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## Article

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Wine Economics and Policy

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*Suggested Citation:* Sellers Rubio, Ricardo; Nicolau-Gonzalbez, Juan Luis (2016) : Estimating the willingness to pay for a sustainable wine using a Heckit model, Wine Economics and Policy, ISSN 2212-9774, Elsevier, Amsterdam, Vol. 5, Iss. 2, pp. 96-104, <https://doi.org/10.1016/j.wep.2016.09.002>

This Version is available at:

<https://hdl.handle.net/10419/194519>

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# Estimating the willingness to pay for a sustainable wine using a Heckit model

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Received 5 April 2016; received in revised form 29 August 2016; accepted 15 September 2016

Available online 21 September 2016

## Abstract

Sustainability is an important challenge for wineries. Although sustainability represents a way to differentiate wines and to meet some market segment demands, it also constitutes a necessary strategy to guarantee the future development of the wine sector. However, some wineries state that production costs are higher for sustainable wines than for conventional wines. Thus, the goal of this paper is to analyze the premium price that consumers are willing to pay for a sustainable wine with respect to the price of a conventional wine with similar characteristics. An experiment based on contingent valuation was designed to test the differences in the willingness to pay for sustainable wines among market segments. Further, a Heckit model was estimated, which avoids the problems of the methodologies applied to date. Results reveal that most consumers are willing to pay a higher price for sustainable wines, and that there are differences among the main market segments. In addition, several variables regarding socio-economic characteristics of the consumer (age, gender and income) affect the willingness to pay. Results show that as consumers' knowledge increases, willingness to pay a premium decreases and that consumers that are more concerned about the environment are willing to pay a higher premium.

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*Keywords:* Willingness-to-pay; Sustainability; Heckit

## 1. Introduction

In the last few decades wineries around the world have included environmental, social and economic aspects of sustainability at different stages in their management practices (Forbes and De Silva, 2012). One of the main reasons for this growing interest in sustainability in the wine industry is that consumers are changing their behavior to integrate sustainable and environmental considerations into their lifestyle choices (Smith and Marsen, 2004). Thus, some consumers' purchasing decisions are based not only on how well products satisfy their needs but also on how these products affect society at large. As a result, more and more wineries have claimed socially or environmentally friendly orientations when producing and

marketing wines, integrating sustainability into their communication strategy in an effort to reinforce their brand and market positioning. According to Nowak and Washburn (2002), through the adoption of these practices wineries could obtain a competitive advantage and increase sales with a clear product differentiation.

The importance of sustainability in the wine industry has led several authors to analyze the impact of these production practices on wine consumers. Most of these studies focus their attention on the environmental aspects of the production process (e.g. Barber, 2010) or deal with organic wines (e.g. Delmas and Grant, 2014). Only a limited number of studies consider the three basic components of sustainability (environmental, social and economic aspects) as a whole (e.g. Forbes et al., 2009).

Regarding the production of sustainable wines, two important considerations arise: firstly, the way wineries signal their sustainable commitment and, secondly, the willingness of consumers to pay premiums for these wines. On the one hand,

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Peer review under responsibility of UniCeSV, University of Florence.

wineries should be aware that sustainable products are credence goods, in the sense that consumers cannot ascertain their sustainable qualities during purchase or consumption (Crespi and Marette, 2005). As consumers are not present during the production process of the wine they cannot assess the sustainable friendliness of production. Therefore, extrinsic cues (such as labeling) are used to reduce the information asymmetry that exists between wineries and consumers, providing credible information related to the sustainable credentials of the product (Leire and Thidell, 2005). However, the large number of different logos indicating environmental sustainability available in the market raises the question of whether their associated messages are successfully conveyed to consumers. Ginon et al. (2014) show large differences in how consumers perceive these logos. On the other hand, one of the main problems of sustainable wines is their higher production costs, which can lead to their prices being between 25 and 30% above the costs of similar “conventional” wines. This price premium could be justified by the higher utility that these products have for consumers who perceive them as having a higher quality, being healthier and environmentally friendly (Brugarolas et al., 2005). Thus, some authors have tried to forecast the number of wine consumers willing to buy sustainable wines, and especially to forecast the size of the premium they are willing to pay for a sustainable wine. While only a few studies consider the three basic components of sustainability as a whole (e.g. Forbes et al., 2009), most previous research deals with environmental friendly wines (e.g. Brugarolas et al., 2005; Mann et al., 2012; Barber et al., 2009). Further, previous papers estimating the willingness to pay for a sustainable wine separately estimate the decision to pay a premium price and the price premium that would be paid as if they were independent decisions. This could cause a misleading interpretation of the results, as nil values representing consumers not willing to pay a premium price are often discarded. In this sense, the application of the Tobit model, which has been widely employed in this stream of research, would be conceptually inappropriate (Sigelman and Zeng, 1999). Thus, in this paper, consumer behavior is decomposed into two stages: “willing to pay a price premium” and “percentage of price premium willing to pay”, which are estimated simultaneously, due to the fact that both decisions are non-independent and nested.

