian consumers.

Brand associations are fundamental to differentiate the brand from its competitors (Aaker, 1991). Krishnan (1996) concluded that brands with strong brand equity tend to possess more positive brand associations than others with weak brand equity. Positive brand associations, influence consumers' choice, benefit the brand's image and enhance brand equity (Faircloth, Capella, and Alford, 2001; Pouromid and Iranzadeh, 2012; Sasmita and Suki, 2015; Yasin et al., 2007). In the context of the wine product category, associations with a brand may be represented by status or by a moment that makes that wine special, giving it an identity that translates into a positive association with that wine brand. Consequently, brand associations can benefit brand equity. Thus:

H_{9a}: Brand associations relate positively with brand equity for Portuguese consumers.

H_{9b}: Brand associations relate positively with brand equity for Canadian consumers.

The greater the brand awareness the more likely the brand is to be considered in purchase situations (Yasin et al., 2007). Consumers usually prefer to buy brands that are familiar to them. As a result, increasing brand awareness can lead to an increase in brand equity (Pouromid and Iranzadeh, 2012; Keller, 2008). This leads to following hypotheses:

H_{10a}: Brand awareness relates positively with brand equity for Portuguese consumers.

H_{10b}: Brand awareness relates positively with brand equity for Canadian consumers.

Consumers' brand loyalty reflects a repetitive purchasing behavior of the brand, which is positively associated to brand equity (Sasmita and Suki, 2015; Zhang, van Doorn, and Leeflang, 2014). Consequently, brand loyalty is considered as an important source of consumer-based brand equity (Aaker, 1991; Kim, Kim, and An, 2003). When consumers are loyal to a brand, even when brands with enhanced characteristics are available, it means that the brand has value for the consumer (Agrawal and Kamakura, 1999). Therefore, stronger lev-

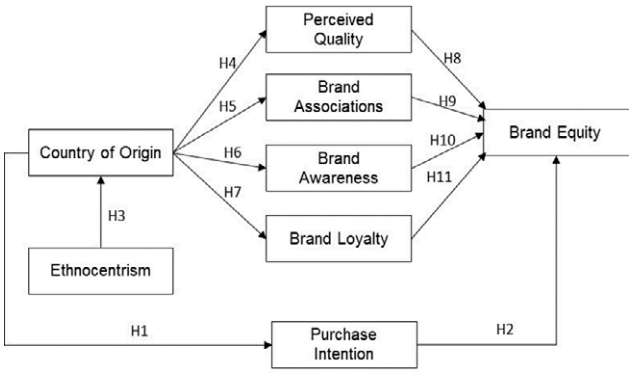

Figure 1. Conceptual model: The impact of the country of origin on brand equity.

els of brand loyalty translate into higher levels of brand equity. Therefore:

H_{11a}: Brand loyalty relates positively with brand equity for Portuguese consumers.

H_{11b}: Brand loyalty relates positively with brand equity for Canadian consumers.

Given the hypotheses previously deducted, the conceptual model proposed is presented in Figure 1.

4. MATERIALS AND METHODS

4.1. Survey development

An online survey was launched based on the literature review. The country of origin measure (Table 2 and Table 3) was adapted from Yasin et al. (2007) and is composed by eight items. Ethnocentrism was measured with a five-item scale version of Shimp and Sharma's (1987) CETSCALE, adapted from Strizhakova and Coulter (2015) and Alden et al. (2013). The purchase intention measure was adapted from Xie et al. (2015) and is composed of three items. Brand associations, brand awareness and brand loyalty were measured with three-item scales, adapted from Yasin et al. (2007) and Yoo et al. (2000). Perceived quality was measured with a six-item scale adapted from Yoo et al. (2000). Brand equity was measured with a seven-item scale adapted from Yasin et al. (2007). All constructs were measured on a Likert scale, with the response anchors from 1, indicating "strongly disagree, to 5 "indicating" strongly agree".

The survey was prepared in English and then translated into Portuguese, following the back-translation process. Prior to the questionnaire released, a pre-test was sent to Canadian and Portuguese correspondents to identify possible improvements in the scope of questions understanding and adaptation to the reality of each country.

Through the application of an exploratory factor analysis, common method bias (Podsakoff and Organ, 1986) was analyzed. The results of the exploratory factor analysis revealed that there is no single factor that explains most of the results variance. In order to test for non-response bias, the early and late respondents (comprising the first 75% and the last 25% to answer the questionnaire, respectively) were compared across all variables in the model (Armstrong and Overton, 1977). No significant differences were found between the initial respondents and the late respondents.

4.2. Sample

This study was developed in order to analyze the influence of the country of origin in the different dimensions of brand equity, in the wine sector, considering the perceptions of Portuguese and Canadian consumers. The Portuguese domestic wine market currently demonstrates a high growth potential and Canada was identified as a strategic market by ViniPortugal (2019) in the strategic plan for the internationalization of the wine sector in Portugal.

Following a quantitative approach and a non-probability sampling procedure, an online survey was implemented in Portugal and Canada to collect the data. To reach a diversified and wide sample, the survey was implemented across universities, wine associations and wine importers. Participants were invited to participate in the study by email. The survey was addressed to individuals over the age of eighteen with Portuguese and Canadian nationalities.

A total of 208 valid responses were collected in Portugal and 63 valid responses in Canada, in the year 2018. In the Portuguese sample, 50.5% of respondents are male and 49.5% are female, which indicates a balanced sample in terms of gender. In the Canadian sample 57.1% are male and 42.9% are female.

The most representative age group in both samples is 28 to 37 years old, with 45.2% and 42.9% of Portuguese and Canadian respondents, respectively. In the Portuguese sample, 40.9% of respondents have a bachelor's degree and in the Canadian sample, this percentage is 49.2%. The Portuguese sample consumes an average of 1 bottle of wine per month and presents Portugal and France as preferred countries of origin. The Canadian sample consumes an average of 2 bottles of wine per month and presents the USA and Italy as preferred countries of origin for wine purchase. Table 1 presents the demographic characteristics of the sample.

Table 1. Final sample characterization.

	Portugal %	Canada %
Gender		
Female	50.5	42.9
Male	49.5	57.1
Age		
18-27	20.2	12.7
28-37	45.2	42.9
38-49	24.5	23.8
50-59	8.2	15.8
60-79	1.4	4.8
>80	0.5	0.0
Qualification		
High school	40.8	27.0
Bachelor degree	40.9	49.2
Master degree	14.4	22.2
PhD	3.9	1.6

5. RESULTS

Data were analyzed with Partial Least Squares Structural Equation Modelling (PLS-SEM) in Smart PLS 3.0. (Ringle, Wende, and Becker, 2015), a technique widely used in behavioral sciences. We selected this method because PLS-SEM is particularly recommended to predict and explain the variance of key constructs through different explanatory constructs (Hair et al., 2012). Consequently, this technique should be selected when prediction is one of the main focus of the research (Hair et al., 2020). Moreover, PLS-SEM is recommended to test complex models with a large number of latent variables (Hair et al., 2020). Furthermore, PLS-SEM is strongly appropriate to test structural models with small sample sizes (Barclay and Smith, 1997). In the evaluation process of the partial least squares structural equation model, the steps identified by Hulland (1999) were followed. The analysis was started with the assessment of the model reliability and validity, followed by the structural model evaluation.

To analyze the measurement model the individual items' evaluation was conducted. All constructs possess items with loadings superior to 0.6 (Bagozzi and Yi, 2012), ensuring convergent validity – Tables 2 and 3. Alpha Cronbach values exceed the desirable value of 0.60, which demonstrates that the scales are reliable and the used measures have content validity (Hair et al., 2009). The composite reliability for each construct is above the desirable value 0.7 (Bagozzi and Yi, 2012). The Average Variance Extract (AVE) in each construct is above the reference value of 0.5 (Fornell and Larcker, 1981) ensuring convergent validity of the constructs.

The assessment of discriminant validity followed Fornell and Larcker's (1981) recommendations. The fact that the shared variance among any two constructs (the square of their intercorrelation) is less than the average variance explained in the items by the construct (Table 4 and Table 5) supports the existence of discriminant validity.

To evaluate the structural model, it is recommended an assessment through the use of R^2, the level of explained variance of each endogenous variable, which should be superior to 10% (Falk and Miller, 1992). As Table 2 and Table 3 evidence, this condition is verified for each endogenous variable.

Regarding the Portuguese sample, Hypothesis 1a is supported by the results as shown by the following values: (β)=0.099; p<0.05, t-value=1.878 (Table 6). Therefore, the country of origin Portugal is positively related with purchase intention for Portuguese consumers. The results also demonstrate that brand equity relates positively with purchase intention for Portuguese consumers, supporting Hypothesis 2a (β =0.784; p<0.001, t-value =17.999). Moreover, Portuguese consumers' ethnocentrism relates positively with the country of origin Portugal, supporting Hypothesis 3a (β = 0.525; p<0.001, t-value = 10.742). The study also demonstrates that the country of origin Portugal relates positively with perceived quality for Portuguese consumers, supporting Hypothesis 4a (β = 0.714; p<0.001, t-value = 17.309). Results support Hypothesis 5a with the following values (β = 0.510; p<0.001; t-value = 6.578), therefore the country of origin Portugal relates positively with brand associations for Portuguese consumers. Hypothesis 6a is supported (β = 0.472; p<0.001, t-value = 9.693), suggesting that country of origin Portugal relates positively with brand awareness for Portuguese consumers. Regarding Hypothesis 7a, the results demonstrate that the country of origin Portugal relates positively with brand loyalty for Portuguese consumers (β = 0.549; p<0.001; t-value = 9.174). Hypothesis 8a is supported by the results (β = 0.481; p<0.001; t-value = 8.177) thus, perceived quality relates positively with brand equity for Portuguese consumers. Hypothesis 9a is not supported (β = -0.026; t-value = 0.376), therefore results don´t provide evidence for a significant effect of brand associations on brand equity. Moreover, Hypothesis 10a is not supported (β = 0.01; t-value = 0.209), thus results provide evidence for a non-significant effect of brand awareness on brand equity. The positive relationship between brand loyalty and brand equity predicted in Hypothesis 11a is supported by the results (β = 0.459; p<0.001, t-value = 7.077).

Table 2. Measurement items and validity assessment for the Portuguese sample.

Constructs	Items	Factor Loading	Cronbach Alpha	Composite Reliability	AVE	R^2
Country of origin	Portugal is an innovative country in manufacturing	0.787	0.901	0.9243	0.592	0.276
	Portugal is a country that has high level of technological advance	0.806				
	Portugal is a country that is good in designing	0.744				
	Portugal is a country that is creative in its workmanship	0.802				
	Portugal is a country that has high quality in its workmanship	0.810				
	Portugal is a country that is prestigious in wine production	0.745				
	Portugal is a country that has an image of an advanced country	0.665				
	Portugal is known for being easy to do business with	0.787				
Ethnocentrism	I believe that I should buy national products first, last and foremost	0.735	0.899	0.8574	0.710	-
	Purchasing foreign-made products is unpatriotic	0.827				
	It is not right to purchase foreign-made products because it puts Portugal out of work	0.888				
	A true Portuguese must always buy products made in Portugal	0.907				
	Portugal should not purchase foreign products, as it puts Portuguese out of jobs	0.846				
Purchase Intention	I will choose Portuguese wines next time when I buy this product category	0.958	0.908	0.9558	0.915	0.722
	I believe that Portuguese wines are my first choice for wine shopping	0.956				
	I am willing to try new Portuguese wines	*				
Brand Associations	I have no difficulty imagining myself drinking a glass of Portuguese wine	0.692	0.747	0.8575	0.670	0.261
	I have an opinion about Portuguese wines	0.866				
	I know the quality of Portuguese wines	0.884				
Brand Awareness	I can quickly recall the symbol or logo of *Wines of Portugal*	0.853	0.668	0.8574	0.751	0.222
	I know how the symbol of wine regions looks like	0.879				
	I am aware of *Wines of Portugal*	*				
Perceived Quality	Portuguese wines are of high quality	0.842	0.904	0.9247	0.639	0.510
	The likely quality of Portuguese wines is extremely high	0.872				
	The likelihood that Portuguese wines are reliable is very high	0.884				
	Portuguese wines must be of very good quality	0.811				
	The likelihood that Portuguese wines would be tasty is very high	0.777				
	The reliability of Portuguese wines is very high	0.684				
Brand Loyalty	I consider myself highly loyal to wines from Portugal	0.838	0.711	0.835	0.629	0.302
	I will think twice before buying wine from another country if it has almost the same characteristics as Portuguese wines	0.740				
	Compared to other origins of wines that have similar features, I am willing to pay a premium (higher) price for Portuguese wines	0.796				
Brand Equity	If there is another wine as good as a Portuguese wine, I prefer to buy a Portuguese wine	0.803	0.927	0.9428	0.733	0.669
	If another wine is no different from Portuguese wines in any way, it seems smarter to purchase Portuguese wine	0.868				
	It makes sense to buy Portuguese wines instead of any other wines, even if they are the same	0.842				
	To impress my guests, I plan to buy Portuguese wine even though there are other wines as good as Portuguese wines	0.886				
	Even if another wine has the same price as a Portuguese wine, I would still buy Portuguese wine	0.871				
	Even if another wine has similar features as Portuguese wines, I would prefer to buy Portuguese wines	0.866				
	If I have to choose among brands of wine, Portuguese wines are definitely my choice	*				

*Item was dropped due to scale purification.

Table 3. Measurement items and validity assessment for the Canadian sample.

Constructs	Items	Factor Loading	Cronbach Alpha	Composite Reliability	AVE	R^2
Country of origin	Portugal is an innovative country in manufacturing	0.848	0.875	0.9050	0.615	0.157
	Portugal is a country that has high level of technological advance	0.768				
	Portugal is a country that is good in designing	0.780				
	Portugal is a country that is creative in its workmanship	0.822				
	Portugal is a country that has high quality in its workmanship	0.653				
	Portugal is a country that is prestigious in wine production	0.820				
	Portugal is a country that has an image of an advanced country*	*				
	Portugal is known for being easy to do business with*	*				
Ethnocentrism	I believe that I should buy national products first, last and foremost*	*				
	Purchasing foreign-made products is unpatriotic	0.940	0.948	0.9621	0.864	-
	It is not right to purchase foreign-made products because it puts Canada out of work	0.918				
	A true Canadian must always buy products made in Canada	0.917				
	Canada should not purchase foreign products, as it puts Canadian out of jobs	0.943				
Purchase Intention	I will choose Portuguese wines next time when I buy this product category	0.891	0.608	0.8283	0.708	0.536
	I believe that Portuguese wines are my first choice for wine shopping	0.789				
	I am willing to try new Portuguese wines	*				
Brand Associations	I have no difficulty imagining myself drinking a glass of Portuguese wine*	*				
	I have an opinion about Portuguese wines	0.973	0.927	0.9645	0.931	0.003
	I know the quality of Portuguese wines	0.957				
Brand Awareness	I can quickly recall the symbol or logo of Wines of Portugal	0.943	0.771	0.8925	0.806	0.042
	I know how the symbol of wine regions looks like	0.851				
	I am aware of *Wines of Portugal*	*				
Perceived Quality	Portuguese wines are of high quality	0.807	0.894	0.9160	0.612	0.164
	The likely quality of Portuguese wines is extremely high	0.615				
	The likelihood that Portuguese wines are reliable is very high	0.835				
	Portuguese wines must be of very good quality	0.891				
	The likelihood that Portuguese wines would be tasty is very high	0.826				
	The reliability of Portuguese wines is very high	0.810				
Brand Loyalty	I consider myself highly loyal to wines from Portugal	0.905	0.875	0.9232	0.800	0.190
	I will think twice before buying wine from another country if it has almost the same characteristics as Portuguese wines	0.926				
	Compared to other origins of wines that have similar features, I am willing to pay a premium (higher) price for Portuguese wines	0.851				
Brand Equity	If there is another wine as good as a Portuguese wine, I prefer to buy a Portuguese wine	0.739	0.939	0.9494	0.678	0.725
	If another wine is no different from Portuguese wines in any way, it seems smarter to purchase Portuguese wine	0.824				
	It makes sense to buy Portuguese wines instead of any other wines, even if they are the same	0.854				
	To impress my guests, I plan to buy Portuguese wine even though there are other wines as good as Portuguese wines	0.875				
	Even if another wine has the same price as a Portuguese wine, I would still buy Portuguese wine	0.907				
	Even if another wine has similar features as Portuguese wines, I would prefer to buy Portuguese wines	0.901				
	If I have to choose among brands of wine, Portuguese wines are definitely my choice	*				

*Item was dropped due to scale purification.

Table 4. Discriminant validity for the Portuguese sample.

	1	2	3	4	5	6	7	8
1.Brand Associations	**0.8185**	-	-	-	-	-	-	-
2.Ethnocentrism	0.3659	**0.8429**	-	-	-	-	-	-
3.Purchase Intention	0.5949	0.5249	**0.9568**	-	-	-	-	-
4.Brand Loyalty	0.5797	0.5242	0.6864	**0.7928**	-	-	-	-
5.Brand Awareness	0.4721	0.3753	0.3572	0.4908	**0.8663**	-	-	-
6.Country of origin	0.5104	0.5249	0.5948	0.5492	0.4715	**0.7694**	-	-
7.Perceived Quality	0.6207	0.5084	0.6826	0.5622	0.3421	0.7142	**0.7992**	-
8.Brand Equity	0.5436	0.6072	0.8463	0.7195	0.3879	0.6328	0.7262	0.8563

Note: The boldface scores on the diagonal are the square roots of AVE.

Table 5. Discriminant validity for the Canadian sample.

	1	2	3	4	5	6	7	8
1.Brand Associations	0.9651	-	-	-	-	-	-	-
2.Brand Awareness	0.4833	**0.8980**	-	-	-	-	-	-
3.Brand Equity	0.6156	0.4708	**0.8233**	-	-	-	-	-
4.Brand Loyalty	0.5381	0.6269	0.8147	**0.8947**	-	-	-	-
5.Country of origin	0.0578	0.2052	0.4871	0.436	**0.7843**	-	-	-
6.Ethnocentrism	-0.2256	0.1605	-0.2733	-0.1219	-0.3963	**0.9294**	-	-
7.Purchase Intention	0.465	0.5726	0.7286	0.7299	0.4205	-0.0905	**0.8413**	-
8.Perceived Quality	0.7347	0.3754	0.6627	0.6132	0.4055	-0.2584	0.5246	**0.7826**

Note: The boldface scores on the diagonal are the square roots of AVE.

Concerning the Canadian sample, the positive relationship between country of origin and purchase intention predicted in Hypothesis 1b is not supported by the results (β =0.131; t-value =0.801) – Table 7. Regarding Hypothesis 2b, the results demonstrate that brand equity relates positively with purchase intention for Canadian consumers, supporting Hypothesis 2b (β =0.656; p<0.001, t-value =8.259). Moreover, Canadian consumers' ethnocentrism relates negatively with the country of origin Portugal, supporting Hypothesis 3b (β = -0.397; p<0.001, t-value = 3.749). The study also demonstrates that the country of origin Portugal relates positively with perceived quality for Canadian consumers, supporting Hypothesis 4b (β = 0.405; p<0.001, t-value = 4.001). Hypothesis 5b is not supported (β = 0.058; t-value = 0.443), therefore results do not provide evidence for a significant effect of the country of origin Portugal on brand associations for Canadian consumers. Moreover, Hypothesis 6b is not supported (β = 0.205; t-value = 1.318), thus results provide evidence for a non-significant effect of the country of origin Portugal on brand awareness for Canadian consumers. Regarding Hypothesis 7b, the results demonstrate that the country of origin Portugal relates positively with brand loyalty for Canadian consumers (β = 0.405; p<0.001, t-value = 4.348). Hypothesis 8b is not supported by the results (β = 0.132; t-value = 1.292) thus, the relationship between perceived quality and brand equity is non-significant for Canadian consumers. The positive relationship between brand associations and brand equity predicted in Hypothesis 9b is supported by the results (β = 0.196; p<0.05, t-value = 2.300). Hypothesis 10b is not supported (β = -0.109; t-value = 0.975), thus results provide evidence for a non-significant effect of brand awareness on brand equity. The positive relationship between brand loyalty and brand equity predicted in Hypothesis 11b is supported by the results (β = 0.697; p<0.001, t-value = 8.255).

6. DISCUSSION AND MANAGERIAL IMPLICATIONS

This study analyses the influence of country of origin on the different brand equity dimensions, in the wine sector, considering the perceptions of Portuguese and Canadian consumers.

Results demonstrate that country of origin partially influences purchase intention. Regarding Portuguese consumers, findings show that consumers are sensi-

Table 6. Hypotheses testing results for the Portuguese Sample.

Hypotheses	T-Value	Path Coefficient (β)	Result
H1a: The country of origin Portugal relates positively with purchase intention for Portuguese consumers.	1.878*	0.099	Supported
H2a: Brand equity relates positively with purchase intention for Portuguese consumers.	17.999***	0.784	Supported
H3a: Portuguese consumers' ethnocentrism relates positively with the country of origin Portugal.	10.742***	0.525	Supported
H4a: The country of origin Portugal relates positively with perceived quality for Portuguese consumers.	17.309***	0.714	Supported
H5a: The country of origin Portugal relates positively with brand associations for Portuguese consumers.	6.578***	0.510	Supported
H6a: The country of origin Portugal relates positively with brand awareness for Portuguese consumers.	9.693***	0.472	Supported
H7a: The country of origin Portugal relates positively with brand loyalty for Portuguese consumers.	9.174***	0.549	Supported
H8a: Perceived quality relates positively with brand equity for Portuguese consumers.	8.177***	0.481	Supported
H9a: Brand associations relate positively with brand equity for Portuguese consumers.	0.376	-0.026	Not supported
H10a: Brand awareness relates positively with brand equity for Portuguese consumers.	0.209	0.010	Not supported
H11a: Brand Loyalty relates positively with brand equity for Portuguese consumers.	7.077***	0.459	Supported

* p < .05; ** p < .01; *** p < .001 (one-tailed test).

Table 7. Hypotheses testing results for the Canadian Sample.

Hypotheses	T-Value	Path Coefficient (β)	Result
H1b: The country of origin Portugal relates positively with purchase intention for Canadian consumers.	0.801	0.131	Not supported
H2b: Brand equity relates positively with purchase intention for Canadian consumers.	8.259***	0.656	Supported
H3b: Canadian consumers' ethnocentrism relates negatively with the country of origin Portugal.	3.749***	-0.397	Supported
H4b: The country of origin Portugal relates positively with perceived quality for Canadian consumers.	4.001***	0.405	Supported
H5b: The country of origin Portugal relates positively with brand associations for Canadian consumers.	0.443	0.058	Not supported
H6b: The country of origin Portugal relates positively with brand awareness for Canadian consumers.	1.318	0.205	Not supported
H7b: The country of origin Portugal relates positively with brand loyalty for Canadian consumers.	4.348***	0.405	Supported
H8b: Perceived quality relates positively with brand equity for Canadian consumers.	1.292	0.132	Not supported
H9b: Brand associations relate positively with brand equity for Canadian consumers.	2.300*	0.196	Supported
H10b: Brand awareness relates positively with brand equity for Canadian consumers.	0.975	-0.109	Not supported
H11b: Brand Loyalty relates positively with brand equity for Canadian consumers.	8.255***	0.697	Supported

* p < .05; ** p < .01; *** p < .001 (one-tailed test).

tive to wine origin during the buying process, preferring to buy national wines. This result is in accordance with previous studies that indicate country of origin as a crucial consumers' decision factor (Yunus and Rashid, 2016). Moreover, Aichner et al. (2017) indicate that a country of origin with strong associations generally exerts a positive impact on purchase intention. However, concerning the Canadian consumers, the positive influence of country of origin on purchase intention was not demonstrated. This result might be explained by the still incipient Portuguese country-product image in the Canadian market, as well as, by the weak presence of the

country when compared to other wine producers such as French, Italian, and North American.

