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### Acknowledgements

I would like to recognize the following people for their support in making the project possible. I wish to express my deepest gratitude to my advisor, Dr. Christie Klimas who devoted countless hours of her time to ensure that my research was successful. I would also like to thank Environmental Science Department Chair, Dr. Judith Bramble, for advising me on the statistical analyses for my research. Without the help and guidance of these two individuals, this project would have been unsuccessful.

## What components influence hypothetical willingness to pay for the environmental benefits of shade-grown coffee?

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**ABSTRACT** Coffee is one example of a good whose consumption can lead to environmental degradation that the consumer is unaware of. During the 19<sup>th</sup> century, new high-yield varieties of coffee were developed that could be grown under the direct sunlight of recently deforested areas. An ecologically friendly alternative to mass-produced sun-grown systems is shade-grown coffee. This coffee is grown under traditional forest cover, providing ecological benefits such as species habitat, but at lower yields. In the global market, a price premium is the practice of placing a higher price than the market price on a specific good. If consumers value the additional economic or social benefits provided by shade-grown coffee, they will pay the additional cost. One way to determine the value that consumers place on the ecological benefits provided by shade-grown coffee is to create a hypothetical market using a contingent valuation survey. This study used a contingent valuation survey to conclude the components that affect hypothetical willingness to pay. Our results determined that gender was the only significant factor in determining hypothetical willingness to pay, with females willing to pay more for shade-grown coffee than their male counterparts.

### INTRODUCTION

Deforestation is large-scale forest clearing, often to make way for agriculture production, timber logging and cattle ranching. It occurs in developing or third world countries as a means for economic growth and expansion. Research shows that tropical deforestation is related to agricultural production, which releases around

250 million tons of carbon dioxide into the atmosphere (Rodrigues *et al.* 2009). The high amounts of carbon dioxide in the atmosphere affect the goods and services that forests provide. Deforestation disrupts water purification, flood control and carbon sequestration, which ultimately results in biodiversity loss in these ecosystems (Foley *et al.* 2007). Agroforestry is one alternative approach that combines techniques from agriculture and forestry to create viable systems. These sustainable systems help reverse the social impacts of deforestation such as increasing the standards of living, literacy and

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life expectancy (Rodrigues *et al.* 2009) while providing environmental benefits. Implementation of agroforests under native management (Moguel & Toledo 1999) is one way to avoid deforestation, and in turn, mitigate atmospheric pollution, ecosystem degradation and the loss of social security for local populations.

Shade-grown coffee production is one strategy that allows for both conservation of forest habitats and economic development for the local people. During the 19<sup>th</sup> century, new high-yield forms of coffee were developed that could be grown in the full sunlight of recently deforested areas. Referred to as sun-grown coffee, these plants obtain the highest yields at the highest environmental cost. The use of chemical fertilizers and pesticides in sun-grown systems results in nutrient runoff as well as competition for water availability and pollination among plant species (reviewed in Zhang *et al.* 2007). Sun-grown coffee systems also cause deforestation, habitat reduction for many migratory bird species and biodiversity decline (reviewed in Moguel & Toledo 1999).

In contrast, more ecologically friendly shade-grown coffee is grown under forest cover, but has lower yields. This coffee production involves relatively small farms, less chemical inputs, lower densities of coffee bushes per hectare and a diverse forest canopy (Gobbi 2000, Rice & Ward 1996). Shaded coffee plantations provide on-site environmental benefits, such as maintaining soil quality and species habitats (reviewed in Moguel & Toledo 1999, Gobbi 2000), ecosystem services like water purification (Albertin & Nair 2004), and reduced surface runoff and soil salinization (Eldridge & Freudenberger 2005). Although shade-grown coffee does not produce the high yields when compared to sun-grown, it does preserve forest biodiversity, ecosystem functions of tropical forests and minimizes the environmental costs associated with fertilizers and pesticides.