Thus, the goal of this paper is to analyze the willingness to pay (WTP) a price premium for a sustainable wine in the Spanish market. Furthermore, this paper analyses the impact of several consumer characteristics on the willingness to pay a higher price for a sustainable wine. Within this perspective, the paper examines the consumer choice sequence through the estimation of the Heckit model proposed by Heckman (1979). The empirical application is carried out in Spain on a sample of 551 wine consumers.

To reach these goals, the rest of the paper has been organized into the following sections. The second section revises previous literature on this topic. The third section describes the methodology and the empirical application. The

fourth section presents the results obtained while the final section presents the main conclusions of the paper.

## 2. Theoretical background

Over the last decade, the concept of sustainability has created great interest in the wine industry (Remaud et al., 2008). As wineries are increasingly competing in the area of product differentiation, several wineries have integrated sustainability into their production in an attempt to respond to consumer demand. However, in spite of its popularity, Szolnoki (2013) demonstrates that it is still very difficult to define the term sustainability. One of the main reasons that could explain this lack of consensus is that in the wine industry each country and even each winery has a different understanding of sustainability. Even today, the term is primarily (and sometimes only) associated with the environmental aspects of wine production, neglecting other important issues.

The most accepted concept of sustainability defines it through the three overlapping principles of environmentally sound, economically feasible and socially equitable production. Generally speaking, sustainable winegrowing comprises growing and winemaking practices that are respectful to the environment (environmentally sound), responsive to the needs and interests of society at large (socially equitable) and economically viable to implement and maintain (economically feasible).

One of the conditions for effective sustainable management practices is that customers are willing to pay a price premium to defray the higher cost of these practices, especially those related with the environment. This is particularly important for organic products, as many wineries claim that the costs of producing these wines are higher than those of producing a similar “conventional” wine.

From an academic point of view, some authors have tried to forecast the number of wine consumers willing to buy sustainable wines, and especially to forecast the size of the premium they are willing to pay for a sustainable wine. However, only a few studies consider the three essential aspects of sustainability as a whole (e.g. Zucca et al., 2009; Forbes et al., 2009), while most of them deal with environmental friendly wines (e.g. Brugarolas et al., 2005; Barber et al., 2009; Barber, 2010; Mann et al., 2012; Delmas and Grant, 2014). Furthermore, consumers appear to have mixed opinions about sustainability, as the circumstances under which these strategies can affect price premiums are not fully understood. On the one hand, several authors state that consumers will not be willing to trade off the quality of a wine for environmental and/or social features (Lockshin and Corsi, 2012), finding that customers' demand is not one of the most important drivers behind the adoption of sustainable practices by wineries (Gabzdylova et al., 2009). On the other hand, some authors argue that sustainability is very likely to become a major competitive advantage, especially at an international level (e.g. Pullman et al., 2010; Forbes et al.,

2009), showing that consumers consider sustainable practices an important feature of wine production and would buy the products from such wineries and vineyards, paying a price premium for this type of wine.

