Evaluating consumers' sustainable choice of wine: A virtual shop experiment

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Introduction

The French program “Ecophyto 2018” aims at achieving a 50% reduction in pesticide use by 2018. The vine-growing sector, being the second largest user of pesticides in France, so there is a strong need for French vine-growers to engage in more environmentally sustainable practices. However, they will do only if they are sure that consumers are ready to buy environmentally friendly wines. It is necessary to better understand consumers’ choice criteria and the potential impact of an information campaign, In order to develop successful environmentally sustainable policies that help consumers to change their consumption patterns. Hypothetical methods are often criticized but, as Smith (1980) and Levitt and List (2007) have showed laboratory behaviour is a good indicator of actual behaviour. So based on their findings we conducted an experiment by creating an experimental online store. This option has made it possible to control the range of proposed wines and their prices, thus study the impact of the production process, price on purchase and to evaluate the impact of information given through the store on consumer purchasing behaviour. The reason of this experiment was a way to create an intermediate step between a lab experiment and field experiment.

Studies of the wine industry fail to demonstrate the default valuation of environmental characteristics. Loureiro (2003), for example, used contingent valuation to estimate consumer willingness to pay (WTP) for geographical and environmental labeling. This study used survey data for Colorado (USA) wines. The main finding is that environmental labels are useless with wines perceived as poor quality products. Certification does not systematically mean produce will be valued more highly.

Delmas and Grant (2010) confirm this result. They argued consumers do not appreciate the point of eco-certification in the wine industry and failed to understand the differences among the various environmental labelings (wine from organically-grown grapes or organic wines, sulphite free, etc.). The authors compare the advantages of eco-certification and eco-labeling (mentioning certification on the label) and report that consumers are not ready to pay a premium for eco-labeled wine but that unlabeled eco-certified wines carry a large premium.

Ginon et al. (2014a, 2014b) showed consumers confusion on environmental labelling in the wine sector.

About one hundred and ten participants, wine consumers aged between 22 and 71 years old from Dijon area (in France) participated in the study. Taking into account that hypothetical

methods are often criticized, we conducted a choice experiment with an incentive compatible mechanism. The choice experiments are recognized as to reveal the preferences of people (Train, 2003). Participants choose from a number of alternatives that are characterized by specific attributes. The incentive mechanism is simple as the consumers had to choose and to buy (and pay for) the chosen wine.

We choose to use an on-line shop in order to control the range of proposed wines, their prices and the products' readable characteristics. So we have studied the impact of production process. prices on purchase and we evaluate the impact of information on purchase. We evaluated if consumers were responsive to the different signals (certification, information about the production method). The experiment included 4 steps. The first step we investigated whether the bottle of wine had an impact on consumer choices. The second step to the third steps, we progressively introduced information about the production method and the certification. The last step we verified how information was understood.

Materials and Methods

Selection of choice attributes and levels

During choice experiment, participants choose from a range of products that are characterized by specific attributes. During our study, subjects has to choose (and buy) one bottle of wine among eleven, according to two main attributes.

The first tested attributes dealing with the pesticide use restriction, basically four pesticide use restriction levels were introduced. The second tested attribute concerning the price range. Table 1 shows levels of each attribute.

Attributes	**Attribute levels**	**Information**
Pesticides restriction use	No restriction	No label
	Sustainable practices with reduced use of pesticides	Integrated label (IPM)
	Ban of chemical pesticides	Organic
	Ban of chemical pesticides + other practices	Biodynamic
Prices	Low price level	4.50 €
	Medium price level	7.40 €
	High price level	11.30 €

Table 1 Attributes and levels

We consider the pesticide reduction level as an increasing constraint according to the labels. The conventional wine, with no quality label, answers to the regulatory constraint on wine

production in vigor. Integrated wine, with a sustainable label, is produced with a reduced pesticide use. The organic wine, with an organic label, is produced under the European regulatory constraints on pesticide restrictions (ban of chemical pesticides) production methods restrictions both necessary to obtain the certification. The biodynamic wine is produced with ban of chemical pesticides as well as constraints linked to respect with nature's cycles. We consider here that conventional wine is the least constraining production method and that biodynamic is the most constraining production method.

