WILLINGNESS TO PAY FOR STRAWBERRIES: EFFECT OF NUMBER OF CHOICES USING NONHYPOTHETICAL VALUATION PROCEDURES

A Thesis

by

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ABSTRACT

The use of experimental economics in valuation of market and non-market goods has grown considerably over the past few years. The ability of experimental auctions (EAs) to reveal consumer preferences and their malleability have been greatly praised by researchers across the profession. Because of the high cost of conducting EAs, researchers have a vested interest in extracting as much information as possible from the research sample, usually presenting multiple products or product alternatives to participants. In the last decade large amounts of work has been done to improve the methodology and design of EAs. However, choosing how many products or product alternatives to use has no clear guideline. Findings of this study support a "choice overload" phenomenon even with a relatively small number of products used for auction. Mean willingness to pay was found to be a decreasing function of the number of alternatives presented to participants. A heteroscedastic error variance scaler was estimated and it was found to be a decreasing function of the number of alternatives presented, implying more variance across responses as the number of alternatives increases.

DEDICATION

First and foremost I would like to dedicate this work to the Creator, who in His wisdom has granted us the chance to use diligence and intelligence to ponder the wonders of his Creation and its evolution.

I would also like to dedicate this work to my mother: wherever you are, I hope you can feel pleased that I have not given up yet, I hope I am making you proud.

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Special thanks go to my mother for her inspiration, tolerance, understanding and encouragement, to my father for pushing me to strive for more, teaching me to ask the right questions and showing me to pick myself up and try again and to my wife for her life changing patience, unimaginable endurance of all hardships and seemingly endless love.

And finally, thank my daughter for giving me the immense desire to become a better man every day.

NOMENCLATURE

BCS	Bryan/College Station
BDM	Becker, DeGroot and Marschak
EA	Experimental Auction
Lbs.	Pounds
RPM	Random Parameters
SPA	Second Price Auction
WTA	Willingness to Accept
WTP	Willingness to Pay

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CHAPTER I

INTRODUCTION

Motivation for the Study

Choice is defined by Merriam-Webster (2014) as the power to make a decision or the act of deciding between two or more possibilities. This carries a very potent message: power and possibility through decisions. The importance of evaluating choices reveals as paramount to economic research. The complexity of a choice task and the ability of people to choose play an important role on the validity of the results (Levitt and List 2007). Louviere (2006) states: "I am not convinced that…subjects placed in strange tasks…tell us much about real behavior". Cason and Plott (2014) propose that the complexity of current experimental valuation techniques produce a "failure of game recognition" where subjects do not make the connection between their acts and the consequences, rendering choices that are not reflections of preferences. Complexity is an issue for subjects, especially those with low mathematical skills, something often neglected by economists (Dave et al. 2010). Burton and Rigby (2012) show that almost unambiguously, increasing the number and complexity of choices increases the error variance in discrete choice experiments (DCE). However, when subjects are permitted to self-select the number of options to choose from, they revealed their preferences more accurately, considerably reducing the variance in the results.

The scientific concern about subjects' behavior when facing many alternatives is not new. In the mid-20th century experimental psychology findings by Miller (1944)

revealed what he called the *double avoidance-attraction conflict*. Conflict as defined by Miller (1944) is produced when an individual must decide between two competing responses that are incompatible and it arises more frequently when a subject has strong tendencies towards approaching and avoiding a goal. In one of his studies, subjects who were classified as "timid" using psychometric tests were charged with asking for a raise in their participation fee for the study. Timid participants had incentives to ask for a higher payment, but strong tendencies, due to their personal traits, to avoid the confrontation of asking for the raise. The concept developed in the results of this experiment is that having to let go of an attractive option or status quo for a potentially better alternative, could lead to conflict in individuals and procrastination in the choice decision. Lewin (1951) expanded this idea further by proposing that options that are not only incompatible but also mutually exclusive lead to more conflict; this situation is enhanced as the differences between competing alternatives appears to be smaller. Lipowski (1970) proposed that the struggle to decide increases with the number of options available, leading to anxiety and failure to choose.

Contrary to the common assumption that more options are better, the concept of *choice overload* (Iyengar and Lepper 2000), describes that an extensive array of alternatives reduces the desire for goods or at least the likelihood of purchase. Iyengar and Lepper (2000) conducted a field experiment placing a promotional tasting booth in an upscale grocery store, which displayed either 6 different flavors of jam or 24 flavors. The flavors of jam that are common in the market (i.e. strawberry, blueberry, etc.) were excluded to avoid strong preference for a particular flavor that could influence the

results. After subjects approached the booth they tasted as many jams as they wanted to, as many times as they wanted to and they were given a coupon towards the purchase of any jam of their choosing from the preserves section of the grocery store. Iyengar and Lepper (2000) found that subjects presented with 24 different jams were much more curious about what was going on than those presented with 6 jams for tasting. Around 60% of the subjects who walked by the booth with 24 different flavors stopped to taste the jams, while only 40% of the shoppers walking by paused when there were only 6 alternatives. However, from those who stopped at the booths to taste the jams, the ones that sampled from the larger number of alternatives were less likely to purchase (3% of them did) than those presented with a relatively smaller set (30% bought a jam after visiting the booth). This counter-intuitive result that more options of a good decrease the probability of purchase is what they define as the *choice-overload effect*. A possible explanation described by the authors (Iyengar and Lepper 2000) is that with simple choices, namely limited options, subjects engage in a search for an optimal selection but not with larger sets of options. Heiner (1983) suggests that individuals resort to simplifying decisions they find complicated, which could be the case if more alternatives offered increases the complexity of the decision.

Most research on choice overload compares large sets of alternatives, i.e. 16-30 (up to 300) with relatively small ones, i.e. 6-8 (Scheibehenne, Greifeneder, and Todd 2010). This study evaluates in a non-hypothetical experimental auction (EA) if individuals choosing among similar competing products manifest choice overload even with few alternatives, reducing the ability of subjects to effectively make market

valuations. As EA have become crucial in marketing (Lusk and Shogren 2007a) choice overload effects could be problematic if they manifest in small sets of alternatives. Due to the cost and time consuming nature of EAs, securing a large sample is always a challenge (Lusk et al. 2001). Hence, researchers conducting EAs have a vested interest in trying to extract as much information as possible and usually include multiple products to be evaluated by participants. In the last couple of decades, research to improve the methodology of EA has gained considerable attention (Lusk and Shogren 2007a, Rousu and Kosa 2005, Corrigan and Rousu 2006, Lusk, Alexander, and Rousu 2007, Drichoutis, Lazaridis, and Nayga 2008). However, there is no clear guideline on how many alternatives should be presented in an EA. Is there a breakpoint where confusion overcomes subjects?

Economists designing EAs are most of the time interested with broader empirical and policy questions, such as: What would be the effect of having more alternatives? How many alternatives are too many? One of the several aspects to consider is the increased search cost associated with a larger set of options. Stivers and Tremblay (2005) define search costs as the loss in utility for each additional unit in the set being considered. Based on this definition a larger set to choose from increases these search costs, thus diminishing utility for all alternatives. There is also another issue to be considered with the change in probabilities of finding the "right" alternative. Norwood (2006) argues that in a choice situation greater variety increases the probability of individuals finding a "new" more preferred option. However, he also points out that if

subjects only peruse a subset of options chosen randomly, the probability of finding a most preferred option is lower with a larger set than a smaller set.

Objectives

This study has as main objective: To answer if having more options in an EA is helping or hindering the research agenda of economics?

The analysis questions can be broken down into two main areas:

a. About the WTP means:
    i. Does the number of products available in an EA affect WTP values?
    ii. Is WTP a non-increasing function in the number of alternatives?
    iii. Is such function monotonic?
b. About the variance of the estimates:
    i. Can a relatively small number of alternatives add enough complexity for a choice overload effect to manifest in an EA?
    ii. Are subjects able to differentiate products among competing alternatives in experimental auctions with increasing number of alternatives?
    iii. Does increasing the number of alternatives hinder respondents' ability to differentiate between products?

Answers to these questions would help improve the design of EAs, providing criteria for tradeoffs between number of products offered, cost of running the EA and quality of the data gathered through EAs. Tackling these questions could also shed some light on the product offering in more complex settings, such as real markets, where the laboratory rigor of experimental economics does not hold.

CHAPTER II

LITERATURE REVIEW

Experimental Methods for Value Elicitation

The introduction of experimentation to the field of economics has brought with it a new era. Louis Wilde (1981) stated that control and accurate measurement were objectives of a laboratory experiment in economics. Vernon Smith (1982) described experiments as mechanisms to identify patterns of behavior and to motivate more explicit theory. By allowing control inside the lab (Davis and Holt 1993b), experiments foster the development of understanding of consumer behavior (Unneverh et al. 2010). There are many ways to conduct experiments in economics. Experiments must be designed to extract information for a particular set of objectives with good experimental methods that allow manipulation of variables (Fouraker and Siegel 1963). To design experiments that meet these objectives and method criteria, an understanding of the theory they are trying to prove or find with them is imperative (Kagel and Roth 1995).

Value Theory

Value theory as described by Debreu (1959) and Fishburn (1964) is the theory that provides a framework to evaluate exchange of goods and services at a price in a given location and time. Under this theory the consumers have a role to choose given limitations and choice criterion. The limitations on the selection of consumption obey *a priori* constrains, e.g. physiological or cultural. They also follow value constrains, where consumption may not exceed the wealth of the consumer. The set of different points of

consumption for each consumer given these limitations is the consumption set or total demand of each customer. The other component of selection, the choice criterion, is expressed as preferences. These expressed preferences (Samuelson 1983) in a hypothetical setting where only two goods are available, would be consumption points *x* and *y* in a plane of all possible consumptions. A function in that plane that passes through all the combinations of x and y that would provide the same level of utility is an indifference curve (Edgeworth 1881, Pareto 1971). When building a price system P, each consumption will have a price in that plane, i.e. $\mathbf{P_x}$, $\mathbf{P_y}$, for our two good scenario. The respective expenditures of a consumer on *x* and *y* would be $\mathbf{P_x}$***X** and $\mathbf{P_y}$***Y**. For each good a function for expenditures in the plane of the price system P can be constructed. If the budget constrain is kept unchanged and consumption of *y* is held constant a function passing through all possible levels of consumption for *x* at different prices is known as the demand curve for good **X** (Marshall 1961).

Consumer Welfare

Since the willingness to buy (preferences) cannot be observed (Smith 1982), mapping for consumption through demand curves provides a tool for measurement of those preferences. Alfred Marshall (1961) used the demand curve to develop the concept of consumer welfare. With it he addressed in a two dimensional space how would consumers be affected by changes in prices, i.e. how would the welfare increase with a lower price and conversely decrease with a higher price. In this analysis, the marginal utility of money is assumed to be constant. This means the income effect is neglected: individuals value the cost of opportunity of a lower price equally, regardless of how

much income they have and how much a price reduction increases their relative wealth. Sir John Hicks (1946) took this concept and developed the idea of compensating variation, accounting for the effect of different levels of income on the demand and therefore on consumer surplus. This theory expresses a gain in consumer surplus in terms of how much income the consumer could willingly lose that would not leave him better off if the price of a good falls. Hicks (1943) also presented the counterpart of this which was the equivalent variation. This addresses the case when the price of a good increases. The equivalent variation then measures the gain in income that would make the consumer as well off with the increased price of a good. If there is no effect of income then these two measures are the same (Willig 1976).

Differences in WTA-WTP

The concepts of compensating variation and equivalent variation can used to measure preferences. By quantifying how much wealth would an individual be willing to let go to obtain a certain good and be as better off than without it, the preferences for such product are identified as willingness to pay (WTP). Conversely, when calculating how much an individual's income would have to increase to let go of a good and still be as well off, the willingness to accept (WTA) is obtained. Following the logic of compensated and estimated variation, without an income effect (with constant marginal utility of wealth) there would be no difference between the WTA and WTP.

There have been studies where a gap has been found (Bateman et al. 1997, Knetsch and Sinden 1984, Shogren et al. 2001a). In particular Kahneman, Knetsch, and Thaler (1990) observe a difference in favor of the WTA, which they allude it to loss

aversion (Kahneman and Tversky 1979) of the good being sold. The idea is that there is an endowment effect (Thaler 1980) that apparently is created in experimental settings when a subject is given an object. Other studies (Plott and Zeiler 2005, Brown and Cohen 2014, Plott and Zeiler 2007, Shogren et al. 1994) have found that when controls in experimental design for subject's misconceptions are implemented, no gap is observed. Plott and Zeiler (2005) point an interpretation of their results that there can be a demand effect through which the subjects perceive the experimenter wants them to remove their ownership values from the valuations. However, there has not been data compiled to support or refute this idea. The controls in design suggested to minimize or eliminate the gap include incentives to express the true valuations, training and practice.

Valuation of Preferences

According to value theory (Fishburn 1964) the consumptions of two goods would go by one and only one of the following: a. **X** is preferred to **Y**; b. **Y** is preferred to **X**; or c. **X** is indifferent to **Y**. The preferences for sets of goods $\mathbf{X_1}$ different from $\mathbf{X_2}$ would follow the same logic. Total expenditures then for a preferred bundle $\mathbf{P_xX}$ would be higher than or equal to a less preferred bundle $\mathbf{P_yY}$ (Samuelson 1983, Houthakker 1950, Richter 1966). These expenditures are the WTP (WTA) for the bundles and become the revealed preferences. When using WTP (or WTA) as revealed preferences for goods, a higher value for good **X** over **Y** implies preference of **X** over **Y** and the opposite for a greater WTP for **Y** over **X**. If the WTP is the same for both goods, then the individual is indifferent between them. WTP (WTA) then becomes the valuation for goods, a tool to evaluate consumer preferences, a mean to measure individual inclination in choices.