Regarding sustainable wines, Forbes et al. (2009) show that most New Zealand respondents (nearly 73 percent) were interested in sustainable wines. Zucca et al. (2009), and that most American (California) customers like the idea of sustainable wine, even if they do not have a clear idea what sustainability means or what wineries do to achieve it. Finally, Mueller and Remaud (2013), based on a cross-national study, find that although social and environmental responsibility claims have highly comparable awareness and penetration and similar consumer trust, marginal WTP for environmentally responsible claims is about three times as high as for the specific socially responsible claim. Moreover, even if the WTP for environmental responsibility is non-negative across all the markets investigated, it is negative for the socially responsible claim in France and Francophone Canada. Vecchio (2013) explore young adult wine drinkers' willingness to pay (WTP) for three sustainable wines. Using a two-stage methodology, the factors influencing the willingness to pay are analyzed employing a Tobit model, while the premium price is estimated using ordinary least squares (OLS). Results show that females and older people are more prone to buying sustainable wines, especially when they know the specific claim for the sustainability of the wine. Pomarici, and Vecchio (2014), based on a survey of 500 Italian respondents, assess millennial consumer interest and willingness to buy three wines with specific labels certifying environmental, social and ethical attributes (a carbon neutral wine, wine produced on land confiscated from a criminal organization and wine that devolves money to African institutions that combat AIDS). Their findings, applying a probit model, reveal that the label related to social features (Libera Terra) obtains the highest patronage rate (almost 75% of respondents). Their results show that living in an urban area and being female and older (age cohort 27–35) significantly increase the probability of buying sustainable wines.

Regarding environmentally friendly wines, most papers show a positive willingness to pay. Berghoef and Dodds (2011) reveal that most consumers are interested in purchasing eco-labeled wine and that more than half (65%) are also willing to pay a premium of half a dollar or more, although this WTP can vary among different types of consumer. Brugarolas et al. (2005) estimate the premium price that Spanish consumers are willing to pay for an organic wine with respect to the price of a conventional wine with similar characteristics. Their results show that the average premium price is between 16.29% and 16.92%, depending on the method used (direct estimation and a logit model). Consumers with a healthy life style are willing to pay a higher price for an organic wine. Barber et al. (2009) find that consumer environmental knowledge influences willingness to buy environmentally friendly wines. Barber (2010) shows that the importance of being environmentally friendly, considering environmental issues when making a purchase, and collectivism are all very good

predictors of consumers' intention to pay a premium price for green wine packaging. Laroche et al. (2001) investigate the demographic, psychological and behavioral profiles of consumers who are willing to pay more for environmentally friendly products, finding that this segment of consumers is more likely to be female, married and with at least one child living at home. Loureiro (2003) shows that environmentally friendly wines receive a very limited premium compared with conventional wines. In this line, Delmas and Grant (2014) find that consumers are not willing to pay a premium for wine eco-labels but that certified though unlabeled wines enjoy a significant premium. They demonstrate that effective eco-labels are associated with changes in production processes that result in superior products, even if this might not necessarily be communicated directly to consumers through the label. Delmas and Grant (2014) show that although certifying the wine increases the price by 13%, including an eco-label reduces the price by 20% confirming the negative connotation consumers apply to "green wine".

In order to better understand wine consumers' interest in sustainable wines, this paper decomposes consumer behavior into two stages: "willing to pay a price premium" and "percentage of price premium willing to pay", and simultaneously estimates the influence that several consumer characteristics have on these decisions.

### 3. Research design

#### 3.1. Sample and variables

To estimate consumers' willingness to pay (WTP) for a sustainable wine a survey based on contingent valuation has been designed. WTP can be defined as the maximum amount a consumer is willing to pay for a given quantity of an item (Kalish and Nelson, 1991; Varian, 1992). Specifically, a questionnaire was designed to test whether consumers would pay a premium price or not (in percentage) for a sustainable wine with respect to a conventional wine with similar characteristics. The survey was created as an internet based questionnaire, which has been shown to be superior to the traditional offline (paper-and-pencil) method (Sethuraman et al., 2005). The target population corresponds only to wine consumers because contingent valuation has to be applied to goods which are familiar to consumers (Cummings et al., 1986; Bateman and Turner, 1993). According to Tversky and Kahneman (1974), contextual factors such as random starting points (also referred to as anchors) often influence value judgments, such that individuals given a low starting point tend to give lower estimates than those given higher starting points (Chapman and Johnson, 1994). Thus, the participants were randomly divided into three sub-samples and three different anchors were selected (5, 10 and 15 euros) for the price of the conventional wine. In the first question participants were invited to suppose they were going to buy a (5, 10 and 15 euros) bottle of wine and then asked: "Are you willing to pay more for a sustainable wine with respect to a conventional wine with similar characteristics?". To be realistic, the concept