Results demonstrate that brand equity positively influences purchase intention for both Portuguese and Canadian consumers, corroborating several previous studies (e.g. Hoeffler and Keller, 2003; Aaker, 1991) who report that brands with stronger brand equity are commonly preferred by the consumer.

Considering the accentuation of protectionist policies, we have been witnessing in the world economy, and their consequences (Andrews et al., 2018), the degree of ethnocentrism has been analyzed in order to understand the behavior of Portuguese and Canadian consumers regarding the country of origin effects. The results show that the effects of ethnocentrism on country of origin are emphasized in the Portuguese market, since the degree of ethnocentrism positively enhances the country of origin effect, accentuating the preference of Portuguese consumers for national wine. Moreover, the degree of ethnocentrism of Canadian consumers negatively influences the effect of Portugal country of origin, restricting their preference for imported wines.

The strong relationship between country of origin and perceived quality, defended by previous authors (e.g. Elliott and Cameron, 1994), was demonstrated in both Portuguese and Canadian samples. Consumers of both nationalities are likely to transpose the favorable characteristics that Portugal as a country conveys, to this product category.

The influence of country of origin on consumers' brand associations was partially demonstrated. The results of the Portuguese sample demonstrate the positive effect, therefore, as advocated by Pappu et al. (2006), favorable associations to the country of origin are transferred to the brand. However, the results of the Canadian sample did not support this positive influence, which might be explained by the limited offer of Portuguese wine in Canada, compared to other sources, which may hinder the consumer's ability to transfer possible qualities, memories and benefits to the brand.

The fact that the product is not "massively" available in the Canadian market might explain the unsupported relationship between country of origin and brand awareness in the Canadian sample, contrarily to what is suggested in the literature (Pappu et al., 2007). Additionally, Portugal may hasn´t achieved yet a distinctive level of wine producer country, compared to other countries present in the Canadian market, such as Italy and France. However, in the Portuguese sample, the positive influence of the country of origin on brand awareness is supported, which is in accordance with previous studies (e.g. Pappu et al., 2007). Therefore, the Portuguese market relies heavily on national demarcated wine regions to underline the country of origin influence.

The positive influence of country of origin on brand loyalty was supported in both samples. This indicates that a favorable country image can increase brand popularity and enhance brand loyalty (Septyanti and Hananto, 2017). Therefore, loyalty to a country may be transferred to loyalty to the country's brands, through the familiarity with a country's products (Paswan et al., 2003).

Regarding the positive influence of Aaker's (1991) four brand equity dimensions, namely perceived quality, brand associations, brand awareness and brand loyalty on brand equity, our results weren´t totally consistent with previous literature. The results partially supported the positive influence of perceived quality on brand equity. In accordance with previous literature (e.g. Liu et al., 2017), the results of the Portuguese sample demonstrate that perceived quality positively influences brand equity. However, the results of the Canadian sample did not support this relationship. One possible explanation for this unsupported relationship, besides the fact that the sample may not be representative of the population, is that Portugal ranks ninth in total wine imports of the Canadian market (Canadian Vintners Association, 2019), both in terms of value and quantity. As defended by Zeithaml (1988), the degree of perceived quality increases with a long-term relationship with the brand, enabling the recognition of brand differentiation and superiority. Thus, compared to other wines available in the Canadian market, Portuguese wines may still evidence some disadvantage in this brand equity dimension.

Moments, episodes, and facts constitute associations that consumers can produce regarding one brand, which will lead them to select one brand over another, thus contributing to the creation and enhancement of brand equity. Although the relationship between brands associations and brand equity has been previously accepted in the literature (Yasin et al., 2007), regarding the wine industry, this study only partially supported it (in the Canadian sample). For Portuguese consumers, the impact of brand associations on brand equity is not significant, which may be explained by the fact that consumers' associations may be essentially connected to the product and not to the brand. Moreover, it is important to emphasize that the survey was drawn up addressing the Wines of Portugal brand, instead of specific national brands.

Previous studies (e.g. Keller, 2008) have demonstrated the importance of brand awareness for brand equity reinforcement. However, this relationship was not supported in this study. In both Portuguese and Canadian samples, the impact of brand awareness on brand equity does not reach the importance of other brand equity

dimensions, namely perceived quality, brand associations and brand loyalty.

The relationship between brand loyalty and brand equity is generally accepted in the literature and has been pointed out as preponderant in the creation of brand equity (Aaker, 1996). The results corroborate this relationship in both samples, therefore for wine consumers of both nationalities, brand loyalty positively influences brand equity.

In the specific case of the Portuguese market, the current country's positive phase regarding tourism may be an important tool to promote the wine industry. The promotion of wine tourism can improve the reputation of wine regions and highlight their differentiating characteristics (Frochot, 2003), allowing the consumer to transfer these positive associations to the brands coming from that region/country. The creation of favorable consumer experiences may be a tool to enhance the wine perceived quality and the creation of memories that enable increased brand loyalty and brand equity (Madeira et al., 2019). This suggestion can be applied to both the Portuguese and Canadian markets. In addition to the above benefit, this action may also contribute to change the Canadian consumer habits towards the product category under study, as according to 2018 data on alcoholic beverages (Statistics Canada, 2019), Canadians prefer beer, with wine appearing as a second choice (only in two provinces British Columbia and Quebec is the situation reversed).

The results of the Canadian sample highlight the need to enhance Portugal's reputation as a distinguished and high-quality wine country producer. To this end, joint and coordinated actions should be considered between governmental and private entities. This joint effort will benefit not only Wines of Portugal, but also individual brands wishing to internationalize to this market or to strengthen their presence, leveraged by the country of origin effect.

The results of this study highlight the work that needs to be done for wine producer countries to become reference countries in this product category and to raise brands to another level of recognition and distinction.

7. CONCLUSION

7.1. Limitations

Our results supported the perspective that country of origin is important for brand equity (Koschate-Fischer et al., 2012), however, country of origin's effects may diverge depending on several characteristics, such as nationality (Johansson et al., 1985) and culture (Balanis et al., 2002). Therefore, the results presented may have been influenced by both the diversity and size of the sample. In the Portuguese sample, most individuals were from Leiria district and aged 28 to 37 years, and the Canadian sample was composed mostly of individuals from the province of Alberta and aged 28 to 37 years. At the same time, the size of the samples and the disparity between them may also affect the results.

The study analyzed the wine industry, however, the generalization of the results needs to be conducted with caution, since specific wines have different behaviors, for instance the Portuguese Porto wine has a different behavior compared to the industry average.

7.2. Future research

Future investigations may extend the analysis of country of origin's effect on wine brands to other markets. Future studies may also analyze how other factors may influence the country of origin's effects on brand equity, such as the difference between inexperienced and experienced consumers. Additionally, in this study four brand equity dimensions identified by Aaker (1991) were used to measure brand equity. Future studies may examine the influence of other brand equity dimensions within the wine industry.

7.3. Final conclusion

Given the above results, the wine market is sensitive to the effects of the country of origin on brand equity, therefore players in the wine industry, such as brands, and producers' associations, should emphasize their origin in their communication strategies. It should be noted that the results suggest that efforts should be made to create brand associations, such as associating the brand to sustainable agriculture policies and cultural events, in order to create favorable consumer memories and to leverage brand equity. Moreover, improving brand image and investing in distinctive packaging, design and memorable logo are possible spontaneous and assisted vehicles to create brand awareness and enhance brand equity.

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Competitive Strategies for Wine Cooperatives in the German Wine Industry

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Abstract. The wine industry is significantly affected by globalization and changes in consumption habits and shifts in lifestyle, which lead to changes in the market environment and intensity of competition in the wine markets. Overall, wine cooperatives have a market share of more than 40 % in Europe. In Germany, they account for around one third of the total wine production. The decreasing number of wine cooperatives and their members leads to the assumption that wine cooperatives have difficulties adapting to the different market environment and though, need to select and implement competitive strategies. The aim of this paper is to identify and develop competitive strategies for wine cooperatives in the German wine industry. Therefore, the external forces affecting competitive rivalry in the wine industry are being evaluated for wine cooperatives in Germany. A qualitative approach has been applied including in-depth interviews with managing directors and chairmen of the board (n=15). Data were transcribed verbatim and content analysed. Results showed that the intensity of rivalry among existing competitors is high. Bargaining power of wine cooperatives towards buyers and suppliers strongly depends on their size. However, generally the bargaining power of retailers is high, although this depends on the retail channel (discounters, food retail, specialized retail, specialized wholesale, gastronomy). Five main strategy dimensions emerged: (1) the cost leadership and cost focus strategy, (2) the differentiation and differentiation focus strategy, (3) collaboration among producers, (4) offering additional services, and (5) options for improved membership relations and increased youth involvement.

Keywords: industry structure, competition, competitive strategies, cooperatives, wine, Germany.

1 INTRODUCTION

The wine industry is significantly affected by globalization and changes in consumption habits and shifts in lifestyle, which lead to changes in the market environment. The total worldwide consumption amounts to around 244 million hectolitres, whereas production is much higher [1,2]. The intensity of competition in the global wine market is increasing [3]. The German

wine industry reflects this tendency. In Germany direct sales from wine producers to consumers are decreasing, and the proportion of wine sold via retail chains now adds up to 89 % of total wine sales [4]. One factor influencing this development is the fact that nowadays many consumers are used to one-stop-shopping in order to save time [5]. Five retailers are dominating the food retail in Germany [6]. Besides the market power of those retailers, the high/constant availability of products of foreign and domestic producers impacts the competitive intensity in the German wine market.

In the past, the process of retailer concentration in Germany has induced a similar development in German agriculture and viticulture [7,8]. As food retailers generally demand large quantities for low prices, wine producers had to grow in size, too, to be able to respond (to these demands) and to be in a position to negotiate with retailers at eye level.

However, in Germany, grape production is still dominated by small-scale producers. Cooperatives "continue to be indispensable for most vineyard owners with small holdings, because wine production and wine marketing (…) would not be possible without prior pooling of resources and cost-sharing arrangements." [9] Similar to other European countries such as France (619 wine co-ops), Spain (551), Italy (493), Portugal (95) and Austria (15) [10], wine co-operatives play an important role in the German wine industry. In Europe, cooperatives are widespread in the agricultural sector. In the wine sector, cooperatives even have a market share of more than 40 % [11,12]. In Germany, around 41,000 grape growers are members of wine cooperatives [13]. For wine cooperatives, the changing market environment is challenging. The number of wine cooperatives in Germany has been decreasing from about 264 in 2000 to 159 cooperatives in 2016 [13]. Correspondingly, the number of members has decreased in the respective years from 61,000 to 41,000, and the acreage of vine cultivated by cooperatives has been decreased slowly for many years [13].

This development emphasizes the need for cooperatives to work customer oriented focusing on the market developments. However, this remains a very challenging task for wine cooperatives. Due to their business principles and characteristics as well as the strong heterogeneity within the groups of their members most cooperatives are still working member oriented, i.e. instead of market orientation they maintain a strong producer orientation [14,15]. Thus, the challenge for cooperatives is to find a competitive position within the industry by working market oriented and to foster the relationship with their members to retain members and vineyard areas. Focussing on just one of those areas will not be sufficient to work successfully in the long-run. The main performance criteria of a cooperative is the amount of grape pay-outs. High grape pay-outs and member satisfaction can only be accomplished if the cooperative is working successfully in the market in the long-run.

So far, the analysis of the German wine market has addressed the wine market displaying the market structure [16–21]. However, an analysis of competition intensity has not been done from the perspective of wine cooperatives.

This paper aims to examine the competitive intensity in order to derive strategies for wine cooperatives. Therefore, semi-structured expert interviews had been conducted with management representatives of 15 cooperatives in different wine growing regions in Germany. Based on the results, competitive strategy implications for wine cooperatives in Germany will be provided. These implications can (partly) be applied to wine cooperatives in other European countries as well.

The paper is structured as follows. Section 'The German wine market and cooperatives' outlines the overall situation of the German wine market and underlines the importance of wine cooperatives in Germany. In the next section 'Framework of competition intensity' predictions for the empirical analysis of competition intensity are being formulated. Section 'Empirical study' details the approach of data collection and evaluation used in this study and presents the results of the study. Section 'Discussion and implications' provides recommendations for competitive strategies for wine cooperatives. In the last section 'Summary' summarizing comments are being provided.

2 THE GERMAN WINE MARKET AND COOPERATIVES

2.1 The German Wine Market

In 2018, the total of volume marketed in Germany was roughly 20 million hl, from which German wine production accounted for approximately 10 million hl of wine. Germany is leading worldwide in wine imports, with more than 14 million hl in 2018. At the same time Germany is (re-) exporting a total of 3.7 million hl. The three main distribution channels are discount retail chains (50 % market share), retailers (28 % market share), and direct sales (11 % market share). Seven percent of the total volume is marketed via specialized retail and four percent via online retail. [4,22]

Discounters have gained market share during the previous years, whereas retail sales by supermarkets have remained stable, and direct sales have decreased.

Accordingly, average prices have been decreasing. Consumers spent on average 3.39 €/l for a German wine, whereas the average price paid for any wine sold via retail in Germany was 3.09 €/l in 2018. This means that imported wines have a lower average price in German retail than wines from Germany. [4]

Regarding the wine quality, consumers have high expectations. Even cheap wine has to be of acceptable quality. Therefore, producers need to meet the demands of their customers, including consumers and retail customers. Working with discounters and supermarkets, producers often have to meet requirements regarding the terms of delivery and minimum quantities [21]. Due to these requirements only few large wineries, large cooperatives (including secondary cooperatives), and producer associations are able to supply such large retailers national-wide. However, recent developments show that there is an increasing number of independent retailers which are part of the retail cooperatives of Edeka and REWE group [23,24]. Because those independent retailers often offer a broad spectrum of wines from regional producers [23] and since the independent retailers source their goods directly from wine producers via direct deliveries, this represents an attractive sales channel for private wine estates, wineries, and smaller cooperatives. Hence, also smaller industry players can benefit from the opportunity to distribute smaller quantities via retail compared to the nationwide distribution in the case of discount retail chains and supermarkets. In order to ensure the quantities and grape qualities required for this distribution channel, wine estates and wineries are now increasingly dependent on the cooperation with grape producers, thus competing with cooperatives in this realm. An example of this are the wines of the Robert Weil Junior brand, which are marketed exclusively through the Edeka group [25,26].

The structure on the demand side of the market strongly influence recent developments on the supply side as well. In former times viticulture was often one of many different plantations in the farms and the cultivated vineyard area per farm was very small. Pursuant to the structural change in the agricultural sector, the average acreage and production per farm increased with the level of their specialization. Viticulture is attractive for full-time as well as for part-time farmers as a high intensity of labour hours is needed and small growers often have simple equipment for viticulture. [21]

In Germany grape production is dominated by small-scale producers. There are more than 43,300 wine businesses in Germany. Out of this number about two-thirds cultivate less than 1 ha. Only 7 % (around 2,900 businesses) own more than 10 ha [27]. These figures show that viticulture in Germany is typically organized on small-scale plots. Corresponding to the structural change in the agricultural sector [28,29] the concentration process also continued in the wine sector. There is a tendency towards fewer estates with, on average, larger vineyard areas. Smaller farms are increasingly being pushed out of the market and forced to close down.

This concentration process is also reflected in the figures of the Federal Statistical Office [30]. There is a tendency to have fewer holdings with larger average vineyard areas. According to these figures, the number of agricultural holdings maintaining vineyards fell from 20,290 to 16,898 in the years 2010 to 2016. In particular, the number of smaller farms with an area under vines of less than 10 ha has declined. Since 2010 the average area per holding has risen from 4.8 to 5.9 hectares. [30]

2.2 Wine Cooperatives in Germany

The origin of wine cooperatives dates back to the 19th century, a century marked by far-reaching economic and political changes. With the beginning of the industrialization the proportion of cheap foreign wines and wine counterfeits increased. Additionally, grape producers were confronted with cultivation difficulties due to vine diseases and pests such as phylloxera and fungal infections (powdery and downy mildew). In response to this, grape and wine producers joined forces to improve their economically weak position. In 1868 the first wine cooperative was founded in the Ahr wine growing region, followed by the emergence of wine cooperatives in various wine growing regions in the subsequent years. [31]

Today, wine cooperatives are still of significant importance in terms of German wine production. In the financial year 2015/2016 wine cooperatives produced around 2.7 million hectolitres wine accounting for about 30 % the total German wine production. The number of wine cooperatives in Germany has been decreasing from about 264 in 2000 to 159 cooperatives in 2016[1]. By creating synergies and reducing costs an improvement of the economic situation should be attained. In 2016 the German cooperative sector could be classified into 157 primary and two secondary cooperatives. However, only 91 possessed their own vinification facilities. Around 41,000 grape growers are members of wine cooperatives in Germany. The acreage planted with vines by all members declined from about 37,000 hectares in 1990/1991 to 28,205 hectares in 2015/2016. Still, this vineyard area represents about 28 % of the total winegrowing area in Ger-

[1] 2016 is the last year for which comparable data are available. The most recent number is 150 Raiffeisen cooperatives in 2020 [32].

many. Most cooperatives are situated in the wine growing regions of Baden, Württemberg, and Palatinate. [13]

The size of wine cooperatives in Germany varies strongly. Especially minor cooperatives without own vinification facilities can be quite small, some only possess an acreage under cultivation of around 28 hectares, whereas other cooperatives (mostly with own vinification facilities) are larger and some even cultivate more than 1,400 hectares[2].

According to their bye-laws, wine cooperatives are self-help organisations for grape producers. The business principles of wine cooperatives can be defined as "by the identity of users and owners, the democratic principle of voting, and the lack of entry barriers" [7]. Furthermore, the legally manifested business objective can be seen as a further characteristic [7]. The main aim is to improve the economic situation of their member businesses (GenG §1) [33] by enhancing the profitability and sustainability of their members [34,35]. In other terms, this refers to supporting the member businesses with highest possible pay-outs.

In cooperatives members and the management have a double function: they are both agents and principals at the same time (Double Principal-agent problem) [36–38]. Based on information asymmetries that arise due to the internal structure certain problems arise in cooperatives. Five general problem areas have been identified by Cook [39]: free-rider problem, horizon problem, portfolio problem, control problem (quantity and quality instabilities due to adverse selection and opportunistic behaviour as well as high agency costs), and influence cost problem (arising from different demands, interests, strategies, and goals of individual member businesses). Furthermore, Ringle [40] identified transaction cost problems and the problem of identification with the cooperative. Due to different interests and approaches to achieve cooperatives goals conflicts can occur [34]. Hanf and Schweickert [7] showed that member heterogeneity increases all challenges which were mentioned above. [35]

The business principles of (wine) cooperatives as well as the internal structure and consequent problems often lead to a strong member orientation [14]. Furthermore, cooperative members are of different size and some are full-time grape producers whereas others are only active part time in viticulture. There also often exists a strong heterogeneity among cooperative members, i.e. the business aim of the members can differ widely [15]. Members also differ in regard to their planning horizons and risk preferences [9]. The organizational form and member heterogeneity contribute to a slow decision-making process, as it can be challenging to aggregate the different members' preferences [9]. However, the key objective of all grape producers is to sell their grapes [15]. Consequently, members as well as cooperatives are often producer oriented [15]. In their article Hanf and Schweickert [15] aimed to disclose the area of conflict between member orientation and customer orientation for wine cooperatives.

3 FRAMEWORK OF COMPETITION INTENSITY

The structure of the German wine industry and degree of competition were analysed by using a framework based on the industry structure analysis. It offers the opportunity to analyse the competitive intensity within one industry as it investigates the industry conditions based on external factors. According to Porter [41], the following forces affect the competitiveness in an industry: (1) intensity of rivalry among existing competitors, (2) bargaining power of buyers, (3) bargaining power of suppliers, (4) threat of substitute products, and (5) threat of new entrants. To be able to derive strategic implications for the wine cooperatives each force is applied to the German wine industry from the perspective of wine cooperatives. The concluding predictions will be analysed in the empirical part of this study.

Intensity of rivalry among existing competitors

The German wine market is a saturated market. For many years the total volume of wine (incl. sparkling wine) traded in Germany varies between 19.5 and 20.2 million hl [22]. Hence, the market size is quite stable and consumption in Germany is not growing. After the large harvest in 2018 [42,43] it has been be observed that high fixed (storage) costs could lead to price-cuts. To a certain extent product differentiation and branding can be achieved [44–47]. There are not many strong brands of German producers in the wine industry, though. Consumers and retailers have low switching costs as there exists a huge number of products of different producers in the market. Domestic producers are also in competition with both foreign producers and imported wines as Germany is leading the worldwide wine imports in respect to volume [1]. Production costs are high [48,49]. Exit barriers are high as well as high sunk costs occur when producers want to switch the production in favor of another product or exit the industry at all. Especially for those producers who are engaged in viticulture and wine production as their main source of income switching is not easy.

[2] Based on own interview results within this study.

Prediction 1: The intra-industry competition is intense and rivalry among existing firms is high.

Bargaining power of buyers

Both retailers and consumers are considered as customers. Most cooperatives with own vinification facilities produce large quantities and therefore need to distribute through supermarkets and/or discounters. Often, cooperatives also engage into direct sales to consumers. In Germany, five big store-based retail groups dominate the food retail market in Germany [6]. This shows that the concentration of food retailers is high. Compared to this the number of individual producers in Germany is high. Additionally, many foreign producers try to sell their products in the German market. This implies low switching costs for customers. During the past years the number of independent retailers that belong to the retail cooperatives Edeka and REWE group has been increasing [15,23,24,50]. They can partly decide about the offered product range [23] which makes it possible to work closely with regional producers. For wine producers forward integration is only possible through direct marketing but not through vertically integrating into the realm of food retail. For retailers, backward integration is not very common. The only existing example in Germany is Edeka group which has its own winery called Rheinberg Kellerei. Apart from this, retailers often have special contracts with wineries or other wine producers to secure the supply of certain products or to produce their own retail brands. Consumers also face low switching costs as they can choose from a broad band of different products.

Prediction 2: Due to the low switching costs for customers and the availability of a large number of different products of domestic and foreign producers the bargaining power of buyers is high.

Bargaining power of suppliers

The group of suppliers is divided into intra-cooperative suppliers (grape growers) and external suppliers which supply inputs other than grapes. Other suppliers include producers of glass bottles, barrels, tanks, corks, screwcaps, labels, cardboard, fining, additives, equipment, and machinery, etc. needed during the wine production process.

Due to the "one-member-one-vote"-principle, cooperative members have limited influence in the decision-making. That means that "irrespective of the amount of grapes or wine that members produce, all members have the same voting power in assemblies" [51]. They always have the possibility to leave the cooperative but have to face switching costs. The grape prices are not negotiated with the grape growers but within the board of members and supervisory board. As these boards are being formed by their members the members that were selected into the boards have influence over grape prices. Information asymmetries can easily occur in the relationship of grape producers and the management of the cooperative [37] which can lead to opportunistic behaviour (e.g. free-riding on quality, partial delivery, …) [52,53]. Up to now, only a few cooperatives in Germany seem to sanction their members when they are in breach of the contract [54,55]. Sanctions often remain low or have not been implemented [54,55] since cooperatives are threatened to lose members and vineyard area.