The second attribute variation for the wines is the price range. We decided to propose three ranges of prices to consumers. All the wines in each price range were given different pesticide reduction level labelling this meant that consumers had both choice of price and choice of pesticide level (except the integrated wine in the high price level because we didn't find any corresponding wine). We didn't allow an intra-range price differentiation. The reason why is because beliefs on the organic wines by consumers are quite heterogeneous. Some surveys show that some consumers negatively perceive the organic wines. Some consumers expect a negative sensory attribute of the organic wines. So we wanted to test how, in the best possible configuration without price differentiation, the market shares were going to divide up.

	Price	**Price range 1]0€;5€]**	**Price range 1]5€;10€]**	**Price range 1]10€;15€]**
	Production type			
Less sustainable	Conventional	P11	P21	P31
	Integrated	P12	P22	N/A*
	Organic	P13	P23	P33
More sustainable	Biodynamic	P14	P24	P34
	Posted price (€)	4.50	7.4	11.3

Table 2 Selected products according to attribute levels

All the selected wines were produced in the same geographical area and were labelled by a “Cotes du Rône” Protected origin. Given participants have been selected in the Dijon area, we have chosen a non Burgundy PDO (Protected Denomination of Origin) in order i) to propose non usual wines for the consumers ii) to avoid reputation effects (more precisely we wanted to avoid specific beliefs on domains or vintners).

About 111 wine consumers participated in the study. Each consumer bought a bottle of wine in a virtual experimental store. The eleven wines supplied in the virtual shop are presented in

table 2. The wines varied according three price levels corresponding to the market price range (4.50. 7.40 and 11.30€) and 4 types of practices (conventional. integrated. organic. biodynamic agriculture).

Data collection and sample characteristics

Data were collected in an online store. We conducted the experiment in Dijon. Burgundy. France in February 2014. The sample of participants was randomly selected on the quota methods in order to obtain a balanced sample in sex, age and occupation characteristics, they had to be wine consumers (at least once a month). Participants were contacted by phone. They were informed that the experiment would focus on food consumption and that they would have to buy a bottle of wine in an experimental store. They were also informed that the experiment would last about one hour with a 20 euros participation fee. In the present study, 111 participants took part to a wine sale. The socio-demo characteristics are presented in the table 4.

Characteritics	Classification	Sample(%)
Sex		
	Female	52.25%
	Male	47.75%
Position		
	Student	4.55%
	Unemployed	4.55%
	Full-time worker	55.45%
	Part-time worker	11.82%
	Retired	21.82%
Age		
	less than 25	9.91%
	[25;35[	22.52%
	[35;45[	24.32%
	[45;55[	13.51%
	[55;65[	18.92%
	65 and more	10.81%

Table 3 socio-demographic characteristics of the sample

Experimental design and choice tasks

Each consumer had to choose a bottle of wine among eleven in three successive informational conditions (see figure 1). In the first informational condition, all the information about environmental labels was erased. consumers had to choose as if all the proposed wines were not differentiated on the environmental point of view. In the second condition, the sustainable labels were introduced. and consumers had to choose among the eleven wines with the information on environmental labels. After this choice, information about the different types of production and associated logos was given to the participants. Given this information. participants have to choose again a wine among the eleven wines.

This informational context was introduce in order to know how exactly a correct knowledge of the logo impacts the choice of consumers. In a previous study Ginon et al (2014a, 2014b), show that wine consumers don't really know and understand environmental labelling and certifications. In the wine market, too many types of environmental certification scramble the message and make it unclear to consumers. The information given was chosen as neutral as possible, resulting in no judgment of the quality of products regardless of the mode of production used. It took the form of a leaflet (available on request).