of sustainability was not explained to the participants. In the second question, with an open format, participants were asked about the maximum premium price that they would pay for a sustainable wine with respect to a conventional one. To classify the participants into the different segments, information on socio-demographics, lifestyle, attitudes and wine consumption habits was also collected through a multiple item Likert scale that was developed from the OEMV (2009) study. The questionnaire was available online in December 2014 and distributed and promoted through wine and marketing blogs. After some adjustments to discard incomplete responses, the final sample is comprised of 553 participants (182 in the first sub-sample, 187 in the second sub-sample and 184 in the third sub-sample).

In order to make the choice model operative, we define the following dependent and independent variables.

- 1) Dependent variables: The discrete nature of the decision “willing to pay a premium price” leads us to use a dichotomous variable, in such a way that it takes a value of 1 if the consumer would pay a premium price and 0 otherwise. The variable relative to the premium price that the consumer would pay is found by a quantitative variable which represents the percentage of premium price that the consumer would pay with respect to a similar conventional wine.
- 2) Independent variables:
  - a) Knowledge: Reflects the consumers’ knowledge about wine culture measured through a self-reported variable. In order to shorten the length of the questionnaire we only considered the following single item to assess it: ‘In a five-point scale, how would you describe your level of knowledge about wine culture?’ (1 = *I am a beginner* to 5 = *I am an expert*).
  - b) Segment: We define six categorical variables that reflect the different market segments identified by OEMV (2009) in the Spanish wine industry: Traditional, Urban, Trendy, Routine, Occasional, and Social. This categorization is the result of a study undertaken by OEMV and the main insights of the different market segments are the following: 1) Traditional. These consumers were introduced to the world of wine as part of their family environment and wine is their preferred drink. They consume wine daily at lunch and dinner and they have a conservative attitude to wine, preferring full flavored, aged reds that fill the mouth. They buy brands that they already know or have tried before and appreciate the wines from their own region. 2) Urban. Entered into the world of wine in a family setting. They consume red wines but also whites and rosés, especially in the summer months. They like to be informed about the world of wine and read specialized magazines and articles. They visit specialized wine merchants and gourmet stores in search of new discoveries. They appreciate the different grape varieties. 3) Trendy. These are young, modern consumers up to date with the latest fashions. Wine is their favorite drink but when socializing they complement it with beer. The price of wine is a fundamental factor in their purchase decisions and they associate high prices with better quality wine. They are well informed about the world of wine, with knowledge gained from magazines or visits to specialized stores. They use wine as a topic of conversation among their friends, with wine being a form of social recognition. 4) Routine. This group only consumes wine at home at weekends and on vacations. They like smooth wines, without much flavor or wood. They are not very knowledgeable about the world of wine and they cannot distinguish flavors or wood or different grape varieties. They usually buy wine that they have tried before, generally from their region and brands that they know. Their consumption is not very frequent and they do not buy large quantities. 5) Occasional. Interested in the world of wine due to its strong social component, linked to free time and fun with friends and family, although it is not their favorite drink. Wine is something new for them that they are exploring bit by bit through visits to wine producing regions and by taking an interest in magazines or the new wines they find in supermarkets. They are open to different wines from various regions or grape varieties and to different brands. They like young, smooth and light wines. 6) Social. These are sporadic wine consumers. They only drink wine at social occasions or celebrations. They are not very interested in the world of wine and they mainly like smooth, uncomplicated red wines with no wood flavors. They usually ask for wines that they already know. They are open to trying wines from other regions or wines presented in new materials or even changes in the qualities of the wine. Wine is not one of their habitual purchases.
  - c) Age: Age of the consumer expressed in years.
  - d) Gender: A dummy variable that takes the value one if the consumer is female and 0 otherwise.
  - e) Income: Measured through monthly income expressed in Euros.
  - f) Environment: Reflects the consumer's environmental concern. It is measured by asking respondents about their level of concern about environmental issues using a five-point scale (1 = *I have no concern about environmental issues* to 5 = *I have a big concern about environmental issues*). Although using a single item to measure this construct could represent a limitation, this alternative was used in order to shorten the length of the questionnaire.

