THE EFFECT OF DIFFERENT OPTIONS ON WILLINGNESS TO PAY AND DECISION MAKING TIME:

AN EXPERIMENT USING THE THEORY OF PLANNED BEHAVIOR

by

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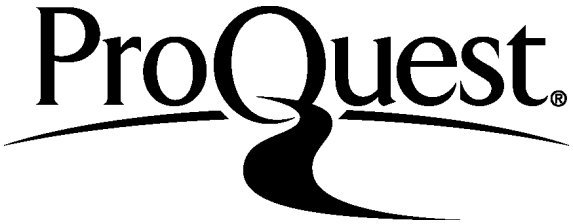
A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Master of Science in Agricultural and Resource Economics

Spring 2016



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ACKNOWLEDGMENTS

I would like to acknowledge everyone who has provided me with the encouragement and support necessary to complete this thesis. I would like to thank my advisor, Dr. Bernard, for his guidance and the time he has invested in helping me accomplish this goal. I appreciate the insights and assistance provided by the members of my thesis committee, Dr. Palm-Forster and Dr. Toensmeyer. Additionally, I would like to thank Dr. Mackenzie and Dr. Awokuse for encouraging me to pursue a graduate degree and sharing their wisdom with me. I am grateful for this experience and chance to further develop my knowledge of Agricultural Economics.

Finally I would like to thank my friends and family for being there for me throughout this experience and encouraging me to pursue this graduate degree. Thank you for everything.

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ABSTRACT

Vickrey auctions are commonly used to capture the true willingness to pay (WTP) of participants in experimental settings. However, to what extent does the experimental design of these auctions, as well as changes in modeling specification, impact the results? This study uses results from Vickrey auctions to determine the impact on WTP when the choices offered to participants change, both in terms of quality and number of options. This study also examines the impact of increasing the amount of options offered on decision making time. If the impact is significant, it could indicate participants are altering their decision making processes. Finally, this study tests if including independent variables related to Theory of Planned Behavior (TPB) improves the predictive power of Tobit models regressing WTP for local and organic food products.

Auction experiment sessions took place in Delaware with a sample size of 128 participants from the general population. A fourth-price Vickrey auction was used to collect bids on a number of food products, specifically focusing on steak, chicken, eggs, and ice cream. For steak and chicken, the quality of the options presented to participants was varied while, for the eggs and ice cream, the number of options presented was varied. Bid data was analyzed using Wilcoxon signed rank tests and Tobit model regressions.

While results varied, they offer evidence that auction bids can be influenced by the mix of products presented. The overall decision making time increased when the number of options increased. However the change in decision making time per option

offered was not significant. Finally, results show that including independent variables related to Theory of Planned Behavior (TPB) improves the predictive power of Tobit models regressing WTP for local and organic food products.

Chapter 1

INTRODUCTION

1.1 Objectives and Purpose

There were four objectives explored in this thesis.

1. To investigate if increasing the quality of one of the goods offered in a Vickrey auction had an effect on willingness to pay (WTP) for the other food product.
2. To determine if altering the number of options offered in a Vickrey auction had a significant effect on WTP for food products.
3. To explore if increasing the number of options offered in a Vickrey auction led to an increase in the amount of time it took participants to make a decision per option offered.
4. To see if including the Theory of Planned Behavior (TPB) in the Tobit models improved their predictive power.

The first two objectives were important because Vickrey auctions are commonly used to collect data regarding WTP for goods (Lusk and Shogren, 2007). The products offered in Vickrey auctions can be presented in a wide variety of ways. The number of options presented to participants can vary across studies and the quality differential between products can also vary. If these factors influence participants' WTP for products, it would be difficult to compare findings from different studies, thus affecting the quality of research. Since Vickrey auctions are used in such a

widespread manner, the consistency of data collected this way is extremely important. If the results between different design structures vary significantly, this would be important information for future researchers to take into consideration.

The third objective was important because a significant change in the amount of decision time per option offered could indicate that participants were using different evaluation methods, which could in turn affect how they make their bid decisions. No previous research was identified regarding decision making time without imposing a time limit. If there was a significant difference in the amount of time it took to make a decision per option, this would indicate that future studies should further investigate whether participants are changing their decision making processes and in what ways they are altered.

The fourth objective was important because the TPB has been shown to improve the predictive power of models regressing WTP for products (Lobb et al., 2007; Hansen et al., 2004; Chen, 2007; Arvola et al., 2008). However, TPB is rarely included when modeling WTP results from Vickrey auction data. Therefore, this study compared results from Tobit models with and without TPB variables to see if including TPB variables improved the predictive power of the models. Since TPB variables are not standard in models investigating WTP, it is important to determine if TPB variables are important for future studies to incorporate.

1.2 Organization of Thesis

Chapter two contains a thorough literature review. The first section of the literature review covers prior research regarding various food preferences, some of which include WTP for organic foods, local foods, other non-conventional food

production methods, and different qualities of meat. The next two sections discuss research regarding the structure of choice experiments and Vickrey auctions. In the third section, this chapter explains what the TPB is, how it was developed, related studies which have incorporated the TPB, and prior studies which have incorporated the TPB in conjunction with Vickrey auction data specifically. The final section of chapter two covers the limited research related to decision making time.

The experimental and questionnaire design are presented in chapter 3. This chapter provides an overview of the demographic information collected and questions asked regarding the TPB as well as how the experimental data was collected. Next, this chapter states the four hypotheses of this paper. The tests and models used to test the hypotheses are described. The end of this chapter reports and discusses the descriptive statistics. These statistics consist of demographic variables, TPB variables, and WTP means. Chapter four reports and discusses the results. The final chapter, chapter five, discusses the meaning and implications of the results.

Chapter 2

LITERATURE Review

2.1 Food Preferences

According to Dimitri and Greene (2000), producers have been making efforts to meet the growing demand for organic food since the 1990s. This growth continued into 2000, where almost half of organic food purchases were made in conventional grocery stores rather than specialty places. With the exception of the 2007-2009 recession, the organic food market has continued to grow (Greene, 2013). From 2011 to 2012, organic food sales increased by 11 percent resulting an estimated $28 billion in organic food sales in 2012.

As interest in non-conventional food options has developed, many people have investigated the effect of non-conventional labeling, such as local and organic, on consumers' WTP (Costanigro et al., 2014; Denver and Jenson 2014; Gracia et al., 2014; and Bernard et al., 2006). Costanigro et al. (2014) conducted an experiment using a Vickrey auction to investigate WTP for conventional, organic, local, and local organic apples. They found that consumers viewed local and organic as substitutes and the participants who had a distrust of government food agencies were willing to pay more for local and organic apples.

Denver and Jensen (2014) investigated consumer preferences for local and organic apples in Denmark. They conducted a choice experiment and found that

participants who had a positive perception of organic apples had a higher level of preference for both organic and local foods, whereas those who had a positive perception of local apples did not necessarily show a preference for organic apples. Using a choice experiment in Spain, Gracia et al. (2014) determined that participants were willing to pay more for eggs produced with non-conventional methods, including barn-raised, free-range, organic, and locally-sourced.

Bernard et al. (2006) explored WTP for non-genetically modified foods when both a conventional and organic option were also available. Estimating WTP for potato chips, tortilla chips, and chocolate milk, they found evidence to suggest some customers would be willing to pay a premium for non-GM foods, but not for other organic characteristics (Bernard et al., 2006). An important implication of their results was that people may be willing to pay a premium for certain aspects of non-conventional foods, but not all aspects. Bernard and Bernard (2009) also examined WTP for certain aspects of non-conventional foods. They used a second-price Vickrey auction to collect and analyze bids for conventional, organic rBST-free, and antibiotic free milk. They also found evidence that people are willing to pay more for specific aspects of non-conventional foods. Their results suggested that participants might be willing to pay a premium for rBST-free and antibiotic free milk that is not specifically labeled as organic (Bernard and Bernard, 2009).

There are a few previous studies which investigated WTP for different steak attributes (Feuz and Umberger, 2001; Feuz et al., 2004; and Lusk et al., 2001). Feuz and Umberger (2001) used experimental data to compare WTP for choice versus select and corn-fed beef versus grass-fed beef among American consumers. They

allowed participants to taste the steaks before making their bids. They found a higher percentage of participants preferred choice steak and they were willing to pay a premium for it. However, they also found that a smaller percentage preferred select steak and those people were willing to pay more for select than choice. Finally, while the overall WTP for grass-fed beef was lower than corn-fed beef, they found evidence of a niche market for grass-fed beef. Feuz et al. (2004) investigated American consumers' WTP for flavor and tenderness in steaks. Their study consisted of 273 participants and employed a random nth-price auction. They found that marbling and tenderness had positive effects on WTP. Meanwhile, dry-aging and Australian origin of the steak had negative effects on WTP. Finally, Lusk (et al., 2001) also investigated WTP for steak tenderness among Americans. They collected their data in a grocery store setting and found that most consumers preferred tender steaks and were also willing to pay a premium for tender steaks (Lusk et al., 2001).

2.2 Choice Experiments

Studies investigating the effect of increasing the number of options offered in experiments are needed, and this paper contributes to the literature by testing how the number of options offered in experimental auctions influences WTP. While choice modeling differs from auction experiments, both methods involve similar experimental design challenges such as determining how many options to present to participants.

In a choice experiment, participants are given a set of options with varying characteristics and corresponding prices, and they are asked to choose the option that they prefer (Lusk and Norwood, 2005). By analyzing the choices people make,

researchers can estimate the WTP for specific attributes of a good or service. Lusk and Norwood (2005) explain that a key challenge with these experiments is picking the characteristics of the options correctly. They also explain that the options presented need to be shown an even number of times to avoid statistical issues with the data, and it is helpful to make each of the characteristics uncorrelated with each other.

Lusk and Norwood (2005) employed six different experimental models in which they knew the true WTP and used a Monte Carlo stimulation to compare how changes in choice modeling designs changed the WTP. The characteristics they varied were "utility function type (continuous or discrete), degree of nonlinearity in the utility function (none, low, and high), sample size (low and high), and experimental design" (pg. 775). They found that none of the models were statistically different from the true WTP, and that the larger the sample size, the closer the mean WTP was to the true WTP. Their results imply that employing a large sample size can mediate the effects of an experimental design flaw. Therefore, the results of this study imply that in choice experiments varying the experimental design may not be a large concern if the sample size is adequately large.

Scheibehenne (2010) performed a meta-analysis of about 50 published and unpublished studies to investigate the effect of increasing the number of options to choose from. He found a high degree of variance between studies, but in general the effect of the number of options offered was almost zero. Hensher (2006) explored the effect of varying some design dimensions, including the number of choices offered, in respect to trip attribute bundles for a car commuting trip. Using stated choice experiments with participants in Sydney, Australia, he did not find any specific design

dimensions that consistently resulted in significant differences. However, when he evaluated each specification individually without controlling for other differences, he found the number of alternatives in a choice set showed differences in aggregate mean WTP.

2.3 Vickrey Auctions

Vickrey (1961) explains an important incentive issue with an ordinary or progressive auction. In a progressive auction, people continue to make bids until no one wants to make a higher one. The design of first-price auctions creates an incentive for the highest bidder to stop bidding around the WTP of the second highest bidder, because this way he or she can obtain the good without paying their maximum WTP (Vickrey, 1961). To correct for this incentive issue, researchers often use different types of auctions, such as a 2nd price Vickrey auction (Vickrey, 1961). In a second-price auction, participants bid on a good and the highest bidder obtains the good; however, instead of paying the price they bid, the highest bidder pays the bid of the second highest bidder. This different type of auction helps give the bidders incentive to bid their true maximum WTP. In the literature, several variations of Vickrey auctions are employed. These variations change which price the top bidder has to pay, as well as how many participants can obtain the item. Some of the types of Vickrey auctions used include random nth-price (Shogren et al.,2001), 4^{th} price (Feuz and Umberger, 2001), and 5^{th} price (Costanigro et al., 2014).

This study explores how modifying the structure of bids can affect participants' WTP. Rousu and Kosa (2005) examined the effect of including more options in auctions. They asked participants to place bids on a variety of products and

to indicate their preferred choice. Their results suggest that increasing the number of substitutes offered could increase the number of accurate bids in auctions. However, their results did not suggest bids were as reliable when increasing the number of complements offered together.

Chavez and Palma (2015) used experimental auction data to study if increasing the number of choices offered can result in a choice overload. They auctioned off seven types of strawberries using a second price Vickrey auction, and they varied how many different types of strawberries were offered. The number of varieties offered ranged from 1 to 8 and they included the baseline variety twice in all of the auction rounds except for the control round. They also included one option of grapes in all the rounds. The control round consisted of the baseline variety and grapes. They reasoned that if the participants were unaffected by a change in the number of options offered, the difference between the WTP for the baseline strawberries and the grapes should stay constant regardless of how many types of strawberries were offered. To analyze the results, they first used random parameter and heteroskedastic Tobit models of WTP for the baseline strawberry variety. Next, they used random parameter linear models to explore if there were any differences in WTP between the baseline variety of strawberries and the duplicated option of the baseline variety of strawberries and to look for any difference in WTP for the baseline variety of strawberries and the grapes. Their results were supportive of choice overload because they found increasing the number of varieties had an effect on WTP. They found that the mean WTP decreased as the number of options offered increased.