In the international market, coffee prices are steadily declining as a result of increased mass production from sun-grown systems. Research shows that in the United States, there is an

increasing demand for green products (Shukri & Noor 2012) with consumers making more conscious choices about the products that they purchase. Shade-grown coffee is a viable economic alternative for developing countries due to this increased global demand for green products (Albertin & Nair 2004). Furthermore, shade-grown farmers must charge the price premium because they would not make enough money to stay in business if they sold the shade-grown coffee for the same price as other farmers. For consumers, the price premium is the expression, in monetary terms, of the value of the benefits of purchasing shade-grown coffee, when compared to sun-grown. Price premiums can vary quite a bit since shade-grown coffee can also be fair trade, and the quality of the coffee can differ. In the market, the price of shade-grown coffee ranged from \$10.49-13.95 per 12-ounce bag for three brands (Audubon, Starbucks and Birds & Beans) in May 2014. Some individuals choose to pay a price premium for shade-grown coffee, not because of attributes like taste or aroma but because the purchasers know they are helping to maintain and sustain valuable ecosystem services.

The price premium on shade-grown coffee keeps producers on the land because they are earning competitive wages for their product and in return, they have an incentive to maintain this revenue source. The associated diverse forest cover from shaded systems can also provide additional income from fruit, rubber and nut production from shade trees (reviewed in Albertin & Nair 2004). Since sun-tolerant coffee plants can produce up to three times more coffee than shade-grown coffee, the amount of land devoted to agricultural production depends on final demand for the product and willingness to pay (WTP) the price premium by consumers for shade-grown coffee (Klimas *et al.* 2014).

The idea of WTP is that a person can measure the amount he/she would be willing and able to pay in order to receive a good or to avoid something undesired, such as the deforestation associated with sun-grown coffee. The more satisfaction a person receives from a good, the more they would be willing to pay for that item. Assessing the monetary benefits of nonmarket goods such as ecosystem services, parks or

wetlands, can be performed through a questionnaire-based contingent valuation (CV) survey that seeks to discover individuals' preferences (Bateman *et al.* 2002). Specifically, this survey type helps determine what an individual would be willing to pay for a given resource by simulating their behavior in a hypothetical market.

Much of the debate on the validity of CV is due to the limited opportunities to compare WTP from CV surveys with WTP in actual markets. Although there have been hundreds of studies done that apply CV, very few studies test the validity of CV responses with the revealed preference theory, which is when the market is used to assess consumer preferences from actual purchases (Loomis *et al.* 1996). Another criticism of CV is that stated WTP may not be a proper indicator of actual WTP (Carson *et al.* 2001). The CV method creates hypothetical markets and therefore, individuals' preferences in hypothetical situations can result in bias answers that are not similar to their actual preferences in a real market. However, methods have been developed to limit responses to amounts to what people are actually willing and able to pay. For example, presenting respondents with a yes/no choice of whether they would be WTP a given price removes the possibility of unreasonably high stated WTP (Bateman *et al.* 2002, Lusk & Schroeder 2004).

This study in its entirety examines whether people are willing to pay more to reduce the negative externalities (like deforestation and decreased ecosystem biodiversity) associated with sun-grown coffee by purchasing shade-grown coffee for an additional price premium. This research is important because it provides a rare opportunity to compare what people say they will pay to reduce deforestation by purchasing shade-grown coffee with what they actually pay when presented with a choice in the market; see Klimas *et al.* (2014) submitted. Presented here is an analysis of how demographic variables influence hypothetical WTP from CV surveys for the shade/sun-grown cup of coffee choice.

I hypothesized that there would be relationships among student major, 5,10 or 15% price

premium and gender, and student's WTP for the shade/sun-grown choice. Specifically, science majors would be willing to pay more for shade-grown coffee than business majors. I also hypothesized that there would be no difference among price premium groups because respondents would overstate their WTP in the hypothetical market, regardless of the price premium placed on the coffee. Research has shown that females are more willing to pay an additional price premium for shade-grown coffee (Loureiro & Lotade 2005). Therefore, I hypothesized that there would be a difference between gender and WTP, with females willing to pay more for the shade/sun-grown cup of coffee choice.

## METHODS

In this study, we surveyed a group of students, faculty and staff at DePaul University (Chicago, Illinois). Surveying was done by emailing participants through an online survey software (Qualtrics, Provo UT). Participants were randomly assigned to one of three price premium groups, each survey expressing a different price premium of 5,10 or 15% for shade-grown coffee option. Individuals in each group were asked a standard set of questions about their demographic, socioeconomic background and environmental attitudes as determined by the New Ecological Paradigm (NEP) (Dunlap *et al.* 2000).