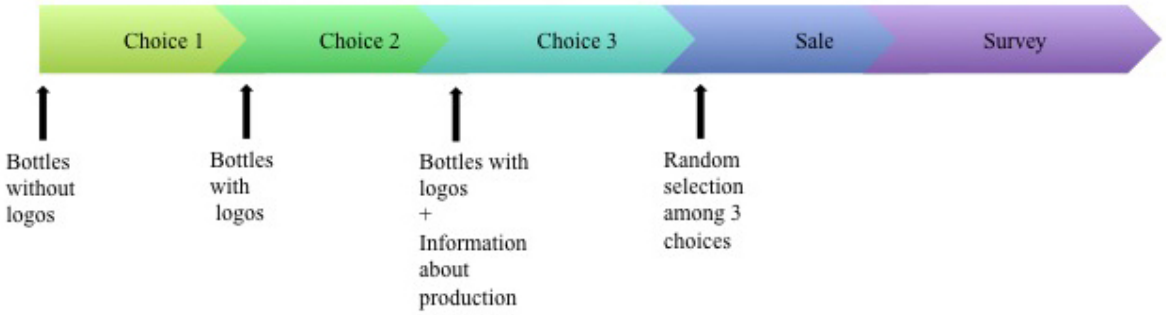

Figure 1 experimental protocol

Participants realized successive choices in different conditions within one session. Each chosen wine was recorded for each consumer in each informational condition. After the last choice, an informational condition was randomly drawn and each consumer had to purchase his chosen bottle in this condition.

Finally, participants answered to questionnaire on consumption habits, comprehension of given information. and socio-demographics characteristics. In this last survey. We also included question on their risk perception about use of pesticides in vineyards (adapted from Glenk et al.. 2012) and their risk aversion in some specific topics (adapted from Dohmen et al.. 2011). Table 4 presents questions on risk perception and risk characterization.

	Questions on risk	Scale
1	There is some reason to worry about from the use of pesticides in vineyard grown	5 points scale
2	I worry about the impact of pesticides in vineyard grown on my health	5 points scale
3	I worry about how spraying of pesticides in vineyard might affect the health of my children or peoples' children in the future.	5 points scale
4	I worry about how spraying of pesticides in vineyard might affect the health of wine producers.	5 points scale
5	I worry about how spraying of pesticides in vineyard might affect animals.	5 points scale
6	I am sure the current controls on the use of pesticides in vineyard are adequate for protecting the environment.	
7	Compared to other health risks. do you think that risk of pesticide use in vineyard farming is very low. very high or somewhere in between?	11 points scale
8	Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?	11 points scale

9	How would you rate your willingness to take risks while driving ?	11 points scale
10	How would you rate your willingness to take risks in financial matters ?	11 points scale
11	How would you rate your willingness to take risks during leisure and sport ?	11 points scale
12	How would you rate your willingness to take risks in your occupation ?	11 points scale
13	How would you rate your willingness to take risks with your health ?	11 points scale
14	How would you rate your willingness to take risks on your faith in other (unknown) people ?	11 points scale

Table 4 questions focus on the risk perception and attitude in the final questionnaire

We decided to include an individual evaluation of risk attitude and risk perception because use of pesticide is often correlated to risk patterns. As Travisi et al. (2006) mentioned. the effect of pesticide use is multidimentional and deals with various kind of risks (loss of biodiversity, health impact, food safety. animal.…). For this reason it appears to us relevant to investigate how the risk attitude and the risk perception could interact with choice of environmental products.

Estimation procedures

The data from the choice experiment are analysed using a mixed logit model for panel data (Train, 2009). According to Revelt and Train (1998), mixed logit allows efficient estimation when there are repeated choices by the same customers.

Each individual is faced with j alternatives in each of t time periods or choice situations. He chooses thae alternative that maximizes its utility. The utility that indiviual n obtains from alternative j in choice situation t is : $U_{njt} = \beta_n x_{njt} + \varepsilon_{njt}$

where x_{njt} is a vector of observed variables, coefficient vector β_n is unobserved for each *n* and varies in the population, ε_{njt} is an unobserved random term .

