How good is the Wine? Measuring the effects of knowing the Price of a Wine on its Perceived Taste

Carson Forter
Angela Gunn
Arthur Mak
Elizabeth Peters
Sayantan Satpati

Abstract
In this experiment, we aim to understand if price impacts the enjoyment of wine. Using an experiment, we served participants three wines of similar varietal and vintage but with differing price points (approximately $10, $20 and $45). We randomly assigned participants to treatment and control groups in which the treatment group was exposed to price and control group was not. We hypothesized that consumers that are exposed to the price of wine will record a higher enjoyment of expensive wines and a lower enjoyment of cheaper wines. The results, while not statistically significant, show price does impact the enjoyment of wine. However, instead of rating cheaper wines lower, participants seeing the prices gave cheap and medium priced wines higher ratings compared to participants given to the same wines but who did not see the prices. We also find that covariates (such as gender, age, county of residence) do not influence enjoyment.

Keywords: Field Experiments, Consumer Preferences, Pricing

1 Introduction and Experiment Justification

Wine consumption in the United States has steadily increased over the past five years. As such, consumers are becoming more knowledgeable and interested in wine, resulting in a "premiumisation" of wine over the past 5 years. Sales of wines that sell for less than $10/L are slowly being eroded by wines with higher price points (Figure 1)[1]. Understanding price on consumer perception of wine is important for both wine producers trying to capitalize on this trend, and for consumers themselves to help counteract any bias during wine purchase. Consumers feel that 'expensive wines taste better' (Figure 2)[2], but is this really the case? Our experiment sets out to understand the impact of price on consumer perception of wine by testing this concept experimentally.

2 Experiment Design

This section will review the experiment setting, solicitation of participants, experiment execution, randomization procedures, and data collection. We will also discuss an overview of the pilot experiment conducted and key learnings from it that were applied to the actual experiment.

2.1 Location and Solicitation of Participants

The experiment was conducted on 11th April 2015 in Petaluma, California. The residence at which it was held had ample room for set-up and gave participants picturesque views of California's wine country. Recruitment was one of our biggest challenges; we were not sure about the turnout rate until the day of the experiment. Due to the expected distance participants may need to travel to get to the experiment location, the event was designed as a "come-and-go" to accommodate the participants' travel and schedules. Many participants were friends and family of the owner of the residence, and lived in nearby counties or made the trip to socialize with the residents. We attempted to solicit other participants from our network of family, friends, coworkers and classmates using social media (Facebook, Slack), posters and direct emails. While we gained interest from those solicited, many were unable to make the trip to Petaluma, or changed plans for the date of the experiment.

2.2 Wine Selection

In choosing wines, we looked to point of sale data and market research in the wine category, as well as insight from industry experts. Picking the wine type and varietal, we decided to focus on red wines for

[1] Source: IRI Point of Sale Data, Total US Food/Drug/Mass Latest 52 weeks ending 3/29/2015

[2] Source: Mintel Wine Category Overview, October 2014

a couple of reasons. First, red wines tend to have a much wider price range and there is much more clout around red wines compared to white. The second reason was logistical - red wines do not require refrigeration for optimal serving, making it much easier for executing the experiment. We chose to use a cabernet sauvignon varietal of wine, which is one of the signature grapes of the Napa region. Additionally, cabernet sauvignon is one of the most popular varietals of wine sold in the US.

Our research of past 52 weeks of sale data showed the price points of a cheap, medium, and high priced wine to be approximately $10, $20, and $40 based on the percentile wine prices in Figure-2. Justification for price is supported by point of sale data from grocery and mass outlets, as well as market research reports. 40% of all wines are sold at less than $10 per 0.75L bottle, while the average price is $15.50. Furthermore, market research performed by Mintel reports that the average price people are willing to spend on bottle of wine to bring to family and friends is $19.30. The $40 price point is considered by many wine experts to be the beginning of premium wines, and it is also approximately the 95th percentile price point for wines sold Grocery/Drug/Mass outlets in the US. With this information, the wines selected were as follows: Central Coast 2013 Line 39, Napa 2012 Robert Mondavi, and Napa 2012 Rombauer – priced at $9.99, $22, and $46 respectively.

2.3 **Wine Quiz**

Wine knowledge and expertise may lead to a more consistent and accurate perception of wine, as tasters may have a more refined palate and have a broad experience with different types of wine. With this in mind, we did not want a person's experience with wine (or lack thereof) to skew results. Instead of simply asking the participants to self-report their wine expertise, we decided to use a wine quiz as a direct method of testing the participant's wine knowledge.

Designing the wine quiz involved some deliberate choices on the format and question types. The format was designed to have ten questions, each with a multiple choice of four options. The initial intent was for participants to receive a point for each correct answer and no points for an incorrect answer with the maximum score of ten. We encouraged participants to answer all questions.

Questions were selected using existing online wine quizzes[3] as resources and from suggestions from wind experts who were friends of the researchers. The questions ranged in difficulty to both encourage completion and to ensure interesting and accurate results.

2.4 **Execution Design**

The experiment took place in three rooms: the waiting room, the tasting room and the wine room. Participants waited their turn in the waiting room with a researcher (the "Host"), and were moved to the

[3] http://www.bbr.com/quiz, http://www.wine-pages.com and http://www.gotoquiz.com/test_your_wine_knowledge were used as resources for the wine quiz

tasting room in randomized groups (a “seating”). The Host handed the researcher responsible for the wines (the “Pourer”) an envelope to be used for that seating. The envelope contained the order the wines were to be served and a wine menu. This envelope was seen only by the Pourer and kept in the wine room.