Uses for Value Elicitation

With valuations regarded as indicators of consumer preferences, its use has spread in different fields. Eastaugh (1991) takes value elicitation to measure marketability of artificial blood. Hayes et al. (1995) explored food safety concerns and preferences among consumers using valuation. Roosen et al. (1998) assess the value effect of insecticide residue in apple demand. Diener, O'Brien, and Gafni (1998) perform a review of literature on valuation techniques for healthcare providers and conditions. Oliver, Mossialos, and Robinson (2004) evaluate the value of technology assessment for services in Europe. Lusk and Hudson (2004) provide some points of interest from the marketing of agricultural and non-agricultural products perspective on the uses of value elicitation. Runge, Converse, and Lyons (2011) use valuation to development of natural resource management programs. Given the diverse applications of valuation, several different value elicitation methods have been developed. Revealed preference methods are the preferred source of value information, when there is a market for a product (Cameron et al. 2002). When the good being evaluated either does not have a market yet or does not have a market at all, other methods to assign value such as conjoint analysis, discrete choice experiments and stated preference are used (Bateman et al. 2002).

Types of Data

The technique and approach to value elicitation also depends on the type of data to be used. As to which type of data to use, it depends on several factors including availability of data and objectives of the analysis. For marketing research the primordial sources of data are transaction data, survey data and experimental data (Dickie, Fisher,

and Shelby 1987, Wertenbroch and Skiera 2002). The objective with all of these kinds of data is the same: trying to find out the "true" WTP from the individuals. Each of these kinds of data has different characteristics which are described below.

Transaction Data

Using actual market transaction data in research increases transferability (external validity) of findings as they represent actual purchases. It is highly accessible and provides relatively simple demand revelation (Dickie et al. 1987). However, it is only valid for existing products (Cameron and James 1987) and private goods (Cameron et al. 2002). It only gives the observed amount of WTP. For the actual buyers, this is not the maximum, but only below their threshold. For the non-buyers, this is not a minimum, but only above their true WTP (Wertenbroch and Skiera 2002). Also, for products that are durable, the market data is very scarce as their buying frequency is very low due to their nature (Corsi 2007).

Survey Data

Surveys were developed to fill the gap of transaction data (Dickie et al. 1987). Originally, they were used alone to do value elicitation, mostly for non-market and public goods (Brookshire, Coursey, and Schulze 1987). Nowadays, they are generally used as a complement to an experimental procedure (Miller et al. 2011). This is mostly due that surveys lack an incentive to state their true preferences (Harrison and Rutström 2008). This leads to low effort from the subjects and possibly less trustworthy data (Gracia, Loureiro, and Nayga 2011).

Experimental Data

Under experimental methods there are experimental choice experiments and experimental auctions, both which have several divisions based on their level of complexity, type of goods being evaluated, manipulability, number of units and procedures (Miller et al. 2011). Experiments have become a weapon of choice in market and non-market valuation and their popularity is mainly derived from the fact that these non-hypothetical choices reveal values closer to the true preferences than hypothetical ones (Chang, Lusk, and Norwood 2009).

Categorizing Experimental Data

A wide variety of diverse topics can be addressed with experiments in economics. Therefore one way to sort experiments and experimental data arising from them can be by their motives, as suggested by Friedman and Sunder (1994). With this in mind, experiments can then be sorted as: 1) speaking to the ears of princes; 2) testing for empirical regularities; and 3) testing theories, the most pedagogical of all.

Types of Value in Goods

As suggested earlier, experimental valuation on goods can be separated into two large categories: private and common value in goods. Experiments that seek private values assume that each person has a value for the good which is known only to him (Paarsch 1992). The experiment then pursues finding this individual private value from all participants. The common value setting considers that a good ha the same value for all subjects, but that value is unknown to all of them (Kagel and Levin 1986). Subjects use private information to assess what that value might be and finding the common value

within all these is the objective of the experiment. Most goods would fall somewhere in between these categories (Goeree and Offerman 2002), as almost all private goods will have some common value component (Corrigan and Rousu 2011).

Where Experiments Occur

Another aspect that can divide the experimental design is the location of the experiments. While most of the original work in experimental economics took place in the laboratory (Smith 1982). In recent years, the interest in field experiments has increased (Herberich, Levitt, and List 2009). This could be a result of larger attention in the generalization of the results from experiments (Schram 2005). Harrison and List (2004) point out, that instead of putting one over the other, laboratory and field experiments should be viewed as complements in providing a better understanding of human behavior. Nevertheless, the lack of control possibilities in field experiments limits studies to be opportunistic, in turn limiting the data and responses that can be collected (Levitt and List 2009).

Experimental Design

The sufficient conditions of having an environment and an institution to form a microeconomic system for experiments as described by Smith (1982) have to be refined and adapted to fit experiments that seek to elicit value. Louviere, Hensher, and Swait (2000) as cited in Viney, Savage, and Louviere (2005) propose experimental design must provide adequate cognitive complexity, identification of the utility factors sought, precision of statistical parameters and market realism. Binmore (1999) insists that in economic experiments three criteria must be satisfied: 1) Problems posed to subjects are

not only “simple”, but presented such that they seem simple to subjects; 2) Adequate incentives are provided; 3) Time for learning by trial and error is sufficient. Cason and Plott (2014) propose that not accounting for these and other nuisances can lead to a lack of game recognition by the subjects, blurring the connection between their actions and the consequences.

Choice Experiments and Conjoint Analysis

There are several methods available to estimate WTP. Stated preference methods and choice experiments are widely used in the environmental literature (Bateman et al. 2002). They are less frequent in the marketing literature, but contingent valuation techniques like dichotomous choice experiments have been applied to food products (Ready, Buzby, and Hu 1996, Wertenbroch and Skiera 2002). In a typical experiment of this kind, consumers are asked if they would buy a good (yes or no) at a stated price. The price is varied between the subjects and the WTP is obtained as the level at which the average of subjects would respond “yes” (Hanemann, Loomis, and Kanninen 1991). A double-bounded choice question is a variant of the previous, where if the subject answers “yes” to the first price proposed, he is then offered a higher price to record his response to such. If in turn the subject would not buy the product at the first price, he is offered a lower price in a second question and his response for this one is recorded as well (Lusk and Hudson 2004). Multiple dichotomous questions follow the same logic with more than two consecutive questions of the same kind. The main advantage of the approach over the single question setting is a higher statistical efficiency (Hanemann et al. 1991). This means that a lower sample size is needed with multiple dichotomous

questions than with one single “yes or no” question to achieve a given level of estimation precision. The main criticism to multiple dichotomous questions is that the answer to the second and subsequent questions depend on the answer to the first, therefore a lack of independence in the responses. These may imply that the preferences captured are “constructed” (McFadden 1994). If this is the case, the validity of the results is diminished. A hindrance to the results from both single and multiple dichotomous choice experiments is that the choices are discrete. This implies that the WTP distribution parameters in the population must be assumed to correspond to those of the sample. Also, these methods assume away the cross-price elasticity effects of substitutes and complements by evaluating a single good.

Conjoint analyses are another tool that can be used for WTP elicitation. In a conjoint analysis subjects are asked to choose from different sets. These sets vary in different attributes of the products being evaluated and may include price as one of the attributes being changed (Louviere 1988). It has been around for over 40 years and it is mostly used to infer the buyers’ worth (referred to as “part-worth” in the literature) for attributes at different levels (Green, Krieger, and Wind 2001). It has been one the marketer’s favorite tools to evaluate tradeoffs between product characteristics in different fields (Chung, Boyer, and Han 2011, Burton and Rigby 2012, Yoo and Doiron 2013). It allows simulation of a real shopping experience and permits incorporation of substitution/complementarity effects. A similar drawback as with dichotomous choice experiment is that choices are discrete, complicating the estimation of WTP. Particular barriers to the applicability of these methods is that experimental design can be

complicated (Kuhfeld, Tobias, and Garratt 1994) and results can be influenced by the complexity of the sets being evaluated (Swait and Adamowicz 2001, Burton and Rigby 2012). A common shortcoming for both dichotomous choice and conjoint analysis is that under hypothetical settings there is a lack of incentive compatibility (Carson and Groves 2007, Collins and Vossler 2009). This produces hypothetical bias: values elicited in hypothetical context do not reflect real market situations (List and Gallet 2001, Murphy et al. 2005). The main issue with its existence is that subjects overstate their values. If there is no cost in expressing a higher valuation, but there is a higher utility to be obtained from expressing it, then it is in the subject's best interest to exaggerate the value of his WTA/WTP. Harrison and Rutström (2008) review 34 studies in experimental economics literature and find that hypothetical bias can be as much as 2600%. For market goods, some measures can be taken in experimental design to make this kind of experiments incentive compatible. For example, after the completion of all trials a random price may be selected as market price and subjects can be asked to act upon it according to their previously stated preferences. However, for non-market goods, public goods or novel attributes and goods, there is no such option, as not all products in the choices are available for subjects to act upon.

Auction Mechanisms

The use of auctions in human affairs in history traces back to ancient times. The simplest form is where a single unique indivisible object is being sold to one of several potential buyers. In recent years auctions have been carried out in laboratory settings as experimental auctions (EA) to be used as valuation methods. The objective of such

auctions is to try to find the individual home-grown values for the good being auctioned. These home-grown values are the subjective private values subjects have for the good, not induced by the experimenter (Rutström 1998). EAs have become one of the most common methods of valuation (Lusk, Feldkamp, and Schroeder 2004). Their rise in popularity is mostly due to the incentive compatibility and the high degree of information manipulation that they allow (Lusk and Shogren 2007b).

Incentive Compatibility of Auction Mechanisms

When choosing a method of value elicitation incentive compatibility is on the top of the list of criteria to consider. A method of value elicitation that is incentive compatible as Hurwicz (1973) described it is one that where subjects find it in their best interest to reveal their true preferences. Vickrey (1961) explains that in an auction the bidder maximizes the probability of obtaining the desired object by bidding his true value. In this case, the difference from the bid and his true value, the gain from the transaction, would be zero. If the bidder offers a lower price than his true value for the good seeking to increase this gain, his chances of obtaining it are decreased. If the bid for the item is higher than his true value he increases the possibility of obtaining the item but with a negative gain, as the price paid for the item is higher than his value.

Nevertheless, it must be noted that the incentive compatibility of auctions holds only under some assumptions. If the values of each subject vary with the valuation of the rivals in the auction, the bids are revised with expectation and visualization of other subject's bids (Rutström 1998). Then values reported may not be the true values for each individual. Also, the price to pay under some auction procedures is uncertain, therefore

the bids are conditional on the distribution of those potential prices (Horowitz 2006). In those cases, bids reveal certainty equivalents, not if the subjects would chose to buy the goods at that price. Wertenbroch and Skiera (2002) noted that though theoretically all value elicitation methods have incentive compatible features, in the field there may be idiosyncrasy generated discrepancies. When asked to state their preferences through WTP, subjects may be inclined to overstate or understate their true values following what they believe will be done with the information they provide (Carson and Groves 2007). Bids obtained can be influenced by the experimenter through the framing and design of the experiment (Lusk and Fox 2003).

Types of Auctions

Auction type mechanisms come in an array of options that can be used. One of the most familiar auction mechanisms is the first price increasing auction, better known as English auction. There are different variants of this kind of auction. The more frequent scenario is where the price begins at a low level and participants offer sequential price bids for a particular good. The price continues to increase steadily, by means of the auctioneer increasing the price or a timed device, until only one bidder is willing to pay for the good at the last offered price. The highest price offered is the winner and purchases the product at the last offered price (Rutström 1998). The WTP of the winner of an English auction is then known to be at least as high as the last bid placed. How much more is undetermined. Kagel and Levin (1986) find that in auctions of this kind with limited information about the good and large number of bidders, more

aggressive behavior is fostered. This leads to bids over the true value, resulting in losses for the winner, known as the winner's curse.

The Dutch auction is similar to the English auction. It receives its name from its common use in the Dutch flower market since the late 1800's (Kambil and van Heck 1998). Instead of starting with a low price and receiving incremental offers, the action begins with a prohibitive high price and descends until one of the participants expresses his intention to purchase and the good is awarded to that subject at that price (Coppinger, Smith, and Titus 1980). In this case the WTP of the buyer is known to be at least as low as the price where he expresses interest in the good by bidding. Both the Dutch and English auctions carry public availability of price information. All rejected offers in the case of the English auction are visible to all participants. All rejected prices in the case of the Dutch auction are visible to all participants. Therefore, in both scenarios bidders must concern themselves not only with their own value for the good, but with the potential value distributions of the competitors. This may increase the transaction costs given the substantial effort of information gathering that it would entail (Vickrey 1961).