Arunachalam et al. (2009) conducted a study to determine if there is an excessive choice effect (ECE). They did not use a Vickrey auction in their research. Instead, the researchers used several other types of experiments, including asking students to choose how many options of soda they wished to pick from, a choice set experiment, a BDM auction, and a hypothetical choice experiment. Over half (58%) of the students asked to choose how many options of soda they wished to pick from chose to be provided with the larger choice set. In the BDM auction, participants had either six or 24 varieties from which to choose. To analyze the BDM auction results, they used a t-test and an OLS regression. The t-test did not show any significant difference in WTP for the two choice sets. The OLS regression found that people who were classified as maximizers experienced an excessive choice effect as opposed to the satisfiers. They used a survey to create a continuous variable where people fell on the maximizer-satisfier scale. They noted that "maximizers" are people who tend to carefully analyze all the options and focus on selecting the best option. On the other hand, they described "satisfiers" as people who are okay with selecting a good option and tend to purchase the first option that meets their criteria rather than searching for the absolute best choice. Finally, the hypothetical choice experiment employed a conditional logit regression to analyze the data. In their summary they stated that their results show the existence of ECE but in general more choice was still better than less choice. As the literature provides somewhat conflicting results, this study hopes to contribute to the literature by further exploring this issue.

2.4 Theory of Planned Behavior

This study intends to include information related to the TPB in the Tobit models, to see if it improves the accuracy of the results (Wu, 2012). Ajzen (1991) explained the TPB as consisting of three major components: attitude toward the behavior, subjective norm, and perceived behavioral control. He then explained how these three components demonstrated intention toward a behavior that then helped explain what the actual behavior would be. The theory was based on the Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980; Fishbein and Ajzen 1975; Ajzen, 1991). Ajzen (1991) explained that the TRA lacked a way to handle behaviors people have no control over, which is why the TPB includes perceived behavior control. People might have a positive attitude towards a good and feel social pressure to purchase the good (subjective norm), but if they feel they have no control over purchasing the good (perhaps the good is out of their budget), then they will not actually purchase the good.

According to Ajzen (1991), the TPB is supported by the empirical evidence. The TPB has been used in multiple studies (Lobb el al., 2007; Hansen et al., 2004; Chen, 2007; Arvola et al., 2008). All four of these studies provided positive feedback for the TPB. Lobb et al. (2007) conducted in home interviews in the UK to explore how food purchases are influenced by risk perception and trust in food safety. They found that including the TPB in their model improved the model's performance. Hansen et al. (2004) conducted web-based surveys in Denmark and Sweden to test and compare the TPB and the TRA. He found that the TPB was a better fit for their data. Chen (2007) used a self-administered customer survey in Taiwan to examine Taiwanese attitudes toward and intentions to purchase organic foods. His results also

supported the use of the TPB in explaining the participants' behavior. Finally, Arvola et al. (2008) used a questionnaire in Italy, Finland, and the UK to measure intentions to buy organic foods. They tested the effectiveness of including attitudes as part of their model and found that in all three countries, attitudes and subjective norms were able to explain variances in consumer intentions.

Several prior studies have used the TPB in conjunction with Vickrey auction data. Wu (2012) used Vickrey auction data to examine WTP for local and organic food. She included the TPB in her models and found the TPB was better at predicting organic food purchases than local food purchases. Schott and Bernard (2015) used auction data to investigate consumer WTP for different types of milk and included TPB variables in their Tobit models. Barber and Taylor (2013) used a Vickrey auction to investigate if certain aspects of the TPB, specifically attitudes and intentions, were good predictors of actual wine purchasing behavior. They found that attitudes and intentions were strong predictors of wine purchasing behavior. Since the literature regarding the use of TPB in conjunction with Vickrey auction data is not extensive, this study plans to contribute to the literature by examining the predictive power of TPB variables in the models.

2.5 Decision Making Time

There has been some research regarding the impact of increasing time pressure on participants while making decisions. One study by Reutskaja et al. (2011), showed hungry subjects pictures of 4, 9, or 16 snacks and asked the participants to pick within 3 seconds. While the participants were making these choices they tracked their eye movements. These researchers found that when the time pressure was increased, in

the form of more options shown, participants focused on each product for less time and increased their searching time. This behavior was mild and only had a small influence on their choices. Haynes (2009) investigated the effect of increasing the number of options offered and time pressure on participants' satisfaction levels. The participants were presented with descriptions for 3 or 10 products. Then they were then asked to pick one object for which they would enter into a drawing. The participants with less time available and more options to pick from reported more frustration and difficulty making a decision. Kocher and Sutter (2006) used a computerized beauty contest experiment and found when participants were under high time pressure the payoffs were lower, and it took longer for participants to reach equilibrium than under low time pressure. However, when participants were operating under time dependent incentives they were able to make quality decisions faster, perhaps because the chance to earn more money for speedy responses increased concentration.

While there has been some research regarding decision making under time pressure, there is no literature regarding the effect of increased options on the amount of time it takes participants to make a decision under no imposed time constraint. This research contributes to the literature by looking at the effect of increased options on decision making time when participants are not under an imposed time constraint.

Chapter 3

METHODOLOGY

3.1 Experimental Design

There were 128 adult participants selected for the experiment through a variety of methods including: flyers at supermarkets, the University of Delaware's Agricultural Day (a large annual event) and a Craig's list advertisement. The experiment was advertised as a "food marketing study." All of the participants were asked to attend a session at the Experimental Economics Laboratory for Policy and Behavior Research at the University of Delaware. There were a total of eleven sessions between 07/28/2010 and 08/19/2010. Each session typically had eight to nineteen participants and took about one and a half hours. All participants were paid $45 and had the option of using that money to make bids on the food products offered during the experiment. The experiment was conducted on computers via Qualtrics, which is a web-based survey platform.

The experiment employed a Vickrey's fourth-price auction. In other words, the three highest bidders paid the price that the fourth highest bidder made (Feuz and Umberger, 2001). Before the auction data was collected, participants were shown the optimal strategy of bidding their WTP. This included examples of over or under bidding and why those strategies can cause problems. Then they participated in a practice auction in which they played against computer bidders for small monetary

stakes. This allowed participants to see that the best strategy was to bid their true value before they began placing actual bids. The food labels were described as shown below in Table 3.1.

Table 3.1: Label Definitions

Label	How it was defined to participants
Conventional	Neither organic nor local. Products may have been produced using antibiotics, hormones, GM, pesticides, chemical fertilizers. All within government standards and limits
Organic	Listed USDA standards and stated that to qualify for an organic seal the product must be at least 95% organic
Local	No standard definition. Since any local foods in the auctions were just purchased you may assume they are from close by.
Free range	Producers must demonstrate to the USDA that the poultry has been allowed access to the outside and it is required to be certified as organic.
USDA Prime steak	USDA Prime (Highest grade) is produced from young, well-fed beef cattle. It had abundant marbling and is generally sold in restaurants and hotels. Accounts for about 2% of all beef qualities.
USDA Choice steak	USDA Choice (2nd grade) is high quality, but has less marbling than Prime. Choice roasts and steaks from the loin and rib will be very tender, juicy, and flavorful. Accounts for about 50% of all beef qualities.
USDA Select steak	USDA Select (3rd grade, typically lowest available in supermarkets) is fairly tender, but, because it has less marbling, it may lack some of the juiciness and flavor of the higher grades.

In the experiment, the participants were asked to bid on a variety of food products, and they were told only one of the auctions would be binding. In other words, the participants were involved in multiple rounds of auctions, but were informed that only one of the rounds would actually be binding. Only one of the rounds was binding so participants would not worry about budgeting their $45 over multiple auction rounds. This way they could treat each auction round individually. The participants were able to see the sealed envelope, which contained the pre-determined binding auction. The envelope was opened by one of the participants at the conclusion of all the auctions. This method follows Bernard and Bernard (2009).

While the experiment asked participants to bid on other food products, this study focuses solely on the chicken, steak, ice cream, and egg bids. Since the chicken and steak bids were both designed to accomplish the first objective of this paper (To investigate if altering the quality and types of meats offered together in a Vickrey auction has an effect on WTP.), the framework for the chicken and steak bids were very similar. Each participant was asked to bid between $0 and $10 on chicken twice. In one round the participants were asked to bid on free range and organic chicken, in the other round they were asked to bid on free range and convention chicken. To control for an ordering effect, half of the participants saw free range and organic chicken first and half saw free range and conventional first. Organic chicken was designed to be the highest quality followed by free range and conventional chicken. Note that free range is a part of the organic definition. In other words, organic chicken is also free range, however, free range chicken is not necessarily organic, as organic chicken has additional production requirements. For the steak bids participants were

asked to bid between $0 and $15. They were asked to make bids on choice and prime steak as well as choice and select steak. In a similar fashion, the steak bids were also controlled for an ordering effect.

The egg and ice cream bids were structured the same way as each other and were intended to investigate the second objective of this paper, which was to determine if altering the number of options offered in a Vickrey auction had a significant effect on WTP for food products. There were two separate sets of bids made for eggs. In one, the participants were asked to bid between $0 and $10 on organic and conventional eggs. In the other round, participants bid on eight types of eggs. These consisted of organic, conventional, local, omega 3, free range, vegetarian, pasture raised, and cage free eggs. The participants also received an information sheet providing definitions for these different types of eggs as seen in table 3.1. There were also two separate sets of ice cream bids, both of which asked participants to make bids between $0 and $10. In one set of bids, the participants were asked to bid on organic and conventional ice cream. In the other set of bids, they were asked to bid on the six types of ice cream: organic, conventional, local, grass fed, no growth hormone, and no antibiotics. For both products, the sets of bids were controlled for an ordering effect the same way the chicken and steak were. Additionally, data on the amount of time it took participants to make their bids was collected for the egg and ice cream bids.

3.2 Questionnaire Design

The participants were given a questionnaire that collected their demographic information and asked questions based on the TPB (see Appendix B). The demographic questions were related to gender, age, income, education level, ethnicity,

state of residence, children, if they were the primary shopper, if they had farming experience, if they were vegetarian, their fashion food involvement, and their self-identity. Questions related to the TPB asked about attitude towards local and organic food, perceptions of social norms (also referred to as subjective norms) regarding local and organic food, and PBC regarding local and organic food.

The questionnaire asked a variety of questions related to Fashion Food Involvement (FFI), which has been included in other studies involving consumer behavior (Chen, 2007; Wu, 2012). These questions intended to gauge how involved in food preparation the participants were. They were asked to indicate if they agreed with the statement or not. All of the following questions were asked on a seven point scale, with 1 indicating they strongly disagreed and 7 indicating they strongly agreed. To create the final FFI variable, the responses to all 11 of these questions were summed and then divided by the total number of questions (11).

Table 3.2: FFI Questions
I enjoy cooking.
I enjoy shopping for cooking supplies.
I have a healthy diet.
I grow a lot of my own food in a garden.
My friends ask me for cooking advice.
I eat out a lot.
I like to watch food and cooking shows.
I like to try new foods.
Food quality is more important than price.
When I travel I enjoy trying local specialties.
I like to try new recipes.

Table 3.3 shows questions asked relating to participants' self-identity. Self-identity is sometimes used as an extension of the TPB and has also been included in prior studies (Wu, 2012; Sparks and Shepherd, 1992; Shaw et al., 2000).

These questions were asked on a seven-point scale with one indicating the participant strongly disagrees and seven indicating the participant strongly agrees. To create the final self-identity variable, the responses to all 3 of these questions were summed and then divided by the total number of questions (3).

Table 3.3: Self- Identity Questions
I consider myself a typical buyer of local food.
I consider myself a green consumer.
I think of myself as a health conscious consumer.

As discussed in the literature review, Ajzen (1991) explained the TPB as consisting of three major components: attitude toward the behavior, subjective norm, and perceived behavioral control. This questionnaire gathered information on these three components. Questions regarding participants' general attitude towards local and organic foods are shown in table 3.4 below. Again these questions were recorded on a seven-point scale. These questions were separated to create a local food attitude variable and an organic food attitude variable. To create the attitude towards local food variable, the responses to the two questions related to it were summed and then divided by the total number of questions (2). The same process was used to create the attitude towards organic food variable.

Table 3.4: Attitudes Towards Local and Organic Foods Statements	
Attitude towards local food	
	Local food is bad/good.
	Local food is foolish/wise.
Attitude towards organic food	
	Organic food is bad/good.
	Organic food is foolish/wise.

This next table shows the questions related to the subjective norm portion of the TPB. Again these questions were asked on the same seven-point scale and the final subjective norm variable was created by summing all of the responses and indexing it by dividing that number by the total number of related questions asked.

Table 3.5: Subjective Norm Regarding Local and Organic food Statements
I tend to do what people who are important to me think I should do.
It's difficult to find organic food.
Most people who are important to me think I should purchase local food.