Each wine bottle was fitted with a one-ounce measured bottle pourer. Wine was first poured into a measuring cup to ensure the amount dispensed was approximately one ounce. We found the bottle pourers had to be “primed” by pouring twice before an acceptable one-ounce measurement was consistently poured.

The wines were poured in the wine room according to the directions in the envelope and placed on a tray with the wine menu displayed in a frame. A researcher responsible for serving the wines (the “Server”) then presented the wines to the seating, giving further instructions on what the expectations were and highlighting the wine menu.

The wine menu identified the wines as Wine A, Wine B and Wine C. If the seating was receiving the treatment, then the appropriate prices were listed beside each wine label. Since the order of the wines was randomized, the Server only knew which wine was associated with each label if the prices were listed. A Server was used in addition to the Pourer to eliminate any potential experimenter’s bias, intentional or unconscious, arising from interaction with the participants. A true double blind experiment was not possible given the treatment of showing the wine prices.

Participants curious about the hypothesis being tested were told the objective of the experiment was to determine whether a decanter has any effect on the taste of wine. This was believable since the participants were rating their enjoyment of the wine. To further support this claim, we placed an empty box from a decanter on the tasting table.

Wines were presented one at a time, starting with Wine A and progressing to Wine C. Participants were asked to rate the wines as they tasted them, though many waited until trying all three to indicate their rating. We did not enforce having to rate each wine as they were presented in case a participant felt the need to rate the first wine as a 3 on the 5-point Likert scale in anticipation of what may be served next.

One wine glass was used for each participant. After the first wine, participants marked their glass with a marker so they could identify their glass. After each wine, the Server returned all the glasses to the wine room. The Pourer drained any wine left in the glasses and poured the next wine. Using the same wine glass poses the possibility of changing the taste of subsequent wines due to residue from the previous wines. This risk was accepted for the practical reason of having one glass per participant.

After completing all questions, the participants were dismissed with our thanks. Questionnaires were reviewed to ensure all wines were rated and a raffle prize wine was selected. Participants were asked to correct their papers if issues were discovered.

2.5 Randomization Procedure

The order of serving the three varieties of wines was randomized per seating across the treatment and control groups. Envelopes were prepared prior to the event that randomized the wine order. Each envelope was labeled for control (no prices shown) and treatment (prices shown). Each possible combination (6) for serving the wines was represented three times for both control and treatment, resulting in 32 different envelopes for each. These envelopes, within control and treatment, were randomized such that the order of wines served was revealed only when serving for the group began. Participants were randomized into treatment and control groups on arrival at the experiment. Each participant's name was entered into a program (written in R) that would randomly place them into a treatment or control group. This was done to avoid clustering of people arriving together into the same group, and reducing bias of the researcher defining who was in each group. Groups ranged from three to six participants, which depended on the flow of arrivals. The decision on how many people were in each group was based on efforts to move people through the testing as efficiently as possible. It should be noted that blocking based on participant characteristics was not possible as we could not know who was arriving when at the experiment.

2.6 Data Collection

Data collection was primarily done on the day of the experiment. We attempted to collect some information on participants prior to the experiment, but found it was easier to collect all the data on the experiment day, hereby capturing the data of people invited and any guests accompanying them.

2.6.1 Pre-Experiment

Prior to participate in the wine tasting, participants were required to take a pre-tasting quiz as discussed in prior sections. In sum, the goal of this quiz was to understand participants wine knowledge.

Covariate information was also collected, including age, zip code and gender. We also asked participants to pick one of a set of nine different wine types as their favorite. The purpose of this question is to identify the participant's preference between red and white wine, and also to determine if a preference towards a specific wine variety exists within our participants

2.6.2 During Experiment

The information collected during the experiment was in two parts: the ranking of the three wines, and the selection of one for entry into a draw to win their selected wine. Participants ranked each wine on a 5-point Likert scale. The specific question they were answering was "How much did you enjoy the wine?" Though instructed to rank each wine based on how much they enjoyed it (taste, smell, etc.), many rated the wines in relation to the other wines, waiting until all three wines were sampled before assigning ranks.

The selection of one wine for entry into a draw was designed as a behavior observation of which wine the participant would want to take home. Specifically the question was "Which wine would you like to receive as a raffle prize?" with the selection of Wine A, Wine B and Wine C. The selection may not necessarily be the one they liked the most - one person may like the medium priced wine best, but prefer

to win the expensive wine in interest to win the larger prize (assuming they see the price). Ultimately this selection was usually correlated to the wine with the highest ranking.

2.7 Pilot Experiment

A pilot study involving nine participants was held three weeks prior to the experiment. The location was a residence in Milpitas, CA, which was convenient for the small group of participants we required. The pilot was executed as close to the experimental design as possible with the following noted exceptions. First, three price ranges of Merlot was used instead of Cabernet Sauvignon. Second, the issue we discovered was the three wines tasted different not only by price but also by perceived type. Multiple participants stated the medium priced wine tasted more like a pinot. Third, for practical reasons, we did not separate the participants into separate rooms. We established an area for tasting and encouraged participants not to discuss the experiment. This was not always adhered to.

All three wines were served at the same time. Participants sampled the wines in the prescribed order, but were allowed to go back and re-sample the previous wines (assuming they didn't already consume their one-ounce pour). In the formal experiment, participants received the wines one at a time, with no option of returning to the previous wine served. Serving all three wines at once also meant each participant had three glasses. Glasses had to be washed between seatings; this was quickly identified as impractical.