The second price sealed bid auction (SPA), also known as Vickrey auction, is a modification of the English auction. The first change is that to avoid public bid information, all bids are submitted simultaneously as sealed bids instead of publicly expressed offers. Bidders cannot modify their bids once they are submitted. The bidder must then know at the beginning of the auction the value of the item to himself to place his bid. This is analogous to the Dutch auction where the bidder must know beforehand where he will decide to act. In English auctions a comparable case happens when book

biddings are allowed: a buyer not present can register a maximum bid in advance to participate in the auction (Cassady 1967). The second difference is that though the winner continues to be the highest bidder, the price to pay will be the second highest bid offered (Vickrey 1961). As in the English auction, the winner is the bidder that values the item the most (Milgrom and Weber 1982). Unlike the English auction he will not pay his value but the second highest bid, a price that allows a gain, therefore providing incentives for subjects to bid their true value.

Another kind of auction used in marketing literature is the Becker, DeGroot and Marschak (BDM) method. In a BDM (Becker, DeGroot, and Marschak 1964) subjects place their bids for an item and randomly a price is drawn from a previously constructed uniform price distribution to be the market price. Subjects who bid the same or higher than the randomly selected price purchase the good at that price and become the buyers (Becker et al. 1964). The bids are also placed in sealed bids as the SPA. When placing the bid, the individual is uncertain as to how much he will have to pay for the item and if he will be the winner. These two aspects allow BDM to be incentive compatible. A variant mixing SPA and BDM is the *n*th price auction. In this kind of auctions the bids are also submitted as sealed bids. The purchase price is selected randomly from the distribution of all offers made. All bidders with offers higher than that nth-price chosen randomly become buyers and pay that price (Lusk and Shogren 2007b). The nth-price auction also uses private values through sealed bids and has subjects bid independently of rival's valuations, therefore ushering true value bidding from the subjects.

Auction Mechanism Considerations

As to which auction to use for a particular scenario, the answer is not straightforward. The theoretical framework of auction theory would indicate that it shouldn't matter since with all of the different auction mechanisms described previously the result yielded would be Pareto-optimal (Vickrey 1961). These results hold under symmetric buyer and seller equilibrium (Milgrom and Weber 1982). However, based on its efficiency Lusk and Shogren (2007b) suggest that the English auction is second to none. The Dutch auction has been known for being fast and low on effort from the seller's perspective (Vickrey 1961). The SPA would follow in terms of efficiency and can be characterized as relatively easy to comprehend by the subjects (Lusk and Shogren 2007b). It has been documented that SPA has a major drawback: overbidding (Kagel, Harstad, and Levin 1987). This is understood as bidding above one's value (Depositario et al. 2014). This effect is less when more bidders participate in the auction (Kagel and Levin 1993). Another shortcoming of SPA is that for bidders whose values are not close to the market price (off-margin), SPA does not capture their preferences (Shogren et al. 2001b). Conversely, it does capture the preferences of subjects that bid closer to the market price (on-margin) better than *n*th price auctions and BDM (Lusk et al. 2007). Shogren et al. (2001b) define these on-margin subjects as the ones bidding in round *t* within $1 of the market clearing price of round *t-1*. Lusk et al. (2007) also mention that these on-margin subjects' responses are highly related with high value bidding. This means SPA will provide more accurate values for high value bidders (Lusk and Shogren 2007b). SPA are also less likely to foster bidder affiliation than an English auctions

(Lusk and Shogren 2007b). As explained by Milgrom and Weber (1982) affiliation of bids is the situation where a high bid from one participant, makes higher bids from other participants more likely. In their study of bidding behavior List and Shogren (1999) find that in SPA treat information as a substitute for posted pricing that could affiliate bids. Information perceived as negative could lower the bids and vice versa.

Number of Rounds

List and Shogren (1999) showed increasing the number of bidding rounds results learning of the methodology but bias of the bids. Bernard (2005) states that repeated trials will increase affiliation of the bids, which decreases the potential value of the information collected. Lusk and Shogren (2007b) argue is that ordering effects and demand reduction can come as a result of fatigue being present in repeated rounds, satiation and law of diminishing returns. These results were also found in Corrigan and Rousu (2006). No clear criterion or formal analysis as to where this breakpoint occurs is found in the literature.

Number of Alternatives

Regarding the number of alternatives to be used in EAs for the bids and the number of rounds to be conducted there are no clear guidelines either. The relevance of this matter is that in most of economic research, including valuation experiments, securing a large sample is a challenge (Lusk et al. 2001). Researchers conducting EAs have a vested interest in trying to extract as much information as possible from the small sample. Rousu and Kosa (2005) pose that separate bids for multiple products offered in the same round of bidding can also serve this purpose, with the caution that the products

be substitutes to maximize the amount of usable data. As for the number of alternatives in an EA for the same product, the literature does not define a cutoff point.

Choice and Decision Making

Choice is defined as the power to make a decision or the act of deciding between two or more possibilities (Merriam-Webster 2014). Both definitions carry a very potent message: power and possibility in decision. There are several factors affecting choice and a plethora of research has been done in trying to measure the impact of diverse elements on decision making. Eckel and Grossman (2008), Babcock and Laschever (2003) and Arch (1993), among others, study the influence the gender of individuals in experiments and how it relates to risk aversion when making decisions, negotiation preferences and motivations when choosing. Kanter, Messer, and Kaiser (2009) studied the importance of information about other products available to making choices and WTP to obtain such information. Eckel and Petrie (2011) study the effect of information on the other parties involved in the decision process, WTP to acquire such information. Both studies find changes in WTP for a session depending on the order information is provided. The value of information is also evaluated by List and Shogren (1999) who found that information on price is valuable for novel products as much as having the chance to learn other qualities of the products. Drichoutis et al. (2008) found that information on price produces higher bids for products in auctions in the laboratory. McAdams et al. (2013) found that information about novel products impacts the ranking the products and changes the WTP for them. The research of Machina (1992), Slovic (1969), and definitely the work of Tversky and Kahneman (1974) pose that the framing

and context of the decision is determinant in the outcome of such decision, inviting us to consider presentation and information as a highly influential part of the decision process. The influence of financial incentives is addressed in the comprehensive compilation done by Camerer and Hogarth (1999). It helps point in the right direction in payments in experiment design and gives a fairly broad overview of the potential effects of monetary incentives in experimental economics. Though their review (Camerer and Hogarth 1999) suggests that in most of the cases financial incentives do not show a clear improvement on average performance, two cases draw attention: if incentives do impact performance, they reduce the variance in the results; and if there is no clear performance standard, incentives push individuals away from being socially correct in their responses. Lusk and Norwood (2011) found opposite results and point that overbidding is more frequent with monetary incentives in SPAs than without them. Depositario et al. (2014) evaluate if changing the moment of payment impacts the amount being bid in SPAs, showing that indeed it does: more overbidding takes place when there is payment upfront of a participation fee.

Attention is drawn to one dimension of influential aspects in choice that are of particular interest to this study: complexity. Depositario et al. (2014) mention that overbidding in SPA could respond to bounded rationality: subjects lack the sufficient ability or resources, i.e. time, information, etc., to find the optimal utility maximizing solution (Simon 1983). If that is the case, then repetition in SPAs should allow learning of an optimal strategy and true value bidding. The risks that repetition in SPAs can have include the affiliation or bias of the bids (List and Shogren 1999). In particular in

economics experiments using food products, repetition could carry the reduced wanting for the food as suggested by Morewedge, Huh, and Vosgerau (2010). They found that by making subjects imagine repeated consumption of the food, they become satiated and therefore less motivated to obtain the food, decreasing their WTP. Another consideration is that for repetition to be effective in teaching the subjects, the optimal strategy should be conditional on having incentives for learning, such as an out of pocket cost associated with not using the optimal strategy (Davis and Holt 1993a). If this were not the case there would be "house effects", i.e. subjects do not really feel it is their money the one being used in the EA and therefore are more risk taking and less committed to it in their decision making, as described by Thaler and Johnson (1990).

Along the same lines of bounded rationality in choices, the complexity of the task and the subject's ability to choose also play an important role on the validity of the results. Louviere (2006) stated: "I am not convinced that…subjects place in strange tasks…tell us much about real behavior". Heiner (1983) posed that when consumers find complex choices they use mechanisms to simplify them into a less complex one. It has been noted that complexity is an important issue for subjects, especially the ones with low mathematical skills and this problem is often neglected by economists doing research (Dave et al. 2010). It was demonstrated by Swait and Adamowicz (2001) that complexity of the task indeed changes consumers' decisions in choice experiments. It has also been revealed that techniques to mitigate the hypothetical bias such as cheap talk are ineffective when the task complexity is high in choice experiments (Silva et al. 2012). Burton and Rigby (2012) point out that the almost unambiguous effect in choice

experiments of increased complexity is an increase in the error variance, which implies a reduction in the consistency of the choices and confounding effects of the treatments. Burton and Rigby (2012) found out in their study that if the subjects are allowed to select the number of options they wish to choose over, the adequate level of complexity for each subject allows them to be able to reveal their preferences correctly or find the best option for each one, reducing the variance in the results. The stated motivations for subjects choosing a smaller choice set included less confusion; while subjects selecting a larger choice set alluded to wanting to find the "right" option. In a separate study Arunachalam et al. (2009) also found close to half of the participants would willingly change to a smaller choice set, even if that would potentially reduce the chance of finding their preferred option. Arunachalam et al. (2009) state that if subjects are not sure on the utility to be gained from each good and the cost of finding enough information to make the optimal choice is rather large, then smaller choice sets are selected. Considering the complexity of a choice situation in terms of the number of alternatives, Chung et al. (2011) found that varying the number of alternatives and choice sets does impact the marginal WTP in DCEs. This makes reference to the "choice overload" concept as described by Iyengar and Lepper (2000), which contrary to the common assumption that having more choices is desirable, they found that an extensive array of option can reduce the desire for a product. A possible explanation described by the authors is that with simple choices, namely limited options, subjects engage in a search for an optimal solution. A large amount of options then, complicates the choice task and as Heiner (1983) suggested, individuals resort to simplifying the decision

possibly by switching their search for optimal choices to a search for satisfactory choices. Norwood (2006) proposes that greater variety increases the probability of individuals finding a new more preferred option. However, if they only peruse a subset of options chosen randomly, the probability of finding such option is lower with a larger set than a smaller set. Norwood (2006) states that having a large amount of options to choose from decreases the probability of purchasing. This is caused by a lower utility from purchasing because of higher search costs. These search costs are defined by Stivers and Tremblay (2005) as the loss in utility for each additional unit in the set that is being considered. Search costs are particularly important for unfamiliar goods (Arunachalam et al. 2009) given the lack of knowledge about the potential benefits of new goods.

Increased complexity in any dimension not only increases the cost of acquiring the information, but also raises the cost of processing it. Processing information is the other facet of rationality that comes into the equation. If information or familiarity with the process or the product is limited, subjects will find themselves looking for cues on how they are supposed to behave (Loewenstein 1999). Good sources of these hints are the other agents, especially when communication is viable. However, most experiments do not allow communication between participants. Therefore, the experimenters themselves can be unknowingly and unwillingly guiding the subjects. With limited cognitive ability and constraints in time to make decisions, subjects faced with such decisions might find the increased complexity overwhelming. Let us take into consideration that economic theory dictates different revealed preferences through

willingness to pay (WTP) would come from individuals perceiving products as being different (Von Neumann and Morgenstern 2007). If consumers do not perceive products as dissimilar or if they lack the ability to discern, they would be indifferent between alternatives (Debreu 1959, Samuelson 1983). This may be important for any market with a large amount of substitutes. The relevance of this to economic experiment design is crucial. If the ability of subjects to discriminate between alternatives is affected by the number of available alternatives or if the dissimilarities amid products being evaluated are not perceived as significant, WTP would not be a true reflection of preferences. An increase in the number of alternatives would increase complexity under this model, which confuses subjects and confusion makes subjects fail to recognize the connection between their actions and consequences.

CHAPTER III

METHODOLOGY

Experiment Description

A total of 197 subjects participated in the experiment. Each subject only participated in one session. A total of 10 sessions were carried out with a range of 12-28 participants per session. A compensation of $30 was paid at the end of the session, minus any purchases incurred during the experiment. To measure revealed preferences an EA was used, namely a second price auction. The second price Vickrey auction (Vickrey 1961) was selected due to its incentive compatibility, manipulability and efficiency (Lusk and Shogren 2007a) as well as being the predominant method in non-hypothetical value elicitation mechanisms (Lusk et al. 2004). The auction product was one pound of strawberries. The reason to use strawberries is that they are highly heterogeneous within each variety, i.e. one pound of the same variety can have an array of sizes, color tones, textures and shapes. Another advantage of using strawberries is they are commonplace: it is safe to assume participants in the experiment are familiar with strawberries. Seven different varieties of strawberries were offered for auction. The most popular variety available in local grocery stores was chosen as baseline for comparison. All varieties were coded in cyphers of three alphabetic characters to avoid ordinal bias (Meilgaard, Civille, and Carr 2007). These cyphers were not related with the names of the varieties, so subjects would reveal their preferences on the sample presented and not bring their perceptions from the market into the lab. Not all varieties

were offered at the same time. The baseline variety was the only strawberry available for bidding in all rounds. The only difference between the rounds was the number of strawberry alternatives available in the auction. Each round had a different number of strawberry varieties available that ranged from one to eight. Each session had a randomized order of the bidding rounds. The randomization controls for subject fatigue and ordering effects in the auction procedure. The design for the product offering in each round is described in Table 1.