Finally, table 3.6 shows the questions related to perceived behavior control (PBC) towards local and organic foods. These questions were also recorded on a seven-point scale. These variables were also indexed by summing the responses to the listed questions and then dividing by the total number of questions.

Table 3.6: PBC Towards Local and Organic Food Purchases Statements	
PBC towards local food	
	Local food is too expensive.
	It's difficult to find local food.
PBC towards organic food	
	Organic food is too expensive.
	It's difficult to find organic food.

The next section will discuss how the information collected in the experiment and questionnaire were used to test the hypotheses of this paper. It also covers the models used to test those hypotheses.

3.3 Hypotheses

There are several hypotheses tested in this paper. Hypothesis (1) was that increasing the quality of one of the goods offered in a Vickrey auction will change WTP for the other good. As there is little to no literature related to this hypothesis, the direction of this change is not hypothesized. Hypothesis (2) is that increasing the number of options offered in a Vickrey auction will decrease WTP for the food product. While there is little literature related to this, the two related articles gave conflicting results. Rousu and Kosa (2005) found bids remained reliable when the goods were substitutes, but not when they were complements. Chavez and Palma (2015) found the mean WTP decreased when the number of options increased. Hypothesis (3) stated that increasing the number of options offered in a Vickrey auction will increase the average amount of time it takes participants to make a decision per option. There is no prior literature regarding the third hypothesis, but this

study predicts it will take participants longer per option to make their decisions when the number of options offered increases because they will have more deliberations to make. Finally, based on the literature (Lobb el al., 2007; Hansen et al., 2004; Chen, 2007; Arvola et al., 2008), hypothesis (4) stated that including TPB variables will improve the predictive power of the Tobit models.

3.4 T-Tests and Wilcoxon Signed Rank Tests

This study conducted a variety of tests of these hypotheses. First, to determine if the data was normally distributed, a Shapiro-Wilk test was conducted. The Shapiro-Wilk test is commonly used to test for normality and for outliers (Kennedy, 2003; Maddala, 1997). T-tests are commonly used to test for differences between means but the data must be normally distributed (Kennedy, 2003). Therefore, if the data was normally distributed, a t-test was used to determine if the WTP means are significantly different from each other. However, for data not normally distributed, one cannot rely on the t-test and must use a Signed Rank Wilcoxon test instead. The Signed Rank Wilcoxon test estimates each data point's deviation from the hypothetical mean and assigns ranks in ascending order and assigns negative ranks to the deviation values. The sum of these negative ranks should be close to zero if the hypothetical mean is truly the population mean (Sprent and Smeeton, 2001). Then the final stage of the analysis will use Tobit models, which are discussed in the next section.

The t-tests and Wilcoxon Signed Rank tests were utilized to test hypothesis (1), (2), and (3). To accomplish this, eight tests were run. To test hypothesis (1), one or both of these tests were used to compare two sets of WTP means. The first set compared the mean WTP for choice steak when offered with prime steak to the mean

WTP for choice steak when offered with select steak. The second set compared the mean WTP for free range chicken when offered with conventional chicken to the mean WTP for free range chicken when offered with organic chicken.

To test hypothesis (2), four sets of WTP means were examined. In the first set, the mean WTP for organic eggs when all eight options were offered was compared to the mean WTP for organic eggs when only two options were offered. The second set compared the mean WTP for conventional eggs when all eight options were offered to the mean WTP for conventional eggs when only two options were offered. The third set compared the mean WTP for organic ice cream when all eight options were offered to the mean WTP for organic ice cream when only two options were offered. Finally, the fourth set compared the mean WTP for conventional ice cream when all eight options were offered to the mean WTP for conventional ice cream when only two options were offered.

To test hypothesis (3), tests on two sets of decision making time means were conducted. The first set compared the mean decision making time when participants were offered two types of eggs to the mean decision making time when participants were offered eight types of eggs. Meanwhile, the second set compared the mean decision making time when participants were offered two types of ice cream to the mean decision making time when participants were offered eight types of ice cream. Again which test(s) were used for all of these sets depended on the Shapiro-Wilk test results.

3.5 Models

The Tobit model was created by James Tobin in 1958. The Tobit model is a censored regression model (Kennedy, 2003). This type of model is employed when the dependent variable is limited, because typical OLS models are biased in that situation (Kennedy, 2003). Since all of the bids in the data were restricted with a lower and upper bound, the Tobit model is a good choice for the regression models. This study will follow the model used by Wu (2012) and adapt the model shown in equation 1. This equation shows the two-limit Tobit model. As seen below L_i and R_i represent the censoring among the variables.

Equation 1: Two-limit Tobit Model

$$y_i = \begin{cases} L_i & if\ y_i^* \leq L_i \\ \beta_{x_i} + e_i & if\ L_i < y_i^* < R_i \\ R_i & if\ y_i^* \geq R_i \end{cases}$$

Where y_i = Observed dependent variable,

y_i^*= Latent variable,

L_i= Censored variable for left-censored data,

R_i= Censored variable for right-censored data,

x_i = Matrix of independent variables (including an intercept term),

β = Vector of unknown regression parameters to be estimated,

e_i = Vector of errors

The definitions of the variables used in the 11 Tobit models described in this section are summarized in tables 3.7 and 3.8. Please note that the summary statistics

of these variables are included in the next section of this chapter, however for the sake of clarity, it is necessary to define these variables before elaborating on the twelve Tobit models used in this study. Table 3.7 provides the definitions for the demographic variables and table 3.8 provides the definitions for variables related to the TPB and the bids. The questions used to create the TPB variables were discussed previously in the questionnaire design portion of this paper.

Table 3.7: Demographic Variables

Variable	Description
Age	age in years
Female	1 if subject is female, 0 if male
Income	Income level
Education	Education level
Caucasian	1 if subject is Caucasian, 0 if otherwise
Delaware	1 if subject is from Delaware, 0 if otherwise
Children	1 if subject has children, 0 if otherwise
Primary Shopper	1 if subject is the primary shopper, 0 if otherwise
Farming	1 if subject has farming experience, 0 if otherwise
Vegetarian	1 if subject is a vegetarian, 0 if otherwise
FFI	Fashion Food involvement, 1 = strongly disagree to 7 = strongly agree
Selfid	Self-identity towards local, green, and organic foods 1 = strongly disagree to 7 = strongly agree

Table 3.8: TPB, Bid, and Time Variables		
Category	Variable	Description
TPB	Localatt	Attitude towards local food, 1 = strongly disagree to 7 = strongly agree
	Orgatt	Attitude towards organic food, 1 = strongly disagree to 7 = strongly agree
	PBCorg	Lack of Perceived behavior control regarding organic foods, 1 = strongly disagree to 7 = strongly agree
	PBCloc	Lack of perceived behavior control regarding local foods, 1 = strongly disagree to 7 = strongly agree
	Socialnorm	Social norm (for local and organic foods), 1 = strongly disagree to 7 = strongly agree
Bids	Choice	Bids for choice steak in dollars
	Prime	1 if prime steak was offered, 0 if select steak was offered
	Organic chicken	1 if organic chicken was offered, 0 if conventional chicken was offered
	Organic eggs	Bids for organic eggs in dollars
	Conventional eggs	Bids for conventional eggs in dollars
	Fewer egg options	1 if only conventional and organic were offered, 0 if all 8 types of eggs were offered
	Organic ice cream	Bids for organic ice cream in dollars
	Conventional ice cream	Bids for conventional ice cream in dollars
	Fewer ice cream options	1 if only conventional and organic were offered, 0 if all 6 types of ice cream were offered

There were 11 Tobit models used to test three of the hypotheses. The models discussed below are economic models rather than econometric models. Models (1), (2), and (3) were designed to test hypothesis (1). Models (4) - (11) were designed to test hypothesis (2). And finally models (2) - (11) were designed to test hypothesis (4).

In all of the models, age, female, primary shopper, children, farming, vegetarian, Caucasian, income, education, and Delaware were included as standard demographic variables which are commonly used in regressions related to WTP for food products. Additionally, FII and selfid were included in all of the models because, as explained previously, in the questionnaire portion of this study, these variables are sometimes included in this type of study (Wu, 2012; Chen, 2007; Sparks and Shepherd, 1992; Shaw et al., 2000). For the models designed to examine the effect of including TPB variables, some combinations of the following variables related to the TPB were included: localatt, orgatt, PBCorg, PBCloc, and socialnorm. Models of auction rounds that included both local and organic foods included all of these TPB variables. Meanwhile, models of auction rounds, which only included local foods included localatt, PBCloc, and socialnorm. Finally, models of auction rounds which only included organic foods included orgatt, PBCorg, and socialnorm. These variables were selected based on the three main components of the TPB, which are attitude towards the behavior, subjective norm (or social norm), and PBC (Ajzen, 1991).

Earlier, hypothesis (1) stated that increasing the quality of the one of the goods offered in a Vickrey auction will change WTP for the other good. Model (1) showed WTP for choice steak as a function of the quality of the other option offered (either

prime or select steak) and other independent variables that can be seen in the model specification below. The reasoning for including these variables was explained earlier. Prime was selected to determine if increasing the quality of the steak offered had an effect on WTP for choice steak. Models (2) and (3) both showed WTP for free range chicken as a function of the quality of the other option offered (either conventional or organic) and other independent variables, which are shown in the model specifications below, and the reasoning for including these variables was previously explained. Organic chicken was included to see if increasing the quality of the second option offered increases WTP for free range chicken. If the variables indicating the quality of the option offered had positive significant effects on WTP for choice steak or for free range chicken, this would provide support for hypothesis (1). Additionally, models (2) and (3) helped test hypothesis (4), which stated that including TPB variables would improve the predictive power of the Tobit models. Since model (2) contained the TPB variables, whereas model (3) did not contain the TPB variables, comparing the predictive power of these two models provided some insight regarding hypothesis (4). This was determined by examining the significance of the TPB variables in model (2) and by comparing the coefficients of the independent variables in both model (2) and (3) to see if the TPB variables were significant and if including them caused other variables to become more significant.

Model (1)

$$WTP\ for\ Choice\ Steak = f\left(\begin{array}{c} prime, age, female, primary\ shopper, children, farming, \\ vegetarian, Caucasian, income, education, Delaware, FFI, selfid \end{array}\right)$$

Model (2)

$$WTP\ Free\ range\ chicken = f\left(\begin{array}{c} organic\ chicken, age, female, primary\ shopper, children, \\ farming, vegetarian, Caucasian, income, education, Delaware, \\ FFI, orgatt, selfid, PBCorg, socialnorm \end{array}\right)$$

Model (3)

$$WTP\ Free\ range\ chicken = f\left(\begin{array}{c} organic\ chicken, age, female, primary\ shopper, children, farming, \\ vegetarian, Caucasian, income, education, Delaware, FFI, selfid \end{array}\right)$$

Models (4) - (7) were designed to test hypotheses (2) and (4). Earlier hypothesis (2) stated that increasing the number of options offered in a Vickrey auction will significantly decrease WTP. Models (4) and (5) both showed WTP for organic eggs as a function of the fewer egg options offered and other independent variables. The justification for including these variables in the models was explained at the beginning of this section. Models (6) and (7) showed WTP for conventional eggs as a function of the fewer egg options offered and other previously justified independent variables, as shown in the models below. As explained earlier "fewer egg options" is a dummy variable representing if two options (conventional and organic) or eight options (organic, conventional, local, omega 3, free range, vegetarian, pasture raised, and cage free eggs) were offered. If "fewer egg options" is positive and significant these models will provide evidence for hypothesis (2).

Hypothesis (4) has been stated as follows: including TPB variables will improve the predictive power of the Tobit models. The following models were used to test this hypothesis by comparing model (4) and (5) as well as comparing model (6) and (7). Models (4) and (6) both contain the relevant TPB variables, whereas models (5) and (7) do not contain the TPB variables. If the TPB variables are shown to have significant effects in models (4) and (6) and the coefficients on overlapping dependent variables differ from models (5) and (7),that would provide evidence that hypothesis (4) is correct.

Model (4)

$$WTP\ for\ Organic\ Eggs = f\left(\begin{array}{c} fewer\ egg\ options, age, female, primary\ shopper, children,, \\ Caucasian, farming, vegetarian, income, education, Delaware, \\ FFI, localatt, orgatt, selfid, PBCorg, PBCloc, socialnorm \end{array}\right)$$

Model (5)

$$WTP\ for\ Organic\ Eggs = f\left(\begin{array}{c} fewer\ egg\ options, age, female, primary\ shopper, \\ children, Caucasian, farming, vegetarian, income, \\ education, Delaware, FFI, selfid \end{array}\right)$$

Model (6)

$$WTP\ for\ Conventional\ Eggs = f\left(\begin{array}{c} fewer\ egg\ options, age, female, primary\ shopper, children,, \\ Caucasian, farming, vegetarian, income, education, Delaware, \\ FFI, localatt, orgatt, selfid, PBCorg, PBCloc, socialnorm \end{array}\right)$$

Model (7)

$$WTP\ for\ Conventional\ Eggs = f\left(\begin{array}{c} fewer\ egg\ options, age, female, primary\ shopper, \\ children, Caucasian, farming, vegetarian, income, \\ education, Delaware, FFI, selfid \end{array}\right)$$

Models (8) - (11) were designed to test hypotheses (2) and (4). As explained earlier, hypothesis (2) aims to determine if increasing the number of options offered in a Vickrey auction will significantly change WTP. Models (8) and (9) regress WTP for organic ice cream as a function of the fewer ice cream options offered (either two or six) and other independent variables (justifications for including these were explained earlier) as seen in the model specifications below. Models (10) and (11) regress WTP for conventional ice cream as a function of the fewer ice cream options offered (again either two or six) and other independent variables. If the coefficient on the "fewer ice cream options" variable is positive and significant this would provide evidence supporting hypothesis (2).