### 3.2. Methods

In this paper, a Heckit model is employed to decompose the consumer choice process into two stages (willingness to pay a premium price and the percentage of premium price that the consumer would pay). A similar model was applied by Nicolau and Mas (2005) to analyze tourist behavior.

First, we consider  $V_{1i}$  a set of  $r$  variables which represent the characteristics of consumer  $i$ . These variables determine the

Table 1  
Descriptive profile of respondents.

Characteristics	n	%
<b>Age</b>		
18–24 years old	139	25,1
25–34 years old	212	38,3
35–44 years old	122	22,1
45–54 years old	48	8,7
Older than 55 years old	32	5,8
<b>Sex</b>		
Male	350	63,3
Female	203	36,7
<b>Monthly household income</b>		
Below €600	100	18,1
€600–€999	149	26,9
€ 1000–€ 1499	130	23,5
€ 1500–€ 2500	94	17,0
More than € 2500	80	14,5

decision to pay a premium price for a sustainable wine – measured by a latent variable  $d_i^*$ , and  $\gamma_r$  are the coefficients which reflect the effect of these variables on this decision. Second, we consider  $V2_{is}$  a set of  $s$  variables that represent the characteristics of consumer  $i$  and explain the percentage of premium price  $P_i$  that the consumer would pay.  $\beta_s$  are the coefficients which reflect the effect of these variables on the premium price. Thus, the Heckman (1979) model can be expressed as follows:

$$d_i^* = \sum_{r=1}^R \gamma_r V1_{ir} + u_i \tag{1}$$

$$P_i = \sum_{s=1}^S \beta_s V2_{is} + \varepsilon_i \text{ observed only if } d_i^* > 0 \tag{2}$$

The variables  $u_i$  and  $\varepsilon_i$  follow a bivariate normal distribution with a zero mean, variances  $\sigma_u$  and  $\sigma_\varepsilon$  respectively, and covariance  $\sigma_{eu}$ . Hence, a dichotomic variable  $d_i$  is defined. If the latent variable  $d_i^* > 0$  then  $d_i$  will be equal to 1, and zero elsewhere. Thus, if  $d_i=1$  then the consumer would pay a premium price for a sustainable wine and if  $d_i=0$  then the consumer would not pay a premium price. Under these assumptions Eq. (1) can be represented by a Binomial model.

If we consider the joint density function of  $u_i$  and  $\varepsilon_i$ , then the estimation of the parameters  $\gamma_r$  and  $\beta_s$  in Eqs. (1) and (2) could be estimated by maximum likelihood. However, this could be difficult to achieve due to convergence problems (Sigelman and Zeng, 1999). Thus, in this paper we use the Heckman (1979) proposal, which uses a two-stage methodology to obtain consistent estimations for the parameters. This method considers the following expression of conditional expectation of  $y$ :

$$E(P_i/d^* > 0) = \beta V2 + \sigma_{eu} \sigma_\varepsilon \lambda(-\gamma V1) \tag{3}$$

where  $\lambda$  is the inverse ratio of Mills, defined as  $\lambda(-\gamma V1) = \phi(-\gamma V1)/(1 - \Phi(-\gamma V1))$ ;  $\beta$  and  $\gamma$  are the vectors of parameters which measure the effect of the previously mentioned variables

$V1$  and  $V2$ ; and  $\phi$  and  $\Phi$  are the functions of density and distribution of a Normal, respectively. This expression shows that both decisions -to pay a premium price and percentage of premium price- are related; in other words, the expectation of  $P_i$  equals  $\beta V1$  only when the errors  $u_i$  and  $\varepsilon_i$  are non-correlated ( $\sigma_{eu}=0$ ); otherwise, the expectation of  $P_i$  is affected by the variables of Eq. (1). The significance of parameter  $\sigma_{eu}$  ratifies the superiority of this model over others.

From Eq. (3) we can obtain that:

$$P_i/d^* > 0 = E(P_i/d^* > 0) + v_i = \beta V2 + \sigma_{eu} \sigma_\varepsilon \lambda(-\gamma V1) + v_i \tag{4}$$

where  $v_i$  is the distributed error term  $N(0, \sigma_\varepsilon(1 - \sigma_{eu}(\lambda(-\gamma V1))))$ . As  $v_i$  is heteroskedastic, we have to use a heteroskedasticity robust covariance-variance matrix to obtain consistent estimators of the standard errors.