Zip code was not collected in the pilot, but was added to the formal experiment's collected covariates. All other aspects of the experiment was replicated during the pilot. The data collected was not used in our formal analysis.

3 Data

3.1 Descriptive Statistics

A total of 39 people participated in the experiment. Of these participants, 2 are removed from the dataset due to concerns about their prior knowledge of the experimental design, and 1 more is removed because the participant appeared to have misunderstood the directions. This leaves us with a total of 36 participants. Each participant tasted 3 wines, giving us 3 records per individual, resulting in a final dataset of 108 observations.

Table 1 shows the descriptive statistics of the participants based on covariates collected. There are 18 participants in the treatment group, and 18 participants in the control group, with slightly more males in the control group and more females in the treatment group. The participant's wine type preferences when broken down into red and white show a greater preference for red wine in both groups. The distribution of counties the participants were from is also comparable between the control and treatment groups, with most participants coming from the Marin County in California.

We also examined the participants' age and the scores they received on the wine knowledge quiz, seen in Table 2. Again it appears the participants are evenly distributed between control and treatment. Our randomization of participants appears to have resulted in comparable control and treatment groups.

Additionally we also attempted to use Principal Component Analysis to transform the results of each quiz score question into the key components utilizing Stata. However, the limited sample size resulted in singular matrices and we were unable to utilize PCA further in our analysis.

3.2 Power Calculation

Estimating the power of the experiment, it is clear that we needed a very large sample to be able to detect any effect size much smaller than 0.5 on the 5-point Likert scale. To achieve 80% power with a true effect size of 0.5, we would have needed approximately 63 participants each in the treatment and control groups, meaning a total of 126.

Our actual final sample size was 36 which yielded 84% power for an effect size of 1.0, but became very underpowered for smaller effect sizes, with the experiment only having 6% power when the true effect size was 0.1. Based on our own intuition and the pilot study, we were expecting an effect size between 0.5 and 1.0, so the power of our final analysis very much depended on where within that range the true effect fell.

4 Results

From the experimental data, we analyze the treatment of exposing price on enjoyment of wine vs. the control (no price exposure). We review the impact on both the Likert ratings of the wine, but also on the wine chosen for the raffle prize. For simplicity, the three wines will be discussed according to their price point, specifically "cheap", "medium" and "expensive".

4.1 Distribution of Wine Ratings

Figure 3 shows the cumulative distribution of ratings from the participants by treatment or control group. The histogram suggests higher ratings in the treatment group. However conclusions on whether the treatment had a positive effect on the ratings should not be made without further analysis, as this plot looks at the ratings of all the wines together, where we are more interested in the ratings of the individual wines. This figure illustrates that participants did not polarize their answers to a particular rating. This is a continuous distribution, with the middle ratings being most frequent as expected.

Figure 4 shows the ratings recorded for the control and treatment groups for each wine price point. Of note, the treatment group has a higher average rating than the control group and the difference in the ratings diminishes as the price of wine increases. These error bars – indicating 95% confidence intervals – show large overlaps between treatment and control. The statistical significance of this data is explored in the next section.

4.2 **Analysis of Wine Rating with Regression**

Table 3 shows the results from our regression analysis that uses the Likert scale as the dependent variable. Within the table are three regressions with different covariates. The primary variables of interest are the interaction terms between the treatment and the wine price (cheap, medium and expensive). The first column shows the regression with no covariates, just the treatment and interaction terms. The second shows a regression that adds only the covariates we determined to be most predictive of our dependent variable[4]. The third regression includes all the covariates we collected. All of the standard errors were obtained using clustering at the level of the individual participant.

Unfortunately due to our small sample size and resulting limited degrees of freedom, our covariates do not add any statistical precision to our model, even when confining them to those that are predictive of our outcome variable. In Table 3, the standard errors on the treatment coefficients are greater in the second regression than the first, and largest of all in the third. Because of this the discussion of the results will focus primarily on the first regression.

The first thing to note is there is a large negative and statistically significant coefficient on the dummy variable for cheap wine. This indicates participants in the control group rated the cheap wine much lower than the expensive wine. Similarly the medium wine has a sizable, though smaller and not significant, negative coefficient showing that it was also rated lower than the expensive wine but slightly higher than the cheap wine. See Figure 3 for the graphical representation of this.

In the regression, the base level factor is the expensive wine. The treatment coefficient represents the effect of showing the price when the wine tasted is the expensive wine. This coefficient is positive, but very small and statistically insignificant. The two interaction terms for the cheap and medium wines are much larger and represent the difference in the treatment effect between the expensive wine and the other two wines. In other words, the effect of seeing the price increased the ratings given to the expensive wine by 0.12, whereas seeing the price of the cheap and medium wines raised the rating on average by 0.78 (0.12 + 0.64), and 0.52 (0.12 + 0.40) respectively. While these interaction terms are not statistically significant, it is surprising to see a relatively large effect, albeit with large standard errors, in the opposite direction of what was anticipated when we designed the study.

We planned this study with a particular hypothesis in mind: there would be heterogeneous treatment effects among the differently priced wines. Specifically, we thought the treatment of seeing the price of the wine would cause people to rate expensive wines higher and cheaper wines lower. However, looking at the interaction terms labeled “Interaction of Treatment and Cheap Wine” and “Interaction of Treatment and Medium Wine”, it is clear the observed effect is the opposite of what we anticipated.