These models were also designed to answer the following question: Will including TPB variables improve the predictive power of the Tobit models? Models (8) and (10) both include TPB variables, while models (9) and (11) do not. If models (8) and (10) were better predictors, this would provide evidence supporting hypothesis (4). If models (9) and (11) were better predictors, this would provide evidence against hypothesis (4). Which models were better predictors was determined by examining the significance the TPB variables had and checking to see if including the TPB variables caused any differing results for the overlapping independent variables.

Model (8)

$$WTP\ for\ Organic\ Ice\ Cream = f\left(\begin{matrix} fewer\ ice\ cream\ options, age, female, primary\ shopper, children,, \\ Caucasian, farming, vegetarian, income, education, Delaware, \\ FFI, localatt, orgatt, selfid, PBCorg, PBCloc, socialnorm \end{matrix}\right)$$

Model (9)

$$WTP\ for\ Organic\ Ice\ Cream = f\left(\begin{matrix} fewer\ ice\ cream\ options, age, female, primary\ shopper, children, \\ Caucasian, farming, vegetarian, income, education, Delaware, \\ FFI, selfid \end{matrix}\right)$$

Model (10)

$$WTP\ for\ Conventional\ Ice\ Cream = f\left(\begin{array}{c} fewer\ ice\ cream\ options, age, female, primary\ shopper, children,, \\ Caucasian, farming, vegetarian, income, education, Delaware, \\ FFI, localatt, orgatt, selfid, PBCorg, PBCloc, socialnorm \end{array}\right)$$

Model (11)

$$WTP\ for\ Conventional\ Ice\ Cream = f\left(\begin{array}{c} fewer\ ice\ cream\ options, age, female, primary\ shopper, \\ children, Caucasian, farming, vegetarian, income, \\ education, Delaware, FFI, selfid \end{array}\right)$$

3.6 Descriptive Statistics: Demographic Variables

Table 3.9 shows some descriptive statistics for select demographic variables along with the estimated portion of the Delaware population according to 2010 Delaware Census data. There were more females (57%) than males (43%) in the sample. According to the Census data, females account for roughly 51% of the population in Delaware. Therefore females are over represented in this sample. This sample also over represented people aged 18-24 (17%) because the census estimates people aged 18-24 represent about 10% of the population. People aged 25-34 were over represented and people aged 35-49 were slightly over represented. The percentage of people aged 50-64 in the sample were close to the estimation provided by the census. Finally, people 65 and older were under represented. These differences between the age demographics in this sample and the general Delaware population

could be the result of a couple factors. First, the sample excluded anyone under the age of 18. Second the experiment took place in a college town, Newark, Delaware, and college towns tend to have a larger population of younger people.

The income distribution of the sample varied from the Census estimates for Delaware. The sample contained about 3% more people with a household income between $0 and $9,999. People earning $10,000-$14,999 were under represented by about 2%. People in the next three income groups ($15,000 - $49,999) were over represented. People in the sample who fell into the next three income groups ($50,000-$149,999) were all under represented. Finally, the percentage of people who fell into the $150,000 - $199,999 were close to the Census estimates, and people earning $200,000 and over were slightly under represented. Overall it appears that the lower half of the income groups were over-represented, while the upper half of the income groups were under-represented. Considering the fact people aged 18-34 were also over represented, this is sensible as these people might be relatively new in their careers. The people in this sample also had a higher level of education than the Census estimates for the Delaware population. This could also be because the experiment was conducted in a college town.

People of a white or Caucasian background were over represented by about 3%. Black or African American people were under-represented by about 5%, and Hispanics were under represented by about 11%. American Indians and Asians were both accurately represented in this sample, and finally those who identify as another race were under-represented in this sample. Based on this, it seems as though the sample did not entirely represent the race distribution of Delaware. Since about 88%

of participants claimed they were from Delaware, using the Census data for Delaware seems appropriate. However, perhaps one aspect of the differences between the sample and the Census estimates resulted from the 12% of the sample from other states. The 2010 Delaware Census estimates for the percentage of the population who are primary shoppers, have farming experience, are vegetarian, or have a child, were unavailable. Most of the participants did not have a child, considered themselves a primary shopper, did not have farming experience, and did not consider themselves vegetarian.

Table 3.9: Demographic Summary Statistics				
	Characteristic	Sample		Census
		Frequency	Percentage	Percentage
Gender				
	Male	55	42.97	49.1
	Female	73	57.03	50.9
Age				
	18-24	22	17.19	10.1
	25-34	42	32.81	12.4
	35-49	31	24.22	20.5
	50-64	24	18.75	19.7
	65+	9	7.03	14.4
Income				
	$0 - $9,999	13	10.16	7.2
	$10,000 - $14,999	4	3.13	5.5
	$15,000 - $24,999	20	15.63	10.8
	$25,000 - $34,999	16	12.50	10.5
	$35,000 - 49,999	20	15.63	14.1
	$50000 - $74,999	19	14.84	18.6
	$75,000 - $99,999	11	8.59	12.3
	$100,000 - $149,999	15	11.72	12.3
	$150,000 - $199,999	6	4.69	4.4
	$200,000 and over	4	3.13	4.2
Education				
	< High School	2	1.56	13.7
	High School	21	16.41	28.0
	Some College	32	25.00	21.2
	College	44	34.40	26.2
	Post-Graduate	29	22.70	11.0

Table 3.9: Demographic Summary Statistics (Continued)

	Characteristic	Sample		Census
		Frequency	Percentage	Percentage
Ethnicity				
	White	98	76.56	74.8
	Black	11	8.59	13.6
	Hispanic	7	5.47	16.3
	American Indian	2	1.56	1.7
	Asian	7	5.47	5.6
	Other	3	2.34	7.4
State				
	DE	112	87.50	
	MD	7	5.47	
	NJ	1	0.78	
	PA	7	5.47	
	Other	1	0.78	
Children Under 18				
	Yes	36	28.13	
	No	92	71.88	
Primary Shopper				
	Yes	92	71.88	
	No	36	28.13	
Farming Experience				
	Yes	35	27.34	
	No	93	72.66	
Vegetarian				
	Yes	8	6.25	
	No	120	93.75	

Source: (U.S. Census Bureau, 2010) and (U.S. Census Bureau, "American Fact Finder")

The next five tables contain the summary statistics of participants' answers to a variety of questions used to create variables for the models. These questions were asked on a scale from 1 to 7, with 1 indicating "strongly disagree" and 7 indicating "strongly agree". To create the "percent positive" column answers from 1 to 3 were classified as negative (disagreed), 4 as neutral, and 5 to 7 as positive (agreed), as done in Wu (2012). Then, the percentage of positive responses were calculated and reported in the tables. To create the overall index for each variable the responses for the questions related to the given variable were summed and then the answer was divided by the total number of questions to keep the scale constant. This was also modeled after Wu (2012).

Table 3.10 shows the summary statistics for the FFI questions. Almost all of the participants responded positively (88-90%) to the following questions: "When I travel I enjoy trying local specialties", "I like to try new foods", and "I like to try new recipes". Since these were the top ranked questions, this indicates that most of the participants were open to new experiences involving food. The next highest ranked questions were "I enjoy cooking" and "I enjoy shopping for cooking supplies". Since 75-79% responded positively to those two questions, it can be inferred that the majority of participants enjoy being involved in the preparation of food. The majority also agreed that food quality is more important than price (about 68%). Also, the majority (64-67%), said they like to watch food and cooking shows and agreed that they have a healthy diet. Most participants did not agree (55-58%) with the statements "My friends ask me for cooking advice" or "I eat out a lot". Finally, a large majority indicated that they did not grow a lot of their own food in a garden (almost 84%).

When the responses to all 11 of these questions were summed and then divided by 11, the overall FFI variable had a large majority of positive responses (85%). While the majority of responses to the questions were not all positive, most of the questions received positive responses. This indicates that the participants had a relatively high level of FFI.

Table 3.10: Summary Statistics for FFI Responses

Question	Mean	Percent Positive	Std. Dev
When I travel I enjoy trying local specialties.	6.01	89.84	1.12
I like to try new foods.	5.84	88.28	1.24
I like to try new recipes.	5.73	88.28	1.21
I enjoy cooking.	5.57	78.91	1.59
I enjoy shopping for cooking supplies.	5.25	75.00	1.55
Food quality is more important than price.	5.04	67.97	1.22
I like to watch food and cooking shows.	4.87	67.19	1.87
I have a healthy diet.	4.84	64.84	1.45
My friends ask me for cooking advice.	4.02	43.75	1.80
I eat out a lot.	3.91	42.19	1.74
I grow a lot of my own food in a garden.	2.52	16.41	1.87
Overall FFI	4.87	85.27	0.80

Table 3.11 shows the summary statistics for the self-identity questions. The majority (82%) considered themselves a health conscious consumer. An interesting result from this table is that the majority (59%) considered themselves a typical buyer of local food, yet a large minority 45% considered themselves a green consumer. This seems a little contradictory because many people consider purchasing local food to be

more “green”. Perhaps, the participants purchased local food, but do not consider themselves green consumers of other types of goods. When these responses were summed and averaged, the responses for the overall self-identity variable were mostly positive (76%). This means that the overall self-identity variable shows participants as identifying with being relatively health conscious, purchasing local food, and being a green consumer.

Table 3.11: Summary Statistics for Self-Identity Responses

Statement	Mean	Percent Positive	Std. Dev
I think of myself as a health conscious consumer.	5.42	82.03	1.21
I consider myself a typical buyer of local food.	4.55	59.38	1.39
I consider myself a green consumer.	4.41	45.31	1.43
Overall Self Identity	4.79	75.97	0.98

3.7 Theory of Planned Behavior Variables

This section contains three tables displaying the summary statistics for the five TPB variables used in some of the Tobit models. The values in these tables were in the previous section. All of the questions were asked on a scale from 1 to 7, with 1 indicating “strongly disagree” and 7 indicating “strongly agree”. To create the percent positive column, answers from 1 to 3 were classified as negative (disagreed), 4 as neutral, and 5 to 7 as positive (agreed), as done in Wu (2012). From there, the percentage of positive responses were calculated and reported in the tables. To create

the overall index for each variable, the responses for the questions related to the given variable were summed, and then the answer was divided by the total number of questions to keep the scale constant, as done in Wu (2012).

Table 3.12 shows the summary statistics for attitude towards local food and attitude towards organic food. The majority of participants, 85.16%, thought local food was good, while 78.13% thought purchasing local food was wise. Since the responses for both of these questions were positive, the overall attitude towards local food was also positive. This means a large majority (83%) of the participants had a positive attitude towards local food. The responses for attitude towards organic food statements were very similar. The majority 81.25%, thought organic food purchases were good and 71.09% thought organic food purchases were wise. This meant the overall response for attitude towards organic food was positive (82%), indicating that the attitudes toward local and organic foods are very similar, and one should expect these variables to have a positive effect on WTP for local and organic food products.

Table 3.12: Summary Statistics for Attitude Towards Local and Organic Food Responses

	Questions	Mean	Percent Positive	Std. Dev
Attitude towards Local Food				
	Local food is bad/good.	5.93	85.16	1.15
	Local food is foolish/wise.	5.70	78.13	1.30
	Overall Attitude towards Local.	5.82	82.95	1.16
Attitude towards Organic Food				
	Organic food is bad/good.	5.76	81.25	1.28
	Organic food is foolish/wise.	5.37	71.09	1.55
	Overall Attitude towards Organic	5.56	82.17	1.33

Table 3.13, below summarizes the statistics for the subjective norm variable. Only 26.56% of participants agreed with the following statement: "I tend to do what people who are important to me think I should do". Only a minority (35%) responded positively to "Most people who are important to me think I should purchase local food". Finally, only 25.78% agreed with the statement "Most people who are important to me think I should purchase organic food". The overall response to the combined subjective norm variable was only 29.46% positive. Since these responses were not very positive one would not expect the subjective norm variable to have a positive effect on WTP for organic and local foods.