From Eq. (4), Heckman proposes the following two-stage procedure: i) estimate by maximum likelihood the coefficients  $\gamma$  of the Probit model represented by Eq. (1), and calculate the Mills' inverse ratio for each observation of the sample  $\hat{\lambda}$ ; and ii) estimate  $\beta$  and  $\beta_\lambda = \sigma_{eu} \sigma_\varepsilon$ , with an OLS regression of  $P_i$  over  $V2$  and the estimation of  $\hat{\lambda}$ .

Therefore, in this two-stage choice context we employ the Heckit model in order to simultaneously model the decisions to pay a premium price and the percentage of premium price to be paid.

#### 4. Results

Table 1 contains descriptive information of the study sample. In terms of sex, 63.3% were men and 36.7% women. The largest age group was the 25 to 44 group (38.3%). The Analysis of Variance (ANOVA) test yielded no profile differences among the different subsamples.

Table 2 shows the results of the percentage of premium price that the total sample of consumers is willing to pay for a sustainable wine. In general, from the sample considered, 77.9% of participants would pay a premium price for a sustainable wine. The average premium price consumers would pay is 12.87% (SD=5.32).

The average WTP varies slightly depending on the anchor (see Table 2), from a minimum of 12.53 (sub-sample 1) to a maximum of 13.19 (sub-sample 3). However, this difference is not statistically significant ( $F=0.548$ ;  $p=0.578$ ).

The results show that WTP varies depending on consumers' knowledge of wine culture. As can be seen in Table 3, as consumers' knowledge increases the average premium price WTP decreases. This difference is statistically significant ( $F=455.75$ ;  $p=0.00$ ).

Finally, regarding the different market segments, results also show important differences in the WTP between segments. As shown in Table 4, Urban consumers show the highest WTP for a sustainable wine, while Trendy consumers would pay the highest premium price. Occasional and Traditional consumers show the lowest WTP for a sustainable wine. These differences are statistically significant ( $F=455.75$ ;  $p=0.00$ ).

Although previous analyses for the Spanish market only analyze the WTP for an organic wine (e.g. Brugarolas et al.,

Table 2  
Average WTP by anchor price for conventional wine.

	Sub-sample 1 (Anchor 5 euros)	Sub-sample 2 (Anchor 10 euros)	Sub-sample 3 (Anchor 15 euros)	Global
% of consumers willing to pay a premium price	82.4	76.5	75	77.9
Average % of premium price (S.D.)	12.53 (5.45)	12.90 (5.32)	13.19 (5.19)	12.87 (5.32)

Table 3  
Average WTP by consumer knowledge of wine culture.

	(1) Beginner	(2)	(3)	(4)	(5) Expert	Global
% of consumers willing to pay a premium price	87.2	76.5	81.2	75	61.6	77.9%
Average % of premium price (S.D.)	18.72 (3.26)	15.02 (3.39)	10.97 (2.31)	8.1 (2.44)	5.08 (2.08)	12.87 (5.32)

Table 4  
Average WTP by market segment.

	Traditional	Urban	Trendy	Routine	Occasional	Social	Global
Average % of consumers willing to pay a premium price	76.9%	84.6%	80.2%	70.2%	74.3%	84.1%	77.9%
Average of premium price paid	9.75 (4.79)	13.11 (5.66)	14.41 (5.15)	13.25 (4.57)	11.92 (4.91)	12.97 (5.91)	12.87 (5.32)

2005), these results confirm the idea that Spanish wine consumers have a positive attitude towards these wines, that not only do they consider the intrinsic characteristics of the wine itself but also the winery's attitude to sustainability.

The identification of the determinants of the willingness to pay for a sustainable wine and the percentage of price premium in terms of the different variables considered implies the estimation by Heckman's two-stage estimator of the Heckit model.

Before applying the model, a detailed study of the correlations between the explanatory variables was carried out in order to avoid possible collinearity. Also, collinearity among variables was tested by calculating the variance inflation factor (VIF) for each of the regression coefficients. The equations presented for each model constitute different combinations of them, in such a way that they all are well below the cut off figure of 10 recommended by Neter et al. (1985). Specifically, two different models have been estimated. The main difference between them is that the variable related to consumer environmental concern is only included in model 2, where the variable income has also been categorized.