Suppliers of scarce or highly differentiated inputs have a high bargaining power. In the German wine industry this is especially true for suppliers of equipment and machinery. Strong suppliers exist in these fields which offer very specialized services for their products to their customers. Suppliers of other inputs such as glass, corks, screwcaps, labels, etc. are more frequent and are expected to have a lower bargaining power. All suppliers rely on a good reputation and customer satisfaction. There is neither a credible threat of forward integration from suppliers of other inputs nor a credible threat of backward integration from cooperatives. In the case of larger cooperatives, the bargaining power is expected to be higher than in the case of smaller cooperatives as large cooperatives supply large amounts of inputs.

Prediction 3: Due to the specific structure of cooperatives and member-management relationship the bargaining power of grape suppliers is medium. For suppliers of other inputs than grapes bargaining power is expected to be medium as well.

Threat of substitute products

Many substitutes for wine of German wine cooperatives exist in the market. These include wines from other national and international producers as well as all other alcoholic beverages such as beer and to a certain extent spirits, wine-based drinks, and cocktails [56]. There is also a recent trend emerging toward cannabis-based drinks [57]. Some big international beverage producers draw their attention to this market segment and launch products which contain THC-extracts [58]. As of today those products cannot be considered as a substitute yet but might be in future [57].

There is a high number of alcoholic beverages, but cooperatives often offer wines at a reasonable price-perfor-

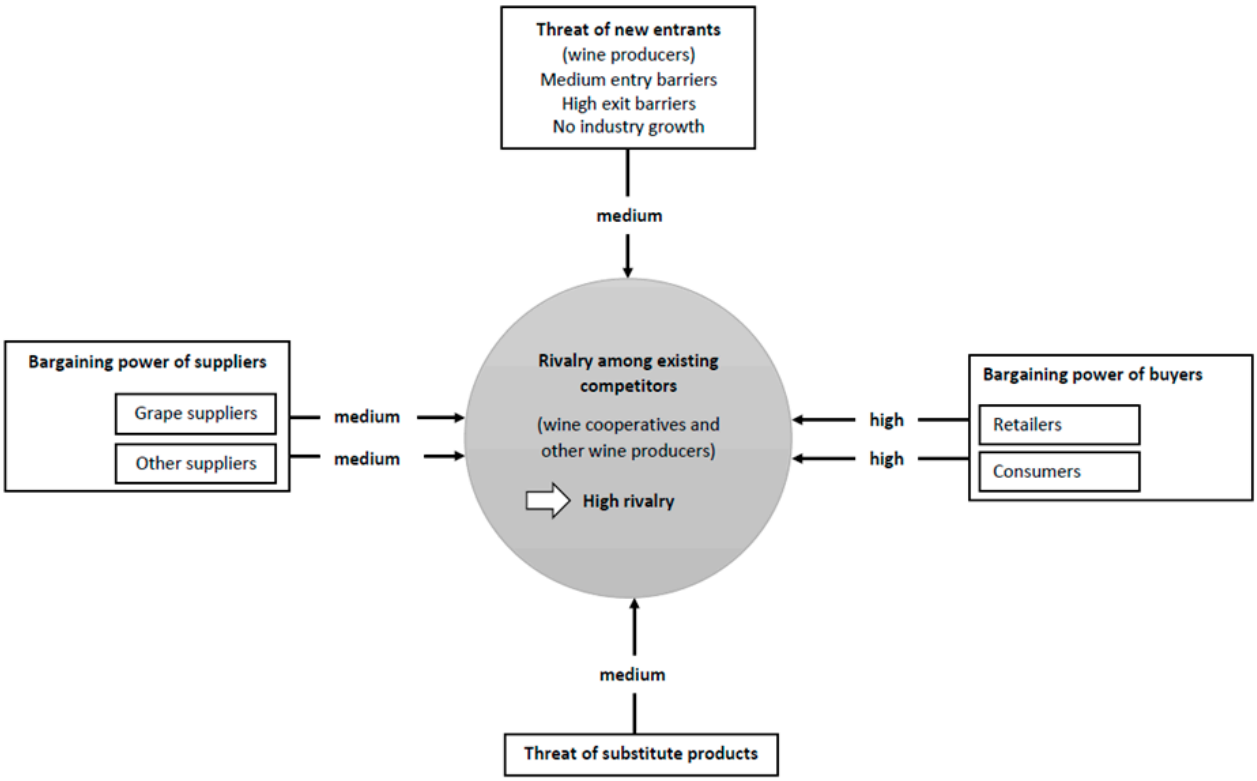

Figure 1. Framework of expected influence of each force.

mance ratio. Consumers can easily switch between products as there are many products to choose from. Wine producers and cooperatives might lose some consumers as they experiment with the introduction of new products.

Prediction 4: The pressure from substitute products is medium.

Threat of new entrants

All kind of new entrants which produce wine represent a threat to established wine cooperatives. These include newly founded cooperatives, wine producer associations, wine estates, and wineries. The most likely new entrants which represent a threat to established cooperatives are other wine producer associations and wine estates that purchase grapes. They both are dependent on grape producers like cooperatives, as they have a need for grapes as input for the production of large volumes and in order to gain market share.

Overall entry barriers to the German wine industry can be viewed as being medium. Factors that could deter potential entrants from entering the market are high capital requirements (e.g. for vineyards, equipment, machinery, production facilities) and high production costs [48,49]. Also, high exit barriers occur for wine producers in the German market. They are high for both new entrants and established firms.

Prediction 5: In the German wine industry barriers to entry are medium and barriers to exit are high. Thus, the threat of entrants is medium.

Figure 1 shows a summary of the expected influence of each force.

4 EMPIRICAL STUDY

4.1 Sample and Interview Description

So far, no research has been done explicitly on the structure and competitive intensity in the German wine market from the perspective of German wine cooperatives. Until now there has only been limited knowledge and an explorative study has been conducted. For this qualitative approach 15 in-depth interviews were conducted via telephone from July to September 2019[3]. The

[3] A total of 27 experts were initially contacted out of which 17 experts (including two pre-tests) agreed to be interviewed. Despite repeated attempts, no reply was received from seven of the contacted experts

interviews were done in German language, transcribed verbatim, and content analysed [59]. Then the main results were translated into English. In order to ensure a wide range of opinions and perspectives, interviewees from cooperatives were chosen which were located in different wine growing regions and different cooperatives of varying sizes. The cooperatives included in this study were all located in Baden, Württemberg, and Palatinate as these regions contain the highest numbers of cooperatives within Germany. Because cooperatives are not subject to publication requirements it was not possible to assemble information on the financial performance of the 15 cooperatives and to relate that information to the answers provided by the interviewees. In the case of wine cooperatives, the payments (grape money) members receive is the decisive performance criterion. This data is not available.

All interviewees of this study are actively working within the German wine industry. Managing directors and chairmen of the board were selected as interview partners as it is vital that all interview partners are involved in the day-to-day business of the cooperative and have in-depth information on structures, strategies, processes, and procedures.

Except for one, all interview partners agreed to the recording of the interview. In the case of the single exception, written minutes were produced. The length of the interviews varied; the shortest lasted 25 minutes while the longest lasted 55 minutes.

Different techniques were used during the interviews to minimize the social desirability bias. In the beginning of each interview details about the study were given including the purpose of the study and details on how the data would be used, how confidentiality would be guaranteed, and information about anonymity procedures. The interviewer also used techniques such as posing indirect questions about the behaviour of others, providing examples, assuring that there are no right or wrong opinions.

The applied research methodology is used to analyse the developed framework and to gain a deeper insight into the structure and competition in the German wine industry.

4.2 Empirical Results

Regarding the ***intensity of rivalry among existing firms***, results will be shown including the following aspects: competitors, market size and evolution, storage and price-cuts, customers' switching costs, export activities, and approaches to face the situation of competition.

The interview partners are mainly considered as competitors, local competitors such as other successfully operating cooperatives or wineries in the same region, as well as foreign producers, that are able to produce wine at lower costs. All interview partners described the German wine market as a mature and stagnant market, without industry growth. The oversupply was mentioned several times[4]. The interviews, which had been conducted shortly before the harvest of 2019 indicated a severe situation of the market as the stocks were still well filled because of the large harvest in 2018 and producers felt the need to empty their storage for the new harvest. The interview partners highlighted the low switching costs their customers have. Both retailers and final consumers can choose between many different products. It was not confirmed that sunk costs are high as online platforms and newspaper advertisements exist to sell and buy second-hand equipment and machinery. In general, shelf space is limited and there is a fierce competition amongst wine producers.

The majority of the cooperatives included in this study is not engaged in export. Only one interviewee mentioned that the cooperative exports 35 % of total sales, another exports 5 %, and 13 interview partners mentioned small, irregular, or no export activities. Reasons cited for small export activities were the production of certain grape varieties or wine types (e.g. red wine), which are not demanded in potential import countries. Furthermore, the representatives stated the lack of financial resources for export. Six interview partners expressed interest in increasing their export activities.

To face the situation of competition, wine cooperatives follow different approaches depending on their size and managerial capabilities in pursuing a clear strategy. Seven interview partners spoke about optimising and reducing costs. Six of them were large cooperatives (> 500 ha under cultivation) and one was a medium-sized cooperative (100-499 ha). One manager stated as aim "to optimize costs and to keep costs permanently slim". With regard to the investment planning, another said that it is absolutely necessary to keep an eye on process optimisation and potential cost reductions. Several

and another three persons were not willing to give an interview. Two of which stated time constraints and the other one generally refuses to participate in interviews.

[4] A visible example of the struggle some German wine cooperatives face as a result of overproduction and a mature market is the cooperative Remstalkellerei eG, which had stopped grape pay-outs to its members because of financial difficulties and the lack of wine sales. In the newspaper article it was mentioned that there are still some quantities of the vintages 2014, 2015 and 2016, which the cooperative had not sold yet and the time has passed to sell those wines to the secondary cooperative at acceptable prices. [60].

cooperatives included in this study have already been part of a merger with the aim of creating synergies in terms of cost reductions. For cost optimisation, the technical facilities have to be up-to-date and the capacity utilisation has to be high, one interview partner specified. The high capacity utilisation contributes to lower the costs per unit (application of economies of scale). Another interview partner mentioned that the cooperative is filling all year in double-shift operations. The medium-sized cooperative also plans to build further collaboration to reduce costs. The manager wants the cooperative working together with other cooperatives or private businesses mainly from other wine growing regions to reduce costs. Such kind of collaboration also enables logistical advantages to customers as different wines from different producers from various wine growing regions can be offered "to get it all from one source". Some interview partners mentioned being part of the WeinAllianz GmbH, which is a collaboration of 14 businesses from different wine-growing regions and of different type (cooperatives and wine estates) with the aim to reduce costs by sharing a joint sales force.

Besides optimising and reducing costs, cooperatives can use branding to differentiate from competitors. Some of the managers have a clear understanding of the meaning of branding. As one interview partner said: "Wine is a luxury good and hence there is a brand awareness and attachment to certain brands." One manager spoke about strong competitors (mainly wineries) who produce wines of a certain brand where the brand concept behind is very similar to their own. Another cooperative offers different brands within the distribution channel depending on the retail chain. For Lidl, for example, they produce another brand than for Aldi or Netto. In order to be able to offer such cheap products in the discount, the cooperative even buys in cheap in order to be able to sell large quantities to the retailers. This business allows the cooperative to experiment with other things as there is a greater financial backup. Furthermore, the respective manager said: "This is not correlated with an enormous risk, as these are single brands, we can decide immediately to stop that." He said: "The aim is to strengthen the brand and increase the demand for our brand, as this will also increase our negotiation power and then we will be able to also increase prices and revenues." However, another interview partner highlighted: "You can't establish brands from one day to another. You need to let a brand grow, and therefore you need time."

Instead of using brands for differentiation others mentioned to use certain attributes in the communication with customers that are relevant to them. One manager stated that the cooperative was even certified as sustainable producer and uses this attribute in marketing communications. Besides this one, others also highlighted that cooperatives live values that recently have gained importance such as joint production, co-working, solidarity, partnership, local production, transparency, and sustainability.

Regarding investments in tangible and intangible assets, the interviews showed that it is much easier to realize investments in tangible assets such as machinery or equipment. Investments in intangible assets are often more difficult to realize. One statement should be given exemplarily: "Investments in tangible assets, e.g. cellar, cellar equipment..., are always easier and better understood by the members, than investments in intangible assets, such as the marketing agency and sales topics. There we have to put more effort into the conviction." Only one interview partner clearly disagreed and stated that there was no difference at all between such investments.

The prediction of a high intensity of rivalry among existing firms within the German wine market was confirmed.

On the subject of the bargaining power of buyers, the interviews showed that the market environment is as described before: the food retail (incl. discounters) in Germany is concentrated and demands minimum quantities for a nationwide supply. However, the increasing number of independent retailers of the Edeka and REWE group represent a new and attractive distribution channel for cooperatives, wineries, and wine estates. Often, they own several markets within one region. Hence, they demand smaller quantities compared to nationwide distributing food retailers, and are interested in working with regional producers. The interviews showed that the competition within such regional retailers is fierce as well. In most wine regions retailers can choose from numerous different producers. The interview partners mentioned that during negotiations with specialised wholesalers and gastronomy other factors vitally important, which influence the business relationship including long-term business relationships, mutual trust, and reliability. In negotiations with retailers, besides prices, conditions such as extra services or reimbursements depending on the sales performance are being negotiated. For German retailers it is not common to backward integrate.

In respect to the consumer all interviewed cooperatives stated that they have established direct sales to consumers. The share distributed via direct sales ranges from 8-50% of total sales in volume between the interviewed cooperatives. Direct marketing is attractive for wine producers as this entails the highest margins for

the cooperative without sharing margins with retailers. To increase direct sales, cooperatives conduct in-store wine tastings, offer wine touristic activities (e.g. guided walk through the vineyards with wine tastings; wine festivals; after-work get-togethers for young professionals). Some cooperatives also maintain an own online-shop for direct sales to consumers. Most interview partners desire to increase the percentage of direct sales to consumers.

The prediction of a high bargaining power of buyers was not confirmed as it strongly depends on the distribution channel and size of the cooperative as to which party has a greater influence in negotiations.

In terms of the ***bargaining power of suppliers*** the interviews revealed that in most cases the management of cooperatives is challenged regarding the relationship with grape suppliers, which are their members. Due to their potential influence in decision making as board members and interest in the highest-possible pay-outs the management of cooperatives is challenged to keep their members satisfied. Some cooperatives struggle with loosing members whereas other successfully operating cooperatives cannot or do not want to accept new members. Some have installed e.g. social mechanisms regarding incentives and control which help to give guidance and support to the members and work market oriented. Some cooperatives organize farmer reunions to inform members about ongoing projects. According to the interview partners, this also helps to raise the member's identification with the cooperative. As expected, the bargaining power of grape suppliers is medium.

In the relationship with their suppliers of inputs other than grapes, the cooperatives included in this study work in different ways. Cooperatives which are attached to the secondary cooperative[5] mostly order inputs of those suppliers with which the secondary cooperative works in order to obtain better conditions. Thus, those do not negotiate on prices and conditions. The bargaining power strongly depends on the size of the cooperative and the type of supplier. Large cooperatives that represent an important customer for the supplier, e.g. a regional supplier of etiquettes or closures, have the possibility to influence negotiations. Smaller cooperatives do not have many possibilities to negotiate on prices, but mostly prefer to work with their regional supplier and have a long-term and stable relationship instead of changing the supplier frequently. In the case of suppliers of technology, equipment, and machinery, room for negotiation is very limited. As these suppliers offer certain services and are very specialized, they are the one in control. Overall, the representatives of the cooperatives mentioned that three factors are decisive for the business relationship with suppliers: the duration, reliability, and reasonable prices. The statements of the interview partners show a clear tendency: The smaller the cooperative, the less important is the price, and the more important is a stable relationship with regional suppliers; the larger the cooperative, the more important is the price, as this is more cost-driven. No information was provided regarding the potential threat of forward integration by suppliers. Regarding the threat of backward integration of wine cooperatives, the interview partners did not show interest in producing their own inputs (except for grapes). The prediction about the medium bargaining power of suppliers (both grape suppliers and other suppliers) was confirmed.

To estimate the ***pressure from substitute products*** interview partners were asked about the kind of products considered as substitutes they compete with as well as consumer preferences and developments in this field. For most cooperatives especially regional competitors with products at the same quality level, price range, and grape variety are rated excessively high in the assessment. These competitors are mainly private-owned wine estates or wineries close by but also other wine cooperatives in the same region. Furthermore, some interview partners mentioned low-cost products from abroad as strong substitutes. Especially for producers from the wine growing region Württemberg that is mainly producing red wines, wines from producers from countries such as Italy, France, and Spain, are evaluated to be strong substitutes. However, other product categories of alcoholic beverages, such as beer, spirits, or wine-based drinks were not considered to be strong substitutes. New product developments such as cannabis-based drinks were not mentioned explicitly by any of the interview partners. One interview partner highlighted the importance of being attentive to market developments: "You try to analyse your market environment and decide, where you could sell more. It is also essential to analyse the wine types and grape varieties (such as Pinot Gris, Blanc de Noir, Rosé) which are demanded at the moment. It is important to discuss about this frequently with the ones who are responsible, thinking about innovations and about which products to cut off." Five interview partners spoke about the importance of product innovations. One interview partner mentioned to have invented a new product that was not known on the German market so far. It is an aromatised wine-based

[5] According to the interview partners, cooperatives that are attached to the secondary cooperative are cooperatives without own vinification facilities as well as cooperatives that have a contract with the secondary cooperative for partial delivery. The latter have own vinification facilities but deliver a fixed amount of the harvest directly to the secondary cooperative for further vinification.

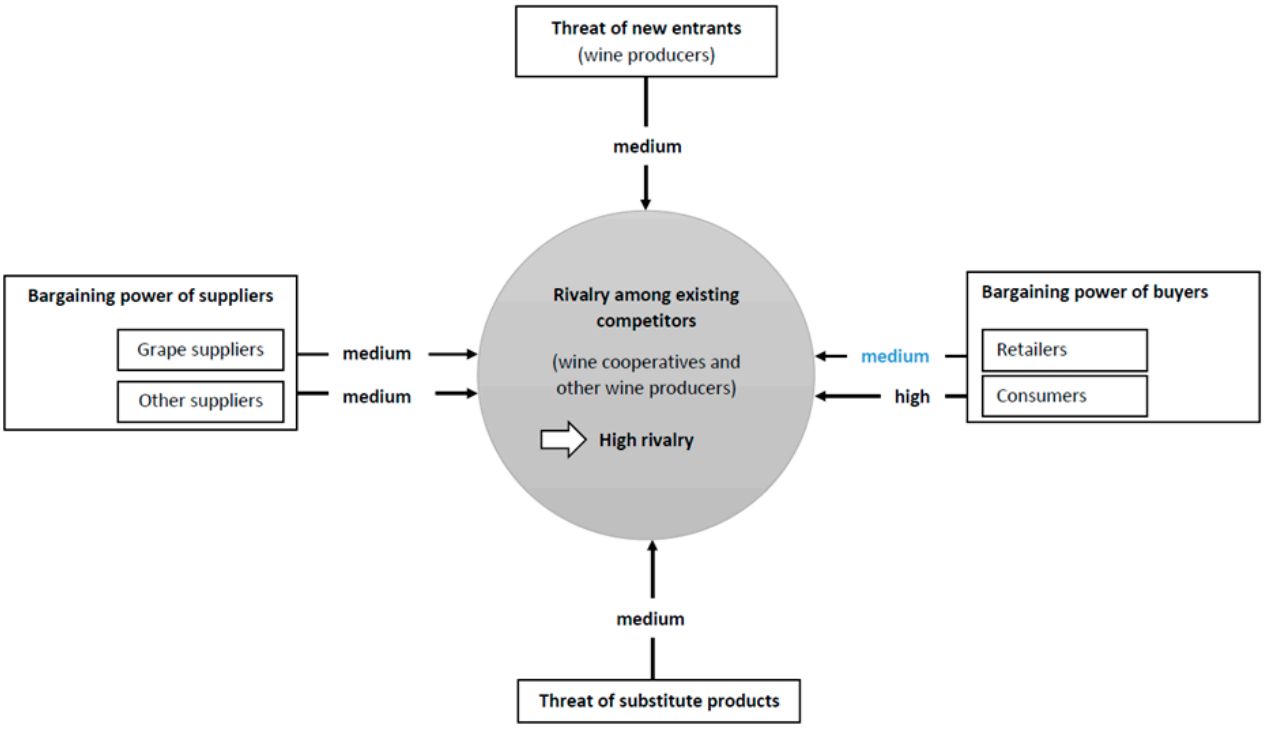

Figure 2. Framework of actual competition in the German wine industry.

drink, more specifically a red-wine aged in whiskey barrels. One also noticed: "Product innovations also require investments: time and money, in order to push the product into the market." The threat of substitutes is medium, hence, the prediction was confirmed.

Regarding the ***threat of new entrants*** the experts stated that economies of scale and scope apply in the wine industry which might retain new entrants from actually entering the industry. Switching suppliers is not always easy, especially in the case of suppliers of equipment and machinery. Working in viticulture and wine production requires high investments, which lowers the threat of new entrants. Also, production costs for wine are high. Product differentiation in terms of branding and product innovation is still possible in the German wine market which makes it more attractive for producers to enter the wine industry. It could not be confirmed that switching costs to produce other products (such as juices, spirits, or wine-based drinks) are high. Several interview partners mentioned the new emerging competition in terms of private-owned wine estates that buy-in grapes from grape producers. In order to be able to guarantee the quantities and grape qualities required for the distribution channel of the independent retailers, wine estates are now increasingly dependent on cooperations/cooperating with grape producers. Due to these developments grape producers have more alternatives for the sale of their grapes, which results in the migration of members. Besides, nearly all interview partners mentioned to struggle with succession. According to the interview partners full-time grape producers often have a successor, as full-time viticulture offers the basis for making a living. One interview partner stated: "It is a challenge to motivate the young generation for the cooperative system. Also finding young people who are willing to work voluntarily in the committees is difficult." Overall, the prediction about a medium threat of new entrants was confirmed.

Figure 2 shows the framework of actual competition in the German wine industry.

5 DISCUSSION AND IMPLICATIONS

The following implications do not only apply to the German wine cooperatives but also partly to wine cooperatives in other European countries. In other European countries which traditionally produce wine differences in production and consumption is increasing and the markets are saturated as well [61]. Furthermore, cooperatives play an important role in countries like Spain, France or Italy. In Spain, for example, cooperatives account for 60 to 65 % of the total Spanish wine production [62]. Due to

the saturated market, cooperatives in Germany and other European countries face the same challenge: to pursue a clear strategy in order to gain a competitive advantage. However, to a certain extent, the derived strategies can only be applied to German wine cooperatives as the market structure differs from some of its neighbouring countries due to the high wine imports from other countries.

Need for market orientation and competitive strategy

The results showed that wine cooperatives in Germany face the situation of intense competition. With the high number of imported products and a wide availability of products with a good price-quality ratio, German consumers have the choice. Besides, the increasing share of wine distributed via discounters and food retail emphasizes the need for cooperatives to work market oriented. The narrow focus on the level of pay-outs and internal structure of cooperatives leads to a strong production and member orientation in many cooperatives, and prevents them from following a more market-oriented approach. This result is consistent with the findings of Hanf and Schweickert (2014) who state "customer orientation is the key to success" [15]. Certainly, the pursuit of a clear strategy is necessary to tackle the intense competition.

On one hand cooperatives have to find a competitive position within the industry and on the other hand they have to foster the relationship with their members to retain members and vineyard areas. The focus on just one of those aspects will not be sufficient to compete successfully in the long-run. High grape pay-outs and member satisfaction can only be achieved if the cooperative is working successfully in the market and generating a surplus. Schamel [63] found that the success of wine cooperatives also depends on particular social factors (e.g. member commitment and trust) as well as on organizational control variables (e.g. training activities).