Table 1: Product offering per round of bidding

Round	Products Offered								
1	Control	Base							
2	Control	Base	Duplicate						
3	Control	Base	Duplicate	Variety 2					
4	Control	Base	Duplicate	Variety 2	Variety 3				
5	Control	Base	Duplicate	Variety 2	Variety 3	Variety 4			
6	Control	Base	Duplicate	Variety 2	Variety 3	Variety 4	Variety 5		
7	Control	Base	Duplicate	Variety 2	Variety 3	Variety 4	Variety 5	Variety 6	
8	Control	Base	Duplicate	Variety 2	Variety 3	Variety 4	Variety 5	Variety 6	Variety 7

To measure changes in subject´s ability to discern, a duplicate of the baseline variety was included in all rounds except for the control round, where only the baseline variety and a substitute were presented. This duplicate has a different code than the base variety, but was in fact the same. If subjects´ ability to differentiate is unaltered by the number of other options presented, the gap (if any) in the WTP between the baseline variety and its duplicate should remain the same regardless of how many other varieties are offered. In order to avoid deception (Cooper 2014) no information about any of the

products was provided. To be able to measure independence of alternatives and consistency in decisions a substitute product was included in all rounds of the auction along with the baseline strawberry variety. This control product was one pound of grapes, which have been regarded as substitutes for strawberries in the literature (Henneberry, Piewthongngam, and Qiang 1999, Lin et al. 2009). If independence of alternatives holds, the revealed preference for the substitute is independent of the number of non-preferred alternatives, i.e. the WTP for grapes should remain unchanged by the number of strawberry varieties presented.

Theoretical Framework

In its simplest form the expected utility of selecting a product can be expressed as the maximum, **U***, of a utility function **U**($\mathbf{X}_1$), where $\mathbf{X_1}$ is the vector of all available alternatives for product $\boldsymbol{X_1} = \{x: x_{11}, x_{12} \dots x_{1n} \in \boldsymbol{X_1}\}$ varying in different attributes and attribute levels. This maximization is subject to a budget constrain $\boldsymbol{P_{X1}X_1} \leq \boldsymbol{I}$, where **I** is the set of resources for the decision, i.e. time, cognitive effort, money, etc. Under such model, $\boldsymbol{P_{X1}}$ represents the relative prices of the resources available for the decision and is a function of the monetary cost of the resources themselves. Additionally, the utility maximization is also subject to constrains on the use of resources to examine $\mathbf{X}_1$ denoted by $\boldsymbol{s} = f(\boldsymbol{n}) \leq \boldsymbol{S}$ where $\boldsymbol{n}$ is the number of alternatives of $\mathbf{X}_1$. The cost of searching is a monotonically non-decreasing function of the size of **X**: as $\boldsymbol{n}$ increases, so does the number of comparisons that need to be performed, increasing the complexity of the choice, **s**, yielding an indirect utility function $\boldsymbol{V}(\boldsymbol{P_{X1}}, \boldsymbol{I}, \boldsymbol{S})$. Now to take this model further consider a two distinct goods case, $\boldsymbol{U}(\boldsymbol{X_1}, \boldsymbol{Y_1})$ where $\boldsymbol{Y_1} = \{y: y_{11}, y_{12} \dots y_{1m} \in$

$\boldsymbol{Y_1}\}$ is a different good from $\boldsymbol{X_1} = \{x: x_{11}, x_{12} \ldots x_{1n} \in \boldsymbol{X_1}\}$, but still a close substitute (there is elasticity of substitution between goods $\boldsymbol{X_1}$ & $\boldsymbol{Y_1}$), and constrains **I, S** exist. Under these conditions, basic microeconomic intuition suggests that with relative prices and resource limitations constant, if the number of alternatives in $\boldsymbol{X_1}$ increases ($\boldsymbol{n}$ grows larger), while the size of $\boldsymbol{Y}$ is fixed (**m** is constant), consumers would substitute x for y to maximize utility. As the number of alternatives increases, so does the complexity of the choices and with it the use of resources to examine the options. The effect on the indirect utility $\boldsymbol{V}(\boldsymbol{P_{x1}}, \ldots \boldsymbol{P_{xn}}, \boldsymbol{P_{Y1}}, \boldsymbol{I}, \boldsymbol{S})$ would be that the resources (including search costs) spent for each good would have to decrease as the number of products increases in order to remain in the same level of utility. What this implies in the practical sense is that with a higher degree of complexity, decision makers can resort to heuristics such as reducing the portion of **X** being evaluated, search only for lower priced goods, inspecting only goods they are familiar with or the ones they have a strong preference for, use more time to make their selection, and also the possibility they may not be able to reveal their true preferences due to cognitive load resulting from the increased number of comparisons the decision carries.

Let us take into consideration that economic theory dictates different revealed preferences through willingness to pay (WTP) would come from individuals perceiving products as being different (Von Neumann and Morgenstern 2007). If consumers do not perceive products as dissimilar or if they lack the ability to discern, they would be indifferent between alternatives (Debreu 1959, Samuelson 1983). This may be important for any market with a large amount of substitutes. The relevance of this to economic

experiment design is crucial. If the ability of subjects to discriminate between alternatives is affected by the number of available alternatives or if the dissimilarities amid products being evaluated are not perceived as significant, WTP would not be a true reflection of preferences. An increase in the number of alternatives would increase complexity under this model, which confuses subjects and as Cason and Plott (2014) propose: confusion makes subjects fail to recognize the connection between their actions and consequences.

Econometric Modeling

In this study the traditional theoretical framework of utility maximization is augmented to account for the factors described above. A number of models can be used in the analysis of the data from of EAs. The choice of which model to use is mainly driven by the data produced in the EA. Data in most EAs is coming from the same subject over multiple rounds or it is aggregated for multiple products, providing a panel structure for the data. To incorporate this panel structure different models are typically used, including linear and non-linear fixed effects regressions (List and Shogren 1999) and random effects models (Corrigan and Rousu 2006). Since in EAs the WTP can be zero, yielding a distribution censored at zero, a censored approach may be used. For these kind of data it is common to use a Tobit (Tobin 1958) model to estimate WTP: $y^* = \boldsymbol{\beta_0} + \boldsymbol{\alpha\beta} + \varepsilon$ where $y = 0 \; if \; y^* \leq 0$ and $y = y^* \; if \; y^* > 0$.

Accounting for Heterogeneity

In order to account for consumer heterogeneity in responses, a factor (or several) can be assumed to have heterogeneous effects on the responses across individuals and a

random parameters (RPM) approach (McAdams et al. 2013) can be used. In the model the parameters assumed to be random are allowed to vary with a specified distribution, usually a normal or log-normal with a mean $E[\beta_i|z_i] = \boldsymbol{\beta} + \Delta z_i + \Gamma v_i$, where $\boldsymbol{\beta}$ is the constant means in the distributions, z_i is the set of observed variables, Δ is the coefficient matrix, v_i is the unobservable latent random terms and Γ is the diagonal matrix that produces the covariance matrix of the random parameters. The probabilities are based on the conditional density $f(y_{it}|x_{it}, \beta) = f(\beta_i', x_{it})\ where\ i = 1, \dots N\ and\ t = 1, \dots T_i$. The model assumes then that Δz_i is the variation in the responses to the parameters across individuals (Greene 2012). Therefore, the estimation of the censored data described previously is now modified to: $y^* = \boldsymbol{\beta_0} + \boldsymbol{X\beta} + \boldsymbol{Z}\Delta + \varepsilon$. The error term then is the reflection of everything else that is not accounted for in the model.

In the model used in this study $\boldsymbol{X}, \boldsymbol{Z}$ are the explanatory variables assumed to influence WTP, $\boldsymbol{\beta}$ is the vector of coefficients for those explanatory variables with fixed effects, Δ the vector of coefficients following a distribution (usually a normal) and ε is the error term accounting for unobserved factors influencing WTP. In this general form, the model (as well as almost all of the models used for EAs) assumes a normal distribution of mean zero and variance σ^2 of the error terms (Greene 2012). The other assumption about the error term is that it has the same variance across all levels of the attributes (x_i) being used for evaluation (homoscedasticity). However, if the changes in WTP are not only due to the explanatory variables but also an effect of unobserved heterogeneous factors across individuals, these unobserved factors can produce heteroskedastic error terms (Hess and Rose 2012).

Unaccounted Heterogeneity

If differentiating between alternatives becomes too complex (Swait and Adamowicz 2001) or increasingly costly by enlarging the set of alternatives (Stivers and Tremblay 2005, Norwood 2006) there could be several consequences on the WTP estimates following the theoretical framework of utility maximization described previously. First, if the number of alternatives presented is used as an explanatory variable in the vector **X**, it can be determined if it has an effect on the WTP and its direction. Second, since search costs and perceived complexity are both unobservable processes, the variance of the error term could depend on the number of alternatives. In this case, a scale parameter can be used to account for the heteroscedasticity of the error variance as a function of the number of alternatives. The Tobit model presented before can be modified to include a scaler for the error term:

(1) $$y_i^* = \boldsymbol{X\beta} + \frac{\varepsilon}{\lambda} \quad where$$

(2) $$\lambda = \boldsymbol{s} + u, \quad with\ \boldsymbol{s} = f(n)$$

Where the scale of the error terms (λ) is 1 when the errors are assumed to be identically distributed across attributes (α) and attribute levels (i) that determine the WTP in the usual homoscedastic model. When incorporating heteroscedastic errors the scaler is used to adjust the influence of the parameters:

(3) $$y_i^* = \lambda\boldsymbol{\alpha\beta} + \varepsilon$$

The scaler captures the influence of unobserved traits on the decision, by adjusting the weight of the coefficients (β). The scalers in this study are a function of the number of alternatives. If the scaler function is non-decreasing as the number of

alternatives (n) increases (i.e. λ has a positive sign) there is a smaller variance: more homogeneous effect of unobserved characteristics with each additional product being considered. If the scaler function decreases (negative λ) with increases in (n), the variance in responses is higher due to the heterogeneous effect of uncontrolled variables with each additional unit presented. A higher magnitude of the scaler implies a stronger effect of the non-observed features mentioned above (search costs and complexity) in the responses.

Implied Differences

In order to measure differences across treatments in EAs Lusk et al. (2004) propose calculating the implied differences: $DeltaWTP_{itj} = WTP_{itj} - WTP_{i(Base)j}$ where $t \neq Base$. These differences are not censored at zero as subjects can choose to increase or decrease their bids in an EA from one round to the next. Thus there is no need for a censored approach to measure differences and a random parameter linear model can be used (Searle, Casella, and McCulloch 1992). Such a model would have a form similar to the RPM Tobit model $y^* = \boldsymbol{\beta_0} + \boldsymbol{X\beta} + \boldsymbol{Z}\Delta + \varepsilon$ where y^* are the differences specified by $DeltaWTP_{itj}$.

In this study to model the WTP and the WTP differences the number of alternatives, stated consumption behavior and demographic characteristics about the subjects were used as explanatory variable. A description of the variables used for the evaluation is shown in table 2.

Table 2. Random Parameter Tobit Model of WTP for base variety

Type	Variable	Description
Continuous	AGE	Age of the participant
Dummy	EDUC1*	Dummy variable for high school education or no education
Dummy	EDUC2	Dummy variable for some or completed college education
Dummy	EDUC3	Dummy variable for graduate education
Continuous	HHSIZE	Household size (number of family members)
Dummy	FEM	Dummy variable for being female
Dummy	MARRIED	Dummy variable for bein married
Dummy	RACE1	Dummy variable for Hispanic individuals
Dummy	RACE2*	Dummy variable for Caucasian individuals
Dummy	RACE3	Dummy variable for Asian, African-American or other races
Continuous	INCOME	Annual household income
Continuous	WFV	Weekly household expenditures on fruits and vegetables
Continuous	N ALT	Number of alternatives available for bidding

*Used as base levels for the respective dummy variable category.

Research Hypotheses

To guide the assessment and discussion of the results, the objectives of this study can be evaluated through the following hypotheses:

1. The number of alternatives available has no effect on the WTP
2. There is a constant error variance across the number of strawberry alternatives presented.
3. There is no difference in the WTP of the duplicate variety across the number of alternatives.
4. The WTP for the substitute relative to all products does not change with the number of alternatives of the products.
5. The number of alternatives has no effect on the variance of the WTP of the substitute with respect to the WTP for baseline variety

CHAPTER IV

RESULTS AND DISCUSSION

The sample consisted mostly of females (65%) with an average age of 46 years, yearly annual income around $54,000 and expenditures on food of $130 per week. In comparison, the study sample is representative of the population according to data from the US Census Bureau (2015). The first comparison to be made was the WTP for each variety with different number of alternatives.