Participants were also asked about their coffee purchasing behavior, including whether or not they bought coffee at DePaul University coffee shops, the frequency with which they purchase it and the price they typically paid. Participants were provided with a short paragraph explaining the difference between shade/sun-grown methods of coffee production. They were then asked to make a hypothetical choice between purchasing a cup of sun-grown coffee at the price equal to what they indicated they paid for a cup of coffee, and a cup of shade-grown coffee at the price premium. Finally, participants were asked an open-ended question regarding the maximum price they would be willing and able to pay for a cup of shade-grown coffee.

The survey was sent out in two waves. The first consisted of 4,516 students, 177 full-time faculty, and 307 full-time staff. From this, we received 558 survey responses from individuals who both drank coffee and completed the questions necessary to analyze the data. The second wave occurred due to the low response rate observed in the first survey wave. It was comprised of sending email reminders to the initial surveyed students, along with emailing an additional 4,000 respondents and administering paper surveys to 264 students in selected classes of finance/business, environmental science and health science. The selected classes provided us with the opportunity to test our hypothesis about major and WTP. After the second set, we received an additional 445 survey responses, totaling 1,003 responses.

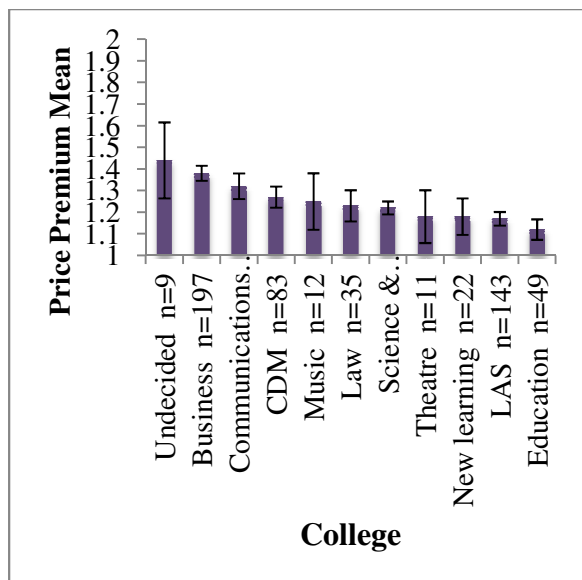
## RESULTS

### DESCRIPTIVE STATISTICS

Twice as many women responded to the survey than men, with most respondents either a business or science and health major. Furthermore, three times as many respondents (711) indicated they would be willing to pay for shade-grown coffee than the sun-grown option (233). An explanation of the variables used in the CV survey and the corresponding population values are depicted in Table 1. Other demographic elements such as age, race and income level were also expressed in the CV survey; however, there were no significant differences between these factors and hypothetical WTP for the shade/sun-grown option. A two-way ANOVA of major and price premium show that overall; there was no significant effect of price premium on student major and WTP for the shade/sun-grown choice, ( $F_{20, 812}=1.086$ ,  $p=0.359$  Fig.1).

**Table 1:** Descriptive statistics of the population who returned CV surveys stating WTP for shade-grown coffee

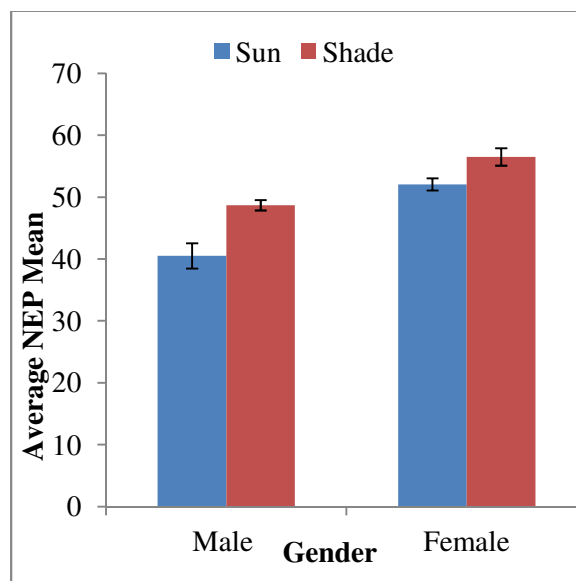
Variable	Definition	N
<b>Major</b>	Business	197
	Communications	63
	CDM	83
	Education	49
	LAS	143
	Science & Health	189
	Music	12
	Theatre	11
	New Learning	22
	Law	35
	Undecided	9
	<b>Gender</b>	Male-1
Female-2		629
<b>Price Premium</b>	5%	355
	10%	245
	15%	346
<b>Total Survey Population</b>		1003