Table 3.13: Summary Statistics for Subjective Norm Responses			
Subjective norm	Mean	Percent Positive	Std. Dev.
Most people important to me think I should purchase local food.	3.77	35.16	1.59
I tend to do what people who are important to me think I should do.	3.24	26.56	1.51
Most people important to me think I should purchase organic food.	3.48	25.78	1.57
Overall Subjective Norm	3.5	29.46	1.19

Table 3.14 summarizes the variables related to PBC, which are included in some of the Tobit models in the next chapter. When participants responded to the statement "It's difficult to find local food", only 36% agreed, and when they responded to the statement "Local food is too expensive" only 30% agreed. This means that the majority of participants did not feel they experienced high barriers to obtaining local food. The results for PBC towards organic food were somewhat different. The majority (85%) agreed that organic food is too expensive. However, only 27% agreed that it is difficult to find organic food. Even though participants found it easy to find organic food, the fact that they believed it was too expensive indicates the participants faced some barriers to obtaining organic food. Together this made the overall PBC towards organic food variable only slightly positive (56%).

Table 3.14: Summary Statistics for PBC Towards Local and Organic Food Responses

Variable	Statement	Mean	Percent Positive	Std. Dev.
PBC towards Local				
	It's difficult to find local food.	3.63	35.94	1.64
	Local food is too expensive.	3.76	30.47	1.42
	Overall PBC towards Local	3.7	34.11	1.19
PBC towards Organic				
	Organic food is too expensive.	5.59	85.16	1.28
	It's difficult to find organic food.	3.38	27.34	1.53
	Overall PBC towards Organic	4.48	55.81	1.16

This chapter covered the experimental design, the questionnaire design, hypothesis, planned tests, Tobit models, and the descriptive statistics. The next chapter, will report and briefly discuss the results.

Chapter 4

RESULTS AND DISCUSSION

4.1 Shapiro-Wilk Test

Table 4.1 below shows the results from the Shapiro-Wilk Test, which is used to determine if the data are normally distributed so that the appropriate test can be selected. The null hypothesis of the Shapiro-Wilk Test states that the data is normally distributed ("Data Analysis and Statistical Software"). If the number in the prob > z column of Table 4.1 is greater than 0.10, then the null hypothesis cannot be rejected. According to the Shapiro-Wilk Test, there were five variables where the null hypothesis could not be rejected. These variables include the following: “Free range chicken bids when offered with conventional”, “Free range chicken bids when offered with organic”, “Organic ice cream bids when six options were offered”, and “Organic ice cream bids when two options were offered”, and “Conventional ice cream bids when two options were offered”. Since these variables were normally distributed, t-tests will be run on the first four normally distributed variables, but not for “Conventional ice cream bids when two options were offered” since its pair was not normally distributed. Wilcoxon Signed Rank tests were run for all pairs since they are appropriate regardless of normality.

Table 4.1: Shapiro-Wilk Test Results				
Variable	Obs	W	Z	Prob> z
Choice steak bids when offered with prime	128	0.98	1.89	0.03
Choice steak when offered with select	128	0.98	1.46	0.07
Free range chicken bids when offered with conventional	128	0.99	0.22	0.41
Free range chicken bids when offered with organic	128	0.99	0.62	0.27
Organic eggs when eight options	128	0.92	4.60	0.00
Organic eggs when two options	128	0.98	1.77	0.04
Conventional eggs when eight options	128	0.82	6.52	0.00
Conventional eggs when two options	128	0.97	2.58	0.00
Decision time per option when two egg options	128	0.85	6.13	0.00
Decision time per option, when two egg options	128	0.94	4.04	0.00
Organic ice cream bids when six options	128	0.99	-0.44	0.67
Organic ice cream bids when two options	128	0.99	0.67	0.25
Conventional ice cream bids when six options	128	0.98	1.29	0.10
Conventional ice cream bids when two options	128	0.99	0.57	0.28
Decision time per option, two ice cream options	128	0.94	4.12	0.00
Decision time per option, six ice cream options	128	0.82	6.49	0.00

4.2 Comparing Means

The first hypothesis of this paper stated that increasing the quality of one of the goods offered in a Vickrey auction would change WTP for the other good. The second hypothesis stated that increasing the number of options offered in a Vickrey auction would significantly decrease WTP. The third hypothesis stated that increasing the number of options offered in a Vickrey auction would increase the amount of time it takes participants to make a decision per option. This set of analyses looked at eight sets of mean comparisons. As explained in the methodology section, these mean

comparisons were used to test these hypotheses. This section contains descriptive statistics for: WTP for a pound of steak, WTP for a pound of chicken, WTP for a dozen eggs, WTP for a pint of vanilla ice cream, decision making time for eggs bids, and decision making time for ice cream bids. These items were discussed in the order listed. First, the WTP means were discussed for each item, followed by the Wilcoxon Signed Rank test and the t-test, both of which indicated if any difference in the means were significant.

4.2.1 Comparing Means: Hypothesis (1)

First, this section examines hypothesis (1). As discussed previously, there were two separate rounds of bids participants made for steak. In one round, they were asked to make bids on choice steak and prime steak. In the other round, they were asked to make bids on choice steak and select steak. Based on the means displayed in table 4.2, one can see that the mean WTP for choice steak was higher when choice was offered with prime than when choice was offered with select. While the significance of this difference in mean WTP has not been determined yet, this does appear to support hypothesis (1) since the mean WTP for choice steak increased when the quality of the other good (prime) was higher than when select was offered. Additionally, from highest mean WTP to lowest mean WTP, the steaks ranked: prime, choice, and then select. This made sense as prime is the highest quality USDA grade followed by choice and then select. Finally as seen in table 4.2, the overall mean WTP for choice steak (when combining both questions) was $6.33, which made sense, as that is between the mean WTP under the two types of steak bids.

Table 4.2: Summary Statistics of Bids for Steak

Bid Description	Variable	Obs	Mean	Std. Dev.	Min	Max
When choice and prime were presented together						
	Choice	128	$6.52	3.49	0	15
	Prime	128	$8.13	4.24	0	15
When choice and select were presented together						
	Choice	128	$6.14	3.46	0	15
	Select	128	$5.17	3.25	0	13
Overall WTP for choice steak						
	Choice	256	$6.33	3.47	0	15

Table 4.3 showed the summary statistics for the chicken bids. As mentioned in chapter 3, the chicken bids were structured similarly to the steak bids. Participants bid for chicken in two separate rounds. In one round, they were asked to bid on free range chicken and organic chicken. In the other round, they bid on free range chicken and conventional chicken. This table showed that when free range chicken and organic chicken were offered together the mean WTP for free range chicken was lower than when free range chicken was offered with conventional chicken. While the numbers reported in this table cannot indicate if this difference in WTP is significant, this difference in mean WTP does appear to support hypothesis (1) since the mean WTP for free range decreased when the quality of the other good offered was higher. The WTP for organic chicken was highest, followed by free range and conventional chicken. This was expected because organic chicken was considered the highest

quality followed by free range and then conventional chicken in the design portion of this paper.

Table 4.3: Summary Statistics of Bids for Chicken

Bid Description	Variable	Obs	Mean	Std. Dev.	Min	Max
When free range and organic were presented together						
	Free Range	128	$3.19	1.52	0	8
	Organic	128	$3.65	1.72	0	10
When free range and conventional were presented together						
	Free Range	128	$3.40	1.64	0	8
	Conventional	128	$2.72	1.44	0	6
Overall WTP for Free Range chicken						
	Free Range	256	$3.30	1.58	0	8

Table 4.4 reports results from the Signed Rank Wilcoxon Test, which indicates whether or not the WTP means previously discussed were significant or not. From the results displayed, one can see that the mean WTP for choice steak when offered with prime steak does not significantly differ from the mean WTP for choice steak when offered with select steak. However, the chicken results were different. The results showed that the mean WTP for free range chicken when offered with conventional chicken does significantly differ from the mean WTP for free range chicken when offered with organic chicken at the 5% level. Since the Shapiro-Wilk Test showed the chicken WTP means were normally distributed, t-tests were also run for this set. The

t-tests also showed the mean WTP for the two sets of bids were significantly different at the 5% level. Therefore, when examining all of this evidence together, the steak rounds do not provide support for hypothesis (1) since the Wilcoxon Signed Rank Test did not find any significant difference in WTP between the two steak rounds. According to the Wilcoxon Signed Rank Test, the chicken WTP did differ between the two chicken rounds. This result in conjunction with the mean WTP for chicken numbers shown indicates that the WTP for free range chicken decreased when the higher quality option was offered (organic rather than conventional chicken). Only the chicken results support hypothesis (1). The chicken bids provided evidence indicating if the quality of one of the goods offered in a Vickrey auction is increased the WTP for the other good will decrease.

Perhaps one potential reason the change in WTP for free range chicken moved in this direction is because free range and organic chicken contain some overlapping similarities in production. Free range chicken is allowed access to the outside, but does not have to meet all the other qualifications of organic chicken. Meanwhile organic chicken producers must allow the chickens access to the outside, as well as follow additional criteria (such as type of feed used). Thus free range is required under the organic label. Maybe WTP for free range chicken decreased rather than increased when offered with organic chicken because participants had a greater preference for the additional qualifications organic chicken must meet and when free range was offered with conventional chicken free range was the best they could do, whereas when organic was the second option they could now do better.

Table 4.4: Wilcoxon Signed Rank Test Results for Steak and Chicken						
Food Product	Sign	Obs	Sum Ranks	Expected	z	Prob >|z|
Choice Steak	Positive	55	4408.5	3864	1.306	0.1915
	Negative	41	3319.5	3864		
	Zero	32	528	528		
	All	128	8256	8256		
Free range Chicken	Positive	62	4963	3965.5	2.382	0.0172
	Negative	41	2968	3965.5		
	Zero	25	325	325		
	All	128	8256	8256		

4.2.2 Comparing Means: Hypothesis (2)

This next section examined hypothesis (2). To test this, first the mean WTP in the egg and ice cream bids were examined. Then the Wilcoxon Signed Rank Tests were used to determine if any of the differences in mean WTP were significant. Table 4.5 below shows the summary statistics for the egg bids. As discussed earlier, the egg and ice cream bids were structurally different than the steak and chicken bids, which was key to examining the second objective of this paper and hypothesis (2). Participants were asked to make two rounds of bids for eggs. In one round, they were asked to place their bids for a dozen organic and conventional eggs. In the other round, they were asked to place their bids for eight types of eggs: organic, conventional, local, omega 3, free range, vegetarian fed, pasture raised, and cage free. In Table 4.5 one sees that the mean WTP for organic and conventional eggs was higher when they were the only two options offered than when all eight types of eggs were offered. While one cannot tell if this difference is statistically significant yet,

this does appear to support hypothesis (2). The Wilcoxon Signed Rank Tests discussed later will indicate if this difference in WTP was indeed significant.

Table 4.5: Summary Statistics of Bids for Eggs

Bid Description	Variable	Obs	Mean	Std. Dev.	Min	Max
When two types of options were offered	Organic	128	$2.91	1.34	0	7
	Conventional	128	$2.02	1.05	0	6
When all eight types of options were offered						
	Organic	128	$2.81	1.46	0	10
	Conventional	128	$1.83	1.12	0	9
Overall WTP for organic and conventional Eggs						
	Organic	256	$2.86	1.4	0	10
	Conventional	256	$1.92	1.1	0	9

Table 4.6 shows the mean WTP for the ice cream bids. Since the ice cream bids were also designed to explore the second objective and tests hypothesis (2), the structure of the ice cream bids was similar to the egg bids. However, in one round of the ice cream bids, participants were offered two types of ice cream (organic and conventional), and in the other rounds of bids, they were asked to bid on six types of ice cream instead of eight types as in the egg rounds. Table 4.6 also showed the mean WTP for organic and conventional ice cream from these two rounds. For both organic and conventional ice cream, the mean WTP fell when the number of options was increased from just organic and conventional to all six types of ice cream. While the

difference appears to be small and in support of hypothesis (2), the Wilcoxon Signed Rank Tests shown in the following tables will determine if this difference was significant.

Table 4.6: Summary Statistics of Bids for Ice Cream

Bid Description	Variable	Obs	Mean	Std. Dev.	Min	Max
When two types of options were offered	Organic	128	$3.16	1.39	0	7
	Conventional	128	$2.28	1.00	0	5
When all eight types of options were offered						
	Organic	128	$3.12	1.39	0	7
	Conventional	128	$2.23	1.05	0	6
Overall WTP for Organic and Conventional						
	Organic	256	$3.14	1.39	0	7
	Conventional	256	$2.26	1.02	0	6

Table 4.7 shows the Wilcoxon Signed Rank Tests for the egg and ice cream rounds and tests hypothesis (2) which stated that increasing the number of options offered in a Vickrey auction would decrease WTP for food products. This table shows the four sets of mean WTP compared. The first set shows the results for the mean WTP for organic eggs when all eight types of options were offered and the mean WTP for organic eggs when only two types of eggs were offered. In this case, the differences in mean WTP were not significant at the 10% level. However, the table did show the mean WTP for conventional eggs when eight types of eggs were offered

did significantly differ from the mean WTP for conventional eggs when only two types of eggs were offered. This difference was significant at the 1% level.