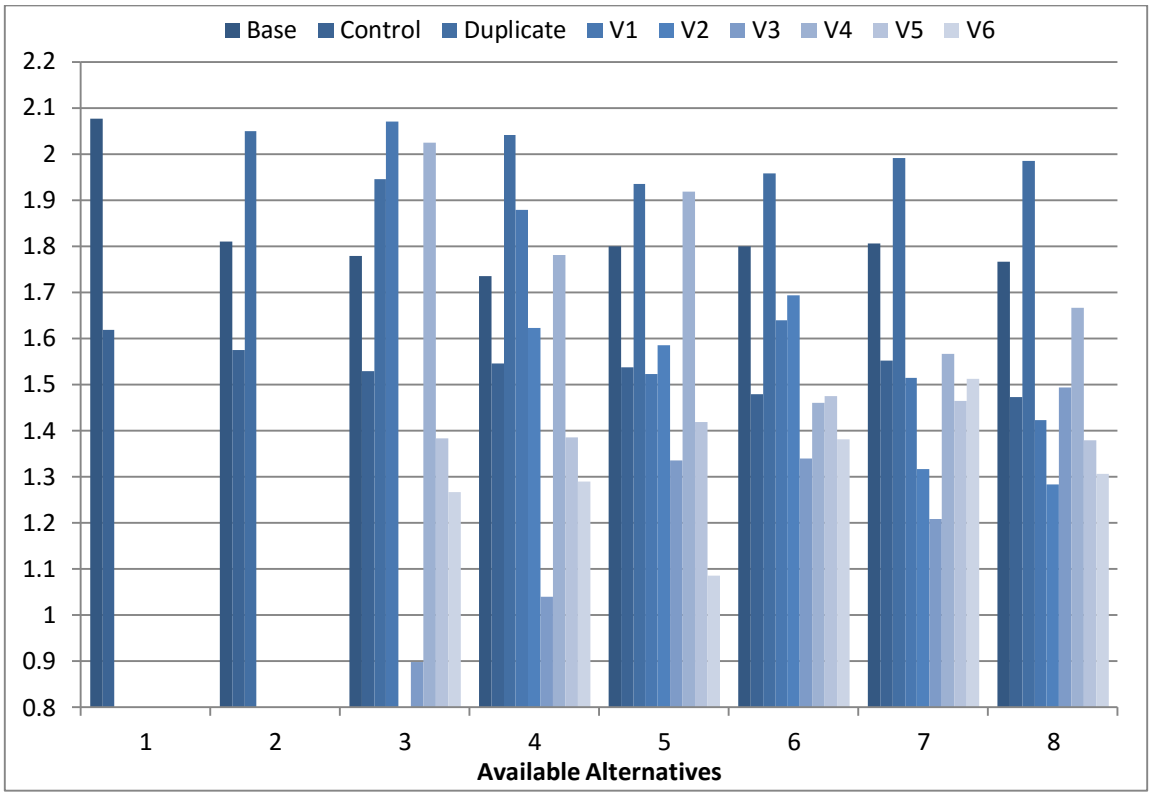

Figure 1: Mean WTP for each variety across different number of alternatives offered

Figure 1 shows a graph of the means of the WTP for each variety with different number of alternatives. At a glance WTP for varieties 1, 2, 3 seem to decrease with more alternatives; varieties 3 and 6 look like they have an increasing trend; and the rest of the products appear not to be affected.

To evaluate the effect of more alternatives on the WTP each variety the mean WTP with different number of alternatives were tested with a Kruskal-Wallis. The results are shown in Table 3, and they show WTP for varieties 1, 2, 4 and variety 3 are statistically different with different number of alternatives, at the 0.05 and 0.1 level respectively. The WTP for the baseline variety, the duplicate, the control and varieties 5 and 6 are not statistically different across the number of alternatives presented.

Table 3: Kruskal-Wallis test results for mean WTP for each variety across different number of alternatives.

Variety	Chi-square statistic	DF	Probability
V1	12.8080	5	0.0252
V2	9.2000	4	0.0563
V3	14.3740	5	0.0134
V4	17.5650	5	0.0035
V5	1.5120	5	0.9117
V6	7.3490	5	0.1959
Base	9.0090	7	0.2520
Duplicate	1.5720	6	0.9546
Control	1.6720	7	0.9758

To verify if the WTP for each variety is different between each other a different Kruskal-Wallis test is conducted on the WTP for the strawberry varieties across different number of alternatives offered. The results are described in Table 4. As the results of the

test show, the WTP for all strawberry varieties is different between each other across different number of alternatives presented.

However, only one variety was present during all bidding rounds, the baseline variety. The comparisons then should be made between this baseline variety and the rest of the varieties available to gauge the effect of the number of alternatives on WTP. To that end, the WTP of the baseline variety was compared with different number of alternatives being presented with a Wilcoxon rank-sum test, described in Table 5.

Table 4: Kruskal-Wallis results for WTP for strawberries variety with number of alternatives.

Alternatives	Chi-square statistic	DF	Probability
2	4.0680	1	0.0437
3	44.3050	6	0.0001
4	52.9110	7	0.0001
5	50.7460	7	0.0001
6	43.5570	7	0.0001
7	59.0350	7	0.0001
8	63.9060	7	0.0001

The mean WTP for the baseline variety is statistically equal when 2-8 competing alternatives being offered as can be seen in Table 5. The mean WTP for the base variety is statistically different from all the other scenarios in the control round, when only the baseline variety is presented. So when the baseline variety is presented by itself the WTP is higher and statistically different than when the baseline variety is presented with competing alternatives.

So if the WTP of the baseline variety is statistically equal when 2 or more competing alternatives are presented, the following question would be then, is there is an effect of number of alternatives being presented, which is the main objective of the study.

Table 5. Wilcoxon rank-sum test z values for WTP of the baseline variety with different number of alternatives presented

N ALT	2	3	4	5	6	7	8
1	**2.152**	**2.152**	**2.671**	**1.938**	**1.993**	**1.871**	**2.376**
2		0.032	0.648	-0.070	-0.050	-0.121	0.305
3			0.580	-0.150	-0.040	-0.165	0.304
4				-0.670	-0.606	-0.689	-0.309
5					0.069	-0.006	0.408
6						-0.129	0.287
7							0.414

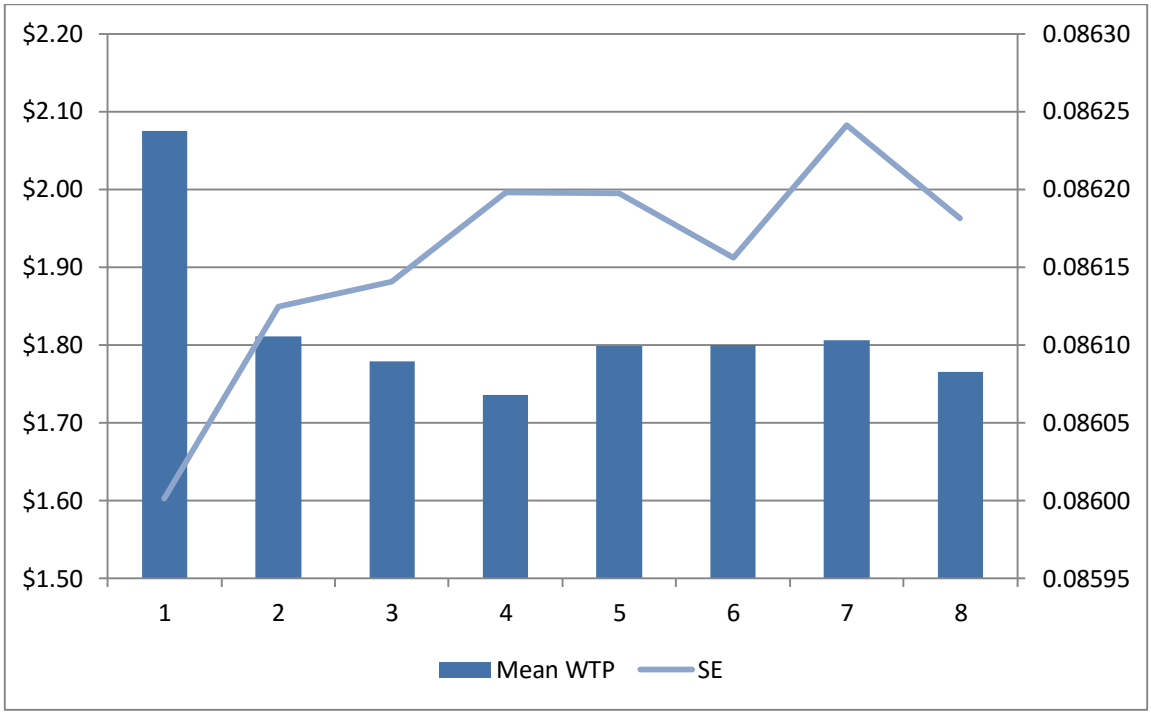

Figure 2: Mean WTP and SE for base variety with different number of alternatives

Figure 2 shows a graph of the mean WTP for the baseline variety on the left axis and the standard error of the WTP with different number of alternatives (1-8) on the right axis. This illustrates better what was shown in Table 5: the mean WTP for the baseline variety is higher and different when it is presented by itself than when it is presented with competing alternatives.

With a simple eyeball test, the graph shows a drop in WTP for the baseline variety as more alternatives are added until four strawberry alternatives are offered. Although the mean WTP in this EA is a non-increasing function of the number of alternatives, the pattern it is not always monotonic for all levels, only until four alternatives are presented. There is also indication of an increasing variance in the WTP in the graph of the standard error as the number of alternatives increases, which leads into the next set of research objectives: the effects of the number of alternatives on the variance of WTP in EAs. This behavior of the WTP led to explore the possibility of structural differences (Wooldridge 2010) in the models across the number of alternatives presented.

A comparison was done between the likelihood ratio of the full model and the likelihood of separate models ran for different number of alternatives shown in table 6. It was found that there are structural differences in the models when splitting the results by number of alternatives presented. Nevertheless, when the results are evaluated in the groups 1-4 and 5-8 there are no structural differences from the full model.

Table 6. Evaluation models of Log Likelihood Ratio test for structural differences in number of alternatives

Alternatives	Log Likelihood	Sum LL	LRT stat	Structurally Different
1	-274.3625	-2131.83	12.757	YES
2-8	-1857.47			
1-2	-542.7014	-2133.8	8.8232	YES
3-8	-1591.098			
1-3	-804.1969	-2135.23	5.9542	YES
4-8	-1331.037			
1-4	-1070.781	-2136.39	3.646	NO
5-8	-1065.607			
1-5	-1343.219	-2136.38	3.6684	NO
6-8	-793.1578			
1-6	-1603.341	-2136.32	3.7916	NO
7-8	-532.9742			
1-7	-1876.352	-2135.76	4.8936	NO
8	-259.4122			
1-8	-2138.211	-2138.21		

Following this logic, the analysis of the data was done evaluating the full model and contrasting it with the two separate models for 1-4 and 5-8 alternatives. The outcomes of the experiment can be best described by answering the questions that motivated it:

Hypothesis 1: The number of alternatives available has no effect on the WTP

Can there be choice overload with a small set of alternatives? We evaluate the WTP of the baseline variety to test this hypothesis since it was the one strawberry variety present in all rounds of the auction. The results for a random parameter Tobit estimation of the WTP of the base variety are described in Table 7. A random parameter Tobit using the number of alternatives following a normal distribution was used to

account for the diversity in cognitive ability, which can be challenged by the complexity of the choice with more alternatives being presented, thus yielding a different response in each subject.

Table 7. Random Parameter Tobit Model of WTP for base variety

	Full Model		1-4 Alternatives		5-8 Alternatives	
	Nonrandom parameters	Marginal Effects	Nonrandom parameters	Marginal Effects	Nonrandom parameters	Marginal Effects
Constant	2.66355*** (0.08699)		2.82800*** (0.1503)		3.33393*** (0.15902)	
AGE	-.01410*** (0.00115)	-.01399***	-.01237*** (0.00188)	-.01205***	-.02052*** (0.00153)	-.02052***
EDUC2	.09910* (0.05057)	.09833**	0.13596 (0.08508)	0.13246	-.18949*** (0.06681)	-.18944***
EDUC3	0.05655 (0.05325)	0.05611	-0.01314 (0.09005)	-0.0128	-.20832*** (0.07204)	-.20827***
HHSIZE	-.03362** (0.01491)	-.03336**	-.04390* (0.02445)	-.04277*	-0.00574 (0.01913)	-0.00574
FEM	-.20080*** (0.03493)	-.19924***	-.15774*** (0.05675)	-.15367***	-.35576*** (0.04469)	-.35567***
MARRIED	0.01226 (0.02232)	0.01217	-0.02398 (0.03689)	-0.02336	.08829*** (0.02815)	.08826***
RACE1	.10235** (0.044)	.10156**	.19291*** (0.07311)	.18794***	-0.011 (0.0582)	-0.011
RACE3	-.27988*** (0.04273)	-.27771***	-.30545*** (0.071)	-.29757***	-.32018*** (0.05876)	-.32009***
INCOME	.00527*** (0.00053)	.00522***	.00462*** (0.00088)	.00450***	.00501*** (0.00069)	.00501***
WFV	-.06583*** (0.02182)	-.06532***	-0.0537 (0.03542)	-0.05232	-.15028*** (0.02905)	-.15024***
	Random parameters		Random parameters		Random parameters	
N ALT	-.04218*** (0.00663)	-.04186***	-.12835*** (0.02492)	-.12504***	-.03942** (0.01756)	-.03941**
Std.Dev.	.72815*** (0.00708)		.75549*** (0.0133)		.53327*** (0.00885)	
Log-Likelihood	-1704.1131		-930.39952		-770.78007	
N Obs	1368		684		684	

Note: Significance is indicated by *, ** and *** for the 10%, 5% and the 1% level or less respectively.