**Figure 1.** Estimated marginal price premium mean per major on shade/sun-grown choice. Results are graphed in decreasing order of mean value. At the  $p < .05$  level, the effect of the price premium on student's WTP for shade/sun-grown choice in each major resulted in a value of  $p = .359$ . Error bars represent standard error of means.

A second model was examined to inspect the outcome between the variables of gender and shade/sun-grown coffee choice on the dependent variable of total NEP score. NEP measures proenvironmental attitudes and beliefs and was expected to be positively associated with WTP. The total average NEP score for both genders and shade-grown coffee was 55.50; the total average NEP score for both genders and sun-grown coffee was 44.34 (Fig. 2). Overall, those who indicated WTP for shade-grown coffee tended to have higher total NEP scores than those who hypothetically chose to purchase sun-grown coffee. The outcome of a two-way ANOVA for the interaction between these two variables on total NEP shows that there was no significant effect of total NEP score on gender or WTP for the shade/sun choice ( $F_{1, 385} = 1.745$ ,  $p = .187$  Fig. 2). An additional model was run that looked at the interaction between business and science and health majors, WTP for the shade/sun-grown choice on total NEP score. Business students had a mean total NEP score of 48.0; science and health students had a mean total NEP score of 56.26. A two-way ANOVA

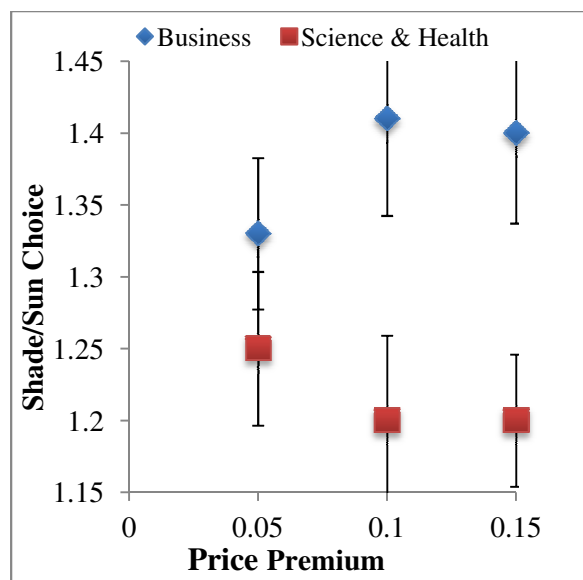
shows that there was no significant effect of NEP score on major or shade/sun choice ( $F_{1,385} = .858$ ,  $p = .355$ ).



**Figure 2.** Average NEP Mean for gender on shade/sun-grown choice. Based on the results from a two-way ANOVA, average NEP score for gender on shade/sun-grown choice. The graph depicts that females had higher average NEP scores for both shade/sun-grown choices when compared with males. Error bars represent standard error of means.