McFadden and Train (2000) show that mixed logit model is an appropriate spécification to take into account for heterogeneity in préférences which are not related to observed characteristics. We are interested in analysing the distributional effects of production certification. Thus in our specification of the model we included production methods (and certification) and price ranges.

Results

The figure 2 shows choice frequency in different informational contexts (choice 1: without logos, choice 2: with logos, choice 3: with logos + information on certifications). Whatever

the information context, about one third of chosen wines are included in the low price range. Medium range wines had been the more frequently chosen wines whatever the informational context (58.5% of chosen wines in the context with logos were included in the medium price range). While the conventional wine at 7.4 € was the most chosen wine when logos were not posted. as soon as the certification is available the most chosen wine is the biodynamic wine at 7.40 €.

We can find surprising that the most sold wines have a price so high, however the mean price of a red burgundy wine sold in a supermarket is 8.1 € (source :BIVB).

		Choice 1	Choice 2	Choice 3
Low price range 4.50 Euros	Wine P11 - Conventional	15.3%	2.7%	3.6%
	Wine P12 - Integrated	8.1%	8.1%	7.2%
	Wine P13 - Organic	2.7%	9.9%	6.3%
	Wine P14 - Biodynamic	9.9%	9.9%	16.2%
Medium price range 7.40 Euros	Wine P21 - Conventional	**28.8%**	13.5%	4.5%
	Wine P22 - Integrated	7.2%	16.2%	13.5%
	Wine P23 - Organic	2.7%	6.3%	6.3%
	Wine P24 - Biodynamic	5.4%	**22.5%**	**23.4%**
High price range 11.30 Euros	Wine P31 - Conventional	7.2%	5.4%	12.6%
	Wine P33 - Organic	7.2%	3.6%	0.9%
	Wine P34 - Biodynamic	5.4%	1.8%	5.4%

Figure 2: choice frequency according to informational context

Estimations Results

The first informational context shows some significant differences among the production methods (see table 5). Given that information on production methods was not available, it would be a mistake to interpret these differences across wines as production method valuation. These differences should likely be credited to the label design (visual design. producers' names. domains' names). But in the second informational context most of these differences are cancelled. So clearly the certification impacts consumers' choices. Given that certification focus on production methods, one can reasonably interpret these valuations as the valuation of the methods of production. Only the biodynamic wine is significantly more

chosen than the conventional wine when logos are available. This effect is confirmed and increased when the information on certifications had been revealed.

On the price range point of view, the high price level is significantly less chosen that the other wines and more specifically when logos are available. When certification is posted by logos, medium range wines are significantly more chosen than the lower range wines.

	Variables	Bottles without logo	Bottles with certification logos	Bottles with logos and information on certifications
Mean	Conventional	*ref*	*ref*	*ref*
	Integrated	-1.060	0.277	0.331
		(3.92)***	(1.03)	(1.17)
	Organic	-1.566	-0.038	-0.511
		(5.33)***	(0.14)	(1.56)
	Biodynamic	-0.947	0.442	0.842
		(4.09)***	(1.79)*	(3.51)***
	Low price	*ref*	*ref*	*ref*
	Medium price	0.139	0.521	0.293
		(0.69)	(2.64)***	(1.47)
	High Price	-0.476	-0.687	-0.389
		(1.86)*	(2.24)**	(1.45)
N		1.375	1.375	1.375
		* $p<0.1$; ** $p<0.05$; *** $p<0.01$		

Table 5 : Estimation results of Mixed Logit

Information comprehension

We used the last questionnaire in order to control the comprehension of the given information. Figure 3 presents the results of the declared previous knowledge on production methods and certification. It clearly appears that even if one third of the respondents declared to know biodynamic method, only 11.71% known the *Demeter* certification and 5.41% the *Biodyvin* certification.