In terms of means of achieving a competitive advantage and determine the respective strategy (and based on the scale of the enterprise and scope of the line), cooperatives can follow the strategy of cost leadership, cost focus, differentiation, or differentiation focus. Cost leadership as a generic strategy to become the industry's low cost producer can only be chosen by a few players in the German wine industry [64]. Alternatively, producers can choose differentiation.

Cost leadership and cost focus strategy

Of the interviewed cooperatives, mainly large cooperatives implement the cost focus strategy for a nation-wide distribution. As shown in the results, managers pay attention to keeping the technological equipment and facilities up-to-date and having a high capacity utilisation. Furthermore, collaboration among producers is seen as a possibility to lower costs in terms of joint sales activities. For the cost focus strategy, the application of economies of scale and scope are vital. The decreasing number of wine cooperatives in Germany and recurring news about mergers of cooperatives show that this is one of the measures cooperatives take to lower the production costs.

Small and medium-sized cooperatives can aim for regional cost leadership. Apart from the secondary cooperatives it is difficult for wine cooperatives to strive for an industry-wide cost leadership as wineries produce low-cost wines of German and international origin.

Differentiation and differentiation focus strategy

Results have shown that the bargaining power of retailers in the German wine industry is often high depending on the distribution channel. In some cooperatives, direct sales to consumers account for up to 50 % of their total sales volume. Direct marketing is attractive for most cooperatives as avoiding retail channels provides them for a better margin. Thus, most of the interview partners aim to increase the share of direct marketing. Options for cooperatives in the wine sector to lower the bargaining power of retailers are: (1) establishment of strong brands, (2) development of new products, (3) market development, and (4) using attributes in the communication with customers that are relevant to them. These options are also applicable to wine cooperatives in other countries.

(1) The establishment of strong brands will allow to differentiate from other wine producers. This will help to increase sales. Brands give orientation to the consumer. E.g. consumers that have had a positive experience with the cooperative (e.g. during a wine touristic activity, wine fest, tasting) are more likely to choose the wine when to decide which wine to buy at the point of sale at the retailer. However, as shown in the interviews, the establishment of brands is costly and needs a long-term plan. Besides, in most cases the investment in intangible assets is difficult for wine cooperatives due to their internal structure and the horizon problem (cf. results and [31]). Krieger et al. (2014) [31] suggest that these problems can, however, be solved by an explicit definition of competences and greater budgetary authority for the brand managers of a cooperative.
(2) Another possibility is the development of new products. As shown in the results, five of the interview

partners have already identified product innovations as important tool to increase or stabilise sales. Innovations such as aromatised wine-based drinks diversify the product portfolio. This is in line with Grashuis (2018) who found that some cooperatives respond to the ongoing segmentation of consumers with product and process innovation in order to diversify the product portfolios [65].

(3) The results showed that export activities of the interviewed cooperatives remain - in most cases - still at a low level. Several interview partners demonstrated their interest in increasing exports. Based on sound market research, the identification of new export markets and investment into export activities contribute to the development of new markets.

(4) As shown in the results interview partners mentioned positive effects of using attributes in the communication with customers that are relevant to them. An example is the usage of the characteristic of being a sustainable producer which can be used as differentiation focus strategy. One interview partner mentioned the certification of the cooperative as sustainable producer which was assessed as competitive advantage by the manager. Cooperatives which follow the approach of sustainable production should use this as an outstanding feature in communication with customers. Furthermore, the usage of the "farmer-owned" attribute can provide a marketing advantage over non-cooperatives [14]. Consumers might associate the cooperative with certain social values such as democracy, equality, or solidarity, which can also provide a marketing advantage [14,66]. Cooperatives could use these values for differentiation [67].

Collaboration among producers

As mentioned in the interviews, another option to lower the bargaining power of retailers is the establishment of inter-firm collaboration. The results show that in Germany so far apart from the collaboration of some interviewed cooperatives with the secondary cooperatives (joint production and distribution of wine) or joint marketing efforts of certain wine-growing regions (e.g. Weinheimat Württemberg) only few collaborate with other producers (e.g. being part of the WeinAllianz GmbH). Especially small and medium-sized cooperatives should develop a collaboration with other producers, e.g. with other cooperatives or wine estates from different wine-growing regions in Germany. This can be implemented as a collaboration between two or more German cooperatives with the objective to join forces and lower costs for joint participation in trade fairs or joint marketing and sales efforts. Such type of collaboration among producers could also be applied in other countries where market structures, common goals and joint interests allow building strategic alliances.

Offering additional services for B2B and B2C customers

Another option to lower the bargaining power of retailers is to expand and improve additional services. As retailers can be considered to be gatekeepers to consumers, the requests of retailers have to be fulfilled. Requests can include a professional supply chain management, including a prompt and timely delivery as well as minimum delivery volumes [15]. For products of retail brands, a high product quality is a prerequisite [15]. Furthermore, medium and large cooperatives could offer consultancy for food retailers in terms of category management. This in turn emphasizes the need for market orientation and hence, customer orientation which is essential for building a professional relationship with the customer. Cooperatives can also offer additional services for gastronomy and specialized wholesalers to create added value and by this to enhance their competitive position. Another promising approach for cooperatives not yet in direct contact with the Edeka and REWE group is to offer their wine range to independent retailers who are able to shape their product portfolio. In this study it was shown that independent retailers gain importance in the German market. Bitsch et al. (2020) [23] have shown that this distribution channel offers a good possibility to market wines for those players who are not able to supply the nation-wide market. By offering concepts closely oriented to specialized retail, consumers also often have the chance to ask for advice of special sales staff and to taste wines at the point of sale, which influences their willingness to pay.

Besides the expansion and improvement of additional services for retailers cooperatives should also pay attention to the increase of services offered to consumers. This can include for instance the intensification of wine-touristic activities. Especially small and medium-sized cooperatives should build on regionality, customer relations, and innovative events.

Options for improved membership relations and increased youth involvement

This study showed that wine cooperatives in Germany have to deal with member fluctuation and the question of succession. In order to counter this, coopera-

tives should improve membership relations by increasing the flexibility of membership and terms of delivery (e.g. permitting partial delivery). Based on the principles laid down in the cooperatives bye-laws members of some cooperatives are allowed to deliver their grapes either to the cooperative or to sell them to wineries or wine estates at better conditions [37,54,55,68]. Research has shown that the permission of partial delivery in wine cooperatives in Germany can contribute to retain members and support member businesses[6] [54,55,70].

A different activity to improve membership relations and increase youth involvement is the promotion of intergenerational exchange in line with peer-to-peer learning. Cooperatives can implement a mentor-system where old and young grape producers can learn from each other not only on technical issues but of equal importance for the cooperatives topics on the rights, duties, opportunities, and long-term vision of being a cooperative member and board member. Adapting this approach older members get in touch with younger members and potential successors who want to take over vineyard areas. This includes also the promotion of interaction among members and with the board and the management of the cooperative.

Another form of peer-to-peer learning a cooperative can offer is the support for young grape producers to acquire practical skills and know-how for working in viticulture by offering demonstration plots where young members can try new techniques and share experiences. The interviews show that some cooperatives already have such groups for young members.

Moreover, the cooperative can establish an internship programme for young talented persons with interest in viticulture. Such a programme could include a mix of internships at the organising wine cooperative, partner cooperatives (in Germany and abroad), wine estates, retailers, research institutes, the German Wine Institute (DWI), or the European and overseas information offices of the DWI, high-end gastronomy, and (wine) trade fair organisers. By this, the whole sector would be covered, and first-hand experiences could be offered in viticulture, oenology, marketing, the cooperative system and applied research.

However, there is not "one strategy for all" but the results of this study demonstrate that there are many options and approaches for wine cooperatives to develop an adequate strategy for their specific situation to meet intense competition and to compete successfully in the (German) wine market.

6 SUMMARY

Changes in consumption and market developments affect the opportunities for wine cooperatives to compete successfully in the wine market. In Germany, today about 50 % of the total wine volume is sold through discounters, 28 % via retailers, and 11 % via direct sales. Seven percent of the total volume is marketed via specialized retail, and four percent via online retail.

The number of wine cooperatives in Germany has decreased from about 264 in 2000 to 159 cooperatives in 2016. Correspondingly, the number of members has declined. The concentration of wine cooperatives is ongoing and reflects the struggle cooperatives face with the recent situation on the German wine market.

To be able to give recommendations for wine cooperatives on how to strengthen their position within the industry, the German wine industry was analysed by using the model of the five forces that affect the competitiveness in an industry. For this, and based on a wine market description, predictions for each force were formulated. In-depth interviews with 15 representatives of German wine cooperatives were conducted. The results show a high intensity of rivalry among existing competitors. Bargaining power of buyers and suppliers is medium, constrained by the actual size of the cooperative. The threat of substitute products is medium, as well as the threat of new entrants.

The results of the interviews which have been conducted permit to derive strategic implications for wine cooperatives in Germany as well as in other European countries with saturated markets. Recommendations which address the competitive position of cooperatives in the wine industry include (1) the cost leadership and cost focus strategy, (2) the differentiation and differentiation focus strategy, (3) collaboration among producers, (4) offering additional services, and (5) options for improved membership relations and increased youth involvement. In the end, it is a difficult task for coopera-

[6] To find out to what extent partial delivery is applied in practice and what significance it has in the German cooperative system the authors [55] conducted 20 expert interviews with managing directors, cooperative members and other experts of the German cooperative system. The authors showed that partial delivery is officially applied in practice on a small scale and unofficially on a larger scale. The official partial delivery applies if the cooperative allows the partial delivery. Cooperative members are then obliged to sell their grapes to market participants other than wine cooperatives or producer associations [69]. Unofficial partial delivery means that the full delivery obligation is circumvented by splitting the members business or by using lease and cultivation contracts. Once the entire vineyard area has been divided, new sites are created and registered to family members. This means that only a part of the vineyard area remains in the cooperative. The area belonging to the newly established business can be freely marketed through other sales channels.

tives to develop an adequate strategy to meet the intense competition but many possibilities to strengthen the position and work future-oriented exist.

Arguably the most important limitation of the empirical study is the exclusive consideration of wine cooperatives from Germany. It is difficult, if not impossible, to apply the findings and conclusions to wine cooperatives in Europe or even apply them on a worldwide level. Another limitation is the limited selection of cooperatives included in this study (from only three out of 13 of the German wine growing regions).

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Valuation of Viticultural Adaptation to Climate Change in Vineyards: A Discrete Choice Experiment to Prioritize Trade-Offs Perceived by Citizens

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Abstract. On a climate change scenario, a discrete choice experiment was applied to elicit the trade-off values for three environmental impacts of current viticultural management practices in vineyards of Mendoza, Argentina. Water availability for other uses was found to be the most concerning topic for the population, followed by use of chemical fertilizers and then by use and conservation of biodiversity. An increase of one percentage point in water availability was estimated to add each citizen on average 13.05 Argentinean pesos – 0.74 US dollars – per year in terms of increased welfare, a figure equivalent to the welfare drop a citizen would experience after an increase of 1.45 percentage points in the use of chemical fertilizers annually per hectare, or a decrease of 2.69 percentage points in the use and conservation of biodiversity. These trade-off values may help policy makers, planners, regional managers, and ecologists to take social preferences into account in setting resource allocation priorities intended to support viticulture. This study approach provides a framework that could guide similar assessments in other regions.

Keywords: viticultural management practices, climate change, discrete choice experiment, human welfare effects of environmental-impact choices.

1. INTRODUCTION

Viticulture is one of the most important agricultural activities in the central west region of Argentina. At the foot of the Central Andes, the Mendocinian vineyards cover a total crop area of 155,900 ha, the largest

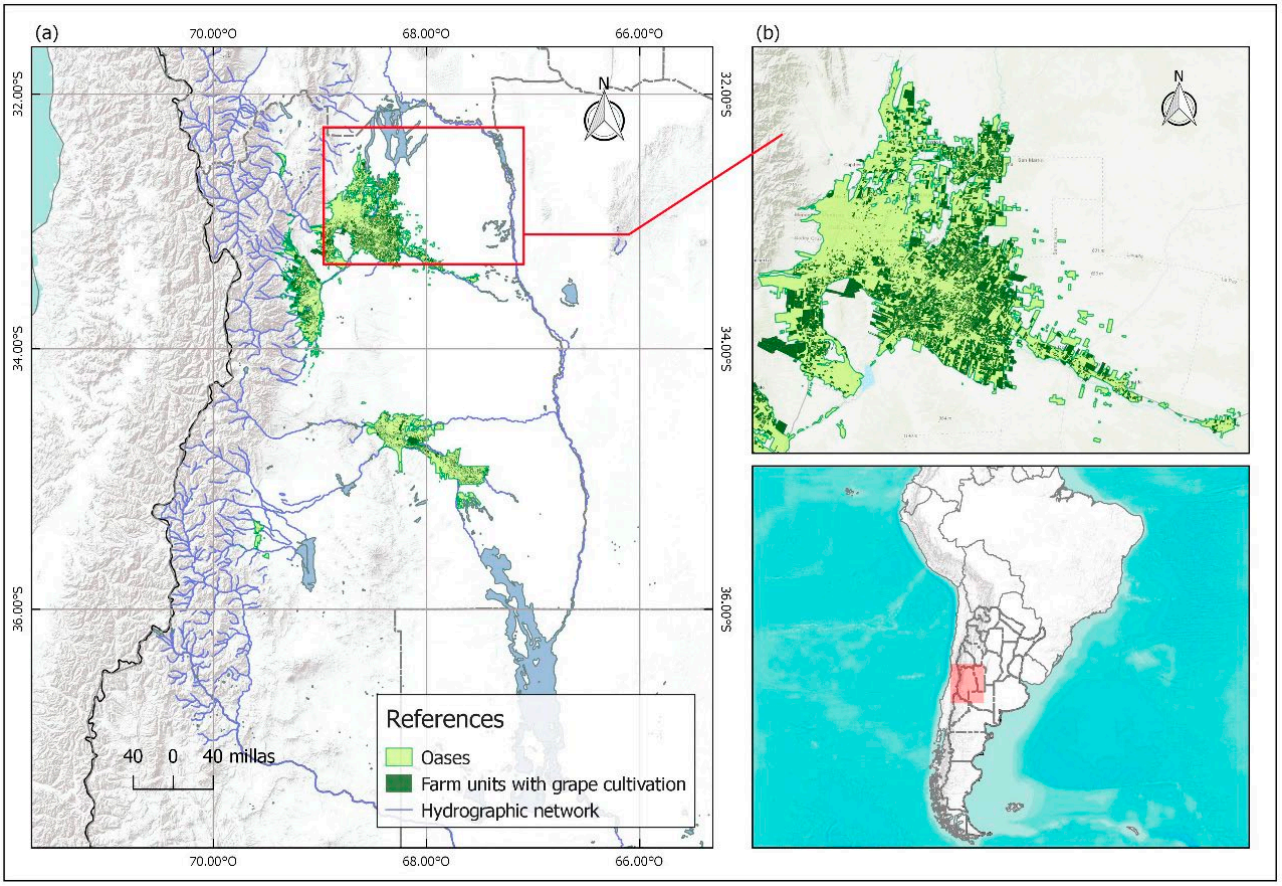

Figure 1. Farm units with grape cultivation (a) in the oases of Mendoza province and (b) in the Mendocinian Northern Oasis (source: Own elaboration based on data obtained from National Sanitary Registry of Agricultural Products (RENSPA) and cartography of the Territorial Environmental Information System (SIAT) and National Geographic Institute (IGN)). The darkened areas are farm units with grape cultivation.

in Argentina (INV, 2018).[1] In Mendoza, viticulture has been developed, like in many other viticultural zones of the region, since the end of the XIX Century, initiated by European immigrants (Lacoste, 2003). Its green and vast vineyards are well known not only because of its productive economic value, but also because of its cultural and identifying values (Montaña, 2007).

The region is characterized by its arid and semi-arid climate, with an annual average rainfall of 220 mm. Due to the dry weather, water availability in Mendoza is a determining factor, most of the Mendocinian agricultural and urban areas are reduced to small portions of its territory (Figure 1. a: Oases and non-irrigated land). These oases were built upon an irrigation system of ditches and canals which strictly takes into account the topography of the place. This system makes the most of the water coming from the mountain rivers, whose streamflow is a result of the fusion between the snow and the Andean glaciers (Morábito *et al.*, 2007).

Vineyards, on average, use 45% of the water available in the oases of the province. About 53% is available for industrial use, public use –green spaces and urban trees– and watering of crops other than vineyards. The percentage of water supply for the population, currently estimated at 2%, completes 100% of the water availability in the oases.[2] The exploitation of irrigation water depends mainly on the irrigation system adopted. Almost 90% of the Mendocinian vineyards use the traditional surface irrigation system with an estimated irrigation efficiency of 39% for a furrow system with drain and 67% for a furrow system without drain. Whilst in

[1] One hectare contains approximately 2.47 acres.

[2] However, to the effects of the empirical application developed below, the percentage of water supply for the population is not contemplated within the 53% of water available in the oases after using it for the vineyards, given that Mendoza Water Law 1884, still applicable, prioritizes population´s supply against any other uses (DGI, 2016).

the rest of the vineyards, the estimated efficiency varies between 82% and 90% as a result of the implementation of water-saving technologies such as the drip irrigation system (Morábito *et al*., 2007; Schilardi *et al*., 2015).

In the last seven years, there has been a substantial deficit in the water balance of the mountain rivers in Mendoza (Castex *et al*., 2015). This hydrological deficit is the result of a decrease in the snowfall and the retreat of the glaciers caused by an average global warming between 0.6 and 0.7°C (IPCC, 2013; Boninsegna, 2014; Poblete and Minetti, 2017). In the upcoming decades, this phenomenon is expected to aggravate as a consequence of a predictable increase in the average temperatures of the Central Andes (Cabré *et al*., 2016). This increase in temperature will drastically raise the regional evapotranspiration, it will alter the relations between rainfall and snowfall and it will modify the seasonal distribution of the runoff of the mountain rivers (Villalba, 2009; Lauro *et al.,* 2019). Global warming and the current and future hydrological deficit will, undoubtedly, have important consequences on the availability of this resource unless there is a more efficient use of the water coming from the mountain rivers (Castex *et al*., 2015). A decrease in the availability of water will probably lead to an increased competition in the oases, compromising the current vineyard surface. That is, unless vineyards can make use of the water destined for other purposes (industrial use, public use – green spaces and urban trees – and the watering of crops other than vineyards; hereinafter, water availability for other uses).

In line with global warming, weather simulations indicate that by the end of the present century there will be changes in the rainfall patterns on the plains located at the foot of the Andes (Boninsegna, 2014; Deis *et al*., 2015). An important increase in the frequency of summer precipitations is expected, mostly associated with severe convective storms (Castex *et al*., 2015; Cabré *et al*., 2016). The effect of rainfall is complex since crops respond differently depending on the type of precipitation and the soil management practices. Practices like applying manure and compost and the use of cover crops provide nutrients and organic matter, improving the structure and fertility of the soil (Miglécz *et al*., 2015). Experimental studies in the vineyards of Mendoza have reported benefits in the conservation of the soil as a result of cover crops used as green manure (Uliarte *et al*., 2013; Martínez *et al*., 2018; among others). However, the vast majority of the vineyards in Mendoza keeps their soils without vegetation cover throughout most of the year. More intense rainfall, as predicted for the upcoming years, can contribute to soil loss, reducing its nutrient content and organic matter. This reduction decreases the size and stability of the soil aggregates and, together with the lack of vegetation cover, reduces water infiltration and increases superficial runoff (Powlson *et al*., 2011). All of this leads to soil erosion and an increase use of fertilizers in an attempt to keep the same crop yield (Pérez Vázquez and Landeros Sánchez, 2009). Currently in Mendoza, it is estimated that per year per hectare, an average of 80% of nutrients replenishment in the vineyards is achieved with the use of chemical fertilizers (van den Bosch, 2017). In the upcoming years, an increase in the use of chemical fertilizers in order to avoid a decrease in crop yield is expected as a result of the current soil management practices and the predictable changes in the frequency and intensity of the precipitations on the plains. However, the overuse of fertilizers can cause groundwater contamination from infiltration of fertilizers or carry-over contamination of fertilizers to surface water course (Meier *et al*., 2015). There have been reports of cases of water contamination caused by nitrates associated with excessive use of fertilizers in crops on the Central Oasis (Morábito *et al*., 2011; Salatino *et al*., 2017; among others).

Field studies show that global warming and global CO_2 concentration have an effect on the population dynamics of the organisms that attack the crops as well as on their natural enemies (Hamada and Ghini, 2011; Karuppaiah and Sujayanad, 2012; among others). Vázquez (2011) has reported an alteration on the population dynamics of common pests as well as changes in their period of emergence, appearance of new pests and a reduction of natural enemies. This shows that global warming together with concentration of CO_2 can cause phytosanitary problems and reduce the efficiency of the chemical control methods. In Mendoza, this phenomenon can be aggravated as a consequence of a raise in summer precipitations. Traditional crops such as vineyards can be affected by a higher occurrence of cryptogamic diseases (Villalba, 2009; Deis *et al*., 2015).

The use and conservation of biodiversity in crops not only make them less vulnerable to weather variations, but also can contribute to an effective control of pests and diseases through its natural or biological management (Nicholls Estrada, 2008). A diverse and complex crop system facilitates the necessary environmental conditions for the development of pests' natural enemies, making the agroecosystem generate its own natural protection (Rolando *et al*., 2017). It is estimated that, in Mendoza, only 2% of vineyards cultivated area utilizes and conserves biodiversity with cover crops and patches of native vegetation, which are maintained to provide habitat for natural enemies and local fauna (SENASA, 2017). This indicates that pesticides employed

for the control of pests and diseases are more widely used than biological management practices. It is foreseen that in the next few years there will not be any significant changes in the use and conservation of biodiversity on the vineyards cultivated area of Mendoza, despite being widely well documented in the literature that the massive use of pesticides may reduce environmental quality (Turgut, 2007; Di Lorenzo *et al.*, 2018; among others) and decrease the species diversity in the agroecosystems, modifying their stability and resilience (see, among others, Moonen and Bàrberi, 2008; Kremen and Miles, 2012).

Consequently, and in line with the above-mentioned literature, viticulture in the region faces new challenges due to global warming that must be considered in the design of its agricultural practices. Lower water availability for other uses, increased use of chemical fertilizers, and a non-significant change in the use and conservation of biodiversity are three of the most pronounced and environmentally concerning consequences of non-adaptive management practices to climate change in the vineyards of Mendoza.

According to the aforementioned results conducted on the vineyards of Mendoza (Uliarte *et al.*, 2013; Castex *et al.*, 2015; Martinez *et al.*, 2018) and the current knowledge on the efficiency of the irrigation methods (Morábito *et al.*, 2007; Schilardi, 2015), on changes in the precipitation patterns (Boninsegna, 2014; Deis *et al.*, 2015), and on population dynamics of pests, diseases and natural enemies (Hamada and Ghini, 2011; Vázquez, 2011; Deis *et al.*, 2015), we hypothesised a possible temperature-change scenario by 2050, which we will refer to as the "do-nothing" or "business-as-usual" (BAU) situation. Considering the three mentioned variables – water availability for other uses, use of chemical fertilizers, and use and conservation of biodiversity – the changes from current average values to new values in 30 years' time were estimated subject to: (i) an increase in annual mean temperature by 2°C, (ii) a rise in precipitations on the plains from 200mm to 250mm per year, and (iii) a 10% decrease in snow accumulation in the Andes per year –figures in the medium range of the predicted change reported by multiple general circulation models for the region over the period of 2071-2100 (IPCC 2013; Boninsegna, 2014; Cabré *et al.*, 2016; Poblete and Minetti, 2017).