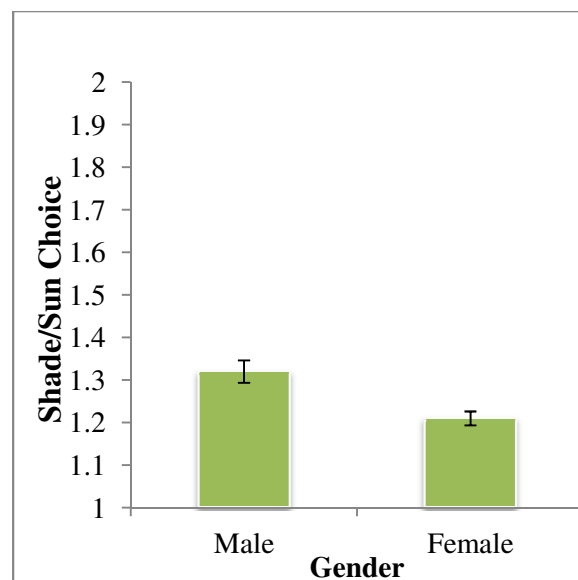
#### HYPOTHESIS TESTING

From the descriptive statistics above, further testing was performed to see if we could support our research hypotheses. A two-way ANOVA was run to observe whether there was a significant difference between specific majors and the price premium on WTP for the shade/sun-grown choice. The specific majors of business and science and health were chosen due to their comparable sample sizes and opposite mean price premium values for the shade/sun choice. Science and health students were significantly more likely to choose the shade option ( $F_{1,380} = 12.453$ ,  $p < .001$ ). The results show that there was no significant effect of price premium and no interaction between price premium and (interaction  $F_{2,385} = .915$ ,  $p = .401$ ; Fig.3).



**Figure 3.** Estimated marginal price premium mean for majors of business and science and health on shade/sun-grown choice. The overall price premium value for business majors was 1.38; science and health students overall price premium value was 1.22. At  $p < .05$  level there was no significant effect of the WTP for the shade/sun choice on major and price premium,  $p = .401$ . Error bars represent standard error of means.

A final model was created to test for a significant difference between the variables of gender and price premium on WTP for the shade/sun-grown choice. The mean WTP for the shade/sun-grown coffee choice for males was 1.32 and females 1.21 (Fig. 4), with males expressing an overall mean closer to the sun-grown coffee choice. The results of the two-way ANOVA show that there was a significant effect of the shade/sun choice on gender and the price premium, ( $F_{2,942} = 3.395$ ,  $p = .034$ ; Fig. 5) with females willing to pay more for the shade-grown coffee than males, indicated by the higher values.

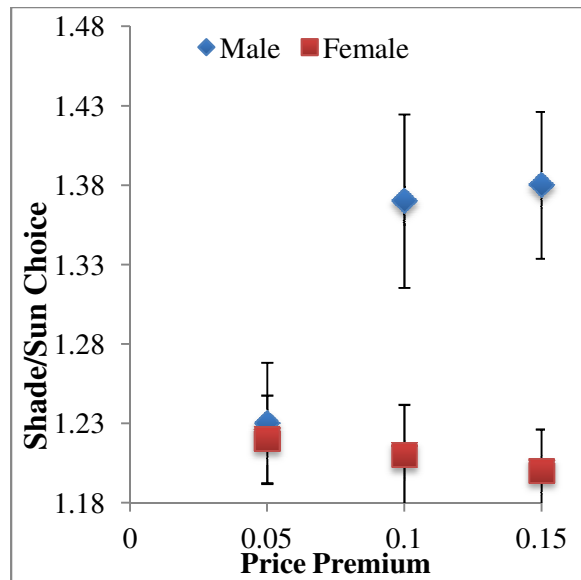


**Figure 4.** Estimated total price premium mean for gender on WTP for shade/sun-grown choice. Males expressed an overall mean of 1.32 for WTP for shade/sun-grown choice. Females expressed an overall mean of 1.21 for WTP for shade/sun-grown choice. Error bars represent standard error of means.

## DISCUSSION

Coffee is one of the world's most esteemed commodities; it is important to explore how consumers value shade-grown coffee and what they are willing to pay for its environmental attributes. Our results indicate that over 70% of the 1,003 respondents stated that they would be willing to pay a price premium for shade grown coffee at either the 5, 10 or 15% premium. Some studies have found an inverse relationship between WTP and the increasing premium offered (Shukri & Noor 2012). However, the collective two-way ANOVA tests showed that price premium alone had no significant effect on WTP for the shade/sun grown choice.





**Figure 5.** Estimated marginal price premium mean for gender on shade/sun-grown choice. At the  $p < .05$  level, there was a significant difference between gender and price premium on WTP for shade/sun-grown choice,  $p = .034$ . Error bars represent standard error of means.