[4] We used relative importance to determine the contribution to R^2 when regressing our outcome variable on all of the covariates without any treatment variables. The two covariates that contributed the most were selected to be included in the second model in Table 3.

4.3 Analysis of Wine Selection with Regression

While we were unable to see a significant effect on the treatment using the Likert scale as the outcome, we did find significant effects when regressing the participants' choice of wine to receive in the raffle on our treatment variables. Table 4 summarizes these results. As before we will be focusing on the first regression model in our table, as the covariates inflate the standard errors on the estimates of the treatment effect (see previous section for description of the second and third regressions).

Looking at wine choice as our outcome, the preference for the expensive wine is more pronounced than in the Likert scale regression. The intercept in this model is 0.833, meaning 83.3% of participants in the control group chose to receive the expensive wine if they won the raffle. 11% of participants in the control group chose the medium wine if they won the raffle, and only 5.5% opted for the cheap wine. All of these results are significant at the 0.01 confidence level.

As in the regression with the Likert scale, the interaction terms show the surprising behavior where participants who received the treatment were more likely to enjoy, or in this case choose, the cheap and medium wines. Here we see the effect of treatment on the expensive wine being -0.89; meaning that among participants who saw the price of the wines, only 44% chose to receive the expensive wine, compared to 83% in the control group.

Because the treatment reduced the percentage of participants who chose the expensive wine, it increased the number who chose the medium or cheap wines by a large margin. The interaction term between treatment and the cheap wine dummy variable is 0.556 and the interaction term between treatment and the medium wine dummy variable is 0.661. This makes the final breakdown of wine choice in the treatment group a more balanced 44% for the expensive wine, 35% for the medium wine and 20% for the cheap wine. The treatment coefficient as well as both interaction coefficients are significant at the 0.05 confidence level.

5 Discussion

When exposed to prices, participants rated the cheap and medium wines higher than when they did not see the prices (though still lower than the expensive wine). The most compelling story that fits this unexpected observation is when participants saw the price of the wine, they adjusted their expectations of how good the wine should be. As a result, their ratings represent a value-adjusted rating rather than a price-independent rating. In other words, they may have not been rating the wine as to their enjoyment, but rather to the value they perceived in it given the price resulting in participants consciously (or subconsciously) elevating or lowering their enjoyment.

To fully understand this idea, consider the following similar example. Suppose you are ordering a ribeye steak at a local chain restaurant. Let's suppose this particular steak is $25 and satisfies the patron's expectation for the meal. Now consider ordering a ribeye steak at an upscale steakhouse. The cost may be twice that of the chain restaurant, but only marginally better in quality. The response we wanted from

participants was “I really enjoy this wine, and given its price, it is no wonder I like it so much!” We believe the responses we got were really “I think these wines are very similar, so I would likely get the lower priced wine.”

To counter this behavior, we could have instructed the participants to not base their enjoyment on the price. However, this may lead the subject to rate the wines differently than they would if they were in the control group. We also considered when designing the experiment including a question as to which wine the participant would actually buy given the option. We excluded this question as we thought it would be a difficult question to answer if the prices were not shown.

The effect of the treatment on the participant’s selection of a wine for the raffle prize suggests they were considering the value of the wine as well as how much they enjoyed it when making their choice. This is despite the fact the participants were picking a wine to receive free of charge. This may be explained by the fact many of the participants know one or more experimenters so may not want to cause undue costs for the more expensive wine.

Another consequence of how we designed our study is participants appear to have rated the wines against each other. As mentioned previously, participants were asked to rate the wines as they tasted them, though many waited until trying all three to indicate their rating. This changes our outcome variable to more of a ranking than a rating measurement. We knew comparing wines to each other was a possibility and hence why we randomized the order of the wines served at each seating. What we could not address was participants changing their rating of how much they enjoyed a wine based on the wines to come. To enforce that participants rate each wine before proceeding to the next would introduce a bias; participants might give a wine a lower rate just in case they end up enjoying the subsequent wines more.

One way to address this would be to conduct the experiment such that every participant tries only one wine. The wine served to the participant, as well as the treatment of showing the price or not, would be randomized at the participant level. With no other wines to compare to, we may have a better measurement of the participant’s enjoyment of the wine. The challenge with a design like this is recruiting a sufficient number of participants, since each participant would be contributing only one data point. However, this would allow a more stream-lined experiment that could be set-up at an event as a walk-up table. This design would not be practical if hosting the experiment in a location that requires participants to purposely travel to participate. This may also reduce chances of spillover since even if participants discuss the wine they sampled, it is likely they tried a different wine than the other participants.

Another possible way of conducting this study is to deceive the participants by serving the same wine for all three samples. The treatment would still include the three different price points, but the wine itself would be the same. This may more accurately measure the influence of seeing the price of the wine on the participant’s enjoyment.

There are two faults to note in our experiment execution. First, a typo in the wine quiz technically resulted in multiple correct choices. Given the participants were family and friends, the error was generally

laughed at with kind notes pointing out the error. In the end, this is not a great cause of concern for our analysis because the wine quiz score has such a negligible effect on the outcome. The potential error of one wine quiz question is not likely to affect the overall outcome.

The second fault was the display of the menu to participants while tasting the wine. A one-sided picture frame was used to show the menu. However, participants sat around a table, meaning there were always some participants that could not see the menu. Though we made a point of ensuring all participants saw the menu, we cannot be certain our efforts to point out the menu with prices did not influence the participant's rating of the wine. Therefore, the resulting treatment effect is potentially underestimated due to the imperfect treatment of showing the prices to some of our participants.