Based on moderate interpretation of the above-mentioned literature and on expert opinions on viticulture and agricultural economics, the BAU situation assumed the following changes: the percentage of water availability for other uses, currently averaging about 53% in the Mendocinian oases, will drop to approximately 41%; chemical fertilizers, currently representing every year on average 80% of nutrients replenishment per hectare of vineyard, will raise to 95%; and finally the percentage of vineyards cultivated area that utilizes and conserves biodiversity, currently estimated on 2%, will not register any significant changes, only reaching 3%.[3]

Nowadays, however, the human-welfare effects of these possible environmental changes are unknown. The information on the social significance of these possible changes can be useful for those involved in making decisions and may be considered in setting resource allocation priorities intended to support viticultural practices for climate change adaptation. In order to explore this, a discrete choice experiment valuation exercise was conducted to elicit the trade-offs perceived by Mendocinian citizens for changes in water availability for other uses, use of chemical fertilizers, use and conservation of biodiversity, and the willingness to pay for the adaptation of viticultural management practices to climate change. With this method the importance of these environmental changes can be expressed in monetary units and the extent to which citizens are willing to consent one change for another can be elicited (Hanley *et al.*, 2002; Hensher *et al.*, 2005; among others).

2. DISCRETE CHOICE EXPERIMENT

The label "discrete choice experiment" concerns to a survey-based valuation method consistent with welfare economic theory (Jones and Pease, 1997; Bennett and Blamey, 2001). This method, which belongs to the family of stated preference methods, describes a hypothetical market with details of the good to be considered (Carson and Louviere, 2011). The good details encompass some of its characteristics, known as attributes. Depending on the proposed action, the attributes can differ in their quantity or quality level. Different level combinations of attributes, alongside with a suggested payment, set up an alternative. In a discrete choice experiment, respondents are presented with a series of alternatives –usually called choice set, comprising BAU and two or more alternatives. Then they are asked to choose their most preferred alter-

[3] The decrease in the availability of water for other uses was estimated by considering that both current cultivated vineyard area and actual average percentage of irrigation efficiency will not register any significant changes during the next 30 years (Morábito *et al.*, 2007; Schilardi *et al.*, 2015; DGI, 2016). The increase in chemical fertilizers was estimated according to experts' opinions based on grape production models generated by the National Institute of Agricultural Technology (van den Bosch, 2017). The change in the use and conservation of biodiversity was estimated using the local trend in organic viticulture certification in Mendoza (SENASA, 2017).

native (Hanley et al., 2002). A respondent can confront several successive choice sets throughout interview. In order to interpret the results in welfare economics terms, the BAU alternative must be included in each choice sets.

The discrete choice experiment is based on Random Utility Maximization (RUM) models (McFadden, 1973). A succinct methodological description is provided below, whilst a more comprehensive one can be found in Farreras *et al.* (2017).

Under the RUM framework, the utility function for each respondent has the form:

$$U_{ij}=V_{ij}+\varepsilon_{ij} \quad (1)$$

Where U_{ij} is individual i's utility from choosing alternative j, V_{ij} is the deterministic component of utility, and ε_{ij} is a stochastic element that denotes unobservable motivates on individual choice (Manski, 1977). Usually, ε is assumed to be independent and identically distributed (iid) across alternatives and individuals.

The condition for individual i choosing a given alternative j over any alternative option k belonging to the set of alternatives A, can be expressed in probability terms, P, as:

$$P_{ij}=P\{V_{ij}+\varepsilon_{ij}>V_{ik}+\varepsilon_{ik};\ \forall k\neq j\in A\} \quad (2)$$

The choice probabilities can be predicted using different models. Most often, choice probabilities are estimated using the Mixed Logit (ML) model. The most straightforward derivation, and most widely used in recent applications, is based on random coefficients (Train, 2009). Given that choice probabilities cannot be calculated accurately, they are approximated through simulation (Hensher and Greene, 2003).

3. EMPIRICAL APPLICATION

3.1 Choice Sets

Alternatives were defined by three non-monetary attributes – water availability for other uses, use of chemical fertilizers, and use and conservation of biodiversity –, and a monetary attribute in the form of an annuity to finance the adaptation of viticultural management practices to climate change.

Each attribute displayed four levels as shown on Table 1. The levels of water availability for other uses were described as an average percentage of water available in the oases for industrial use, public use – green spaces and urban trees – and the watering of crops other than vineyards. Likewise, the levels of use and conservation of biodiversity were also expressed in percentages and were defined as the average percentage of the vineyards cultivated area with native vegetation strips and cover crops that promote the biological control of pests and diseases. The levels of both attributes were distributed between the expected values in the BAU situation and the values above the BAU levels. The levels of use of chemical fertilizers were also expressed in percentages and were defined as the average percentage of nutrients

Table 1. Attributes and levels used in the choice questionnaire.

Attribute	Description	Levels
Water availability for other uses	The average percentage of water that is available in oases for industrial use, public use –green spaces and urban trees– and other irrigated crops other than vineyards in 30 years' time.	· 41% (business-as-usual) · 53% (current level) · 65% · 76%
Use of chemical fertilizers	The average percentage of nutrients replaced with chemical fertilizers in the vineyards, per year per hectare in 30 years' time.	· 95% (business-as-usual) · 80% (current level) · 50% · 25%
Use and conservation of biodiversity	The average percentage of vineyards cultivated area with native vegetation strips and cover crops that promote the biological control of pests and diseases in 30 years' time.	· 3% (business-as-usual) · 10% · 25% · 50%
Annual payment subject to adjustment for inflation†	The annual payment required per household over the next 30 years to finance the adaptation of viticultural management practices to climate change.	· 600 Argentinean pesos · 400 Argentinean pesos · 200 Argentinean pesos · 0 Argentinean pesos (business-as-usual and current level)

†Average exchange rate in spring 2017: 1 US dollar equals 17.54 Argentinean pesos.

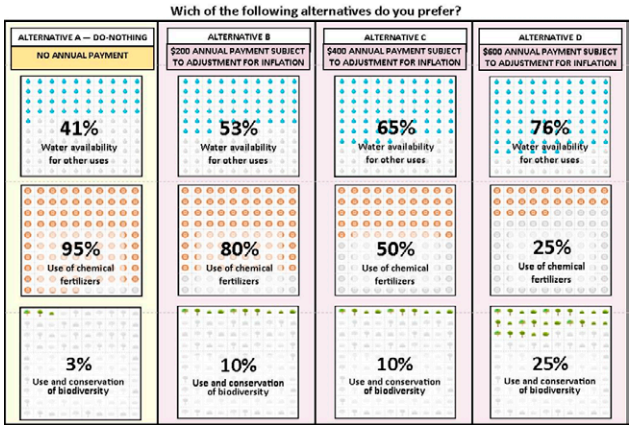

Figure 2. Example of a choice set presented to respondents.

that are replenished in the vineyards, each year per hectare, with chemical fertilizers. The levels of use of chemical fertilizers for scenarios different to BAU were defined below 95%. The levels of BAU for the non-monetary attributes reflected the estimated situation in 30 years' time as a result of the use of non-adaptive management practices to climate change in Mendocinian vineyards, whilst the rest of the levels could be reached through the adaptation of viticultural practices to climate change. Focus groups confirmed that the temporal horizon of 30 years was perceived as reasonable and did not show any credibility problems.

The levels of payment were determined based on different focus groups in which the participants stated the maximum quantity of money they would be willing to pay for the different scenarios. The extra cost for "do-nothing" was zero. The monetary levels were expressed in Argentinean pesos subject to adjustment for inflation, to be paid per household each year, during the next 30 years.

There were 81 (3^4) possible combinations of attribute levels or different alternatives, excluding the BAU levels, given that this situation does not vary. Since this universe was large, a statistically efficient choice design combining the attribute levels into alternatives and choice sets was constructed using NGENE (ChoiceMetrics, 2014), (Table 1). A D-optimal fractional factorial design consisting of 27 alternatives was identified. The alternatives were randomly grouped into 9 blocks of three alternatives plus BAU. Each block of four alternatives corresponds to a choice set. The efficiency for the final design expressed as the Bayesian D-error was 0.00148. A pilot exercise, used to complete the design process, confirmed that random combinations of the attribute levels posed no problems to participants and ensured the choice task adequacy.

The final version of the questionnaire included three different choice sets, which were randomly presented to each individual. Respondents were asked to pick within the choice set the alternative they preferred the most. Figure 2 reproduces a typical choice set.[4]

3.2 Questionnaire

The first part of the questionnaire focused on the presentation of the attributes. It described the current average level of each non-monetary attribute –water availability for other uses, use of chemical fertilizers, and use and conservation of biodiversity– in the Mendocinian oases and the most reliable prediction of the average levels of each attribute in 30 years' time (based on the working hypothesis that predicts a raise in temperature and annual precipitations of 2°C and 50mm, respectively and a 10% snowfall reduction) (Table 1). Hence, the questionnaire showed, in the first place, the expected change in the three non-monetary attributes under the "do-nothing" or BAU situation.

Afterwards, respondents were explained that with the adaptation of viticultural practices to climate change, the BAU situation could be modified. These practices included the sustainable agricultural management of water, soil and biodiversity such as the implementation of water-saving technologies, the substitution of chemical fertilizers for organic manure and cover crops used as green manure that additionally would allow, together with the conservation of native vegetation strips, the vineyards to generate its own protection against pests and diseases. Three alternative levels to BAU levels were presented for each non-monetary attribute indicating that the level each one of them would finally reach would depend on the quantity of money destined to finance the adaptation of the viticultural practices to climate change. In order to further familiarize individuals with possible levels of change, and check for satiation within the levels segment, participants were then asked to indicate the preferred attribute level, regardless of the cost.

After the introduction of non-monetary attributes, the monetary compensation was described. It was stated that the local government was considering the possibility of financing the adaptation of viticulture to climate change. It was explained that the degree of adaptation would depend on the quantity of resources allocated to this end, which in turn would depend on the answers to the questionnaire. If, on average, the answers indi-

[4] Given the sample size, each alternative was seen by an average of 70 respondents in the whole survey.

cated that people were willing to pay some money for the adaptation of the viticultural practices to climate change, then the payments would be obligatory and would be charged annually to the citizens through a council tax. Some possible alternatives on the payment vehicles were tested on different focus groups. It was confirmed that the obligatory payment gathered by the council city through its tax was reasonable, credible and easily accepted by the interviewees; whilst other alternatives on payment vehicles such as direct payment to an organization created to this end caused rejection for its lack of credibility.

The central part of the questionnaire focused on the choice tasks and a set of debriefing questions. The third and last part of the questionnaire was designed to gather socioeconomic data, such as income, gender, age, and level of formal education, among others.

The survey was carried out in spring 2017. A representative sample of the residents of the Northern Mendocinian Oasis – which concentrates 58.20% of the total Mendocinian farm units with grape cultivation and in which more than half the total population of the province lives – was interviewed face to face in the respondents' households (Figure 1. b). According to the National Institute of Statistics and Censuses (INDEC, 2010), the Northern Oasis has a population close to one million people. The total number of interviewees between the age of 24 and 80 was 226. The sample included residents in cities of more than 10,000 people randomly drawn – after weighting cities according to their population size – and were interviewed in blocks of 6. The selection of individuals within a block was conducted through a random-route procedure to find a household and then, within the household, a particular individual to fulfil a specific quota for age and gender. Around 90% of the people chosen accepted to be interviewed. All of them completed the choice tasks, which resulted in 678 valid observations –three sets of choice per person. From a social economic point of view, the sample and composition of the population were relatively similar (Table 2).

The questionnaire was handed out in paper format and read by the interviewer. Each questionnaire came along with a set of coloured cards, which showed the attributes being valued. Each interview took approximately 30 minutes and no signs of fatigue or other obvious problems were detected.

Table 2. Sample and population composition in the Northern Oasis.

Gender and age groups	Northern Oasis † (%)	Sample (%)
Women	52.63%	54.21%
Age		
24–35	16.59%	16.82%
36–49	14.71%	13.55%
50–65	13.85%	14.49%
66–75	5.47%	6.54%
76–80	2.01%	2.80%
Men	47.37%	45.79%
Age		
24–35	16.34%	18.22%
36–49	13.54%	10.75%
50–65	11.99%	12.15%
66–75	4.18%	2.34%
76–80	1.32%	2.34%
Income ‡	Argentinean pesos (at 2017 prices)	Argentinean pesos (at 2017 prices)
	27,019 §	24,030

† INDEC 2010

‡ Brackets were used in the survey, making the comparison less accurate between the average monthly income of the Argentinean urban agglomerations and that of the sample.

§ Average monthly household income in the fourth quarter of 2017, according to INDEC 2017.

4. RESULTS

An ML model was determined to detect the relation between the levels of the attributes and the probability of the interviewees choosing certain alternatives. The specification of the ML model requires certain characteristics such as the selection of the parameters –attributes– that are going to be considered random and the distribution supposed to them. In this way, it was considered, in the first place, that the preferences of the interviewees for the three non-monetary attributes were heterogeneous and followed a triangular distribution whilst the preferences for the monetary attribute were considered homogeneous.[5] However, the standard deviations of the non-monetary attribute distributions were not statistically significant, which shows that the preferences for these variables were homogeneous among the individuals of the sample (Table 3). The three non-monetary and monetary variables entered the regression expressed in the units of the respective attributes as they were described in Table 1.

The coefficient signs were as expected and most of the variables were statistically significant with a 95% lev-

[5] Due to the higher probability of occurrence that some of the levels showed in relation to others considered. For the attributes water availability for other uses and use and conservation of biodiversity, the higher levels were the most selected ones within the range considered. Whilst for the attribute use of chemical fertilizers, the lower levels were the most chosen ones.

Table 3. Results of the mixed logit regression analysis.†

Variable	Coefficient (Standard Error)
Random parameters in utility functions	
Water availability for other uses	0.02062496*** (0.00586975)
Use of chemical fertilizers	–0.01422602*** (0.00289968)
Use and conservation of biodiversity	0.00767425* (0.00451211)
Non-random parameters in utility functions	
Annual payment	–0.00158077*** (0.00042721)
Income A	–0.50662382** (0.23111555)
Gender A	–0.48969585** (0.24946993)
Age A	0.02142159*** (0.00694294)
Derived standard deviations of parameter distributions	
Water availability for other uses	0.06695391 (0.04430034)
Use of chemical fertilizers	0.620393D-04 (0.02512014)
Use and conservation of biodiversity	0.00016680 (0.03114923)
Log likelihood function	–798.5422
Pseudo-R^2	.131664
Observation	642

NB: 6% of respondents chose the BAU situation (annual payment of 0 pesos) quoting reasons other than lack of value for the adaptation of viticulture to climate change, which could be considered as protests. After removing those observations, the quantitative analysis was performed on a subset of 214 respondents.
† Estimates were obtained using 1,000 random draws to simulate the sample likelihood.
***Significant at 1% level.
**Significant at 5% level.
*Significant at 10% level.

el of confidence. The positive sign of the coefficients of water availability for other uses and of use and conservation of biodiversity shows that Mendocinian citizens tend to prefer higher levels of these attributes to lower levels. This implies that the alternatives with higher percentages of water availability for other uses and of use and conservation of biodiversity are more likely to be chosen. On the contrary, the coefficient signs of use of chemical fertilizers and of payment were negative, which shows that higher levels of these attributes decrease the population welfare.

Since the socioeconomic variables of the respondent do not vary over alternatives, they can only enter the model if they are specified in ways that create differences in utility over alternatives (Train, 2009). With 4 alternatives per choice set, one alternative-specific coefficient of income, gender and age variables entered the model, where three of the coefficients were normalized to zero (i.e., the three non-BAU alternatives were left out). The income data were collected in the survey using nine categories: no direct income; <8,060 Argentinean pesos; 8,060–12,000; 12,001–17,000; 17,001–22,000; 22,001–30,000; 30,001–40,000; 40,001–50,000, and >50,001 Argentinean pesos. Thus, income entered the regression as a categorical variable reflecting the monthly earnings of the respondent's household, with A being the alternative-specific. While, the gender entered the regression as a dummy variable, we coded females to be 0 and males to be 1; with A being the specific alternative. Finally, the age entered the regression as a continuous variable reflecting the age in years of the individual, with A being the alternative-specific.

The negative sign of the coefficient of the variable income indicates that the interviewees with higher incomes are less likely of choosing option BAU, i.e., they are more likely to pay for the adaptation of the viticultural practices to climate change. On the other hand, the negative sign of the coefficient of the variable gender indicates that women are more prone to choose an alternative other than BAU. Conversely, the positive sign of the coefficient of the variable age denotes that the older the interviewees, the more likely they would choose option BAU. This suggests that, on average, women, younger respondents, and respondents with higher income obtain greater utility from the adaptation of viticulture to climate change.

Once estimated the parameters, the marginal values for each attribute can be inferred from the following relation of regression coefficient, $-\beta_n/\beta_m$, where β_n is the coefficient of the attribute to be considered and β_m represents the coefficient of the attribute in which units one wishes to express the value of the attribute of interest (Hensher *et al*., 2005). These values show the mean of the marginal values of the population, in the units of the variable in which change wants to be expressed – percentage points or Argentinian pesos at 2017 price subject to adjustment for inflation. The marginal values for each attribute are illustrated in Figure 3.

According to the respondents' perception, for example, in order to obtain an increase of one percentage point in the water availability for other uses, a representative Mendocinian citizen would, on average, be willing to consent (at most) an increase of 1.45 percentage points

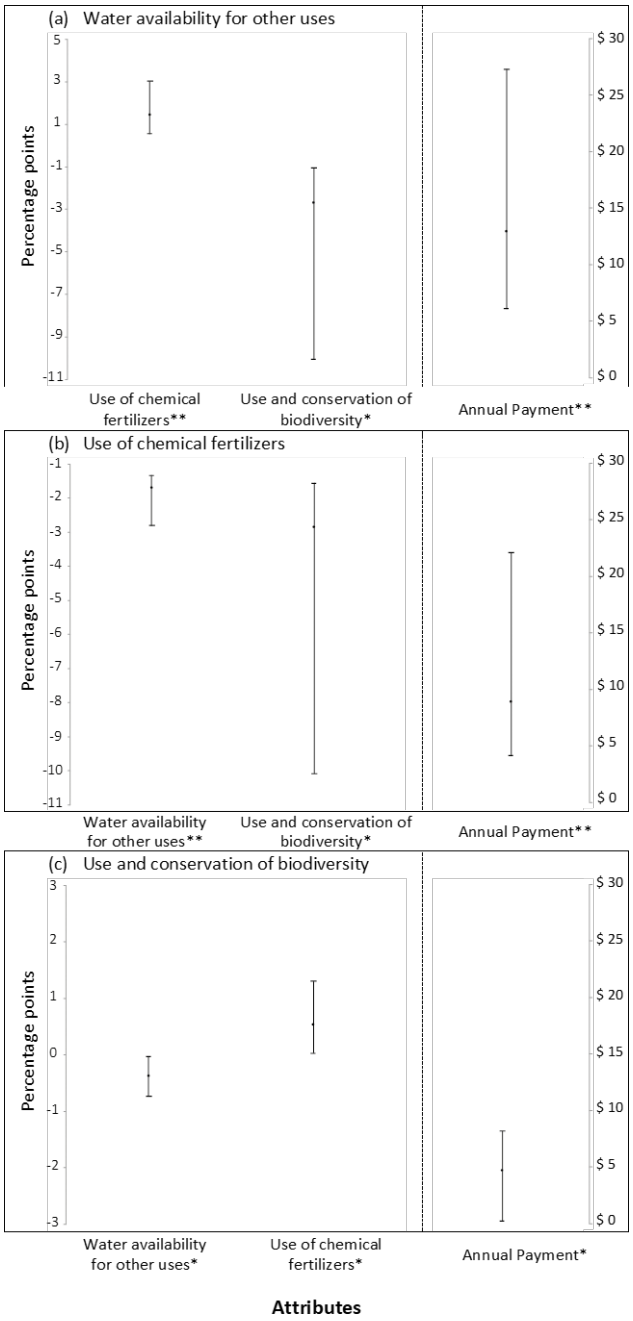

Figure 3. Marginal values for each non-monetary attribute (equivalent to a one percentage point change). Values in relative units of attributes with their respective confidence intervals for (a) an increase of one percentage point in the water availability for other uses, (b) a decrease of one percentage point in the use of chemical fertilizers, and (c) an increase of one percentage point in the use and conservation of biodiversity. Non-monetary attributes are expressed as percentage points on the left-hand vertical axis, while the monetary attribute is expressed in Argentinean pesos (at 2017 prices subject to adjustment for inflation) on the right-hand vertical axis. (a) An increase in the water availability for other uses of one percentage point– e.g., from 41% to 42% – offsets (1) an increase, on average, in the use of chemical fertilizers of 1.45 (0.55, 3.02) percentage points, the figures in parentheses denoting the limits of the 95% CI; (2) a decrease, on average, in the use and conservation of biodiversity of 2.69 (1.05, 10.05) percentage points, the figures in parentheses denoting the limits of the 90% CI; and (3) the equivalent, in terms of welfare, of an annual expenditure per household, on average, of 13.05 (6.24, 27.28) Argentinean pesos [0.74 (0.35, 1.55) US dollars] over the next 30 years, the figures in parentheses denoting the limits of the 95% CI. (b) A decrease in the use of chemical fertilizers of one percentage point – e.g., from 95% to 94% – offsets (1) a decrease, on average, in the water availability for other uses of 0.68 (0.33, 1.80) percentage points, the figures in parentheses denoting the limits of the 95% CI; (2) a decrease, on average, in the use and conservation of biodiversity of 1.85 (0.55, 9.07) percentage points, the figures in parentheses denoting the limits of the 90% CI; and (3) the equivalent, in terms of welfare, of an annual expenditure per household, on average, of 9.00 (4.22, 22.09) Argentinean pesos [0.51 (0.24, 1.26) US dollars] over the next 30 years, the figures in parentheses denoting the limits of the 95% CI. (c) An increase in the use and conservation of biodiversity of one percentage point – e.g., from 3% to 4% – offsets (1) a decrease, on average, in the water availability for other uses of 0.37 (0.03, 0.73) percentage points, the figures in parentheses denoting the limits of the 90% CI; (2) an increase, on average, in the use of chemical fertilizers of 0.54 (0.03, 1.30) percentage points, the figures in parentheses denoting the limits of the 90% CI; and (3) the equivalent, in terms of welfare, of an annual expenditure per household, on average, of 4.85 (0.39, 8.27) Argentinean pesos [0.28 (0.02, 0.47) US dollars] over the next 30 years, figures in parentheses denoting the limits of the 90% CI.

** 95% confidence interval.
* 90% confidence interval.

in the use of chemical fertilizers, or a decrease of 2.69 percentage points in the use and conservation of biodiversity, or to pay per household (at most) 13.05 Argentinean pesos – 0.74 US dollars – annually during the next 30 years. The confidence intervals for the marginal value of each attribute were calculated using the Krinsky and Robb procedure (1986) with 3,000 repetitions.

Likewise, these marginal values can also be useful to elicit the trade-offs, as perceived by Mendocinian citizens, for expected changes if none or only some viticultural practices are adapted to climate change. Assuming a unitary price elasticity of demand, for example, the increased welfare that a citizen would experience, on average, as a result of an increase from 3% to 25% in the use and conservation of biodiversity is equivalent to the welfare drop he or she would experience after an increase from 80% to 91.85% in the use of chemical fertilizers. These social-welfare changes are inferred from Figure 3.

5. DISCUSSION AND CONCLUSIONS

This research intends to contribute to a deeper and further discussion on the way of managing the relation between agriculture and the conservation of the environment and natural resources. On a climate change scenario, the monetary value of sustainable agricultural management practices in Mendocinian vineyards was estimated.