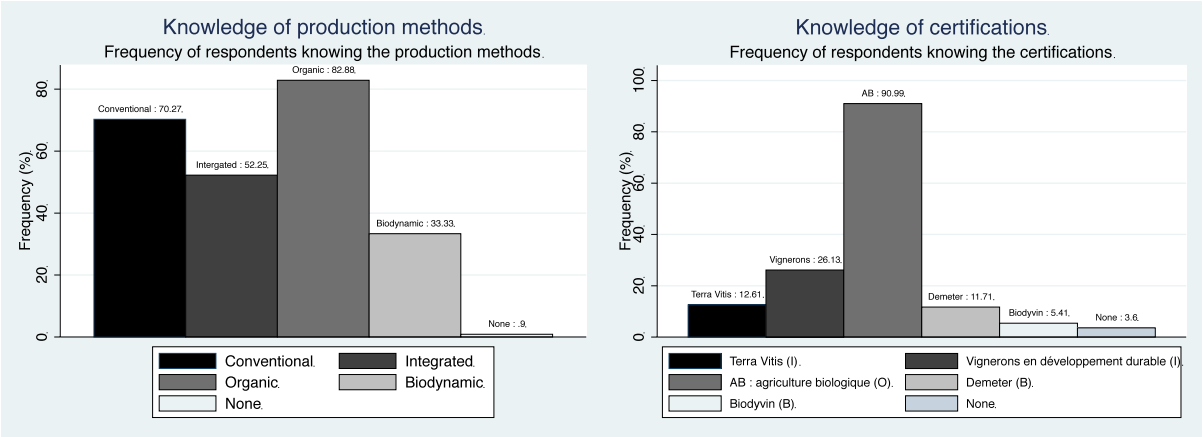

Figure 3: Previous knowledge on production methods and certifications. (I : integrated production. O : organic production. B: biodynamic production).

Only 60% of the respondents were able to identify the logos presented in the virtual shop. In the questionnaire we presented six logos on sustainable certification and we asked participants to indicate the corresponding production method. In spite of logos are all present on the leaflet. they caught the attention of respondents heterogeneously. For example, only the 10% of the respondents recognized the European organic logo and 63% say they don't know the associated production method (the French organic logo was perfectly recognized by the respondents). The *Demeter* "brand" was associated with the correct production method by 71% of the respondents while only 60% of the sample has associated *Terra Vitis* with integrated production.

Finally, when participants were asked about the cultural practices (described in this leaflet). some information seems be more confusing than others. The European regulatory constraints about production methods don't seem to be very clear for consumers because 24% of respondents believe that biodynamic production is defined by a European law (and 30 % of respondents think that is the case for the integrated production)

However, 71 % of respondents are now capable to identify integrated production method as a decreasing use of chemical products.