The mean WTP for organic ice cream when only two types of options were offered did not significantly differ from the mean WTP for organic ice cream when six types of ice cream were offered. Since the organic ice cream WTP means were found to be normally distributed under the Shapiro-Wilk Test, a t-test was also conducted and the results also showed no significant difference between the WTP means. Finally, the table shows the mean WTP for conventional ice cream when only two types of options were offered does not significantly differ from the mean WTP for conventional ice cream when six types of ice cream were offered.

Since the WTP means shown in table 4.6, indicated the WTP for conventional eggs fell when the number of options was increased from two to eight, this provided support for hypothesis (2), but the other three goods did not have any significant changes in WTP between rounds and therefore did not support hypothesis (2). These results indicate that while it does not always occur, sometimes WTP for a food product can decrease when the number of options offered increase. It is interesting that the WTP for either of the organic products did not change, whereas the WTP for one of the conventional products (eggs) was significantly affected. Perhaps the WTP for conventional eggs fell when additional types of eggs were offered because the additional varieties were products that contained some but not all aspects of organic eggs. On the other hand, the same did not happen to the WTP for conventional ice cream. However, the ice cream bids only increased from 2 to 6 rather than 2 to 8 as in

the egg bids, so maybe there was not a large enough increase in options offered to see a significant effect on WTP for conventional ice cream.

Table 4.7: Wilcoxon Signed Rank Test Results for Eggs and Ice Cream

Food Product	Sign	Obs	Sum Ranks	Expected	z	Prob >|z|
Organic Eggs	Positive	40	3193	3830.5	-1.532	0.1256
	Negative	54	4468	3830.5		
	Zero	34	595	595		
	All	128	8256	8256		
Conventional Eggs	Positive	36	2691.5	3925	-2.950	0.0032
	Negative	64	5158.5	3925		
	Zero	28	406	406		
	All	128	8256	8256		
Organic Ice Cream	Positive	47	3720.5	3895.5	-0.419	0.6750
	Negative	51	4070.5	3895.5		
	Zero	30	465	465		
	All	128	8256	8256		
Conventional Ice Cream	Positive	36	3193	3564	-0.906	0.3649
	Negative	45	3935	3564		
	Zero	47	1128	1128		
	All	128	8256	8256		

4.2.3 Comparing Means: Hypothesis (3)

While collecting the two egg and ice cream bids, data was also collected on how long it took them to make their bids. This data was used to explore the third objective and test hypothesis (3), which stated that increasing the number of options

offered in a Vickrey auction would increase the average amount of time it takes participants to make a decision per option offered. Table 4.8 shows the summary statistics for decision making time with two options and decision making time with all eight options. When the participants were offered organic and conventional eggs, participants on average took 19.12 seconds to submit their bids. This is the equivalent of 9.56 seconds per option. When the participants were asked to make bids on all eight types of eggs, participants took an average of 76.47 seconds to submit their bids. However this average was equivalent to 9.56 seconds per option, so the mean decision time per option is the same between the two sets of bids. A Wilcoxon Signed Rank Test was conducted and confirmed that the mean decision time per option did not significantly differ. These results are shown later in this section.

Table 4.8: Decision Making Time (in Seconds) During Egg Auction Rounds

Bid Description	Variable	Obs	Mean	Std. Dev.	Min	Max
When only 2 types of options were offered						
	Total	128	19.12	10.95	3.89	68.74
	Per Option	128	9.56	5.48	1.95	34.37
When all 8 types of options were offered						
	Total	128	76.47	35.72	11.88	204.27
	Per Option	128	9.56	1.47	1.48	25.53

Since table 4.8 also showed an interesting difference between the standard deviations for decision making time when two types of options were offered and decision making time when eight types of options were offered, figures 4.1 and 4.2 show the distributions of these variables. Both appear to be skewed to the left, with decision making time per option when only two options were offered showing a longer rightward tail than decision making time per option when all eight options were offered. Based on this graph, it seems the difference in standard deviations is mostly due to the two participants who took between 30 and 35 seconds when only two options were offered.

Figure 4.1: Distribution of Decision Making Time per Option when Two Types of Eggs were Offered

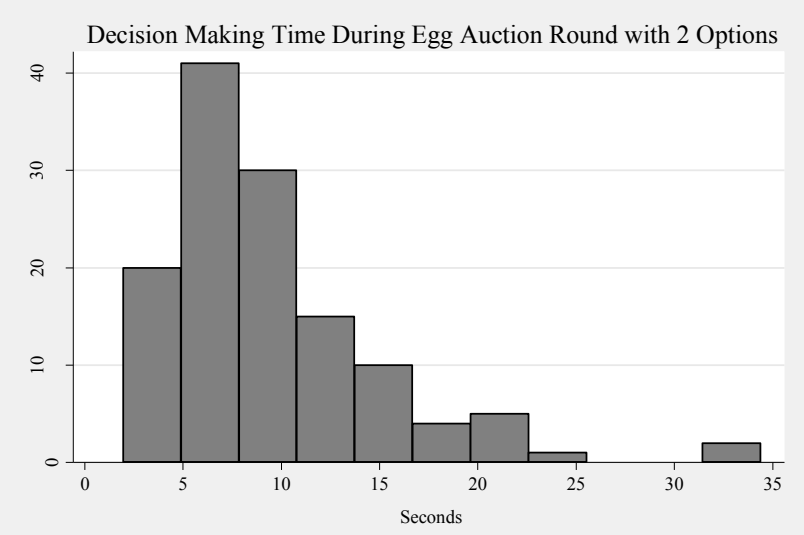
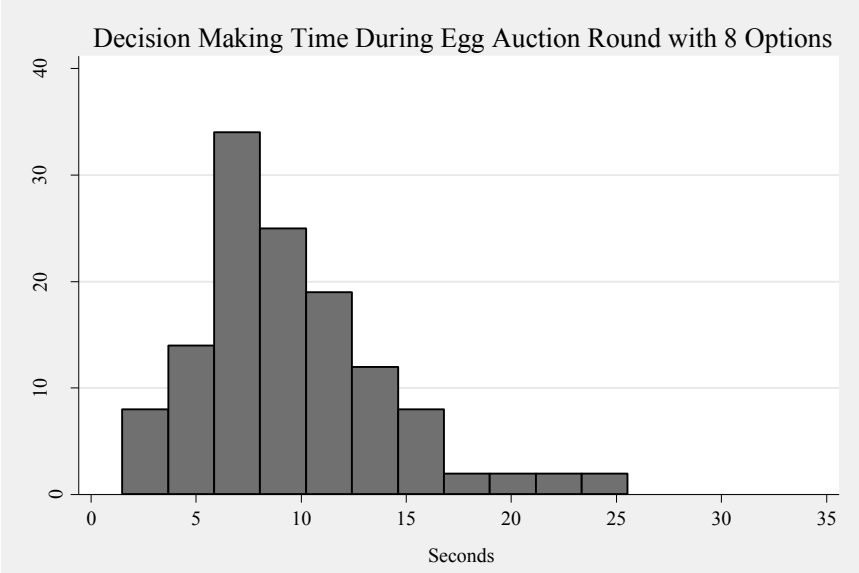


Figure 4.2: Distribution of Decision Making Time per Option when Eight Types of Eggs were Offered



Tables 4.9 shows the summary statistics for decision making time during the ice cream rounds. One can see that when only organic and conventional ice cream were offered it took participants an average of 16.60 seconds to submit their bids, yielding an average time per option of 8.30 seconds. When all six types of ice cream were offered it took the participants an average of 50.82 seconds to submit their bids. This equates to an average of 8.47 seconds per option. Therefore, the average decision making time per option was 0.17 seconds longer when participants had to make bids on six types of ice cream than when they had to make bids on two types of ice cream. This does not seem to be a large difference, but the Wilcoxon Signed Rank Tests shown later on will determine whether or not this difference was significant.

Table 4.9: Decision Making Time (in Seconds) During Ice Cream Auction Rounds

Decision Making Time	Variable	Obs	Mean	Std. Dev.	Min	Max
When only 2 types of options were offered						
	Total	128	16.6	7.74	3.95	45.87
	Per Option	128	8.3	3.87	1.97	22.93
When all 8 types of options were offered						
	Total	128	50.82	26.65	9.38	180.47
	Per Option	128	8.47	4.44	1.56	30.08

Since table 4.9 also showed an interesting difference between the standard deviations for decision making time when two types of options were offered and decision making time when six types of options were offered, figures 3 and 4 show the

distributions of these variables. Both appear to be skewed to the left, with decision making time per option when six options were offered showing a longer rightward tail than decision making time per option when only two options were offered. Based on this graph, it seems there was a wider spread in decision making time per option when all six options were offered than when only two options were offered.

Figure 4.3: Distribution of Decision Making Time per Option when Two Types of Ice Cream were offered

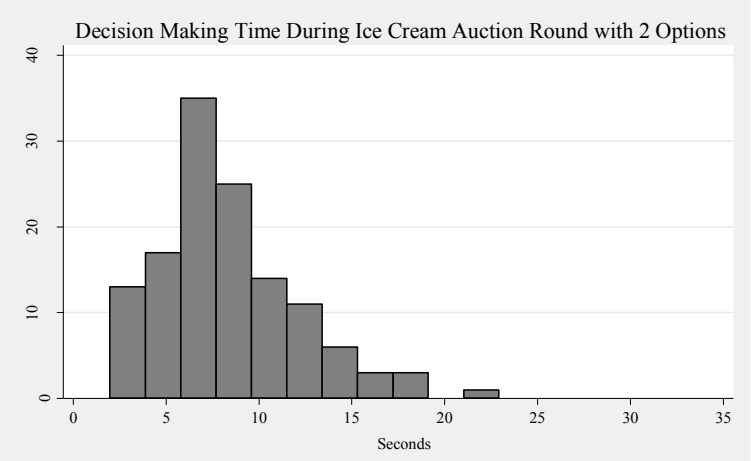


Figure 4.4: Distribution of Decision Making Time per Option when Eight Types of Ice Cream were offered

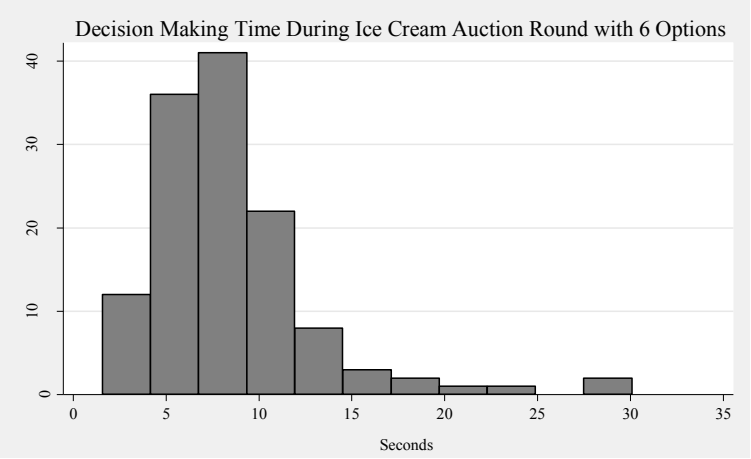


Table 4.10 is the final table for the Wilcoxon Signed Rank tests. This table tests hypothesis (3), which states that increasing the number of options offered in a Vickrey auction will increase the amount of time per option it takes participants to make a decision. First this table shows the results for comparing the mean decision making time per option when participants were offered two types of eggs and the mean decision making time per option when participants were asked to bid on all eight types of eggs. There was no significant difference between those means. The next part of this table shows that there was also no significant difference between the mean decision making time per option when only two types of ice cream were offered and the mean decision making time per option when participants were asked to bid on all six types of ice cream. These results provide rather strong evidence against hypothesis (3). This result was rather surprising. One possible explanation stems from a study by Reutskaja et al. (2011). In the literature review it was stated that this study found when time pressure was increased in the form of more options, participants focused on each product for less time and increased their searching time. While the participants were not under pressure in this situation, perhaps they still decreased their focus time for each individual product, which resulted in no significant change in decision making time per option.

Table 4.10: Wilcoxon Signed Rank Test Results for Decision Making Time						
Decision Making Time	Sign	Obs	Sum Ranks	Expected	z	Prob >|z|
Decision time per option for eggs	Positive	62	4035	4128	-0.221	0.8250
	Negative	66	4221	4128		
	Zero	0	0	0		
	All	128	8256	8256		
Decision time per option for ice cream	Positive	65	4137	4128	0.021	0.9829
	Negative	63	4119	4128		
	Zero	0	0	0		
	All	128	8256	8256		

4.3 Tobit Models

As discussed in the methodology section of this paper, 11 different Tobit models were used to test three of the hypotheses: (1), (2), and (4). Hypothesis (1) looks at the effect of changing the quality of the options offered on WTP and this is what regression (1) tests. As discussed in section 3.4: Models, model (1) showed WTP for choice steak as a function of the quality of the other option offered (prime or select steak) among other independent variables. This section also noted that since the types of steak offered were not labeled as local or organic the TPB variables could not be included in this regression. Table 4.11 shows the results from model (1). Recalling that prime steak is a dummy variable which is equal to one when prime steak was offered and 0 when select steak was offered, one can see this independent variable did not significantly affect WTP for choice steak. Being the primary shopper of one's

household had a negative effect on WTP for choice steak. This effect was significant at the 5% level. Having children had a significant effect at the 10% level and positively influenced WTP for choice steak. As expected, being a vegetarian negatively affected WTP for choice steak at the 10% level, and finally, FFI had a positive effect at the 10% level. The rest of the independent variables did not have a significant effect. In conclusion, similarly to the Wilcoxon Signed Rank test results for choice steak, regression (1) does not provide support for hypothesis (1).