The valuation exercise results show that Mendocinian citizens are willing to pay for the adaptation of viticultural management practices to climate change. This result is in line with the findings of Riera *et al.* (2007), a study that elicited the trade-off values for three climate-sensitive attributes – plant cover, fire risk, and soil erosion – of Mediterranean shrubland. They found that Catalan citizens were willing to finance programs that might mitigate climate-change impacts on shrublands. Arora *et al.* (2017) also reached similar findings for rice cultivation in India. Using the discrete choice experiment, they found that farmers were willing to pay a significant premium for reducing the abiotic stresses, such as droughts and flood, induced by climate change. Similar conclusions from climate change adaptation in cultivated areas were found by Waldman and Richardson (2018). They looked into the Malian farmers' valuation of hybrid-perennial sorghum technologies that might facilitate adaptation to climate change. Although not specifically dealing with climate change adaptation, Sellers-Rubio and Nicolau Gonzalbez (2016) and Lanfranchi *et al*. (2019) found that individuals were willing to pay for implementation of sustainable wine production methods. Using a contingent valuation method, Sellers-Rubio and Nicolau Gonzalbez (2016) looked at the non-market value of these production methods in Spain, while Lanfranchi *et al.* (2019) estimated the willingness to pay of Sicilian consumers for a sustainable wine.

Our findings also suggest that, on average, women, younger respondents, and respondents with higher income are more prone to choose an alternative other than BAU. That is, they are more likely to be willing to pay for the viticultural adaptation to climate change, a result consistent with welfare economic theory and expectations. These findings have also been reported in several other studies which show consumer's general interest towards environmental-friendly wine production methods (see, among others, Sellers-Rubio and Nicolau Gonzalbez, 2016; Pomarici *et al*., 2018; Lanfranchi *et al*., 2019).

As well, our research provides results not only in monetary units, but also in the units of the other attributes considered (Figure 3). These trade-off values provide useful information for both private sector and policy makers. For instance, those involved in making decisions may wish to set resource allocation destined to finance viticultural practices prioritizing the balance among water availability for other uses, use of chemical fertilizers, and use and conservation of biodiversity, as expressed by citizens. Moreover, these social values expressed in monetary units can be useful for planners and regional managements to evaluate whether the benefits of a given policy outweigh its costs. Likewise, the results suggest that citizens are prepared to invest on sustainable agricultural management on private land, a result also found in Yao and Kaval (2010). Thus, the estimated values of the environmental impact reduction of viticulture may be useful not only for future government policy decision making, but also to be incorporated in the market goods price. For instance, the estimated value of an additional percentage point in the water availability for other uses could indicate the price premium that a citizen would, on average, be willing to pay (at most) for each wine glass produced with water-saving technologies. In this context indeed, an analysis of young consumers' preferences for wines labelled with a water saving claim was conducted by Pomarici *et al.* (2018). This study revealed that on average consumers are willing to pay an extra of half a dollar or more for water saving labelled wines. Others studies have also shown that consumers are willing to pay a premium price for wines with sustainable production characteristics (Barreiro-Hurlé *et al*., 2008; Mueller and Remaud, 2010; Schäufele and Hamm, 2017; among others).

Water availability for other uses was found to be the most concerning attribute for the population considering the expected changes under the "do-nothing" situation. This finding is consistent with the answers to an explicit question on the relative significance of the attributes. As show in Table 4, water availability for other uses was the attribute that three quarters of all respondents had in mind when deciding on the contingent choices. This information denotes a certain consistency with the results followed from marginal rate of substitution (Figure 3).

Even though there was not an explicit question that discloses the reason of this preference, the province of Mendoza has been on hydrological emergency for the last seven years. Hydrological emergency is an issue frequently mentioned on the news and the population is constantly being asked to make a rational and careful use of water. This result is also in line with the findings of Farreras and Lauro (2016), a study that dealt with the valuation of possible environmental waste landfills impacts in Mendoza. They used a discrete choice experiment to value different attributes – water quality, air quality, and vector-borne diseases –. Water quality was defined as the resource aptitude to be used in the fol-

Table 4. Percentage of respondents that took into account this variable more than any other when deciding on the contingent choices.

Variable	Respondent consideration (%)
Water Availability for other uses	75.59%
Use of chemical fertilizers	53.52%
Use and conservation of biodiversity	50.23%
Annual payment	49.07%
Years †	21.30%

NB: Percentages do not add to 100% because respondents could select more than one answer.
† The temporal horizon of 30 years for viticultural adaptation to climate change.

lowing possible uses: (i) domestic, (ii) agricultural, (iii) industrial, and (iv) recreational. An attribute in common between their paper and ours is that related to water availability, which was found to be the most valuable attribute.

Concerning biodiversity valuation, there is some disconcert reflected in the relatively modest statistical significance of this attribute. This seems to reflect a lack of *a priori* well-formed preferences of some respondents. Whereas some people were sure about the implications of changes in biodiversity to themselves, other respondents were not so sure. A similar conclusion has been reached by Lienhoop and MacMillan (2007), Szabó (2011), among others, who have reported the prevalence of unformed or ill-formed preferences for non-marketed public goods, such as biodiversity which is often complex and unfamiliar.

In short, this study displays that the welfare of Mendocinian citizens is expected to drop in line with the environmental impacts predicted to occur as a result of the non-adaptive viticultural management practices to climate change. The most socially concerning topic is water availability for other uses, followed by use of chemical fertilizers and then by use and conservation of biodiversity. From a social point of view, this result implies that agricultural practices that are more focused on sustainable water management are the ones that increase welfare to citizens the most. This information can be useful for policy makers, planners, regional managers, and ecologists in order to take social preferences into account in setting resource allocation priorities intended to support viticulture. Finally, this study approach provides a framework that could guide similar assessments in other regions.

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Does the Institutional Quality Affect Labor Productivity in Italian Vineyard Farms?

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Abstract. The paper aims at analyzing the effect of institutional quality on labor productivity in the agricultural sector. To meet this aim, a Gaussian log-linear model was applied to 773 vineyard farms, located in 71 Italian provinces. The applied methodology enabled to quantify the overall impact of the institutional quality on labor productivity by discriminating with respect to the Italian regions and macro-areas (i.e. North, South or Central Italy). The findings of the investigation show a positive effect of the institutional quality on labor productivity, with an overall impact of 39%. Moreover, huge differences among Italian regions and macro-areas were detected. The study findings provide recommendations for academics and policy-makers to improve both theoretical and practical aspects.

Keywords: IQI, labor productivity, vineyard farm.

1. INTRODUCTION

In the last decades, institutional factors have attracted great interest as one of the main determinants of economic performance of countries and regions [1, 2, 3, 4]. A large literature has emphasized the role of institutions in influencing both inputs (physical and human capital) and productivity, thus focusing on the existence of an additional effect of institutions on the per capita Gross Domestic Products (through productivity changes). Previous studies have also emphasized the role of institutions into influencing the ability of firms to combine inputs more efficiently [5, 6, 7]. Often, a positive and important *of context* factor is also recognized in the good institutional quality of the geographical area where the firm is located. Such a quality may be defined as a fruitful combination of formal institutions, good rules and

practices, cooperation among firms, researchers and policy makers [8, 9, 7, 10].

In this vein, institutions shape the key incentives of individuals and firms, influencing investments in physical capital, human capital, technology and the ability to organize production, determining not only the potential for aggregate economic growth, but also the distribution of resources [11, 12, 13]. As for the agricultural sector, some authors have theoretically analyzed the effect of institutional context on economic performances of farms [14]. However, few researches have empirically investigated the effect of institutional quality on farm's economic performances [15, 13, 16]. Accordingly, the general goal of this study is to empirically investigate the effect of institutional quality on economic performances of Italian farms. In particular, since better institutions create a legal structure which increases: i) the adoption of technological innovation [17], ii) the likelihood that a firm conducts and transfer R&D activities [18] and iii) the human development [19], the research hypothesis is that the institutional quality positively affects labor productivity in Italian vineyard farms. Precisely, by taking Italian farms specialized in viticulture (wine of excellence) as a case study, the specific goals of the present study are to: i) investigate the effect of the institutional quality on labor productivity, ii) quantify the effect of institutional quality on labor productivity, and finally, iii) assess the effect of institutional quality on labor productivity among Italian regions and macro-areas (North, Center and South).

Italian vineyard farms have been chosen for the following reasons: i) Italy is one of the main wine producing and wine-exporting country in the world [20, 21, 22]. In fact, in 2016, Italy has produced more than 50 million hL of wine, the highest in the world. [23] Currently it counts more than 600.000 hectares of vineyards and around 350 autochthonous grape varieties, 470 protected designation of origin (PDO) wines and 120 protected geographical indication (PGI) wines [24]; ii) viticulture is widely spread in all Italian regions; iii) during the last decade, the labor productivity in Italian viticulture is gaining attention by strengthening the mechanization along the production process [25, 22].

For the purposes of the present paper, we refer to the Farm Accountancy Data Network (FADN), a dataset which records information about statistically representative aspects of farms and farmers, referred to 2012. As for the institutional quality, we have accounted for the Institutional Quality Index (IQI) developed by Nifo and Vecchione [9]), which regards institutional quality in Italian provinces as a composite indicator derived by 24 elementary indexes grouped into five institutional dimensions (namely corruption, government effectiveness, regulatory quality, rule of law, voice and accountability).

The investigation is conducted on a sample of 773 Italian vineyard farms, located in 71 of the overall 107 Italian provinces. Given the nature of the data, a Gaussian log-linear model is performed.

The paper is organized as follows: paragraph 2 outlines the theoretical framework; paragraph 3 illustrates the statistical model once described the materials of the study. Then, the study findings are exploited in paragraph 4, and discussed in paragraph 5. Conclusions and implications are drawn in paragraph 6.

2. THEORETICAL BACKGROUND

The decisive impact that institutions may have on economic growth, on the environment, on service level-of-quality, and on overall efficiency of an area has been examined by a broad strand of the economics literature that, in recent years, has paid growing attention to the role of political and administrative contexts as well as social, historical and cultural factors in conditioning and steering development processes. Starting from the work of Douglass North [1, p. 3], according to whom "institutions are the rules of the game in a society", institutions contribute to forming the set of incentives underlying behavior and individual choices. As a consequence, several studies have been concerned with measuring the quality of political and administrative institutions (in terms, for example, of well-defined property rights, respect for regulations, degree of corruption, and barriers to entry on markets) both for cross-country [26, 27, 28, 29, 30, 31, 32, 33] and inter-regional comparisons [34, 35, 36, 37]. Several researches [6, 38, 39, 40] have specifically focused on the importance of institutional quality as the basic determinant of economic growth and total productivity of factors in the long term. The institutional differences as a key factor of growth and stagnation as well as disparities in productivity and accumulation of physical and human capital is also investigated [11]. Some authors have focused on the role of sub-national institutions, particularly the regional ones, in fostering economic growth. Porter [41, 42] has argued that economic development is pursued by favoring not isolated companies but industrial clusters, which include firms, suppliers and also local institutions and research centers. Additional contributions have extended the notion of institutional quality to social capital endowment [43, 44, 45] and institutional thickness [46]. Empirical evidence has pointed out that social cohesion [47] as well as the spread of collaborative

and associative practices [43, 48, 49] are drivers of economic development.

Notwithstanding the institutional quality has been investigated from decades to come, the role of institutional context on value creation in agricultural sector has gained attention only in the last few years [16, 50, 13, 51, 14]. Through disparate analytical perspectives, several theoretical and empirical studies have shown different relations between institutional quality and economic performance in agricultural sector ([6, 14, 51]. Lin et al. [16], by using structural gravity models to measure how institutions affect the trade performance of some coconut producing countries, have shown that government effectiveness increases trade flows of high value coconut products. Conversely, Nadarajah and Flaaten, [13] by investigating the relationship between annual growth in aquaculture production and the quality of institutions, emphasized the insignificant correlation between aquaculture growth and the quality of institutions in analyzed countries. The institutional context has been also analyzed as determinant of voluntary traceability standards in the Italian wine sector (50).

A previous study, from Marotta and Nazzaro [14], theoretically analyzed the role of institutional context in new business models for value creation in agriculture sector. More deeply, according to the "value portfolio" (VP) model, macroeconomic factors such as territorial assets, the quality of institutions and policies play a strategic role on value creation in agricultural sector.

In other words, the VP of a farm is composed by organizational schemes in which internal resources of a farm (i.e. entrepreneurship and human resources; physical and financial resources; technological resources and networking) are combined with the external ones, such as social capital, fixed social capital and institutional context [52, 53, 14]. Based on what has been discussed so far, it is crucial to investigate also empirically the effect of institutional quality on labor productivity in agricultural sector.

3. MATERIALS AND METHOD

3.1 Data

In order to achieve the specific aims of the study a cross-section dataset from the FADN have been used. The dataset records information about statistically representative farms and farmers aspects. The FADN is composed by an annual survey carried out by the member states of the European Union. It is the unique source of microeconomic data based on the same principles in all European countries that aims to provide representative data along three dimensions: the economic size, type of farming and the region. More deeply, the aim of the network is to collect accounting data from farms in order to know incomes and to conduct business analyses of agricultural holdings with the aim of evaluating, ex-ante and ex-post, the impacts of the Common Agricultural Policy (CAP). Our analysis includes data on overall 773 Italian farms specialized in viticulture producing grapevines for quality wine (with certification of origin PDO/PGI or variety indication as regulated by EU Reg. 1308/2013 and Reg. 607/2011) and located in 71 Italian provinces of all Italian regions (Appendix A). A summary statistics of the variables included in the model is given in section 3.2.

In order to know information about the quality of institutions in Italian provinces, we referred to the institutional quality index. Major attention should be devoted to the IQI description. This is achieved in the following subsection.

3.1.1 The IQI index

The aim of this subsection is to describe the IQI that is getting momentum in recent scientific studies [7, 54, 55, 10]. It is a composite indicator that measures the quality of Italian institutions at province level through the analytic hierarchy process [56] for the period 2004-2012. The following five dimensions: "Voice and Accountability", "Government Effectiveness", "Regulatory Quality", "Rule of Law" and "Control and Corruption" are the main components of the IQI. The first one concerns the degree of freedom of press and association, the second one is related to the quality of public services as well as the definition and the implementation of policies by the local government. The third refers to the ability of government to promote and formulate effective regulatory interventions, while the fourth accounts for the perception of the law application in terms of contract fulfilment, property rights, police forces, activities of the magistracy as well as crime levels. Lastly, the fifth dimension takes into account the degree of corruption of public employees. The IQI index is prompted by the World Governance Indicator (WGI) proposed by Kraay et al. [57] in the context of the *Knowledge for Change Programme* promoted by the World Bank. However, it considers only five of the six dimensions of the WGI. Indeed, the so-called "Political stability and absence of violence and terrorism" dimension is omitted in the IQI since it is related to the frequency of terrorist attacks and to the presence of military in politics, that are not relevant in Italy [9]. Each dimension is composed, in turn, by the aggregation of elementary indexes (see Figure 1) evaluated by data from institutional sources,

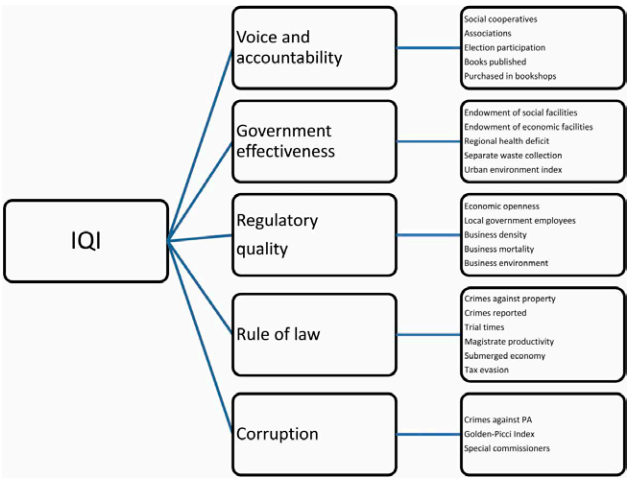

Figure 1. Dimensions and elementary indexes of IQI. Source: Structure of the Institutional Quality Index (IQI) from Lasagni et al, [7].

research institutes and professional registers. Appendix B reports the list of all elementary indexes employed and sources.

As for the methodological approach, three steps have been implemented to obtain the IQI index from elementary indices, such as: normalization, attribution of weights to each index and aggregation. First of all, the elementary indices were normalized, then measured in the interval [0, 1], determining the distance of each of them from the maximum value found at the province level. Thus, through the analytical hierarchy process (AHP) [56], a weight was assigned to each normalized elementary index. Finally, once normalized and weighed, the elementary indices were aggregated to obtain the institution's quality index for 107 provinces – from 2004 to 2012 – which, by construction, takes values in the interval [0,1] [9]. Appendix B reports values of IQI of each Italian province and region included in the study.

3.2 Method description

The effect of institutional quality on labor productivity in Italian vineyard farms is assessed by designing the following Gaussian log-linear model:

$$ln\_LP_i=\alpha+\beta\ young_i+\boldsymbol{\gamma}\ farm_i+\delta\ IQI_i+\varepsilon_i \quad i=1,2\ldots 773. \qquad (1)$$

where *ln_LP* is the logarithmic of the labor productivity for each *i*-farm. More specifically, the LP is the dependent variable of the model obtained by the ratio between the gross marketable output (GMO) and the work units employed in each farm (euro/worker).

Some control variables were chosen, including farmers and farms aspects, based on what the scientific literature considers as crucial elements for labor productivity in agricultural sector [58, 59, 60, 61, 62, 63, 64, 65, 66]. *Young* is a dummy variable, meaning the youth of the farmer that assumes value 1 if the farmer is 40 years old and 0 otherwise. In our model we called *farm* the vector of farms' variables. The vector includes five control variables, i.e. *machines capital, land-labor ratio, circulating agricultural capital, irrigation and second pillar founding*. The variable *machines capital* is the ratio between the economic value of machines and the used agricultural area (UAA), attached to the level of farm's investments in mechanization. The *land-labor ratio* variable, obtained by dividing the UAA per worker, giving information on the number of hectares per worker is a measure of the labor intensity. The *circulating agricultural capital*, defined as the ratio between the circulating agricultural capital and the (UAA), is an indicator that suggest the availability of euros per hectare. The *irrigation* variable is a dummy variable that assumes value 1 if the farm has irrigated land and 0 if the farm has not irrigated land. As for the *second pillar founding* variable, it is a dummy variable that means whether or not the farm received subsidies from the second pillar founding of the CAP. In other words, the variable assumes value 1 if the farm has received some payments for measures of Axis 2 from the Rural Development Plan and 0 otherwise.

The *IQI* is an explanatory variable of our model that measures, in the interval from 0 to 1, the institutional quality of the province in which the farm is located. Finally, ε is the error term.

A descriptive statistics of the variables included in the model is given in Table 1.

The average *LP* is around 50 thousand euros. As for the age of farmers, only 13% is younger than 40 years. The average value of the *machines capital* is roughly 3 thousand euros per hectare, about 1 thousand euros lower than the average *circulating agricultural capital* per hectare (3985.73 euros/ha). As for the *land-labor ratio*, each worker has, on average, less than 10 hectares (9.22). The 38% is the percentage of the irrigated land, while the 47% is the percentage of farms that have received founding from the second pillar founding. Last, the average value of the IQI is 0.69, with the lowest equal to 0.04 and the highest value equal to 1 (meaning the maximum of the IQI).

Table 1. Descriptive statistics of the variables included in the statistical model.

Variable name	Variable Description	Mean	Std. Dev.	Min	Max
Dependent variable					
LP	Labor Productivity (euro/worker). The ratio between the GMO and the units of labor	48262.17	43514.6	1148.39	360860.8
Independent variables					
Young	1 = under 40 years old; 0 = otherwise	.13	N.A.	0	1
Machines capital	Ratio between machines capital and UAA (euro/ha)	2949.81	7482.68	0	105383.8
Land-labor ratio	Available UAA per worker (ha/worker)	9.22	9.54	.64	107.25
Circulating Agricultural Capital	Ratio between circulating agricultural capital and used agricultural area (euro/ha)	3985.73	17223.03	0	333915.2
Irrigation	1=yes; 0=no	.38	N.A.	0	1
Second Pillar Founding	1=yes; 0=no	.47	N.A.	0	1
IQI	Institutional Quality Index	.69	.14	.04	1

N.A.: Not Applicable*.

Table 2. Effect of IQI (Institutional Quality Index) on value creation in vineyard farms. Gaussian log-linear model estimates.

Parameters	β	Coef. (e^{β})	Std. Err.	t	*p*-Value
IQI	0.330	1.39	0.17	1.88	0.060 *
Young	0.104	1.11	0.07	1.43	0.155
Machines_capital	0.006	1.01	0.00	1.65	0.099*
Circulating Agricultural Capital	0.013	1.01	0.00	9.29	0.000***
Irrigation	0.202	1.22	0.05	3.95	0.000***
Second pillar founding	0.115	1.12	0.05	2.33	0.020 **
Land-labor ratio	0.035	1.03	0.00	13.44	0.000***
Cons	9.719	16.63	0.13	72.80	0.000***

Note: N=773; * p-value < 0.1; ** p-value < 0.05; ***p-value < 0.01. R^2 =0.26.

4. RESULTS

4.1 The Gaussian log-linear model estimates

Results from the designed statistical model are summarized in Table 2. At a first glance, the coefficient of IQI has a significant and positive effect on LP, meaning that the institutional quality positively affects the labor productivity thus corroborating our research hypothesis. As for the impact of the institutional quality on the dependent variable, we followed Benoit [67] for interpreting coefficients with logarithmic transformation. In the log-linear model, the interpretation of estimated coefficient β (see the second column of the Table 2) is that a one-unit increase in X will produce an expected increase in log Y of β units. In terms of Y, this means that the expected value of Y is multiplied by e^{β}. Briefly, in terms of effects of changes in X on Y (unlogged), each 1-unit increases in X multiplies the expected value of Y by e^{β}. Accordingly, the impact of the IQI on LP is quantified in 39% (the third column of the Table 2). This means that going from the lowest level of the IQI (equal to 0) to the maximum one (equal to 1), the labor productivity will increase by 39% in Italian vineyard farms. Except for *young*, all control variables are statistically significant. More deeply, all of them have a positive effect on LP.

4.2 The sensitivity analysis of the IQI index

The sensitivity analysis allows to determine and to quantify the impact of small input perturbations on the model output [68]. Thus, we have carried out several perturbations to the IQI index. More deeply, we have assigned several different values to the institutional

Table 3. Assumptions tested in the sensitivity analysis.

Assumptions	Average labor productivity (euro/worker)
*The **IQI** index is equal to **0***	*42901.02*
*The **IQI** index is equal to **0.1***	*44340.35*
*The **IQI** index is equal to **0.2***	*45827.97*
*The **IQI** index is equal to **0.3***	*47365.49*
*The **IQI** index is equal to **0.4***	48954.60
*The **IQI** index is equal to **0.5***	50597.03
*The **IQI** index is equal to **0.6***	52294.56
*The **IQI** index is equal to **0.7***	54049.04
*The **IQI** index is equal to **0.8***	55862.39
*The **IQI** index is equal to **0.9***	57736.57
*The **IQI** index is equal to **1***	59673.63

quality index in the range from 0 to 1 (0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9 and 1) where 0 corresponds to the minimum level of the institution quality while 1 is the maximum value. Afterwards, we have quantified the average labor productivity, at each level of IQI (Table 3).