6 Conclusion

We planned this study to specifically test if there would be heterogeneous treatment effects among the differently priced wines. Specifically, we thought that seeing the price of wine would cause people to rate expensive wines higher and cheaper wines lower. However, it is clear the observed effect is the opposite of what we anticipated, as participants tended to bolster their rating of the cheapest wine when exposed to price and may not change the rating of the more expensive wines. Similarly, when examining which wines to win in a raffle as an implicit measurement of absolute preference, our original hypothesis was not supported. Results of our study are not statistically significant to draw definite conclusions, but we believe with adjusted execution and larger sample size would likely produce significant effects.

Even though our experiment did not support the intended hypothesis, valuable insights were still found. For wine in particular, as consumers become more aware knowledgeable of brands and prices, and increase overall expectations, knowing the impact of price on initial selection of wine and ultimate enjoyment could have applications for marketing and pricing. Gaining a greater understanding of the impact of price on selection and expectation of the enjoyment of the product has implications for a person's willingness to pay and ultimately profitability of the firm selling that good. While we researched wine in particular, the findings could be applicable for similar goods and services that have similar societal weight, a wide price range and an obvious stratification of prices.

Appendix 1 – Figures

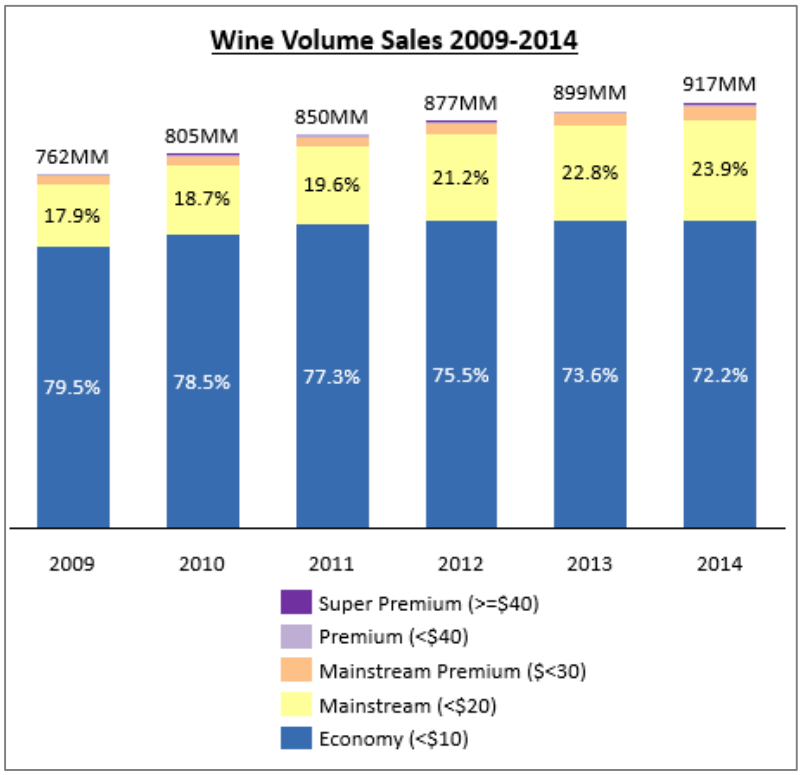


Figure 1: Wine Sales by Price Category from 2009 to 2014

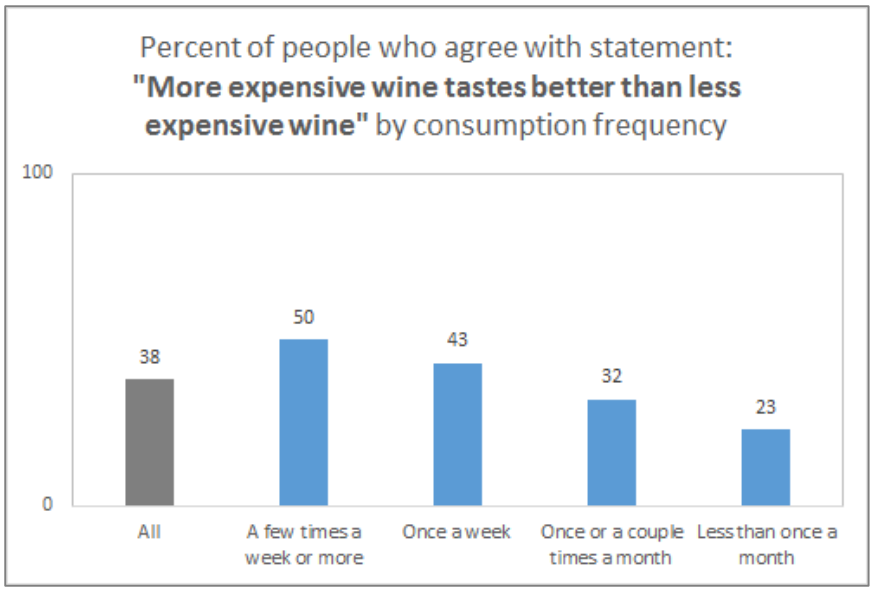


Figure 2: Distribution of Wine Price-Taste Opinion over Consumption Frequency

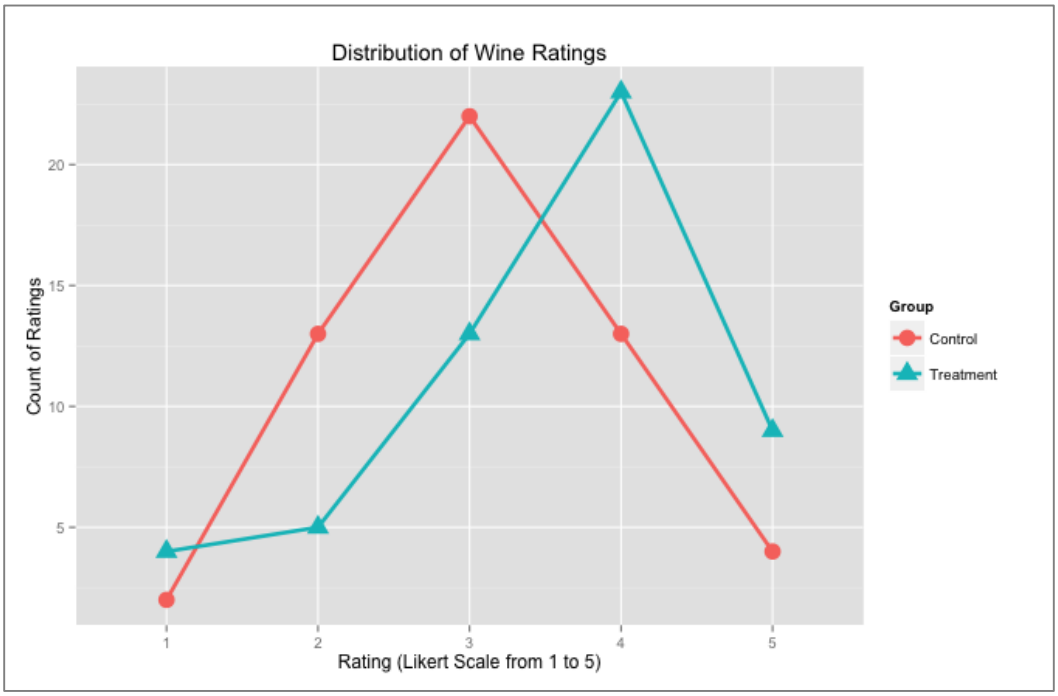


Figure 3: Distribution of Wine Ratings by Participants

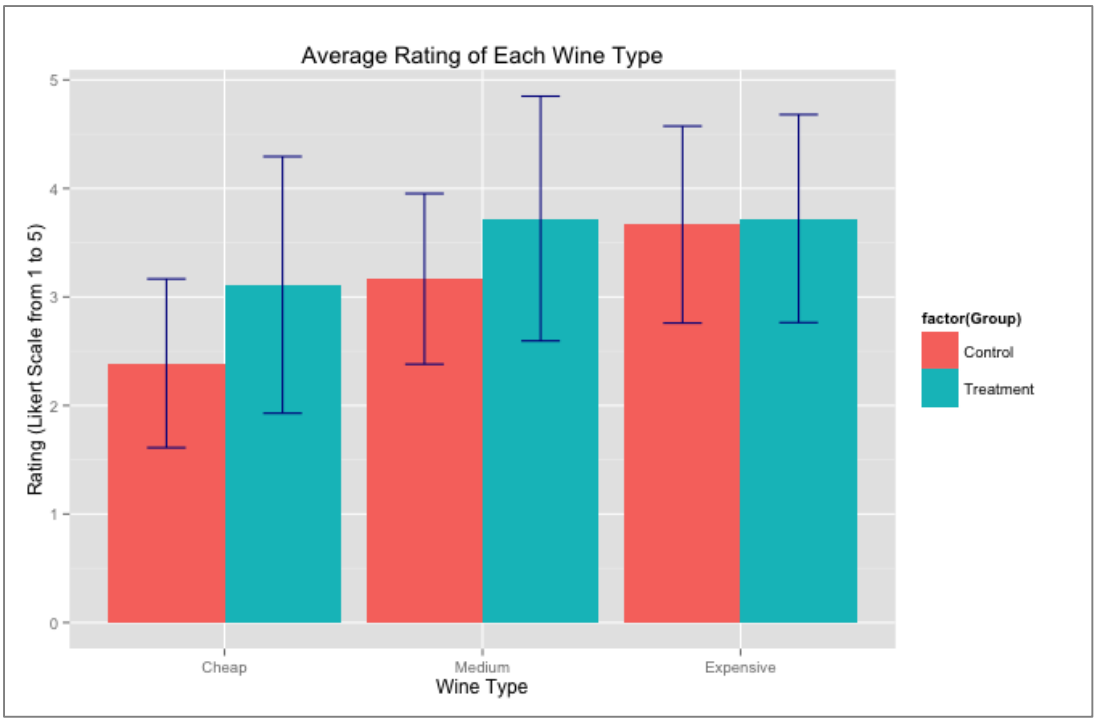


Figure 4: Average Wine Ratings of Different Wines

Appendix 2 – Tables

Table 1: Descriptive Statistics on Quiz Score and Age

	CONTROL (Subjects= 18)				TREATMENT (Subjects= 18)			
	Mean	Standard Dev.	Min	Max	Mean	Standard Dev.	Min	Max
Quiz Score	6.67	1.68	4	10	5.89	1.78	3	9
Age	39.65	12.85	24	69	46.5	12.98	21	76

Table 2: Descriptive Statistics on Gender, Wine Preferences, and Resident Location