The results obtained show that the coefficient associated with the inverse Mill's ratio is significant in both models, which indicates that the correlation between the error terms of the decision to pay a price premium ( $u_t$ ) and that of price premium ( $\varepsilon_t$ ) is different than zero,  $\sigma_{eu} \neq 0$ . This shows that the Heckit model is appropriate for this type of analysis since it allows for covariance in the errors and, therefore, that consumer choice can be decomposed into a two-stage process

(willingness to pay a price premium and the specific price premium that the consumer would pay).

With regard to the individual and joint significance of the explanatory variables of the estimation, the following aspects stand out. Firstly (see Table 5), the likelihood ratio test for the Binomial model (equations WTP) and the statistic F for the regression (equations PP) are significant in all the equations at a level below 0.1%, which means that individual characteristics provide relevant information on the decisions considered.

Secondly, the significance tests of the individual parameters show that the determinants of the decision to pay a price premium are knowledge of wine culture, the variable related to segment 4 (routine consumers), age, and income. It should be stressed that the estimations of these coefficients show robust results in both models. Further, the variable related to the consumer environmental concern, which is only included in model 2, is also significant.

The negative sign of the parameter related to consumer knowledge about wine culture shows that higher knowledge about wine culture is associated with a lower propensity to pay a premium price for a sustainable wine. The negative sign of the variable related to routine consumers implies that this segment shows a negative propensity to pay a premium price (compared to the omitted segment, social consumers). The positive sign of the parameter related to age shows that older consumers are associated with a higher propensity to pay a premium price for a sustainable wine. Regarding the income variable, the positive sign of the parameter related to this variable in model 1 suggests that a greater income is associated

Table 5  
Determinant factors of willingness to pay (WTP) and percentage of price premium (PP).

Independent variables	Model 1				Model 2			
	Eq. (1) (WTP)		Eq. (2) (PP)		Eq. (1) (WTP)		Eq. (2) (PP)	
	Estimate	SD	Estimate	SD	Estimate	SD	Estimate	SD
C	0.145	0.329	18.692*	0.954	−1.414	0.409	20.408	1.178
Knowledge	−0.208	0.046	−3.896	0.121	−0.205	0.054	−3.634	0.098
Traditional	−0.262	0.269	−	−	−0.164	0.302	−	−
Urban	−0.133	0.253	−	−	−0.319	0.293	−	−
Trendy	−0.276	0.229	−	−	−0.285	0.264	−	−
Routine	−0.661	0.219	−	−	−0.954	0.262	−	−
Occasional	−0.342	0.224	−	−	−0.352	0.260	−	−
Age	0.018	0.007	0.037	0.012	0.023	0.008	0.016***	0.010
Gender	−0.076	0.137	−0.593*	0.224	−0.170	0.159	−0.493**	0.214
Income	0.392*	0.054	0.668*	0.191	−	−	−	−
Income 1	−	−	−	−	1.454*	0.213	−0.887	0.680
Income 2	−	−	−	−	1.670*	0.226	−0.477	0.726
Income 3	−	−	−	−	1.303*	0.227	0.219	0.634
Income 4	−	−	−	−	2.807*	0.385	0.225	0.838
Environment	−	−	−	−	0.537*	0.070	0.587*	0.134
@MILLS	−	−	4.512*	0.972	−	−	−3.634*	0.098
Adj.R-squared	−	−	0.815	−	−	−	0.830	−
F-Snedecor	−	−	379.014*	−	−	−	235.013*	−
LR	96.331*	−	−	−	206.933*	−	−	−
Schwarz B.I.C.	275.221	−	984.191	−	232.551	−	975.098	−
Log likelihood	−243.644	−	−965.993	−	−188.343	−	−944.767	−

\*  $p < 0.001$

\*\*  $p < 0.05$

\*\*\*  $p < 0.1$

with a higher propensity to pay a premium price for a sustainable wine. In model 2 all the categorical variables relative to income levels show a positive sign, showing that the category Income 4 has the greatest impact on the probability of paying a premium price. Finally, from model 2, the positive sign of the parameter related to the consumer environmental concern shows that a greater concern is associated with a higher propensity to pay a premium price.