In the Figure 2 we have plotted the LP (y–axis) versus the perturbations of the IQI(x–axis). The graph reveals the linear effect of institutional quality index on the LP. Specifically, the sensitivity analysis indicated that the institutional context has a positive and constant impact on labor productivity in vineyard farms. The slope of the line in Figure 2 is the sensitivity of the LP with respect to the IQI (by taking fixed the other variables).In particular, as shown by the statistical model, if the IQI index is equal to 1 the average LP is 39% higher than that obtained under the IQI index equal to 0.

In Table 4, the difference between the average LP at region level by considering the current IQI and that obtained by giving to all provinces the maximum IQI value (i.e. equal to 1) suggests the economic loss, in terms of labor productivity, due to low institutional quality. The developed analysis shows that the LP in the

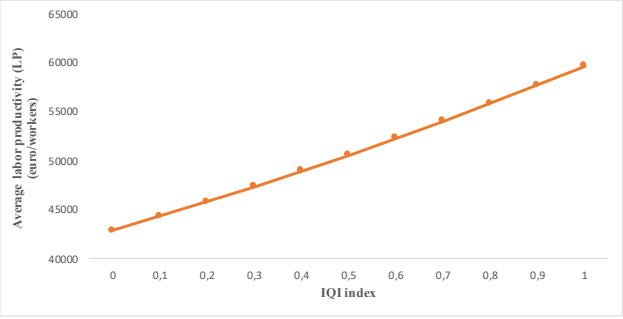

Figure 2. The sensitivity analysis changing IQI index.

Table 4. The average labor productivity (LP) in Italian regions at current IQI and at maximum value of IQI (equal to 1) in all Italian provinces.

	Average LP (tEur/w) at current IQI	Average LP (tEur/w) at IQI equal to 1 in Italian provinces	Economic loss (%) due to low institutional quality
Trentino Alto Adige	139633	146329	4.80
Tuscany	44225	47043	6.37
Abruzzo	37970	40589	6.90
Emilia Romagna	110657	119892	8.35
Valle D'Aosta	57200	62182	8.71
Veneto	46239	50291	8.76
Umbria	72550	79120	9.05
Friuli Venezia Giulia	49611	54512	9.88
Piedmont	46027	50775	10.32
Lombardy	45512	50218	10.34
Marche	43628	48158	10.38
Lazio	46242	52960	14.53
Liguria	45628	53438	17.12
Campania	35125	41444	17.99
Puglia	44793	54109	20.80
Sardinia	76916	93006	20.92
Basilicata	45715	55770	21.99
Molise	48154	62701	30.21
Sicily	60323	78563	30.24
Calabria	31245	42894	37.28

Italian regions and macro-areas (Northern, Southern and Central) is not homogeneous.

More specifically, it is possible to state that in Calabria the average economic loss caused by the low quality of institutions is more than 37%. Conversely, in Trentino Alto Adige the average economic loss is roughly 5%. Moreover, the economic loss increases by passing from the North to the Southern regions, as shown in the last column of the Table 4. Accordingly, investments for improving the institutional quality in the Southern regions would enhance the labor productivity in vineyard farms, thus improving the agricultural sector in underdeveloped areas.

5. DISCUSSIONS

The present paper had three specific goals. First, it developed, for the first time, an empirical study to analyze the relation between the institutional quality of the Italian provinces and labor productivity in Italian vineyard farms. Second, once answered to the first aim, the

study quantified the effect size of the institutional quality on the economic value created per worker and finally, it measured the impact of the institutional quality on labor productivity in vineyard farms located in all Italian regions and macro-areas (North, South and Central Italy). To this end, we developed a Gaussian log-linear model, which considers the ratio between the gross marketable output and the number of workers employed in each farm as the dependent variable of the statistical model. Further, the IQI is one of the independent variables together with the farms and farmers' aspects. The model output highlighted a significant and positive effect of the institutional quality on labor productivity in Italian vineyard farms.

Although there are no previous empirical studies about the effect of institutional quality of Italian provinces on labor productivity in agricultural sector, our findings are consistent with previous theoretical and empirical studies developed in non-agricultural sector [5, 14, 51, 69, 9, 7, 70]. Based on the study findings, one can state that vineyard farms operating in a good institutional context consistently increase the labor productivity. Several reasons may explain this result. First, getting the "right" price from the market and reducing the transaction costs is helpful in increasing the gross marketable output. Several authors, from decades to come, have indeed highlighted the role of both formal and informal institutions in improving the level and quality of entrepreneurship [71] as well as in removing the market imperfections and the transaction costs [1, 32]. Furthermore, a favorable institutional context (in terms of bureaucracy efficiency and economic facilities) encourages farms to invest in technology and mechanization [18, 7], thus increasing the economic value created through the intensification of output produced per worker. The availability of economic facilities is also helpful for improving crop productivity and technical efficiency by the increase of financial services [72]. Further, associations and social cooperatives are helpful tools for labor productivity by overcoming market imperfections and constraints [73, 74, 75, 76]. Indeed, according to Fischer and Qaim [77] social cooperatives increase farm income and profit. Moreover, being part of social cooperatives and associations may improve labor productivity by sharing knowledge and information among workers.

As for the measure of the effect of the institutional quality on the average labor productivity in vineyard farms located in the North, South and in the Central Italy, the finding showed the lowest LP in farms located in the Southern regions. This is in agreement with the work of Lasagni and co-authors [7]) who showed that the total factor productivity in manufacturing firms is lower in industries located in the Southern Italian regions than those located in the Northern and in the Central ones. Differences in LP among Italian vineyard farms may be attributed to differences in transport and infrastructures [78] as well as to institutional factors [79]. More deeply, as for the transport field, according to Carlucci et al. [78] the Southern Italy suffers from an infrastructure and logistic gap compared to Northern Italian regions and, in the same regions, bureaucracy is less efficient in terms of costs and time required [80]. Moreover, widespread differences among Italian macro-areas are also shown in terms of corruption. Indeed, 6 of the 7 Southern regions have the number of reported crimes higher than the national average, meaning a high index of corruption that is a relevant issue in transport infrastructure financing and service provision [81, 82, 78]. To summarize, the main result of this study not only confirms the well known differences in endowments of institutional quality among Italian provinces, but it pointed out, for the first time, that these differences also affect economic performances, specifically the LP in the Italian vineyard farms.

The impacts of control variables assessed in this research, except for the "young" one, are also significant and they are in line with scientific evidences. First, the higher capital endowment, both in terms of machines and financial capital, increases the LP. These results are consistent with previous studies in which the mechanization at farm level is a very critical tool for enhancing economic productivity [58, 66]. Mechanization improves value created per workers in two ways: i) reducing the hard labor (and, consequently, drudgery) and ii) improving gross marketable output through the timeless of agricultural operations [59, 63]. Conversely, the un-mechanized agriculture reveals much more negative economic performances [60, 64]. On the other hand, the availability of financial capital is helpful in purchase inputs of production, such as fertilizers and pesticides. Indeed, a good amount of economic capital allows a huge consistency of fertilizers and pesticides increasing crop yield and, once again, the gross marketable output per workers [62]. Likewise, the endowment of irrigated hectares may enhance value created reducing the risk of yield loss in vineyard farms located in the Mediterranean area, where a deficit of irrigation reduces the yield of grape [61]. As for the second pillar founding, the model output has shown a positive impact on LP. It is a natural result since several measures of the second pillar of the CAP providing physical investments[1] could enhance the

[1] http://www.europarl.europa.eu/factsheets/en/sheet/110/second-pillar-of-the-cap-rural-development-policy

output per workers. A positive role on value creation is also played by the land-labor ratio variable, in agreement with Urgessa [62] and Fuglie [65]. The latter highlighted that the growth of population in rural areas-through the decline of the ratio between land and labor - can reduce the average output per workers [65].

6. CONCLUSIONS AND POLICY IMPLICATIONS

The present study analyses, for the first time, the effect of macroeconomic aspects, e.g. the quality of institution, on labor productivity in Italian farms. To this end, we built a cross-section dataset of overall 773 Italian farms specialized in viticulture and located in 71 Italian provinces, where both micro and macroeconomic aspects are considered. Then, data were analyzed by means of a Gaussian log-linear model in order to grasp the effect of the institutional quality on LP. Despite some limitations, among the others the specificity of the farms (vineyard farms) considered for the research and the type of the dataset used (cross-section), results assign a critical role to the business environment and institutional quality into determining labor productivity differentials in Italian vineyard farms, in accordance with previous conceptualizations and empirical studies. This means that the economic performance of vineyard farms does not depend on internal resources of farms solely, but it is also affected by the quality of institutions in which farms operate. However, the variables (which we have shown to have a significant and positive impact on LP) that were used in the present study to describe the institutional quality, are not managed by farmers neither by the CAP instruments. As a consequence, the findings of the present study have theoretical and political implications. As for the former, a wide discussion can be found in pervious publications where the role of institutional context on economic performances of farms is discussed [83, 84, 69, 51]. As for the political implications, it should be emphasized that critical aspects for the agricultural development, such as infrastructure facilities, bureaucracy efficiency and business environment, are not influenced by the CAP. However, in the last decades, the policy makers have considered the second pillar of the CAP the only available tool to enhance the rural development, without considering the general EU development strategies. These latter, meaning the European Regional Development Found (ERDF) and the European Social Found (ESF), were indeed never integrated within the European Agricultural Fund for Rural Development (EAFRD), since they are almost exclusively implemented in urban areas.

Given the findings of the present study, one can state that the integration among different EU strategies is crucial to develop the agricultural sector, especially in Italian underdeveloped (typically southern) regions. As a consequence, since the institutional quality plays an important role in increasing the economic performances of farms, balancing all the EU strategies should be the main aim of the policy maker for the next programming period (2021-2027). An effective integration among EU strategies is needed to improve the agricultural sector to which citizens require many challenges, such as a better quality of food and environment as well as social sustainability.

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APPENDIX A

Table 1A. Number of vineyard farms located in each considered province.

Province	Number of farms	Province	Number of farms	Province	Number of farms	Province	Number of farms
Agrigento	3	Firenze	22	Palermo	1	Salerno	1
Alessandria	55	Foggia	1	Pavia	4	Sassari	4
Ancona	17	Forlì-Cesena	1	Perugia	26	Siena	3
Aosta	51	Genova	3	Pesaro e Urbino	4	Sondrio	6
Arezzo	5	Gorizia	20	Pescara	10	Taranto	7
Ascoli Piceno	20	Grosseto	15	Piacenza	1	Teramo	9
Asti	57	Imperia	4	Pisa	1	Terni	17
Avellino	1	Isernia	9	Pistoia	1	Torino	1
Benevento	15	La Spezia	6	Pordenone	42	Trapani	3
Bergamo	5	Latina	1	Potenza	2	Trento	21
Bologna	3	Lecce	3	Prato	1	Treviso	15
Bolzano/Bozen	18	Lucca	1	Ragusa	2	Trieste	1
Brescia	12	Macerata	1	Ravenna	5	Udine	41
Brindisi	38	Mantova	7	Reggio di Calabria	2	Venezia	9
Cagliari	8	Modena	4	Reggio nell'Emilia	3	Verona	19
Caserta	3	Novara	1	Rieti	1	Vicenza	7
Chieti	36	Nuoro	1	Rimini	1	Viterbo	5
Cuneo	41	Padova	6	Roma	3		

Source: FADN dataset.

APPENDIX B

Table 2A. Structure of elementary IQI indexes

Index	Value	Source (details in notes)	Year
Voice and accountability			
Social cooperatives	Absolute Value[1]	ISTAT	2001
Associations	Absolute Value[1]	ISTAT	2004
Election participation	Turnout %[2]	Interior Ministry	2001
Books published	Absolute Value[3]	ISTAT	2007
Purchased in bookshops	Index[4]	Sole24Ore	2004
Government effectiveness			
Endowment of social facilities	Index[5]	Tagliacarne	2001
Endowment of econ. facilities	Index[6]	Tagliacarne	2001
Regional health deficit	Absolute Value[7]	MEF and MH	1997-2004
Separate waste collection	Separate/total[8]	Tagliacarne	2007
Urban environment index	Index[9]	Legambiente	2004
Regulatory quality			
Economy openness	Index[10]	Tagliacarne	2001
Local government employees	Absolute Value[11]	ISTAT	2003
Business density	Index[12]	Tagliacarne	2008
Business start-ups/mortality	Registration/cessation[13]	Tagliacarne	2003-2004
Business environment	Index[14]	Confartigianato	2009

Rule of law			
Crimes against property	Absolute Value[15]	ISTAT	2003
Crimes reported	Absolute Value[16]	ISTAT	2003
Trial times	Trial lengths I, II, III[17]	Crenos	1999
Magistrate productivity	MagistrateTrials[18]	Ministry of Justice	2004-2008
Submerged economy	Index[19]	ISTAT	2003
Tax evasion	Index[20]	Revenue Agency	1998-2002
Corruption			
Crimes against PA	Index[21]	Interior Ministry & ISTAT	2004
Golden-Picci Index	Index[22]	Golden and Picci (2005)	1997
Special Commissioners	Municipalities overruled[23]	Interior Ministry	1991-2005

Notes:[1]Social cooperatives per 100,000 residents, provincial level. ISTAT: "Le cooperative sociali in Italia" (2006) and "Le organizzazioni di volontariato in Italia" (2005); [2]2001 general election, provincial level. Interior Ministry: "Archivio storico delle elezioni" http://elezionistorico.interno.it/ ; [3]Books published, in absolute value, provincial level. ISTAT: "La produzione libraia" (2007); [4]Purchased books over resident population, provincial level. Il Sole24Ore "Dossier sulla qualità della vita" (2004); [5]Includes education, healthcare and leisure facilities, provincial level.Tagliacarne Institute "Atlante di competitività delle province italiane" (2001); [6]Includes the following networks: roads, railroads, ports, airports, energy, ICT, banking, provincial level. Tagliacarne Institute "Atlante di competitività delle provincie italiane" (2001); [7]Regional health deficit per capita 1997-2004, regional level. Elaboration on Ministry of Economy and Finance and Ministry of Health data from "Relazione generale sulla situazione economica del Paese" (1997-2004); [8]Share of separate waste collection on total waste collection, provincial level. Tagliacarne Institute "Atlante di competitività delle province italiane" (2001); [9]Includes 25 indexes relative to: air quality, water quality, purification plants, waste management, public transportation, energy consumption, Public parks, Eco management, provincial level. Legambiente "Ecosistema Urbano 2004" (2004); [10]Import + Export on the gross domestic product, provincial level. Tagliacarne Institute "Atlante di competitività delle provincie italiane" (2001); [11]Public servants over resident population, regional level. ISTAT: "Indicatori statistici sulle amministrazioni centrali e locali" (2003) http://dati.statistiche-pa.it/ ; [12]Number of firms for 100 residents, provincial level. Tagliacarne Institute "Atlante di competitività delle province italiane" (2008); [13]Firms registration/mortality, provincial level. Tagliacarne Institute "Atlante di competitività delle province italiane" (2003-2004); [14]Includes 39 indexes relative to: entrepreneurship, job Market, tax system, market competition, banking, bureaucracy; public services to firms, firms' cooperation, provincial level. Confartigianato: "L'indice Confartigianato – Qualità della vita dell'impresa" (2009); [15]Number of crimes against property over resident population, provincial level. ISTAT: "Indicatori territoriali per le politiche di sviluppo" (2003); [16]Number of crimes reported over resident population, provincial level. ISTAT: "Indicatori territoriali per le politiche di sviluppo" (2003); [17]Average length of judicial process, regional level.CRENOS "Data-base on crime and deterrence in the Italian regions (1970-1999)"; [18]Number of completed civil and criminal trials for magistrate, regional courts level. Ministry of Justice, statistics: "Graduatoria rispetto agli esauriti per magistrato presente" (2004-2008); [19]ISTAT estimation, provincial level.ISTAT: "Le misure dell'economia sommersa secondo le statistiche ufficiali" (2003); [20]Based on the difference between the estimated added value by national accounts and tax system (IRAP and individual income tax returns), provincial level. Agenzia delle entrate: "Analisi dell'evasione fondata su dati IRAP, Anni 1998-2002" (2006); [21]Number of crimes against the public administration over number of public servants, regional level. ISTAT: "Indicatori territoriali per le politiche di sviluppo" (2004); [22]Difference between the amounts of physically existing public infrastructure and the amounts of money cumulatively allocated by government to create these public works, provincial level. Golden and Picci (2005); [23]Absolute value of the overruled municipalities on total municipalities, regional level. Interior Ministry: "Relazione sull'attività svolta dalla gestione straordinaria dei Comuni commissariati" (1991-2005).

Table 3A. The Institutional Quality Index of considered provinces in 2012.

Province	IQI	Province	IQI	Province	IQI	Province	IQI
Agrigento	0.2135	Firenze	1	Palermo	0.1998	Salerno	0.5378
Alessandria	0.6651	Foggia	0.3511	Pavia	0.6229	Sassari	0.4713
Ancona	0.7505	Forlì-Cesena	0.7719	Perugia	0.7572	Siena	0.877
Aosta	0.7469	Genova	0.5228	Pesaro e Urbino	0.7524	Sondrio	0.6969
Arezzo	0.8635	Gorizia	0.775	Pescara	0.6235	Taranto	0.3795
Ascoli Piceno	0.6794	Grosseto	0.7928	Piacenza	0.7435	Teramo	0.7788
Asti	0.6614	Imperia	0.4221	Pisa	0.8757	Terni	0.7312
Avellino	0.4538	Isernia	0.2001	Pistoia	0.7705	Torino	0.6823
Benevento	0.5197	La Spezia	0.6083	Pordenone	0.703	Trapani	0.147
Bergamo	0.7405	Latina	0.5209	Potenza	0.3976	Trento	0.873
Bologna	0.695	Lecce	0.4937	Prato	0.8179	Treviso	0.7935
Bolzano/Bozen	0.8553	Lucca	0.8504	Ragusa	0.2887	Trieste	0.7984

Brescia	0.7029	Macerata	0.7209	Ravenna	0.8135	Udine	0.698
Brindisi	0.4459	Mantova	0.729	Reggio di Calabria	0.0398	Venezia	0.7247
Cagliari	0.3927	Modena	0.7035	Reggio nell'Emilia	0.7126	Verona	0.7312
Caserta	0.411	Novara	0.7585	Rieti	0.5958	Vicenza	0.7186
Chieti	0.8574	Nuoro	0.4515	Rimini	0.7645	Viterbo	0.5397
Cuneo	0.8075	Padova	0.7308	Roma	0.7297		

Source: 9.

Table 4A. The average IQI at region level in 2012.

Italian regions	Italian macro-area	Average IQI
Trentino Alto Adige	Northern	0.8642
Tuscany	Central	0.8109
Abruzzo	Southern	0.8020
Valle D'Aosta	Northern	0.7469
Veneto	Northern	0.7452
Emilia Romagna	Northern	0.7436
Umbria	Central	0.7396
Friuli Venzia Giulia	Northern	0.7158
Lombardy	Northern	0.7033
Piedmont	Northern	0.7021
Marche	Central	0.6955
Lazio	Central	0.5831
Liguria	Northern	0.5313
Campania	Southern	0.5010
Apulia	Southern	0.4374
Sardinia	Southern	0.4214
Basilicata	Southern	0.3976
Sicily	Southern	0.2065
Molise	Southern	0.2001
Calabria	Southern	0.0398
Total		0.6898

Source: our elaborations on data by Nifo and Vecchione (2014).

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The Role, Scope and Management of R&D and Innovation in the Wine Sector: an Interview with Antonio Graca

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Abstract. Antonio Graca is Director of Research and Development at SOGRAPE VINHOS and an eminent figure in the Wine Business. With this extensive interview, he shares his thoughts and views on many key aspects of the business, starting with the role of R&D and innovation and the connection between academic research and the operators of the wine sector. The experience and knowledge that emerges from this in-depth conversation can represent a precious source of inspiration for researchers, managers and all the stakeholders in the sector, as it sheds a light on many key issues in the way to success in the wine business.

Keywords: wine business, R&D, innovation, management, leadership, interview.

PH: Antonio, you are very well known and respected across the wine sector for your commitment to, and considerable influence on, R&D and innovation not only within your company, but across Portugal and the broader international community. Your activities are diverse, embracing a market focus in defining R&D programme development and extending across a wide field of interests from genetic diversity, climate change mitigation and adaptation to sustainability, amongst many others.

Might I therefore open this discussion/interview by asking what first motivated your interest in grapes, wine, and the business of wine; was it your early upbringing, exposure during schooling or university or some other avenue?

AG: I was born into a family that always had professional connections with wine, Port wine, that is. My father and uncle both worked for competing Port companies while my grandfather, a printing entrepreneur (before digital times) supplied all type of barrel marks, wood case engravings, white seals to most Port companies. Further back in my lineage there were other people working in the wine business. You also must understand that, in Portugal, wine is a staple, an element inseparable from food, always present at every table, a part of our collective history, culture and lifestyle. Wine was there, since ever. Having close relatives in the business, made it a recurring topic at family gatherings. I remember, since a very early age, being fasci-

nated by tales of growers and vineyards, harvest, of coopers and sailors, of winemakers, tasters and blenders, the cosmopolitan feel with so many non-Portuguese names working the business and the praise those wines received in international markets. My father, especially, has always been a fantastic storyteller, listening to him is always a wondrous experience. My mother, on the other hand is an innate naturalist, with a special understanding of plants. We spent my childhood and early teen years living in a very rural area of South Portugal and in that period, she awoke in me the love of nature and the curiosity for its discovery making me realize the knowledge trove therein and the recurring cycles providing never-ending opportunities to experience again what you missed last time. I was not explicitly groomed to get into the business in any way but looking back I guess it would be hard not to.

PH: In your present (and perhaps recent) roles, you facilitate and mentor personal and professional development as you engage with many organisations and individuals; may I ask how you transitioned from pursuing your individual, scientific and professional development to that where you more broadly foster the careers of others, the development of the your employer company SOGRAPE VINHOS, and for that matter, industry?

AG: It was evolution, adaptation. At one point I just realized that if I aligned my personal goals with those of larger organizations my sphere of influence would expand, opening opportunities that would be much harder to get on my own, maybe even downright impossible. The hardest to do was to understand and clearly define what I thought could be my best contribution. It took years. However, once I did, it became quite easy to identify those organizations that would open channels, leverage my efforts, provide fast-tracks and materialize ideas. It is not that I have been harnessing critical mass to fight uphill battles, quite the opposite. I dream goals, as unrealistic as they may seem but presenting a clear case to advance from the current state, the baseline. Next, I establish steppingstones to get there and wait for opportunities, for «stones» to emerge. When I spot one, I put all my effort to get my feet onto it and move closer to the goal. Of course, when you are in a network that shares your goals (an organization), you exponentiate eyes and brains looking for or creating steppingstones. If you combine organizations into more complex levels (companies, associations, federations, intergovernmental bodies, etc.), like the layers in an onion, you become able to align their goals together which, if supported by scientific knowledge, becomes a powerful «stone» maker. For that, the opportunities provided by Sogrape's entrepreneurial stance and its own evolution as a family-owned company with a clear view of its purpose and how to achieve it, were always a strong lever. Today, a lot of my work consists of a constant evaluation of which goals from different organizations are in line or may be merged. The critical factor is always the human factor. The basic units of human organizations are human beings so I give the greatest importance to making sure people in organizations understand how goals can be shared and aligned and how each one's contributions will advance the organization's and their own personal goals. The key to tap into the immense potential of human beings is communication: clear, concise, and courteous communication. Hence my increasing dedication to facilitating and mentoring roles.

PH: Have you any thoughts on what might constitute the ideal combination of qualifications, experience (within and outside the vitivinicultural sector) and other attributes (soft skills etc.) which would best fit an individual for Research Development & Innovation (RDI) leadership and management in the current era?