In the model, the number of alternatives offered in each round is included as a random parameter assumed to have a normal distribution. The coefficient for this variable is non-zero, statistically significant and negative. Therefore, the number of alternatives does have an influence on WTP: for each additional alternative offered the WTP decreases $0.04 as shown in the second column describing the marginal effects of each parameter. When evaluating the model when only 1-4 alternatives are offered the significance of the number of alternatives is increased and the WTP decreases $0.12 for each additional alternative presented. In contrast, the model of WTP if 5-8 alternatives are shown also has a negative and significant effect of the number of alternatives shown, but it is smaller than when 1-4 alternatives are presented. What this implies is that in experimental design it is a non-trivial task to determine the number of products being auctioned. Outside of the laboratory an argument can be made that not only the overwhelming set of 24 jams compared to the 6 jam set in the Iyengar and Lepper (2000) study can have effects on the intent to purchase in the audience, but a movement within the range of 1-8 alternatives can also have an impact on WTP.

Hypothesis 2: There is a constant error variance across the number of strawberry alternatives presented. [This means that in the model $\mathrm{WTP}^{*}_{\mathrm{Base}} = \lambda\mathbf{X\beta} + \varepsilon$ where λ is a scaler of the variance and it is a function of the number of alternatives, $\lambda = 1$]

Choice overload was observed in the results of Hypothesis 1: a reduction in the WTP as the number of alternatives increases. The next question is if the responses are consistent: whether the variance in responses is constant over the number of alternatives. Do the unobserved factors increasing complexity and search costs changes as the

number of alternatives presented increases? When more unobserved processes impact WTP as the array of products increases, this reflects in higher variance of the error term. The results of a heteroscedastic Tobit (hTobit) model for the WTP of the baseline variety using a scale parameter from a function of the number of alternatives for variance are described in Table 8.

Table 8. Heteroscedastic Tobit model of WTP of the baseline variety

	Full Model		1-4 Alternatives		5-8 Alternatives	
	Nonrandom parameters	Marginal Effects	Nonrandom parameters	Marginal Effects	Nonrandom parameters	Marginal Effects
Constant	-3.14854*** (0.13363)		-2.57122*** (0.14468)		-5.02753*** (0.30055)	
AGE	0.00046 (0.00058)	0.00008	-0.00002 (0.00068)	0	0.00127 (0.00116)	0.0001
EDUC2	0.02726 (0.05607)	0.00454	0.00586 (0.06794)	0.00016	0.02868 (0.08266)	0.00221
EDUC3	-0.02733 (0.05608)	-0.00456	-0.00594 (0.06795)	-0.00016	-0.02871 (0.08267)	-0.00221
HHSIZE	-0.00048 (0.00152)	-0.00008	0.00022 (0.00182)	0.000006	-0.00165 (0.00236)	-0.00013
FEM	0.00028 (0.00081)	0.00004	0.00015 (0.00098)	0.000004	0.00042 (0.00117)	0.00003
MARRIED	0.00009 (0.00073)	-0.00002	-0.00007 (0.00087)	0.000002	-0.00013 (0.00104)	-0.00001
RACE1	0.08605 (0.0792)	0.01435	0.04192 (0.09643)	0.00112	0.08027 (0.11583)	0.00618
RACE3	-0.08596 (0.07916)	-0.01433	-0.04203 (0.09639)	-0.00112	-0.07994 (0.11578)	-0.00615
INCOME	0.00021 (0.00035)	-0.01433	0.00015 (0.00044)	0.000004	0.00021 (0.00052)	0.00002
WFV	-0.00017 (0.00021)	0.00003	-0.00014 (0.00025)	0.000004	-0.00012 (0.00032)	-0.00001
	Het. Scaler	Sigma	Het. Scaler	Sigma	Het. Scaler	Sigma
N ALT	-.06540*** (0.00703)	-.06540*** (0.00703)	-.33640*** (0.0277)	8.30988*** (0.90598)	.11939*** (0.01403)	1.82134*** (0.15422)
Log-L	-6188.22486		-2942.61565		-3529.43926	
N Obs	1576		788		788	

Note: Significance is indicated by *, ** and *** for the 10%, 5% and the 1% level or less respectively.

The hTobit accounts for unobserved differences in the conditional variance of the WTP estimates but not the effect on the WTP means themselves. In the results only the heteroscedasticity scaler and the intercept of the regression are statistically different than zero. For the full model and the one where 1-4 alternatives are shown the variance scaler is negative. This implies that the variance in the responses is not only dependent on the number of alternatives presented, but that it increases as the size of the array of options increases. With a limited allowance of resources such as time and cognitive ability, individuals making purchasing decisions have to push themselves to maximize these resources. This pressure to achieve a result can lead to confusion and a suboptimal performance (Ariely et al. 2009, Cherry et al. 2004). With suboptimal decision making with a larger number of alternatives to choose from, what the model shows is that the revealed preferences are not clean cut: no single factor can be traced to have an effect on the WTP for the base variety when accounting for heteroskedastic variance.

The model when 5-8 alternatives are presented on the other hand has a positive variance scaler as a function of the number of alternatives. This implies that the variance in WTP decreases as more alternatives are shown: the decision making process when 5-8 alternatives are offered becomes less heterogeneous. Subjects may be simplifying their decision making process past the four alternatives threshold and using heuristics that allow more efficient decision making. Nevertheless, the results of the EA when 1-4 alternatives are presented are different from the ones when 5-8 alternatives are offered. Therefore, as EAs and other experimental techniques have become stalemates in

research, conclusions drawn from them could be tarnished by the confounding effect of having too many options to evaluate.

Hypothesis 3: There is no difference in the WTP of the duplicate variety across the number of alternatives. [In the utility model $\mathbf{U}(\mathbf{X_i}, \mathbf{X_j}), \mathbf{V}(\mathbf{P_i}, \mathbf{P_j}, \mathbf{I}, \mathbf{S})$ if $x_i^{(1)} = x_i^{(2)} \in \mathbf{X_i}$ it implies that $p_i^{(1)} = p_i^{(2)} \in \mathbf{P_i}$; Then if the size of $\mathbf{X_i}$ increases, $p_i^{(1)} = p_i^{(2)} \in \mathbf{P_i}$ should still hold. If this is true the WTP for two identical products is unaffected by the number of alternatives presented. So, if the number of alternatives does not impact the ability to differentiate between products, the gap (if any) between the WTP of two identical products should be the same across all different number of alternatives presented].

Is the ability of subjects to tell differences between products impacted by the number of products they have to evaluate? The ability of subjects to tell differences between products is crucial for all valuations gathered through EA. Since resources to evaluate a decision, such as time to decide and discerning ability are limited, increasing the size of the array to evaluate could have an effect on the capability to tell differences between goods. This effect can be captured by measuring the difference between the WTP of the baseline variety and its duplicate: $\Delta WTP = WTP_{Base} - WTP_{Duplicate}$. These implied differences between the base variety and the duplicate can be either positive or negative, as subjects in the EA can choose to increase or decrease their bids for the products offered. This eliminates the need of a censored approach. A random parameter linear regression using the number of alternatives as random parameter is described in Table 9.

Table 9. Random Parameter Linear Model of WTP differences between base variety and its duplicate

	Full Model	1-4 Alternatives	5-8 Alternatives
	Nonrandom parameters	Nonrandom parameters	Nonrandom parameters
AGE	-.00437***	-.00380*	-0.00165
	(0.00114)	(0.00197)	(0.00159)
EDUC2	-0.0702	-0.07096	0.08087
	(0.04731)	(0.08597)	(0.06722)
EDUC3	-.12880**	-0.10796	-0.00535
	(0.05006)	(0.09032)	(0.07106)
HHSIZE	-0.00636	-0.00871	0.00891
	(0.01583)	(0.02783)	(0.0209)
FEM	-.06597*	-0.04662	-0.02449
	(0.03479)	(0.06013)	(0.04761)
MARRIED	.04252*	0.0258	.07234**
	(0.0233)	(0.03881)	(0.03082)
RACE1	-0.06849	-0.04684	-0.05333
	(0.0466)	(0.08087)	(0.0601)
RACE3	0.06365	0.09879	0.08118
	(0.04861)	(0.08416)	(0.06559)
INCOME	.00101*	.00157*	-0.00019
	(0.00052)	(0.00087)	(0.00074)
WFV	0.01433	0.04757	-0.01446
	(0.02358)	(0.04029)	(0.03081)
	Random parameters	Random parameters	Random parameters
NALT	0.00346	-0.04019	-.03443**
	(0.00831)	(0.02975)	(0.01462)
Std.Dev.	.60323***	.62078***	.55465***
	(0.00556)	(0.01155)	(0.00793)
Log-Likelihood	-1171.29105	-539.00169	-633.91417
N Obs	1197	513	684

Note: Significance is indicated by *, ** and *** for the 10%, 5% and the 1% level or less.

This estimation yields two interesting results. First, subjects seem to find differences where technically there aren't any. There should not be any gap between the WTP for the baseline variety and its duplicate since they are identical; nevertheless, the number of available alternatives affects WTP. The second result is that as the number of

alternatives increases the gap between the WTP of the base variety and its duplicate decreases. This entails that subjects that once perceived two goods as being different, no longer consider them distinct when they have more items to choose from. The number of alternatives in the model of 5-8 alternatives is statistically significant and the variance of the parameter is lower than the model with 1-4 alternatives. A possible explanation is that the ability to discern of an individual is limited, so if other resources such as time and required effort to perform an evaluation are constrained, it would imply that a smaller portion of the resources will be dedicated to each comparison as the set to peruse from grows larger. With fewer resources devoted to make comparisons, less attributes of the products may be used for the evaluation, a subset of the array may be selected to evaluate or any other heuristic can be used to maximize the use of resources. In any case, the evaluation process of a small array is different than the process to make such evaluation when the size of the array grows larger.

Hypothesis 4: The WTP for the substitute relative to all products does not change with the number of alternatives of the products. [If the number of elements in $\mathbf{X}_n$ in the utility model $\mathbf{U}(\mathbf{X_n}, \mathbf{Y_m})$ increases, then following the indirect utility $\mathbf{V}(\mathbf{P_{i\ldots n}}, \mathbf{P_j}, \mathbf{I}, \mathbf{S})$ the relative price $\mathbf{P_j}$ will increase. Therefore, in a regression of $\Delta\text{WTP} = \text{WTP}_{\text{Base}} - \text{WTP}_{\text{Substitute}}$ having a statistically significant coefficient for the number of alternatives implies the WTP gap changes as such number increases, i.e. the substitute produce becomes relatively more attractive].

If the preference for a substitute and the preference for a product are independent of which alternatives are presented, the gap between the WTP of the substitute and the

base variety should remain the same with different number of alternatives of the strawberries. To measure this relationship a random parameter linear regression of the WTP differences between the baseline strawberry variety and the substitute grapes is estimated. As was shown in the results under hypothesis 1, the WTP of the baseline strawberry variety decreased as the number of alternatives increased (up to four alternatives). The mean WTP for the control product (grapes) was not statistically different from one round to the next as shown in Table 10.

Table 10. Wilcoxon rank-sum z values z values for WTP of the grapes with different number of strawberries alternatives presented

N ALT	2	3	4	5	6	7	8
1	0.329	0.690	0.556	0.578	1.097	0.509	0.959
2		0.395	0.219	0.259	0.770	0.183	0.637
3			-0.164	-0.134	0.393	-0.194	0.262
4				0.023	0.560	-0.033	0.427
5					0.522	-0.056	0.404
6						-0.571	-0.115
7							0.461

Since the differences can go either way, positive or negative from one round to the next, a random parameter linear approach is convenient and no censoring is needed. To account for the potential effects across individuals of the increase in the number of alternatives, the number of alternatives presented is used as a random coefficient in the regression. The results for such a model are described in Table 11. The number of alternatives as a parameter of the regression is statistically significant and negative when 1-4 alternatives are presented. This implies that increasing the number of alternatives

reduces the gap between the WTP for the baseline variety and the substitute when 1-4 alternatives are presented.

Table 11. RPM Linear regression of WTP differences between the baseline variety and the grapes

	Full Model	1-4 Alternatives	5-8 Alternatives
	Nonrandom parameters	Nonrandom parameters	Nonrandom parameters
AGE	-.00380***	-0.00236	-.00592***
	(0.00098)	(0.00161)	(0.00153)
EDUC2	.42108***	.49030***	.31207***
	(0.03933)	(0.06343)	(0.06561)
EDUC3	.18864***	.22142***	.19340***
	(0.04272)	(0.069)	(0.07108)
HHSIZE	0.01872	0.01408	.05920***
	(0.01445)	(0.02335)	(0.02085)
FEM	.06548**	.14790***	-0.00016
	(0.02971)	(0.04817)	(0.04564)
MARRIED	-0.01238	-0.03018	.09241***
	(0.01918)	(0.03148)	(0.02874)
RACE1	0.05625	0.10389	0.05463
	(0.04026)	(0.06424)	(0.06057)
RACE3	.19301***	.19528***	.11927*
	(0.04101)	(0.06424)	(0.06197)
INCOME	.00223***	.00154*	0.00108
	(0.00051)	(0.00084)	(0.00074)
WFV	-0.0322	-0.01533	-.08004***
	(0.02191)	(0.03416)	(0.03092)
	Random parameters	Random parameters	Random parameters
NALT	-0.00563	-.06343***	0.00377
	(0.00672)	(0.02253)	(0.01457)
Std.Dev.	.69965***	.71507***	.58334***
	(0.00727)	(0.01286)	(0.00964)
Log-Likelihood	-1626.07344	-868.07237	-793.17734
N Obs	1368	684	684

Note: Significance is indicated by *, ** and *** for the 10%, 5% and the 1% level or less.