Finally, the determinant factors of the amount of price premium consumers are willing to pay seem to be knowledge of wine culture, age, and gender. These results are also robust in both models. However, the income variable is only significant in model 1, while the variable related to the consumer environmental concern, which is only included in model 2, is also significant to explain the price premium willing to pay.

The negative sign of the variable related to the consumer knowledge of wine culture implies that a higher knowledge is associated with a lower premium price. The positive sign of the age variables suggests that the premium price decreases as the age increases, while the positive sign of the gender variable suggests that females are willing to pay a higher premium price than males. Finally, the positive sign of the variable related to consumer environmental concern implies that more concerned consumers are willing to pay a higher premium price.

Generally speaking, these results imply that most consumers positively value sustainability attributes of wine. However, the willingness to pay for a sustainable wine depends on the specific characteristics of the consumer. In this sense, knowledge about wine culture, age, gender, income, and environmental concern affect the willingness to pay and the price premium they are willing to pay. Further, results also show that specific market segments (routine consumers) are less prone to pay a higher price. Finally, although gender is not important in determining the willingness to pay, it is relevant in explaining the premium price that the consumer would pay.

Our findings should prove particularly useful for marketers, especially when designing marketing strategies for sustainable wines. If the cost of producing sustainable wines is higher than that of producing conventional wines, marketers need to specifically target the market segments which are more prone to pay a premium price.

## 5. Conclusions

The objective of this paper has been to analyze the willingness to pay a price premium for a sustainable wine and to estimate the average premium price that consumers are willing to pay for a sustainable wine. The percentage of premium price is given with respect to a conventional wine with the same characteristics. For



the first time, this paper analyses the WTP of the different market segments identified in the Spanish wine market and the impact of several consumer characteristics on this willingness to pay using a Heckit model.

Results show that most Spanish wine consumers are willing to pay a price premium for a sustainable wine. Results also show important differences in the WTP between different market segments. Several variables regarding socio-economic characteristics of the consumer and the level of knowledge about wine culture and sustainability affect WTP.

This paper contributes to the growing literature on consumer valuation of sustainable wines. Our findings are in line with previous studies showing consumers' general interest toward environmentally friendly or socially responsible wines (Forbes et al., 2009; Zucca et al., 2009; Mueller and Remaud, 2013; Pomarici and Vecchio, 2014). Further, our results support the idea that some consumers' socio-demographic characteristics play a significant role in forecasting their interest in sustainable wines.

Furthermore, our results have several implications for the wine industry. Over the last decade, the concept of sustainability has created great interest in the wine industry (Remaud et al., 2008). Changes in consumers' lifestyles and choices of food products and an increasing market globalization have modified the structure of the wine sector both in terms of production organization and of marketing and distribution aspects (Castellini et al., 2014). As wineries are increasingly competing in the area of product differentiation, several wineries have integrated sustainability into their production in an attempt to respond to consumer demand. Given that in Spain the consumption of quality wine is in a very competitive situation, the results show that sustainable wines can be considered as a market opportunity for wineries. Particularly, wine managers considering the adoption of sustainable production practices should consider the potential WTP premium for this type of wine as these production practices face higher production costs. However, although an increasing number of wineries are responding to environmentally friendly cues from consumers, these wineries should not forget that willingness to pay is determined not only by wine sustainability but also by sensory attributes and perceived product quality. In this sense, Schmit et al. (2013) show that once consumer WTP is conditioned by a wine's sensory attributes, the addition of environmentally friendly information does not affect their WTP; however, adding sensory information significantly influences WTP initially based only on environmental attributes. Thus, wines produced and marketed as environmentally friendly should also meet consumer demand in sensory qualities. Recently, Barber et al. (2016) have investigated whether the product matters in determining willingness to pay for pro-environmental products compared to non-pro-environmental products, showing differences among consumers.

As with all studies, this research has some limitations. The main limitation of this paper is that willingness to pay has been estimated through contingent valuation. In this sense, wineries should not forget that the intention to purchase does not always translate into actual purchase behavior when consumers are confronted with a purchase situation. Thus, future research

should try to deal with real situations to evaluate the "real" WTP of the consumer.

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