	% (Control)	N (Control)	% (Treatment)	N (Treatment)
Male	66.7	12	33.3	6
Female	33.3	6	66.7	12
Gender Missing	0.0	0	0.0	0
Prefer Cheap Wine	5.6	1	22.2	4
Prefer Medium Wine	11.1	2	33.3	6
Prefer Expensive Wine	83.3	15	44.4	8
Missing Cheap/Medium/Expensive Pref	0.0	0	0.0	0
Prefer White Wine	16.7	3	22.2	4
Prefer Red Wine	66.7	12	72.2	13
Missing White/Red Wine Pref	16.7	3	5.6	1
Alameda/Contra Costa County	11.1	2	5.6	1
Marin County	50.0	9	61.1	11
San Francisco County	16.7	3	22.2	4
San Mateo County	5.6	1	0.0	0
Sonoma County	11.1	2	11.1	2
Missing County Info	5.6	1	0.0	0
Total	100.0	18	100.0	18

Table 3: Regression Analysis of Wine Ratings

	Dependent variable:		
	Wine Rating (Likert Scale from 1 to 5)		
	(1)	(2)	(3)
Treatment of Showing Price	0.056	0.016	0.150
	(0.314)	(0.323)	(0.354)
Cheap Wine [i]	-1.278***	-1.294***	-1.231***
	(0.314)	(0.336)	(0.342)
Medium Wine [i]	-0.500**	-0.529**	-0.538**
	(0.248)	(0.264)	(0.231)
Interaction of Treatment and Cheap Wine	0.667	0.683	0.643
	(0.496)	(0.513)	(0.516)
Interaction of Treatment and Medium Wine	0.500	0.529	0.597
	(0.402)	(0.414)	(0.389)
Live in Alameda/Contra Costa County [ii]		-0.656	-1.184***
		(0.432)	(0.370)
Live in Marin County [ii]		-0.589**	-0.544*
		(0.264)	(0.293)
Live in San Francisco County [ii]		-0.582*	-0.644*
		(0.334)	(0.345)
Live in San Mateo County [ii]		-0.630**	-0.644*
		(0.264)	(0.379)
Gender Being Male		0.009	0.247
		(0.205)	(0.282)
Age			-0.001
			(0.007)
Prefer White Wine			0.162
			(0.362)
Wine Quiz Score			0.005
			(0.078)
Constant	3.667***	4.229***	4.010***
	(0.216)	(0.302)	(0.634)
Chosen Model	No	Yes	No
Observations	108	105	90
R^2	0.205	0.230	0.232
Adjusted R^2	0.166	0.148	0.100
Residual Std. Error	0.969 (df = 102)	0.986 (df = 94)	1.017 (df = 76)
F Statistic	5.270*** (df = 5; 102)	2.808*** (df = 10; 94)	1.761* (df = 13; 76)
Note:	*p<0.1; **p<0.05; ***p<0.01		
	Clustered standard error is used (cluster by each subject id)		
	(1) Regression without covariates		
	(2) Regression with selected set of covariates (final model)		
	(3) Regression with full set of covariates		
	[i] Expensive Wine being the reference wine type		
	[ii] Sonoma County being the reference county		

Table 4: Regression Analysis of Wine Selection for Raffle

	Dependent variable:		
	Wine Selection for Raffle		
	(1)	(2)	(3)
Treatment of Showing Price	-0.389***	-0.379**	-0.434**
	(0.135)	(0.146)	(0.189)
Cheap Wine [i]	-0.778***	-0.765***	-0.769***
	(0.135)	(0.145)	(0.172)
Medium Wine [i]	-0.722***	-0.706***	-0.769***
	(0.135)	(0.145)	(0.172)
Interaction of Treatment and Cheap Wine	0.556***	0.542***	0.593**
	(0.191)	(0.202)	(0.228)
Interaction of Treatment and Medium Wine	0.611***	0.595***	0.710***
	(0.191)	(0.202)	(0.228)
Live in Alameda/Contra Costa County [ii]		0.000	-0.000
		(0.190)	(0.244)
Live in Marin County [ii]		-0.000	0.000
		(0.134)	(0.153)
Live in San Francisco County [ii]		0.000	-0.000
		(0.159)	(0.175)
Live in San Mateo County [ii]		-0.000	0.000
		(0.281)	(0.312)
Gender Being Male		-0.000	0.000
		(0.092)	(0.144)
Age			0.000
			(0.004)
Prefer White Wine			0.000
			(0.141)
Wine Quiz Score			0.000
			(0.034)
Constant	0.833***	0.824***	0.846***
	(0.096)	(0.158)	(0.310)
Chosen Model	No	Yes	No
Observations	108	105	90
R^2	0.301	0.283	0.270
Adjusted R^2	0.267	0.207	0.145
Residual Std. Error	0.406 (df = 102)	0.422 (df = 94)	0.438 (df = 76)
F Statistic	8.781*** (df = 5; 102)	3.709*** (df = 10; 94)	2.164** (df = 13; 76)
Note:	*p<0.1; **p<0.05; ***p<0.01		
	(1) Regression without covariates		
	(2) Regression with selected set of covariates (final model)		
	(3) Regression with full set of covariates		
	[i] Expensive Wine being the reference wine type		
	[ii] Sonoma County being the reference county		

Appendix 3 – Price Treatment and Control, Wine Quiz, Data Collection

Figure 5: Control Menu (example)