Then with a decreasing WTP for the baseline variety and a relatively constant WTP for grapes, there is a substitution effect happening between the baseline variety of strawberries and the grapes. In contrast, when 5-8 alternatives are presented, the effect of the number of alternatives on the difference between the WTP of the baseline variety and the substitute is not statistically different. Once the boundary of four alternatives is crossed, the mean and the variance of WTP of both the baseline variety and the substitute are not statistically different across number of alternatives, thus no effect on the differences between them. The implication is that as the cost of evaluating more alternatives of the strawberries increases, the grape substitute whose search costs are constant becomes more attractive and a portion of the market indeed makes the switch and selects the substitute product.

Hypothesis 5: The number of alternatives has no effect on the variance of the WTP of the substitute with respect to the WTP for baseline variety. [Therefore, in the model $\Delta\text{WTP} = \lambda\mathbf{X\beta} + \varepsilon$ where $\Delta\text{WTP} = \text{WTP}_{\text{Base}} - \text{WTP}_{\text{Substitute}}$ and λ is a scaler of the variance from a function of the number of alternatives, $\lambda = 1$. Then if the scale parameter in the model is not equal to 1 the variance in the differences in WTP changes, depending on the sign, as the number of alternatives increases].

As shown under hypothesis 5, the gap between the WTP of the substitute and the WTP for base variety decreases as the number of alternatives increases. The array size may also have an unobserved effect on the WTP gap, impacting the error term with each level. The output of a heteroscedastic linear regression using a scaler parameter as a

function of number of alternatives is in Table 12. Once again, the implied differences don't have bounds, so there is no need for a censored approach.

Table 12. Heteroscedastic Linear Regression of WTP differences between baseline variety and the grapes substitute

	Full Model	1-4 Alternatives	5-8 Alternatives
	Nonrandom parameters	Nonrandom parameters	Nonrandom parameters
AGE	-1.92506*** (0.07993)	-2.11967*** (0.08299)	-2.15131*** (0.08346)
EDUC2	-154.883*** (9.74437)	-170.543*** (10.11744)	-173.095*** (10.175)
EDUC3	155.725*** (9.74347)	171.471*** (10.11651)	174.036*** (10.17406)
HHSIZE	0.21582 (0.24764)	0.23752 (0.25713)	0.24095 (0.25859)
FEM	0.22013 (0.13604)	.24241* (0.14124)	.24599* (0.14205)
MARRIED	.60249*** (0.12392)	.66351*** (0.12867)	.67348*** (0.1294)
RACE1	1.73459 (13.99005)	1.9141 (14.52567)	1.94688 (14.60831)
RACE3	-0.89316 (13.98448)	-0.98767 (14.51988)	-1.00655 (14.60249)
INCOME	-.63384*** (0.05803)	-.69786*** (0.06025)	-.70831*** (0.0606)
WFV	.67141*** (0.03803)	.73931*** (0.03948)	.75038*** (0.03971)
	Random parameters	Random parameters	Random parameters
Scaler	.04134*** (0.00729)	-.00025*** (0.00003)	-.00011*** (0.00003)
Sigma	732.950*** (15.60386)	782.668*** (10.50813)	841.113*** (7.68559)
Log-Likelihood	-70460.15938	-70800.8925	-70824.30825
N Obs	1576	788	788

Note: Significance is indicated by *, ** and *** for the 10%, 5% and the 1% level or less respectively

With a positive and significant effect, the scale parameter in the full model shows that as the number of alternatives increases, the variance of the gap between the WTP of the baseline variety and the substitute is reduced. As the number of alternatives increases, the unobserved factors account for less of the variability of the differences between the WTP of the baseline variety and the substitute. In contrast, when the results are split into models for 1-4 alternatives and 5-8 alternatives, the scale parameter as a function of number of alternatives is negative and significant. This implies that the variance in the differences between WTP of the baseline variety and the substitute within each group increases with the number of alternatives presented within each group. Therefore, the unobserved and unaccounted effects of having more alternatives to choose from are increasing the variance in the differences in WTP.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary and Conclusions

As the markets for different products grow, so do the number of alternatives presented to consumers in those markets. In an effort to develop new products and marketing strategies, experimental economics and the laboratory have proved tremendously useful. In particular, the use of experimental auctions has become widespread in the marketing and economics literature. Though great lengths have been taken to improve the methodology of EA, the number of products or product alternatives being auctioned on does not have a clear guideline. The intrinsic assumption is that the ability of subjects to evaluate the products is unaffected by the number of alternatives available. If this is not the case, this can be a hazard to the results gathered through EAs.

The results of this study showed that changing the number of alternatives in EA can have non-trivial effects on the WTP gathered from subjects. Furthermore, there is an unequivocal increase in the variance of responses with an increase in the size of the array of options to choose from. This noise, these unobserved effects, are confounding the results of WTP estimates, providing results that are not true reflections of preferences. The results are more than a cautionary note on experimental design regarding number of alternatives. When conducting valuation experiments the cognitive effort demanded from subjects is not negligible and increasing the number of alternatives to choose from exerts even more stress. In the field, the cognitive ability of subjects dedicated to

evaluate differences between products remains limited, but time is not always constrained, contrary to most laboratory settings. If time is not under constrains, then more effort can be devoted to each comparison. However, other resources that are also part of the discerning process can be limited and lead to results similar to the ones found in this study.

So, having more products to choose from in EAs is fostering or hindering the research agenda of economics? From the results of this study, the answer would be the latter. The preference revealing features of the second price auction seem to succumb to the lack of recognition of the objective from the participants. The preferred method of non-hypothetical valuation is not immune to a cognitive load effect on subjects. As the number of different alternatives provided increases so does the complexity of the choice, forcing subjects to maximize their resources, sometimes beyond their own abilities to discern between products. Extensive research is still needed in this area with other valuation techniques and different products, but so far it seems that at least for subjects in EAs, more is not always better.

Limitations and Suggestions for Future Research

The main limitation to this study is that it was conducted in a laboratory setting, with the subtle and sometimes not so subtle experimenter effects that can accompany any laboratory experiment with human subjects. A logical extension would be conducting field experiments on whether actual purchasing of goods is affected by a relatively small change in the number of alternatives in the same way as it is in the lab.

Interesting candidates to be evaluated for choice overload effects would be products that have a high heterogeneity associated with each alternative, like strawberries used in this study. This would allow for a higher number of comparisons to be made on many different levels. That is another observation to this study: the products used are highly heterogeneous within each category used for evaluation. The results may not hold for products with very consistent differences across alternatives.

A field experiment with a similar setting could prove interesting for different areas given that for example in 1997 the amount of fresh produce items carried in the average grocery store were 345 and by 2008 the number of available products in the fruit and vegetable sections in grocery stores had increased to 2,200 (FMI 2015); this increase took place while the consumption of fruits and vegetables per capita has decreased from 311 to 180 pounds per year in the same period of time (ERS 2011).

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APPENDIX A

NEWSPAPER ADVERTISEMENT FOR RECRUITING

ATTENTION GROCERY SHOPPERS!

We are looking for individuals to participate in a study on **fruit purchasing**. Participants are needed for either **May 9 or 10, 2014.**

Participants will receive a compensation of **$30** for their participation of approximately from 60 to 90 minutes. To participate, you must be at least 18 years of age. The study includes strawberries tasting, if you have a known strawberries allergy, you may not participate in this study. Participation in the study is completely voluntary.

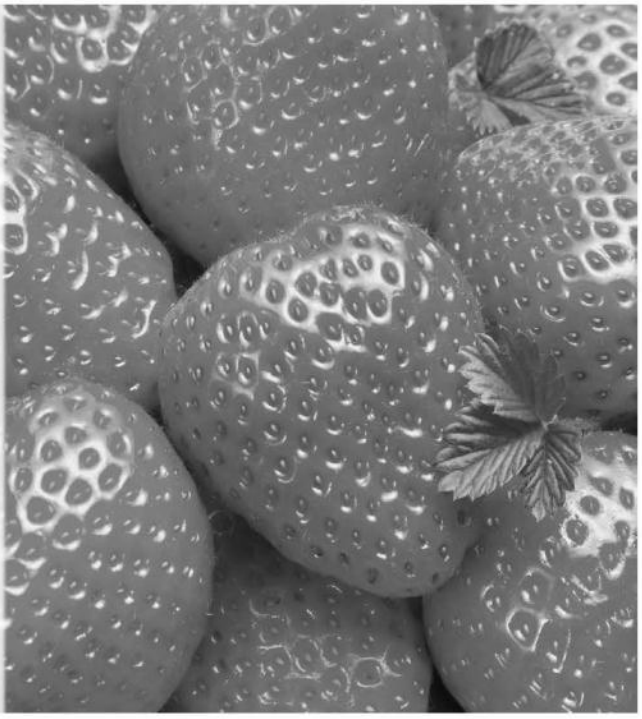
If you are interested in participating, please contact **AGECMarketing@gmail.com** or **(979) 587-4492** to sign up for the most convenient session.

APPENDIX B

EXPERIMENTAL AUCTION QUESTIONNAIRE

Questionaire

Decision making for fruit products



PLEASE DO NOT TURN THE PAGE UNTIL INSTRUCTED TO DO SO

Failure to follow the instructions outlined here may result in being asked to leave by a session monitor. If this occurs any compensation for your participation may be forfeited.

Texas A&M University
Participant ID
1

Introductory Instructions

Welcome! Thank you for agreeing to participate in today's session.

When you were assigned to your seat you received this **packet of information** and with it your participant **ID number**, located on the front page of this packet. You should use this ID number to identify yourself throughout the session today. The use of identification numbers ensures individual confidentiality.

As a reminder before we start today's session, your participation is **completely voluntary**. At any time you may elect to end your participation in the session. However, in order to receive the participation fee you must complete the session. All information collected today will be kept confidential and will not be used for any purpose other than this research.

The purpose of today's session is to gather some general information on the decision making process for purchasing fruits. We will now go through a series of instructions. These instructions will be read from a script to make sure the procedures are accurately described. There will be an opportunity for questions once we go through the instructions.

For the rest of today's session, it is very important that there be no further talking or other communication between participants. If you have questions or comments, please inform a session monitor. If you are not able to comply with these requests you may be disqualified from the experiment.

If you have any questions, please direct them to a session monitor who will gladly answer them.

Again, thank you for your participation.

IRB NUMBER: IRB2014-0101D
IRB APPROVAL DATE: 04/04/2014
IRB EXPIRATION DATE: 04/01/2015

Overview

The purpose of today's experiment is to help us understand purchasing decisions for fruits. To accomplish this purpose, you will be asked to complete a survey and submit bids in an auction for several items. This is a real purchasing experiment; if you are one of the buyers of the auctions, you will pay the auction price and in exchange you will receive the item. You will be given more information on the auction procedures shortly.

The experiment will proceed in several stages as described below.

STAGE 1: Learn How Bids Are Submitted 3
STAGE 2: Learn How the Market Price and Buyers Are Determined 4
STAGE 3: First Practice Round of Auction 7
STAGE 4: Short Knowledge Quiz 8
STAGE 5: Fruit Auctions 11
STAGE 6: Survey 15

If you have not already done so, please review and sign the Consent Form. Please leave the portion for the "Signature of the Person Obtaining Consent" blank. You will be provided with a copy of this document.

IRB NUMBER: IRB2014-0101D
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STAGE 1: Learn How Bids Are Submitted

The Auction: The auction that you will participate in today is called a "sealed bid 2nd-price auction".

1. You will examine the products that will be auctioned.
   You will be given the opportunity to re-evaluate each item if you would like to do so.

2. **Write down** your bid.
   Your bid is the **maximum amount of money** that you would be **willing to pay** for each item on the "Bid Sheet."

3. Return to your seat and wait for the Bid Sheets to be collected.

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STAGE 2: Learn How the Market Price and Buyers Are Determined

How The Auction Price is Determined:

After all the bids for the items have been collected from all participants, we will sort the bids from highest to lowest. The 2nd highest bid will be the **market price**. The price to pay by the buyer will be this market price for the product.

How the Auction Buyer is Determined:

You will participate in more than one round of auctions today. However, we will select randomly one of these rounds to be the official one. All rounds have an equal chance of being drawn. Once the applicable round is drawn, a single product from that round will be selected.

For the round that will be acted upon, only the highest bidder will purchase the selected product at the market price. This buyer will pay the market price for that round, which will be deducted from the participation fee, and will take home the product.

IMPORTANT REMINDERS:

Remember, in the auction it is in your best interest to submit a bid of EXACTLY your true value for the good. If you submit a bid for less than your value, you may end up not winning the auction even though you could have bought the item at a price you were actually willing to pay. If you submit a bid for more than you value the item, then you may end up having to buy the item at a price that is more than you really want to pay.

* ***The practice round is hypothetical, but the auction rounds for fruit products are not***. The buyer of the auction will actually pay money and in exchange receive the fruit item.