AG: Besides a Ph.D. in life or earth sciences, I believe restless curiosity, an open but inquisitive mind, out-of-the-box creativity, courage to manage calculated risks and diplomatic skills to be of utmost importance for someone who wishes to make a difference in wine RDI. Wine science is a confluence of many scientific disciplines; therefore, they should be able to manage radically different areas of knowledge and understand more than just the basics for each and all of them. It's a job where you are constantly being humbled by what you don't know, leading to a life of permanent, intensive learning, mostly from others. Critical thinking is of the essence and they should quickly sniff out unsound science, unfortunately so commonplace today, from a distance. Someone playing such a role should think of themselves as bridge-builders, establishing connections where they don't exist, understanding the differences and the common denominators to bring the relevant people together, strengthening bonds, weeding out disruptive factors while anticipating future needs. Someone who is relentless in the pursuit of scientific rigour yet seasoned with a mild spray of non-conformism and an overt loathing of dogma. Someone who can successfully match history with a vision of the future, tradition with innovation. Finally, someone who excels in the art of communication, not just scientific but more than anything else, layman communication. This is a role that permanently requires the summarizing of knowledge,

concepts, ideas and outcomes, so concision is key. But so is translation in all its forms, between people of different backgrounds and scientific disciplines, researchers, entrepreneurs, policymakers, teachers, journalists, technical staff, and common citizens. This is an era of fast change and someone who wants to lead that change needs to be prepared to change faster.

PH: Understanding your strong focus on quality research to inform company and industry development, I then have several questions for you relating to development of industry capacity along with investment and management of R&D and its role in supporting your company's strategic objectives:

Q: Do you see R&D largely as a means of resolving production, supply chain or market problems, or does it also offer a means to generate opportunities, then test and calibrate the company's potential to address current imperatives and future priorities?

AG: Actually, I think R&D is meant to perform both roles and there is even a third one: it offers a means to dream the future, to break the boundaries created by the current reality and the past originating it, allowing us to imagine ideal worlds and tools and approaches that do not exist yet. Then, identify the course of action, pick up the right tools and start opening the path that would take us there. It is probably the most powerful aspect of R&D and companies who devote a sensible share of their effort to it are the ones that usually lead development and innovation (and growth) in their sectors.

PH: So you see the most powerful potential of R&D is the generation of dreams and visualisation of opportunity, providing the foundations and mechanisms from which to successfully adapt and innovate; there's clearly potential for many who are prepared to act on this advice!

Q: Within your experience, what are the key elements underpinning the most successful models of company or industry-wide adaptation and innovation? (top-down, bottom-up, strategy driven, team-based----); perhaps some examples?

AG: In 2004, just one year after I started Sograpé's R&D department, over a glass of Shiraz in a Melbourne restaurant, I made that very same question to a researcher I respect a lot who had worked for a US company, arguably the one having the largest private wine R&D department ever. She told me that success lies in the intersection between top-down and bottom-up, because that is when you maximize all possibilities. It was advice I never forgot and going back home started to apply that concept to our strategy, generating an inventory of knowledge gaps at the operational points where they were identified and establishing links with the overall company strategy for development and innovation. To materialize it, I insisted on having two meetings every year with the company's senior management and shareholders where identified gaps were compared to research avenues that could be pursued to solve them. In these meetings, finished, ongoing and pipelined projects were presented as a function of where they fit in the overall company's strategy and by doing so, a few years later we were getting our R&D effort more and more in tune with the company's purpose, vision and mission. At the end of the day, this was building a bridge between practical needs, strategic options, and the scientific offer. Our first project to be funded by a national program for business R&D was named ICONE – Integrating Coherently and Optimizing Nodes of Excellence, a fancy name for a bridge between the company, high-tech SMEs, national and international universities. The project aimed at gaining collinearity between market needs, oenological production, and viticulture and so it did. Among many other important outcomes, we were able to bridge the old gap between grape growing and winemaking by adopting precision farming technologies. Today, the science of sustainability is strengthening another bridge across the also traditional gap between production and marketing. Bridges, convergence points and intersections are for me the essential elements of successful R&D wherever you do it because they enlarge your spheres of possibilities while allowing you to retain focus on your priorities.

Q: Is research in the wine business mostly a competitive advantage tool that companies should pursue independently and in competition with each other or is it a cooperative endeavour for joint progress?

AG: I have always been very careful by not mixing either of those two approaches. I believe there cannot be cooperation "per se" between competing companies as that is against their nature as organizations. Companies are out there to maximize profits and returns on equity and investments and that means that any gain your competitor has is a gain you lose. However, there is an interesting concept that was proposed under game theory by Von Neumann and Morgenstern and later developed by John Nash (of 'A Beautiful Mind' fame) and others. That concept is coopetition, that is, cooperating for the basic conditions that allow your business to build on shared resources while competing for market and consumers. So, from an early stage I started to rank research projects in terms of cooperative or competitive, developing the former as shared, networked projects that would produce capacities, skills and knowl-

edge while self-funding competitive projects that would translate into competitive market advantages and innovations. The distinction is not always an easy one, and it takes luck and a fair amount of good judgement to avoid mistakes. Hardest of all is having public research institutions understanding the fine line separating them (that is, the cooperative or the competitive approaches), most especially at a time where it is self-evident that research materializes results and progress much quicker when done under some level of collaboration with private companies.

Q: What types of scientific journals, abstracting services and industry publications do you regularly read or scan, and how do they inform your thinking, strategic plans, and project execution? Have you any suggestions how these might better support industry innovation and progress? What is the role and the performance of wine specialized press in raising awareness for wine research – in R&D teams – in the business? What other entities or fora inform and influence your perspectives? Do you (or your team) have any scheduled methodology or specific tools for doing that?

AG: My best source of knowledge is the global network of scientific contacts we have been building in the last 15 years. A careful choice of who to follow in Research Gate or Google Scholar does wonders to keep you in tune with the latest research coming out of labs across the world. It is important not to stick just to grape and wine researchers. More and more of early awareness of breakthroughs come from paying attention to other disciplines and evaluating the possibilities of their application to the business of wine. We still subscribe to grape and wine scientific journals and specialized press both under electronic and paper formats but most of the knowledge we gain there had already been published elsewhere, so if we want to anticipate trends and position ourselves at the start of the development of a new breakthrough for grape and wine, we have to have wider scanning, from architecture to quantum physics, from archaeology to neurology.

When it comes to research that is funded by public sources, I am a firm believer their results should be published in open formats, accessible to anyone, free of charge. I have seen the move of the European Union in that direction as very positive and inspiring. It would be great to see more of that happening elsewhere. PLOS is another great example and so is OenoOne a specialist open publication for the wine sector. I am hoping that these formats will develop more and become the format of choice for top researchers around the world to share their research. The recent boost towards open publishing stirred by the COVID19 pandemic was reassuring.

Wine specialized press (the non-scientific type) is devoting more and more importance to science and research because their audiences are becoming more and more permeated by Gen-Y's and Millennials and these readers were born in a world where they can gain access to any knowledge and want to see beyond the label and marketing gimmicks. Twenty years ago, no one could care less whether Touriga Nacional was a native Portuguese variety or if Burgundy was produced organically or not. Today, these trivia became the matter of talk among a growing number of wine consumers, so publications follow the lead to explain wine matters. It still is quite incipient, from a scientific point of view, but the level of scientific terms, references and features you see today in the Wine Spectator, Just-Drinks or La Vigne is a far cry from just two decades ago.

So, we keep an open eye for all these sources and organize and index each relevant piece of knowledge in an internal technical database that is accessible to all technical staff in the company, searchable by author, keyword, theme, year of publication and other criteria. And yes, we have regular knowledge survey routines that target scientific publications, extension journals, books, specialized press, event proceedings and the odd feature that may pop-up in an innocent publication, filing them in the database under the same searchable structure.

Q: You will have observed significant changes in the type and style of project teams, internally or in the public sector, and in their project funding, structures, reporting and measures of success (KPIs etc) over recent years; have you any comments on how projects and their structure might evolve over the next decade?

AG: The major change was a higher concern with having companies involved in research projects and fostering contacts and collaboration between academia and companies. This, in Europe, resulted from the European Commission orientations towards funding programs such as Horizon 2020, a major boost for European R&D with a budget of 80 B€ to spend over 7 years. Grant proposal evaluation was much more focused on results' impacts and ensuing innovation. Yet, for the grape and wine sector, which in Europe still counts a very small number of companies with a clear focus on R&D and a lesser number of companies that have in-house R&D structures, this translated as many being lured into participating for the funding they would get and not as much for the knowledge and innovation they could obtain. In any case, R&D became understood as an activity that brings tools and possibly solutions for problems but that understanding is still a far cry from being

materialized in practical terms. An evaluation done this year (2020) by the Comité des Entreprises Européennes de Vins – CEEV, an industry representative in Brussels, found that while this sector represents a bit more than 8% of total European agri-food exports, its capture of Horizon 2020 funding was less than 0,6%, revealing a large loss of R&D funding for other, more R&D-happy, food sectors. The same lack of understanding and of common ground I identified more than 10 years ago still exists and is a looming threat for the European sector's competitiveness, one that is currently exploited by other wine origins with better integration between research and entrepreneurship. In Europe, with a few honourable exceptions, researchers only take companies onboard projects because funding initiatives force them to and because companies have data that otherwise they could not access, their main focus being to publish highly-cited scientific papers, solving companies problems being, at best, a secondary objective. Companies, on the other side, often lack the needed qualified staff and adequate organization to extract benefits from scientific knowledge and research, therefore joining research projects more for the funding they will get and less because they are confident they will have their problems addressed and solved. Also, often companies reject R&D because they are not ready to accept the investment risk it entails as an activity, even though that risk for most European countries is usually well offset by funding incentives.

Q: Do you see and understand that wine consumers are aware of and appreciate research efforts in the sector, and by extension, might research be better deployed as a marketing tool for companies?

AG: I don't think consumers equate spontaneously wine with research. A vast majority of consumers still eye the wine sector romantically not acknowledging the huge technical evolution that has occurred in the last 70 years. For them, research is stereotyped as a lab activity performed by public institutions or large-cap corporations bent on ruling the world! The association between wine and research won't come easily to their minds. Yet, the most recent generations, because of being quite wary of lack of authenticity, misleading ads and wrong choices social- and / or environmental-wise, are a lot more open to delve deeper into how wine is made, where it comes from and how their choice of wine impacts environmental and social issues irrespective of where their purchased product comes from. This opens an interesting window of opportunity for the grape and wine sector in terms of marketing messages, as there is curiosity regarding what wine producers are doing to produce a wine that is authentic, responsible, and sustainable. Conversely, this also means that gone are the days of marketing by managing the consumers' ignorance. Marketing claims and overall branding including brand communication need to have clearly accessible, credible support information and producers must walk the talk if they don't want to risk being put off-market. These are the days where marketing needs to manage consumers' education.

Q: Regarding development of capacity within the sector, what do you see as the 3 main skills required of a researcher to be successful in the industry, and do you see a role for researchers in defining and supporting the training and education needs of aspiring wine professionals?

AG: Knowledge management, systems thinking, transformational communication. I think we live in a world where professionals are at a permanent risk to be overtaken by their clients or consumers in knowledge about their own product. In order to avoid that, professionals need to keep a good level of awareness of what is happening and, most especially, how do they and their organizations stand on critical fracture issues. For that, they need indeed support from researchers that will update them on the evolution of technology, new knowledge insights and breakthroughs from scientific research, their implications, expected impacts and potential threats. A professional that works supported by science is a professional that will be regarded as no-nonsense, up-to-date, dependable, and trustworthy. To achieve this, professionals need periodic contact with researchers that can translate even the most difficult and complex science in a message accessible by them, their clients, and consumers. Not all researchers are able to provide this; a careful cherry-picking is thus in order. Continuous training programs for wine professionals should therefore be setup with the participation of researchers but also important is to create always-on science helpdesks that allow professionals to react in a timely manner to questions and challenges they receive from the marketplace.

PH: Returning to some of the key issues around industry sustainability (TBL) and social licence, all of which have complex interactions and many competing interests, where and how might research best be directed to guide policy development and review, resolve tensions in resource allocation and ensure a long-term future for the wine sector?

AG: Many of the issues regarding sustainability collide headfirst with lack of qualification by wine profes-

sionals, the designation, ' sustainability', itself being a prime example as it is often mistaken as environmental protection and not triple-bottom-line. Here, again, transformational communication is of essence, researchers needing to first understand who their counterparts are, how they think and what is the common ground that can be used for a clear, successful communication. Communicating on sustainability and social license is such a minefield that the United Nations had to compile a guide to support their staff at the Environment Program. Science-based observations, initiatives and targets are, in my view, the only way to progress on those issues constructively, consequently and…yes, sustainably. Exactly because sustainability and social licence are complex, they require clear systems thinking, a skill not often found in researchers as they (still) are mostly trained to focus and dissect their specialty from everything else. However, these issues require an understanding of what is going to change in the whole system if you tweak something here or there. Approaches such as Life-Cycle Assessments need to be deployed to understand which is the net gain or loss from a specific change in the system. This is especially critical when dealing with policies which, by nature, affect a great number of actors in the system.

Q: Have you any suggestions on how governmental, intergovernmental and professional associations, nationally and internationally might be better informed and engaged regarding the potential of R&D initiatives to inform policy, prioritise funding and ensure industry and societal impact?

AG: Knowledge management takes first-row here. Peter Høj of The Australian Wine Research Institute (AWRI) at that time, wrote, already in 2003, that the vast majority of knowledge is produced outside any single organization and that successful R&D lies in tapping into that knowledge pool. It appals me at how little this critical activity is taken seriously by the majority of governmental, intergovernmental or professional organizations in the grape and wine sector be they national or international almost 20 years later. I don't know one such organization in the wine sector in Europe that has a staff position with the continuous responsibility to manage access and awareness to publicly available knowledge. The few ones I know to perform some knowledge managing activity, at best, do it under a need-to-have basis, not like the routine activity made necessary by the current level of instantaneous knowledge production and dissemination. As a result, more often than not, policies are ill-informed, funding is prioritized as a function of political, not scientific criteria and the impact is dimmed and a long way from what it could and should be. The simple creation of a Knowledge Manager position in those organizations would improve their R&D impact almost overnight.

Q: In a similar vein, but now directed to the industry itself, is research's role adequately portrayed and understood among wine entrepreneurs and managers?

AG: I would say mostly not, even though a few companies, regardless of size or market relevance, did take R&D role seriously and by doing so, have risen among their peers. What baffles me is why others do not see and follow these clear examples. After some careful observation and even situations where I asked bluntly to shareholders and managers why they downplayed or ignored R&D as a business activity, I came to the impression that it has a lot to do with the experience and vision of each company's senior management. Companies that have a Ph.D. among shareholders or senior management tend to have a better perception of the role R&D can play in raising their profitability. The same observation goes for companies having in the senior management, people who had previous experience in sectors that rely heavily in R&D, such as the pharmaceutical, software or chemical industries. In the grape and wine industry of today, research is still mostly seen as something to be done in university labs and not in companies.

Q: What are the greatest hindrances or blockers of adoption of research results in wine businesses?

AG: I am probably sounding repetitive, but in my experience, the greatest hindrance to research results adoption in the grape and wine industry is poor communication. Conversely, research projects where the final user (the person or persons, not the organization as a whole) participates since day one, offering opinions in hypothesis formulation, experiments design and results interpretation are the ones I have seen with fastest and most complete results adoption. Cocreation and coproduction are powerful and efficient concepts in R&D.

Q: Shall we see a rebalancing between discovery, design to objectives, innovation in product, processes, operating and supply systems etc?

AG: The irony lies in that in the grape and wine sector, by its own nature, research does happen often and innovation almost every day. More than a rebalancing, I believe that we will witness a progressive realization than many activities that are executed to sort out a specific client's request, to solve a new problem or to address an identified opportunity, are in fact innovation

and research activities. They are now, just not identified as such and not part of a specific, systemic insertion in businesses' organizations. It is my persuasion that it is this systemization that will drive research's integration in business activities and materialize its potential benefits.

Q: Might there be more reliance on science and technology, scientists and technologists being embedded in the business and in multi or cross-disciplinary teams?

AG: Yes, I believe firmly that we are already seeing a growth in this reliance because of a growth in the average qualification of the grape and wine professional.

Q: What do you see as the 3 most pressing issues and 3 greatest opportunities amenable to being successfully addressed by well-designed, directed, and funded R&D? Have you some current examples to illustrate progress down that pathway towards clear objectives

AG: The three most pressing issues are:

- Pressure from health agencies to curb alcohol consumption.
- Climate change.
- Balancing resilience with efficiency from grape to glass.

The three greatest opportunities are:

- The Global Earth Observation System of Systems (GEOSS). Projects like MED-GOLD and the recently published Australia's Wine Future: A Climate Atlas are the very first hints of what may come after, from the integration of myriad sensors, space- and earth-bound that observe our planet in near-real time. The Destination Earth (DestinE) digital twin of our planet currently under development will make this potential accessible to everyone opening a whole new way of understanding farming, agribusiness and consumption through real-time data integration.
- Biodiversity. Policies such the European Green Deal and the Farm to Fork Initiative open a much-needed window of opportunity to reverse biodiversity loss and secure this fundamental resource for all businesses and industries. The recent call to action from the Business for Nature initiative has joined 600 companies across the world (just 3 wine companies, one of which Sogrape), totalling over 4.1 TUSD in revenues in a stern warning to the UN that more measures are needed from national governments to conserve nature and secure the estimated 44 TUSD of global GDP at risk from nature loss.
- Wine in Moderation. This project itself is a great opportunity that can be made into huge market potential if carefully and well-designed R&D is applied to scientifically unravel the nexus between the role of wine in balanced diet and lifestyles and its direct effects in the health of moderate wine drinkers. This initiative, that has known so far limited success, demonstrated that the wine sector is willing to self-regulate and promote sustainable and responsible consumption. It was, however, not as successful in deterring health agencies across the world from using unsupported claims and even bad science to implement ill-advised policies curbing wine consumption. A global coordinated research effort to find scientific answers to the right questions, has the power to get policies back into a science-based framework that may have an audible voice even in the WHO.

Q: The Covid-19 pandemic has affected our society in an unprecedented way. What do you think were the most important consequences in the wine business? And what lessons can we learn from it to move into the future?

AG: I believe the pandemic boosted the sector's resilience by showing that such a disruptive event could be handled without major disruptions to production while reducing exposure of the people involved in this production system. Challenges are more in the drop of economic value being traded rather than in volumes. I believe we need to rethink our business models and adapt to the situation, namely in increasing the diversity of options for distribution and sale. As an example, take-away restaurants are not new, but how many wine companies have targeted this specific way of buying wine offering solutions that can be beneficial for both take-away owners and clients? The pandemic had the virtue of showing these types of uncared-for niches that can then become mainstream solutions overnight as a result of a catastrophic event. Identifying them, designing specific solutions to increase the value being traded through them will not only provide for a more resilient sector but also provide increased revenues under so-called normal situations.

PH: Finally, recalling that you have a rich life outside the wine sector, what other cultural, social and recreational pursuits have you that allow you to escape from an intense engagement across our sector, but also refresh and energise you to continue your contribution? Perhaps they may even translate directly in some cases!

AG: My «rich life outside the wine sector» is a life where wine still plays an important role. In Portugal, wine is an everyday presence at every table and our rich

cuisine is a great match for the vast diversity of wines we produce. I enjoy every aspect of wine: the emotions it elicits from our senses, the interplay it has historically played in the development of the human race as a civilized and civilizing species, the art it expresses through the craft of farmers, winemakers or sommeliers, the tamed natural world it lays within our grasp when in a vineyard or when tasting the climate bound in every sip. Wine is for celebration and for introspection. It offers countless hours of storytelling to thrill my friends and it is a warm friend when I need to sit alone considering my place in the grand scheme of things. I try never to cellar more bottles than those I can consume, alone or in good company, in the space of one year and I am always on the lookout for wines I never tasted before and the unsuspected sensations they keep for my enjoyment.

Despite and through my passion for wine many other interests fill my life. I am an undecided person when it comes to wave some interest away in favour of another. Being an innate universalist, my greatest frustration arose when I discovered as a teenager that I would not live enough to experience or learn about everything my curiosity lands on. So, I devoted my entire life to reducing the number of things I will never have the chance to discover and thus, became interested by science and research.

The most interesting subject I have ever found is people. The endless learning opportunities to discover the amazing offers every other person has in store for me led to the creation of my life motto: searching undaunted for the novelty in every human being. It is something I cherish within the realms of loved ones, friends or the stranger who sits near me in the train or airplane.

I enjoy and appreciate most art forms, but only one elicits in me the same inner and primal response as wine does: music. The same way wine allows me to travel through time and space, music allows me to transcend reality and consciousness. Both touch what I call my soul, delivering my emotions from the strict and rigorous grip of the scientific method and allowing my imagination to run wild and free. I keep an incredibly eclectic and dynamic selection of music genres in my car music disk, ranging from Portuguese fado and Balkan techno to Seattle grunge metal and Australian white reggae, my first criteria when choosing a new car being the quality of its high-level sound system.

I devote a great deal of time to learning history as a tool to understand the present and prepare the future, avoiding mistakes already made. I have a profound respect and proud admiration for the improbable outcomes my Portuguese forefathers achieved when they decided to brave the ocean and went off the last rocky tip of the Eurasian western end of the world. Today, because of them, this obscure, hard to master, language made from mixing Roman, Celtic and Arabic is the 3rd most spoken European language in the world. Because of them, I can go to West Africa, South America, India, Sri Lanka, Singapore, Malaysia, Macao or Indonesia and find native people who can, not just communicate in Portuguese, but also show me the local buildings and monuments that carry the unmistakable lines of Portuguese architecture and say, bursting with pride, that they too ARE Portuguese, even though it has been centuries since they lived under Portuguese rule. How a small kingdom in the periphery of medieval Europe with less than one million people achieved such an outcome never ceases to amaze me and everybody else, who foreign to this country, takes the time to discover its unique history.

My final word goes to that entity whose omnipresence shaped my life, being at the same time, a playground, a soothing vision, a place for imagination and a support for meditation. I mean that entity after which, in all fairness this planet should have been named after: the Ocean. No one can claim being a Portuguese without having a special relationship with the Ocean. As a Portuguese, it defines my citizenship, my culture, my social universe and my spirit, in brief, my place in the universe. The Portuguese Ocean, that is, the oceanic area under Portuguese sovereignty is 19 times the size of its land surface, equivalent to half of India. Nowhere is that notion more felt than in any of the 9 Azorean islands, tips of underwater mountains of the Atlantic ridge, places of volcanic fire encased by the sky and the ocean. Not living in those islands, the mainland's oceanic coastline has been for me the place for redemption from the pressures of everyday life or professional stresses. Every weekend I spend time strolling along it, my gaze lost in the immensity. If the human spirit is constrained by the limits of the reach of the eye, the ocean is that place where the spirit breaks all boundaries and becomes one with the infinite universe. Looking at the ocean, no impossibility lingers, no worry remains, freedom becomes the framework where all thoughts and the wildest ideas gain life and material possibility. Without the Ocean there would be no Portugal and I would be a very different person indeed, who knows…

PH: Antonio, my sincere thanks for your most generous and expansive responses in this interview, addressing not simply the pragmatic, elements of R&D as influencing the international wine industry, but also disclosing equally important aspects of your systems- view on society, ecology, economics and the market. Above all,

your preparedness to engage, facilitate, mentor and to apply philosophical principles to your professional and personal life shall, I hope, offer considerable inspiration and future guidance for many readers.

In particular, I trust that interviews and influencers such as illustrated here, shall assist in generating innovation in the Wine Industry R&D and Innovation nexus, to the enduring benefit of all stakeholders.

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