Table 4.11: WTP for Choice Steak

Regression (1)

Variable	Coefficient	P value
Constant	8.6578**	0.001
prime	0.4016	0.377
age	-0.016	0.35
female	-0.218	0.637
primary shopper	-1.4404**	0.004
children	0.7444*	0.091
farming	0.5897	0.254
vegetarian	-2.9186*	0.058
Caucasian	0.1991	0.771
income	0.0000	0.993
education	-0.1258	0.59
Delaware	-1.109	0.131
FFI	0.6161*	0.081
Selfid	-0.5902**	0.028

Note: Significant at 0.05 **; Significant at 0.10 *

The results from regressions (2) and (3) can be seen in table 4.12 below. They test hypothesis (1) as well, but in addition they test hypothesis (4). Hypothesis (4) states that including TPB variables will improve the predictive power of the Tobit models. These regressions both regress the WTP for free range chicken as a function of organic chicken among other independent variables. It is important to recall organic chicken is a dummy variable indicating if organic or conventional chicken was offered with the free range chicken. The only difference between regression (2) and regression (3) is that regression (3) contains related TPB variables whereas regression (2) does not. In regression (2) organic chicken did not have a significant effect on WTP for free range chicken. Age had a negative effect and was significant at the 5% level. Again, vegetarian had a negative effect. It was significant at the 10 % level. Being Caucasian was positively significant at the 5% level. Finally, FFI was positive and significant at the 5%. The rest of the independent variables did not have a significant effect. Regression (3) had very similar results for all the non-TPB variables and all of the TPB variables had a significant effect. Attitude toward organic food had a positive effect at the 10% level. PBC towards organic food had a positive effect and was significant at the 5% level. Finally, socialnorm had a negative effect and was significant at the 10% level. Based on these results, these regressions did not provide support for hypothesis (1). It is unclear why, but the results regarding hypothesis (1) from regression (2) and (3) are worth noting as they contradict the Wilcoxon Signed Rank test for free range chicken, which found that offering organic chicken rather than conventional chicken resulted in a decreased WTP for free range chicken. Additionally, regression (3) provided support for hypothesis (4), as all of the

TPB variables had a significant effect this indicates that adding TPB variables may have an impact on the predictive power of the regression. However, the rest of the Tobit models related to hypothesis (4) need to be addressed before a final decision can be made about the accuracy of hypothesis (4).

Table 4.12: WTP for Free Range Chicken

		Regression (2)		Regression (3)	
Category	Variable	Coefficient	P value	Coefficient	P value
	Constant	1.1923	0.203	-0.5688	0.586
	Organic Chicken	0.2045	0.275	0.2054	0.260
Demographics	Age	-0.0211**	0.001	-0.0205**	0.001
	Female	0.1219	0.578	0.0205	0.926
	Primary Shopper	-0.2813	0.236	-0.3585	0.133
	Children	0.0081	0.969	0.063	0.766
	Farming	-0.2068	0.335	-0.2145	0.329
	Vegetarian	-1.4630**	0.011	-1.5886**	0.003
	Caucasian	0.6555**	0.011	0.7213**	0.005
	Income	0.0000	0.983	-0.0004	0.812
	Education	0.0597	0.763	0.0945	0.621
	Delaware	-0.1998	0.465	-0.1956	0.439
	FFI	0.6471**	0.000	0.6569**	0.000
	Selfid	-0.0926	0.420	-0.0604	0.616
TPB	Orgatt			0.1527*	0.042
	PBCorg			0.2201**	0.007
	Socialnorm			-0.0573*	0.101
	Note: Significant at 0.05 **; Significant at 0.10 *				

The rest of the regressions in this thesis were testing hypothesis (2) and (4). Regression (4) and (5) both regressed the WTP for organic eggs as a function of the number of options offered and other independent variables. The two regressions are the same, except regression (5) contains related TPB variables. The results from these two regressions are shown in table 4.13. In both regressions, the number of options did not have a significant effect. Being a female and/or the primary shopper of one's household had negative coefficients and were significant at the 5% level. Being a vegetarian only had a significant effect in regression (5). Finally, income was more significant in regression (5) than in regression (4). Additionally, only one of the TPB variables in regression (5) was significant. Attitude towards organic food had a positive coefficient and was significant at the 5% level. Based on these results it can be concluded that neither of these regressions provide support for hypothesis (2). Additionally, regression (5) partially supports hypothesis (4), because only one of the TPB variables had a significant effect and vegetarian becomes significant when the TPB variables are included in regression (5). This change in the significance of vegetarian indicates that including the TPB variables have eliminated some bias in the regression.

Table 4.13: WTP for Organic Eggs

		Regression (4)		Regression (5)	
Category	Variable	Coefficient	P value	Coefficient	P value
	Constant	2.7334**	0.006	1.7848	0.128
	Fewer Egg Options	0.0994	0.559	0.0986	0.546
Demographics	Age	-0.0231**	0.001	-0.0198**	0.002
	Female	0.1258	0.490	0.1842	0.305
	Primary Shopper	-0.5840**	0.004	-0.6107**	0.002
	Children	-0.1189	0.515	-0.1795	0.326
	Farming	-0.1186	0.547	0.0124	0.948
	Vegetarian	-0.4491	0.272	-0.7320**	0.031
	Caucasian	0.1537	0.477	0.2912	0.172
	Income	-0.0027*	0.064	-0.0031**	0.025
	Education	0.1690	0.384	0.1922	0.319
	Delaware	0.1283	0.570	0.0951	0.667
	FFI	0.1668	0.254	0.1876	0.178
	Selfid	0.0896	0.351	-0.0465	0.669
TPB	Localatt			-0.0861	0.422
	Orgatt			0.2976**	0.000
	PBCorg			-0.0628	0.463
	PBCloc			0.0867	0.274
	Socialnorm			0.0227	0.546

Note: Significant at 0.05 **; Significant at 0.10 *

Table 4.14 shows the results from regressions (6) and (7). The framework for these two regressions were exactly the same as regressions (4) and (5), except this time the regressions looked at WTP for conventional eggs instead of WTP for organic eggs. Number of options did not have a significant effect in either regression. The coefficient for age and vegetarian were negatively significant at the 5% level for both regressions. FFI only had a significant effect in regression (7). The coefficient was

negative and significant at the 10% level. Additionally, only one TPB variable was significant in regression (7). Attitude towards local food was positively significant at the 5% level. Again, neither of these regressions support hypothesis (2) and regression (7) only provides minimal support for hypothesis (4) since only one TPB variable was significant. While neither of these regressions provide support for hypothesis (2), the Wilcoxon Signed Rank Test was contradictory. It showed that the mean WTP for conventional eggs when 2 options were offered was significantly different from the mean WTP when 8 options were offered.

Table 4.14: WTP for Conventional Eggs

		Regression (6)		Regression (7)	
Category	Variable	Coefficient	P value	Coefficient	P value
	Constant	3.3385**	0.000	2.3198**	0.029
	Fewer Egg Options	0.1871	0.154	0.1874	0.143
Demographics	Age	-0.0178**	0.001	-0.0211**	0.000
	Female	-0.1442	0.370	-0.192	0.248
	Primary Shopper	-0.1951	0.263	-0.1408	0.454
	Children	-0.0945	0.491	-0.0999	0.455
	Farming	0.0040	0.978	-0.1491	0.387
	Vegetarian	-1.2128**	0.000	-0.9263**	0.003
	Caucasian	0.0017	0.992	-0.0003	0.998
	Income	-0.0002	0.847	0.0007	0.532
	Education	-0.0333	0.829	-0.0028	0.985
	Delaware	-0.1014	0.607	-0.1508	0.420
	FFI	-0.1376	0.204	-0.1763*	0.088
	Selfid	0.0578	0.556	-0.0297	0.737
TPB	Localatt			0.2001**	0.004
	Orgatt			0.0124	0.790
	PBCorg			0.0995	0.218
	PBCloc			-0.0312	0.588
	Socialnorm			0.0411	0.264

Note: Significant at 0.05 **; Significant at 0.10 *

Regressions (8) and (9) were designed to test hypotheses (2) and (4). They were identical except regression (9) contains TPB variables. They both regressed WTP for organic ice cream as a function of the number of options offered among other independent variables. The results between the two regressions were rather similar and are shown in table 4.15. Fewer Ice Cream Options did not have a significant effect in either regression. Age had a negative effect significant at the 5% level in

both regressions. Caucasian and Education were also significant at the 5% level and had a positive effect in both regressions. Finally, FFI had a positive effect which was significant at the 10% level in both regressions and of the TPB variables included in regression (9), only orgatt had a significant effect at the 10% level. Since Fewer Ice Cream Options did not have a significant effect these regressions did not support hypothesis (2). Additionally, since the results in regression (8) and (9) were so similar and only one of the TPB variables included in regression (9) was significant, these regressions only provided minimal support for hypothesis (4).

Table 4.15: WTP for Organic Ice Cream

		Regression (8)		Regression (9)	
Category	Variable	Coefficient	P value	Coefficient	P value
	Constant	1.8051**	0.019	1.7699*	0.06
	Fewer Ice Cream Options	0.0397	0.809	0.0391	0.809
Demographics	Age	-0.0299**	0.000	-0.0269**	0.000
	Female	-0.0605	0.749	-0.0375	0.846
	Primary Shopper	-0.2568	0.186	-0.2623	0.187
	Children	0.2066	0.264	0.1566	0.390
	Farming	0.0803	0.679	0.1675	0.407
	Vegetarian	0.1393	0.683	-0.0844	0.802
	Caucasian	0.4924**	0.016	0.5816**	0.005
	Income	0.0016	0.336	0.0012	0.428
	Education	0.4417**	0.021	0.4242**	0.026
	Delaware	0.2904	0.273	0.3187	0.223
	FFI	0.2269*	0.058	0.2218*	0.066
	Selfid	0.1049	0.292	0.0547	0.639
TPB	Localatt			-0.1076	0.232
	Orgatt			0.1871*	0.005
	PBCorg			-0.0386	0.635
	PBCloc			-0.0339	0.672
	Socialnorm			-0.0004	0.991

Note: Significant at 0.05 **; Significant at 0.10 *

The set up for regression (10) and (11) was exactly the same as the frame work for regression (8) and (9) except (10) and (11) looked at WTP for conventional ice cream rather than organic ice cream. The results for regression (10) and (11) are in table 4.16. In both regressions age had a negative effect that was significant at the 5% level. In regression (10), the coefficient for vegetarian was negative and significant at

the 10% level, however vegetarian was not significant in regression (11). Finally, two of the TPB variables included in regression (11) were significant. Attitude towards local food had a positive effect and was significant at the 5% level and social norm was significant at the 10% level. Neither regression provided support for hypothesis (2) and regression (11) only provided some support for hypothesis (4) as two of the TPB variables had a significant effect.

Table 4.16: WTP for Conventional Ice Cream

		Regression (10)		Regression (11)	
Category	Variable	Coefficient	P value	Coefficient	P value
	Constant	2.8847**	0.000	2.5861**	0.001
	Fewer Ice Cream Options	0.0570	0.647	0.0572	0.640
Demographics	age	-0.0203**	0.000	-0.0233**	0.000
	female	-0.0592	0.698	-0.0685	0.657
	primary shopper	-0.2313	0.143	-0.1748	0.256
	children	0.1431	0.310	0.1306	0.341
	farming	0.0749	0.584	-0.0456	0.750
	Vegetarian	-0.5425*	0.087	-0.2596	0.337
	Caucasian	0.1719	0.259	0.1376	0.371
	income	0.0010	0.393	0.0019	0.135
	education	0.1740	0.230	0.1903	0.166
	Delaware	0.0863	0.651	0.0432	0.820
	FFI	-0.0061	0.952	-0.0354	0.728
	Selfid	-0.0101	0.904	-0.0810	0.354
TPB	localatt			0.1720**	0.012
	orgatt			-0.0557	0.254
	PBCorg			0.0148	0.812
	PBCloc			-0.0140	0.811
	socialnorm			0.0426*	0.089

Note: Significant at 0.05 **; Significant at 0.10 *

This chapter employed a variety of tests to explore the four main objectives of this paper. It showed results from the Shapiro-Wilk Test, compared means using the Wilcoxon Signed Rank Test, and 11 different Tobit models. This chapter focused mainly on reporting the results. The next chapter will further explore these results by discussing what these results mean, why certain hypotheses did not hold, the implications of these findings, and the potential for future studies.