These results are consistent with our hypothesis that indicated a high stated WTP for social and environmental attributes. Furthermore, even at the highest price premium of 15%, respondents who drank coffee twice a week, or more than twice a week, indicated a mean price premium value that corresponds with a shade-grown choice. This may suggest that even those who buy coffee frequently (defined as at least twice a week) are willing to pay for the ecological attributes of this coffee. Other studies have shown similar WTP results. For example, one study found that one fifth of the WTP premium for grass-fed beef was explained by people's concerns for societal benefits (Umberger *et al.* 2009). The values we obtained for WTP may be inflated due to the fact that this was a hypothetical market and survey respondents did not actually have to pay this price premium: respondents only had to say they would. For example, a study by Lusk and Schroeder (2004) found that WTP to obtain grass-fed beef was 1.2 times higher in a hypothetical market than in the actual marketplace.

A high percent of individuals with stated WTP for shade-grown coffee was consistent across

race, price premiums, income level and faculty, staff and students. Our results indicate that student major does not have a significant effect on WTP behaviors for coffee choice. More specifically, students enrolled in the business and science and health majors did not display significantly different WTP behavior with the price premium for the shade/sun-grown coffee choice. The higher mean WTP for shade/sun-grown coffee from business majors shows that the difference is in the direction predicted (Fig.3). A general trend in the analysis (Fig.3) shows that as the price premium for a cup of shade-grown coffee increased, business majors were more inclined to choose the sun-grown option, whereas science students were more likely to choose the shade-grown option. Although there were no significant difference the two majors, the trend in these data supports our hypothesis. Further evidence to support this aim comes from the mean total WTP scores between the majors. Business students scored lower when compared science and health students, demonstrating less proenvironmental behavior. This could explain why we saw less business students willing to pay for the shade-grown coffee as the price premium increased.

Surprising to our results was that there was no significant difference between total NEP score and WTP for the shade/sun choice. A study on purchasing behavior towards sustainable foods showed that psychological variables like attitudes, beliefs and norms, more than demographics, better predict intent to purchase objectives for sustainable products (Robinson & Smith 2002). Our results indicate that on its own NEP was not a significant factor in hypothetical WTP. Taking a different approach, we analyzed the data using NEP as a dependent variable, looking at overall average NEP scores for the shade/sun-grown choice. The trend in this data was that higher NEP score was associated with WTP for shade-grown coffee; the lower NEP score was connected with the sun-grown option.

WTP for shade-grown coffee was not consistent across genders. Although one particular study found that gender differences were not a significant component in explaining ethical buying behavior of coffee (De Pelsmacker *et al.*

2005a), our results found that gender was the only significant element in determining WTP for the shade/sun choice. Studies that have found gender to be a significant element in ecological coffee purchasing differ between which sex displays the more proenvironmental behavior. For example, one study found men to have a stronger choice for ecological coffee than women (Carlsson *et al.* 2010), but this study lacked income data. On the other hand, Loureiro & Lotade (2005) found that women with higher incomes and more awareness of environmental concerns were more likely to pay a price premium for ecological coffee than when compared to males.

Our results are similar to the latter, with more women willing to pay the price premium for shade-grown coffee than men (Fig. 5). However, social norms may play a significant role in explaining these gender differences. Carlsson *et al.* (2010) found that when women were told that a large percent of consumers chose the ecologically friendly coffee, WTP for these types of coffee increased. Therefore, conforming

to societal standards may explain situations where women are more likely to pay the hypothetical price premium for ecologically friendly coffee.

### LIMITATIONS AND CONCLUSION

This study illuminates some of the elements that influence hypothetical WTP for the ecological benefits of shade-grown coffee. The present study was limited to DePaul University faculty, staff and students, and therefore may not be representative of a larger non-university population. Another limitation of the study was from the well documented limitations of hypothetical contingent valuation surveys. Future experimentation could occur by replicating this at other universities or doing experiments for coffee shop customers. This research was associated with another study that took these hypothetical WTP responses and tested them in the actual market at DePaul University. See Klimas *et al.* (2014) submitted for the continuation of our results.

### ACKNOWLEDGEMENTS

I would like to recognize the following people for their support in making the project possible. I wish to express my deepest gratitude to my advisor, Dr. Christie Klimas, who devoted countless hours of her time to ensure that my research was successful. I would also like to thank Environmental Science Department Chair, Dr. Judith Bramble, for advising me on the statistical analyses for my research. Without the help and guidance of these two individuals, this project would have been unsuccessful.

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