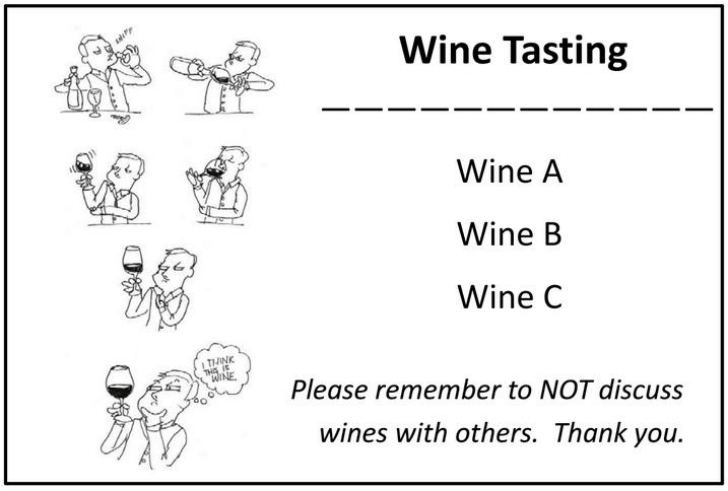
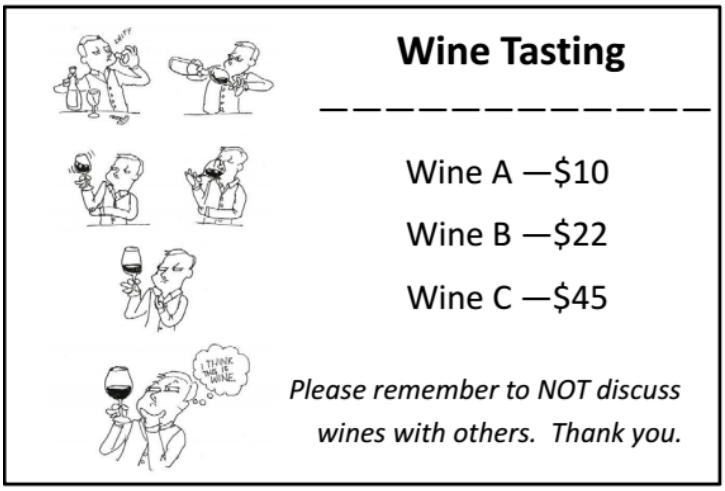


Figure 6: Treatment Menu (example)



Wine Quiz

Note: correct answers are bolded below.

Name

Instructions - Read This First

The questions below are designed to give us a sense of how much you know about wine in general. Please answer as many as you can, but if you don't know and don't have a guess, feel free to leave the question blank.

1. Which of the following is a type of white wine grape?
   A. Syrah
   B. **Pinot Grigio**
   C. Sangiovese
   D. Malbec

2. Which of the following actions does NOT help to preserve the value of a bottle of wine?
   A. Avoid direct sunlight
   B. Place bottle in constant temperature environment
   C. **Keep bottle tilted at 10-degree angle**
   D. Use preservation spray on the wine label

3. What is the fruit combination most commonly associated with the taste of Pinot Noir?
   A. Cherries and citrus fruits
   B. Gooseberries and grass
   C. **Raspberries and redcurrants**
   D. Peaches and pears

4. How much volume of wine is in a standard bottle?
   A. 500 ml
   B. 600 ml
   C. **750 ml**
   D. 1000 ml

5. Which of these grapes is not used for Champagne?
   A. Pinot noir
   B. **Gros Manseng**
   C. Chardonnay
   D. Pinot Meunier

6. Which of the following wine type would typically be enhanced most by decanting?
   A. Young red wine
   B. **Old red wine**
   C. Young white wine
   D. Old white wine

7. California visionary Robert Mondavi was associated with all of the following brands except:
   A. Charles Krug
   B. Opu One (*Note: this should have been Opus One*)
   C. Woodbridge
   D. **Gallo**

8. What is a good temperature to store your red wine?
   A. Between 25 and 37 degrees Fahrenheit
   B. Anywhere below 70 degrees Fahrenheit
   C. **Between 45 and 55 degrees Fahrenheit**
   D. Exactly 80 degrees Fahrenheit

9. Zesty, spicy pepper, wild berry, cherry and plum flavors best describes the characteristics of which of the following varieties:
   A. Chardonnay
   B. Merlot
   C. Roussanne
   D. **Zinfandel**

10. Which one of these is NOT a variety of grape used for wine production?
    A. Merlot
    B. Cabernet Sauvignon
    C. **Shirazonnay**
    D. Pinot Noir

Data Collection Form

Name _____ **Age** _____

ZIP Code _____ **Gender** _____

Email _____
(for contacting you if you win the raffle)

Which type of wine do you prefer? (select one)

☐ Cabernet Sauvignon	☐ Merlot	☐ Pinot Noir
☐ Chardonnay	☐ Riesling	☐ Zinfandel
☐ Syrah	☐ Sauvignon Blanc	☐ Pinot Grigio

Instructions:
For each of the wines below, please tell us how much you enjoyed it, by circling a number on the 1-5 scale provided. Please feel free to include in this rating the taste, smell, appearance or anything else about the wine.

Please do not discuss the wines with other participants.

Wine A

How much did you enjoy the wine?

Did not enjoy at all				Enjoyed very much
1	2	3	4	5

Wine B

How much did you enjoy the wine?

Did not enjoy at all				Enjoyed very much
1	2	3	4	5

Wine C

How much did you enjoy the wine?

Did not enjoy at all				Enjoyed very much
1	2	3	4	5

Which wine would you like to receive as a raffle prize? (select one)

☐ Wine A ☐ Wine B ☐ Wine C