Chapter 5

CONCLUSION

There were four objectives of this thesis. The first objective was to investigate if increasing the quality of one of the goods offered in a Vickrey auction had an effect on WTP for the other food product. This thesis hypothesized that increasing the quality of one of the goods offered in a Vickrey auction would have altered WTP for the other good. The second objective was to examine if increasing the number of options offered in a Vickrey auction affects WTP for food products. It was hypothesized that increasing the number of options offered would decrease WTP. The third objective was to explore if increasing the number of options offered in a Vickrey auction increases the amount of time it takes participants to make a decision per option. This paper hypothesized that increasing the number of options offered in a Vickrey auction would lead to an increase in the amount of time it takes participants to make a decision per option. The fourth and final objective of this paper was to see if including TPB variables related to local and organic food in Tobit models improves the predictive power of the models. It was hypothesized that including the TPB variables would improve the predictive power of the Tobit models. T-tests, Wilcoxon Signed Rank tests, and Tobit regressions were used to test these hypotheses.

Only one of the results supported hypothesis (1). The rest of the results did not support hypothesis (1). The Wilcoxon Signed Rank test that did support hypothesis (1) showed that the WTP for free range chicken fell when the quality of the other good offered increased. In other words, that result indicated that the mean WTP for free range chicken decreased when the quality of the second option offered increased.

One possible explanation for this direction of change in WTP stems from the fact that the key quality difference between organic and free range chicken is not necessarily based on a difference in taste, but rather a difference in production regulations. The production regulations for organic chicken include allowing the chickens access to the outdoors (as required for free range chicken), but it also imposes additional restrictions to production methods. Perhaps the WTP for free range chicken decreased rather than increased because of overlapping qualities between free range and organic chicken (the higher quality option). Maybe participants placed greater importance on the additional restrictions to production methods required for organic chicken than the free range aspect and when conventional chicken was the only other option they were willing to pay more for free range chicken because that was their best option, but when organic chicken was the other option they were now able to achieve an even better outcome and thus were willing to pay less for free range chicken.

This thesis concludes that researchers should be aware that the quality of options offered in a set could influence WTP and recommends future studies further investigate this issue. One idea for future study would be to examine if there is a difference in effect on WTP when using non-conventional food options to vary the

quality of options offered, when compared to using other aspects of quality such as taste or freshness. Since this study was limited to solely meat products when examining for hypothesis (1), future studies might also investigate the effect of altering the quality of options offered using other types of food products. For example, perhaps different results would occur when examining produce or processed foods.

The results related to hypothesis (2) were also somewhat conflicting. Again only one of the Wilcoxon Signed Rank test supported this hypothesis. The rest of the tests did not show any significant difference in WTP when increasing the number of options offered. Since Wilcoxon Signed Rank test found a significant decrease in WTP for conventional eggs when the number of options increased from 2 to 8, but neither of the ice cream products had a significant change in WTP between 2 options offered and 6 options offered, perhaps there would have been more evidence in support of hypothesis (2) if the increase in the number of options offered was larger. This thesis concludes that researchers should be aware of the potential to alter WTP bids based on the number of options offered. Future studies should investigate further. They could replicate this premise, but offer more options to see if this leads to a large change in WTP. Additionally, this thesis was limited to bids for eggs and ice cream. Future studies could investigate other types of food products. Does it make a bigger difference for other types of food products?

The third hypothesis of this paper stated that increasing the number of options offered in a Vickrey auction would lead to an increase in the amount of time it takes participants to make a decision. While the overall amount of decision time increased,

the amount of decision time per option did not. While this result seems rather counter intuitive, an eye tracking study by Reutskaja et al. (2011) provides some insight. This study found when time pressure was increased in the form of more options (note the time limit remained constant as the number of options increased), participants focused on each product for less time and instead increased their searching time. Initially this study theorized that the effect in this experiment would be different because there was no time limit imposed on these participants, but maybe the participants still behaved similarly to the participants in Reutskaja's study. Perhaps the participants felt internal pressure and increased their scanning time to speed up the decision making process.

It is impossible to know if the participants altered their searching time while not under time pressure because this study was limited by a lack of eye tracking data. Future studies should replicate this premise and track participants' eye movements to gather more information on how people respond to an increase in the number of options offered without an imposed time limit.

The final hypothesis said that including the TPB variables related to local and organic food products in Tobit models would improve the predictive power of the Tobit models. Since this hypothesis could not be rejected, this study implies that future studies should consider adding variables related to the TPB as they could influence the results.

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Appendix A

DEFINITIONS FOR VARIOUS POSSIBLE LABELS ON EGGS

Cage-free:
Hens are not kept in cages, though there are no regulations to govern care beyond that.

Free-range:
From hens that have access to nesting boxes, open floor space, perches and outdoor runs.

Organic:
Follow all the standards for organic we discussed

Omega-3:
Produced by hens fed a diet rich in omega-3 fatty acids (for example, flax seed).

Pasture or Pasture-raised hens:
Birds are raised outdoors using moveable enclosures located on grass and fed an organic diet (without hormones or non-organic additives) and/or raised without antibiotics (drugs that are intended to prevent or treat animal illnesses). Hens are able to eat a wide variety of the natural foods for chickens such as greens and grubs.

Vegetarian Fed:
Hens are fed a special feed containing ingredients of plant origin only.

Appendix B

QUESTIONNAIRE/EXPERIMENT

Q.1 Please rate your agreement with the following statements

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
I enjoy cooking	O	O	O	O	O	O	O
I like to try new foods	O	O	O	O	O	O	O
I like shopping for food or cooking supplies	O	O	O	O	O	O	O
I think I have a very healthy diet	O	O	O	O	O	O	O
Food quality is more important than price	O	O	O	O	O	O	O
I am loyal to my favorite brand foods	O	O	O	O	O	O	O
When I travel, I enjoy trying area specialties	O	O	O	O	O	O	O
I don't have the time to eat or cook like I'd like to	O	O	O	O	O	O	O
I rarely talk about food	O	O	O	O	O	O	O

Q.2 Please rate your agreement with the following statements

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
I grow a lot of my food in my garden	O	O	O	O	O	O	O
My family and friends turn to me for advice on foods and cooking	O	O	O	O	O	O	O
I prefer 'comfort food' to trendy food	O	O	O	O	O	O	O
I eat out a lot	O	O	O	O	O	O	O
The latest food and cooking trends matter to me	O	O	O	O	O	O	O
I like to watch food and cooking shows	O	O	O	O	O	O	O
I eat mainly just to satisfy my hunger	O	O	O	O	O	O	O
I like to try new recipes	O	O	O	O	O	O	O

Q.3 What is your gender?

O Male
O Female

Q.4 What is your age?

Q.5 What is your ethnicity?

O White, not of Hispanic origin
O Black or African American
O Hispanic or Latino
O American Indian or Alaskan Native
O Asian
O Other (please specify)

Q.6 What is your total household income?

O Less than $10,000
O $10,000 to $14,999
O $15,000 to $24,999
O $25,000 to $34,999
O $35,000 to $49,999
O $50,000 to $74,999
O $75,000 to $99,999
O $100,000 to $149,999
O $150,000 to $199,999
O $200,000 or more

Q.7 What is your highest education
youhave completed?

- O Less than High School
- O High School
- O Some College
- O College
- O Post Graduate

Q.8 What state do you live in?

- O DE
- O MD
- O NJ
- O PA
- O Other

Q.9 Are you the primary shopper in your household?

- O Yes
- O No

Q.10 Do you have children under 18 in your household?

- O Yes
- O No

Q.11 Have you lived or ever worked on a farm?

- O Yes
- O No

Q.12 Are you a vegetarian?

- O Yes
- O No

Q.13 Please enter your bid for each of the following versions of 1 lb of boneless, skinless, chicken breasts

	Bids
Free Range	
Conventional	

Q.14 Please enter your bids for each of the following versions of 1 lb of boneless, skineless, chicken breasts

	Bids
Free Range	
Organic	

Q.15 Please enter your bids for each of the following versions of 1lb of Boneless Top Loin Steak

	Bids
Choice	
Prime	

Q.16 Please enter your bids for each of the following versions of 1lb of Boneless Top Loin Steak

	Bids
Choice	
Select	

Q.17 Please enter your bids for each of the following versions of one dozen of Grade A Large eggs

	Bids
Organic	
Cage free	
Omega-3	
Pasture raised (Pastured)	
Free range	
Local	
Conventional	
Vegetarian Fed	

Q.18 Please enter your bids for each of the following versions of one dozen of Grade A large eggs

	Bids
Organic	
Conventional	

Q.19 Please enter your bids for each of the following versions of a pint of Vanilla Ice Cream

	Bids
Organic	
Cows grass-fed	
Cows not treated with antibiotics	
Cows not treated with growth hormones	
Local	
Conventional	

Q.20 Please enter your bids for each of the following versions of a pint of Vanilla Ice Cream

	Bids
Organic	
Conventional	

Q.11 When you are purchasing food, how important is it to you that you are:

	Very Unimportant	Unimportant	Somewhat Unimportant	Neutral	Somewhat Important	Important	Very Important
Obtaining fresher food	O	O	O	O	O	O	O
Purchasing better tasting food	O	O	O	O	O	O	O
Improving my health and the health of my family	O	O	O	O	O	O	O
Supporting small family farms	O	O	O	O	O	O	O
Improving animal welfare	O	O	O	O	O	O	O
Reducing gasoline consumption due to transportation (lower food miles)	O	O	O	O	O	O	O
Supporting the rural community	O	O	O	O	O	O	O
Purchasing safer food	O	O	O	O	O	O	O

Developing personal relationship with farmers	O	O	O	O	O	O	O
Getting better quality food	O	O	O	O	O	O	O
Benefiting the environment	O	O	O	O	O	O	O
Supporting sustainable farming practices	O	O	O	O	O	O	O

able to tell where the food is from	O	O	O	O	O	O	O

Appendix C

CITI TRAINING REPORT

COURSEWORK REQUIREMENTS REPORT*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Audrey Peo (ID: 4311463)
- **Email:** ajp@udel.edu
- **Institution Affiliation:** University of Delaware (ID: 1198)
- **Phone:** 3027571477

- **Curriculum Group:** Course In The Protection Human Subjects
- **Course Learner Group:** Human Subjects Protections - Social-Behavioral-Educational Focus - All UD Researchers/Faculty/Staff
- **Stage:** Stage 1 - Basic Course

- **Report ID:** 13785468
- **Completion Date:** 08/27/2014
- **Expiration Date:** 08/26/2017
- **Minimum Passing:** 85
- **Reported Score*:** 96

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
Belmont Report and CITI Course Introduction (ID: 1127)	08/27/14	3/3 (100%)
Students in Research (ID: 1321)	08/27/14	9/10 (90%)
History and Ethical Principles - SBE (ID: 490)	08/27/14	5/5 (100%)
Defining Research with Human Subjects - SBE (ID: 491)	08/27/14	5/5 (100%)
The Federal Regulations - SBE (ID: 502)	08/27/14	5/5 (100%)
Assessing Risk - SBE (ID: 503)	08/27/14	5/5 (100%)
Informed Consent - SBE (ID: 504)	08/27/14	5/5 (100%)
Privacy and Confidentiality - SBE (ID: 505)	08/27/14	5/5 (100%)
Research with Prisoners - SBE (ID: 506)	08/27/14	4/4 (100%)
Research with Children - SBE (ID: 507)	08/27/14	4/4 (100%)
Research in Public Elementary and Secondary Schools - SBE (ID: 508)	08/27/14	4/4 (100%)
International Research - SBE (ID: 509)	08/27/14	3/3 (100%)
Internet-Based Research - SBE (ID: 510)	08/27/14	5/5 (100%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	08/27/14	4/5 (80%)

Unanticipated Problems and Reporting Requirements in Social and Behavioral Research (ID: 14928)	08/27/14	3/3 (100%)
University of Delaware (ID: 12245)	08/27/14	4/5 (80%)

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

CITI Program
Email: citisupport@miami.edu
Phone: 305-243-7970
Web: https://www.citiprogram.org

Appendix D

IRB APPROVAL

Fwd: IRBNet Board Action Inbox x

John Bernard
to me

---------- Forwarded message ----------
From: **Robin Bhaerman** <no-reply@irbnet.org>
Date: Mon, Jul 12, 2010 at 4:08 PM
Subject: IRBNet Board Action
To: Na He <nahe@udel.edu>, John Bernard <jbernard@udel.edu>

Please note that University of Delaware IRB has taken the following action on IRBNet:

Project Title: [179955-1] Local and organic foods
Principal Investigator: John Bernard, Ph.D

Submission Type: New Project
Date Submitted: July 12, 2010

Action: EXEMPT
Effective Date: July 12, 2010
Review Type: Exempt Review

Should you have any questions you may contact Robin Bhaerman at bhaerman@udel.edu.

Thank you,
The IRBNet Support Team

www.irbnet.org