Risk perception and attitude

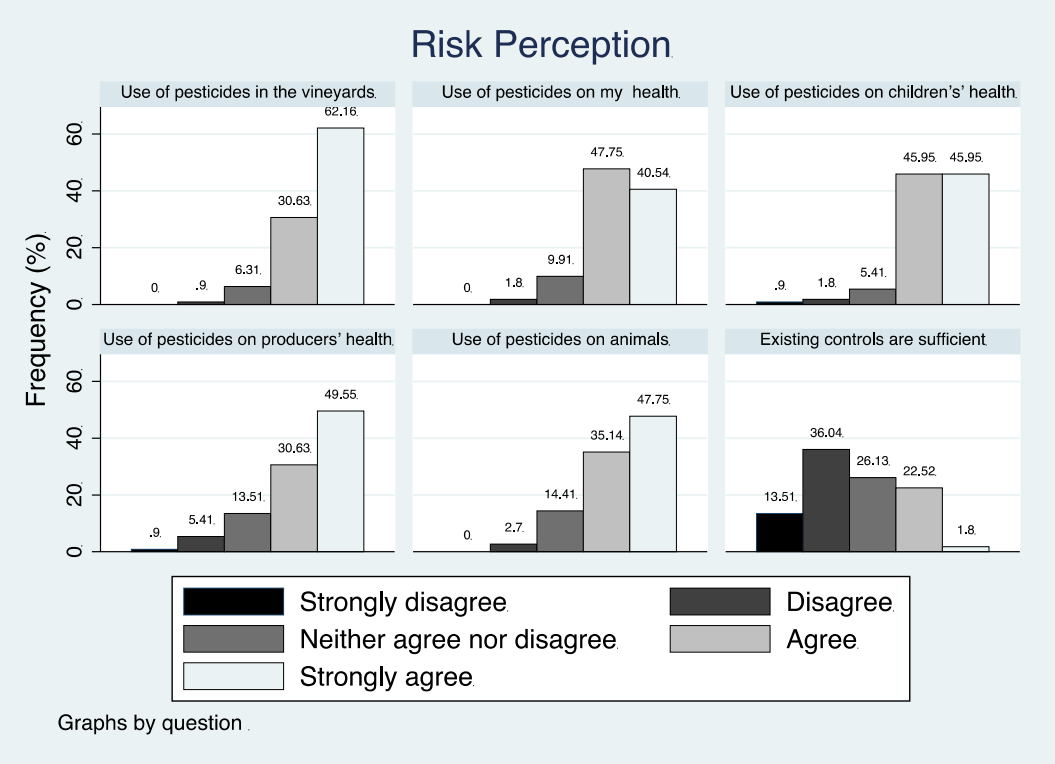

Figure 3: Risk perception on pesticide use in vineyards

Risk perception results are presented in figure 3. We can see that more than 93% of respondents consider that there are some reasons to worry about the use of pesticides in vines. Consumers don't seem to be confident with the existing controls because 49.5% of them are disagreed (or strongly disagree) with the fact that these controls are sufficient. It appears clearly that consumers don't consider the pesticide use without danger. Indeed. for each cited domain (health. future generations. animals. producers' health) proportion of consumers declaring be worried about pesticides use is greater than 80%.

Let us consider now the risk attitude by analysing questions 7 to 11 described in table 4. Results described in table 6 reveal an heterogeneity in risks attitude across domains. In general, participants by mean are close to be risk neutral (close to 5), however if we pay attention to the distribution of answers, a relatively small percentage of respondents (less than 1%) choose a value of 10, indicating that they are not wiling to take risks.

Car driving and health are clearly domains where participants are risk adverse (domains with smaller means and smaller 3rd quartiles. Sports and leisure and career are the domains where participants are more willing to take risks.

Questions	Mean	Std. Dev.	Min	Max	1rst quartile	2nd quartile	3rd quartile
General (Q8)	4.52	2.40	0	10	3	5	7
Car driving (Q9)	2.46	2.30	0	10	1	2	4
Financial matters (Q10)	3.18	2.53	0	10	1	3	5
Sports/leisure (Q11))	5.41	2.57	0	10	4	6	7
Career (Q12)	5.81	2.04	1	10	4	6	7
Health (Q13)	2.40	2.17	0	8	1	2	4
Faith in others (Q14)	3.35	2.41	0	10	1	3	5

Table 6 : risk attitude in different domain of life – eleven-point scale from 0 to 10, where 0 indicates "not at all willing to take risks" and 10 indicates "very willing to take risks".

When we asked, after choice tasks, how consumers made their choices, 41% of them answer that they choose mainly in order to discover a domain, 35% to discover a production method. However when we asked them which is the first criterion utilized to make their choice 39% answered the price, 19 % answered the production method and 14% answered the producers' name. When we asked them if they considered having uses the same choice criteria in the virtual shop than in the supermarket, 81% answered that they did.

Conclusion

The comparison between the first informational condition and the second one, allow us to evaluate the impact of the sustainable labels on consumers' preferences. We find that the probability to buy a sustainable wine is lower when labels are not shown (the conventional wine is significantly more chosen), while when sustainable labels are introduced there is no significant difference on the probability to purchase a conventional wine. an integrated wine or an organic wine. Nevertheless, the biodynamic wine is significantly more frequently bought when logos were shown.

The comparison between the second informational condition and the third one allow us to evaluate the impact of an information campaign. The first results show that the information campaign does not affect the fact that there is no significant difference on the probability to purchase a conventional wine, an integrated wine or an organic wine. However, the preference for the biodynamic wine is confirmed and amplified.

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