* ***You may bid any value for the item***, including zero if you do not like the product and would not pay anything for it

* ***You may bid the same value for two or more items***, if you think the products do not differ from each other enough and would not pay the same amount for both

You will not buy more than one fruit item from the auctions. We will randomly select one round and one product to be binding.

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Please do not read any further until instructed to do so by the session monitor. Your cooperation is greatly appreciated!

IRB NUMBER: IRB2014-0101D
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IRB EXPIRATION DATE: 04/01/2015

STAGE 3: Practice Round of Auction

INSTRUCTIONS:

In this stage you will participate in a hypothetical practice round. You will be asked to bid on three types of pens. The practice round will proceed as follows:

1. When instructed by a session monitor, you may go to the table to examine each product. Please do not talk to other participants during bidding. We will be happy to answer any of your questions.
2. On the practice-bidding sheet, you will write down your bid for each item. Then, return to your seat.
3. Wait until a session monitor collects the practice-bidding sheets.

While you wait for the price and buyers of this practice round to be determined, you will complete a short knowledge about the auction procedures. The knowledge quiz starts on the next page.

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Please do not read any further until instructed to do so by the session monitor. Your cooperation is greatly appreciated!

IRB NUMBER: IRB2014-0101D
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IRB EXPIRATION DATE: 04/01/2015

STAGE 5: Fruit Auctions

Thank you for your participation so far. The next auction rounds will be for several fruit products, but only one of the rounds will be acted upon. The official round will be selected at random after all rounds have been completed.

INSTRUCTIONS: The stage will proceed as follows:

1. Taste samples from left to right following the order of the sample code.
2. You can find crackers and water in the table to rinse your palate between each sample.
3. Please refer to the tasting report sheets provided during the tasting and mark with an **"X"** the appropriate box according to your evaluation for the attributes of each sample.

   0= Extremely Dislike 10= Extremely Like
4. For each item, please indicate your bid on each bidding sheet. Please do not talk to other participants during bidding.
5. Wait until a session monitor collects your sheets.

If you have any questions, please direct them to a session monitor who will gladly answer them. Please do not turn the page until directed to do so.

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IRB EXPIRATION DATE: 04/01/2015

Please do not read any further until instructed to do so by the session monitor. Your cooperation is greatly appreciated!

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IRB NUMBER: IRB2014-0101D
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STAGE 6: Survey

INSTRUCTIONS: Please select **only one** answer by marking an "X" in the blank unless otherwise indicated. There is no right or wrong answer. Your survey responses are very important to the results of today's sessions. **Please remember that all responses will be kept confidential**.

1. **Now that you have completed the bidding rounds, please tell us what number of alternatives did you feel more comfortable with?**

[2] [3] [4] [5] [6] [7] [8] More than 8. How many ___

2. **How many alternatives would have been acceptable?**

[2] [3] [4] [5] [6] [7] [8] More than 8. How many ___

3. **Did you feel there was enough time for you to make your bids?**

[0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

Too little time — About Right — Way too much time

4. **Did you find the bidding process difficult?**

[0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

Not so much — Manageable — Totally excruciating

5. **At any point did you feel frustrated with the bidding process?**

[0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

Not at all — A little — Totally annoyed

6. **How confident are you that you bid the right amounts?**

[0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

Not so much — About Right — Totally confident

7. **Would you change any of your bids if you had the chance?**

[0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

Not at all — Maybe a couple — Definitely all of them

8. **PRIMARY SHOPPER: Are you the PRIMARY grocery shopper for your household?**

a.___ Yes **b.**___ No

9. **WEEKLY FOOD EXPENDITURES: How much, on average, does your household spend on food PER WEEK?** (Include grocery, snacks, restaurants, and any other food purchases).

a. ___ $0-$49
b. ___ $50 - $99
c. ___ $100 - $149
d. ___ $150 - $199
e. ___ $200 - $249
f. ___ $250 - $299
g. ___ $300 - $399
h. ___ $400 - $499
i. ___ $500 - $749
j. ___ $750 or more

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10. **WEEKLY FRUIT AND FRUIT EXPENDITURES: How much, on average, does your household spend on fruits and fruits PER WEEK?**

a. ___ $0-$24
b. ___ $25 - $49
c. ___ $50 - $74
d. ___ $75 - $99
e. ___ $100 or more

11. **FREQUENCY OF FRUIT AND VEGETABLE PURCHASES: How often does your household purchase fresh fruits and vegetables?**

a. ___ Less than once a month
b. ___ Once a month
c. ___ Two to three times / month
d. ___ Once a week
e. ___ More than once a week

12. **AGE: Please indicate your age in years: _____ years**

13. **EDUCATION: Please indicate the highest degree or level of school you have completed:**

a. ___No schooling completed
b. ___Regular High School Diploma, GED or alternative
c. ___Some College, Associate's degree, or Bacherlor's degree
d. ___Master's degree, Professional degree or Doctorate degree

14. **HOUSEHOLD SIZE: Including yourself, how many people live in your household?**

___ People

15. **CHILDREN: How many children live in your household, if any?**

___ Children

16. **SEX: Please indicate:**

a. ___ Female
b. ___ Male

17. **MARITAL STATUS: What is your current marital status?**

a. ___Never married
b. ___Married
c. ___Widowed
d. ___Divorced
e. ___Separated

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18. RACE: Please indicate your race:

- **a.** ___ Hispanic, Latino or Spanish origin
- **b.** ___ White
- **c.** ___ Black/African American
- **d.** ___ American Indian or Alaskan Native
- **e.** ___ Asian Indian
- **f.** ___ Chinese
- **g.** ___ Filipino
- **h.** ___ Japanese
- **i.** ___ Korean
- **j.** ___ Vietnamese
- **k.** ___ Native Hawaiian
- **l.** ___ Gaumanian or Chamorro
- **m.** ___ Samoan
- **n.** ___ Other lease List: _____}

19. INCOME: Please indicate your household yearly income for 2013. (Include all forms of income, including salary, interest and dividend payments, tips, scholarship support, student loans, parental support, social security, child support, and allowance).

- **a.** ___Less than $20,000
- **b.** ___$20,000-$29,999
- **c.** ___$30,000-$39,999
- **d.** ___$40,000-$49,999
- **e.** ___$50,000-$59,999
- **f.** ___$60,000-$69,999
- **g.** ___$70,000-$79,999
- **h.** ___$80,000-$89,999
- **i.** ___$90,000-$99,999
- **j.** ___$100,000-$149,999
- **k.** ___More than $150,000

20. EMPLOYMENT: Which of these <u>BEST</u> describes your employment status?

- **a.** ___Unemployed
- **b.** ___ Stay-at-Home Parent
- **c.** ___ Part-time Employed
- **d.** ___ Full-time Employed
- **e.** ___ Self employed
- **f.** ___ Retired
- **g.** ___ Disabled
- **h.** .___ Student

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21. Would you rather be somewhere else than participating in this study?

0	1	2	3	4	5	6	7	8	9	10

Not at all — Neither agree or disagree — Definitely

22. How important do you feel it is for you to be here?

0	1	2	3	4	5	6	7	8	9	10

Not at all — Neither agree or disagree — Very important

23. How interested are you in the outcome of the experiment?

0	1	2	3	4	5	6	7	8	9	10

Not at all — Neither agree or disagree — Very important

24. Would you recommend this study to a friend of yours?

0	1	2	3	4	5	6	7	8	9	10

Not at all — Neither agree or disagree — Definitely

25. Would you be participating if there was not participation fee?

0	1	2	3	4	5	6	7	8	9	10

Not at all — Neither agree or disagree — Definitely

26. Would you participate in a study with this experimenter in the future?

0	1	2	3	4	5	6	7	8	9	10

Not at all — Neither agree or disagree — Definitely

27. How friendly/likable do you think the experimenter was?

0	1	2	3	4	5	6	7	8	9	10

Not at all — Neither agree or disagree — Very friendly

28. How much do you care about whether the experimenter's study works?

0	1	2	3	4	5	6	7	8	9	10

Not at all — Neither agree or disagree — Very much

29. How much do you care about Texas A&M experiments?

0	1	2	3	4	5	6	7	8	9	10

Not at all — Neither agree or disagree — Very much

30. Would you participate in another research by Texas A&M?

0	1	2	3	4	5	6	7	8	9	10

Not at all — Neither agree or disagree — Definitely

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Please do not read any further until instructed to do so by the session monitor. Your cooperation is greatly appreciated!

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IRB NUMBER: IRB2014-0101D
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Thank you for your participation!

Your responses are very important for us.

Please do not discuss the procedures of today's study with anyone who will be participating in later rounds of the study until after they have completed their session. This will help ensure the validity of our results.

Please wait for further instructions.

Tasting Report

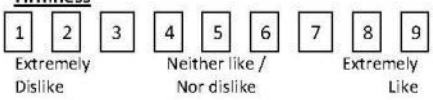
Texas A&M University
Participant ID
1

One Sample: ABN

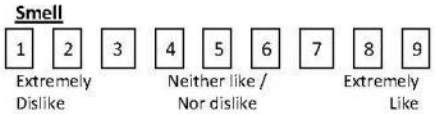
Appearance

Sweetness

Firmness

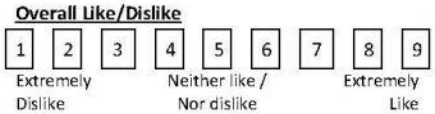


Smell



Flavor

Overall Like/Dislike



1

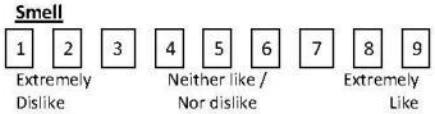
Two Samples: ABN

Appearance

Sweetness

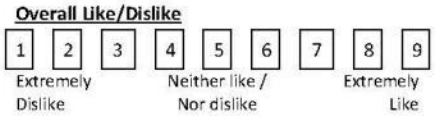
Firmness

Smell



Flavor

Overall Like/Dislike



1

IRB NUMBER: IRB2014-0101D
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IRB EXPIRATION DATE: 04/01/2015

Bid Sheets

Texas A&M University
Participant ID
1
IRB2014-0101

STAGE 3: PRACTICE ROUND 1: Pen Bidding

INSTRUCTIONS: Please indicate the maximum amount that you would be willing to pay for each of these items. Write the amount of your bid (in dollars and cents) in the "Bid" column in the chart below.

PAPER MATE PEN	PILOT B2P PEN	BIC PEN
BID:$_____	BID:$_____	BID:$_____

1

STAGE 5: One Fruit Product Bid

INSTRUCTIONS: Please indicate the maximum amount that you would be willing to pay for each of these items. Write the amount of your bid (in dollars and cents) in the "Bid" column in the chart below. **Please be sure to write a bid for ALL products listed.**

CDS	Grapes
BID:$_____	BID:$_____

Did you feel there were enough choices for you to make your bids? Yes___No___

1

STAGE 5: Two Fruit Product Bidding

INSTRUCTIONS: Please indicate the maximum amount that you would be willing to pay for each of these items. Write the amount of your bid (in dollars and cents) in the "Bid" column in the chart below. **Please be sure to write a bid for ALL products listed.**

SLD	CDS	Grapes
BID:$_____	BID:$_____	BID:$_____

Did you feel there were enough choices for you to make your bids? Yes___No___

1

STAGE 5: Three Fruit Product Bidding

INSTRUCTIONS: Please indicate the maximum amount that you would be willing to pay for each of these items. Write the amount of your bid (in dollars and cents) in the "Bid" column in the chart below. **Please be sure to write a bid for ALL products listed.**

CDS	CMR	SLD	Grapes
BID:$_____	BID:$_____	BID:$_____	BID:$_____

Did you feel there were enough choices for you to make your bids? Yes___No___

1

STAGE 5: Four Fruit Product Bidding

INSTRUCTIONS: Please indicate the maximum amount that you would be willing to pay for each of these items. Write the amount of your bid (in dollars and cents) in the "Bid" column in the chart below. **Please be sure to write a bid for ALL products listed.**

CDS	CDS	CDS	CDS	Grapes
BID:$_____	BID:$_____	BID:$_____	BID:$_____	BID:$_____

Did you feel there were enough choices for you to make your bids? Yes____No___

1

STAGE 5: Five Fruit Product Bidding

INSTRUCTIONS: Please indicate the maximum amount that you would be willing to pay for each of these items. Write the amount of your bid (in dollars and cents) in the "Bid" column in the chart below. **Please be sure to write a bid for ALL products listed.**

CDS	CDS	CDS	CDS	CDS	Grapes
BID:$_____	BID:$_____	BID:$_____	BID:$_____	BID:$_____	BID:$_____

Did you feel there were enough choices for you to make your bids? Yes____No___

1

STAGE 5: Six Fruit Product Bidding

INSTRUCTIONS: Please indicate the maximum amount that you would be willing to pay for each of these items. Write the amount of your bid (in dollars and cents) in the "Bid" column in the chart below. **Please be sure to write a bid for ALL products listed.**

CDS	CDS	CDS	CDS	CDS	CDS	Grapes
BID: $_____	BID: $_____	BID: $_____	BID: $_____	BID: $_____	BID: $_____	BID: $_____

Did you feel there were enough choices for you to make your bids? Yes___No___

1

STAGE 5: Seven Fruit Product Bidding

INSTRUCTIONS: Please indicate the maximum amount that you would be willing to pay for each of these items. Write the amount of your bid (in dollars and cents) in the "Bid" column in the chart below. **Please be sure to write a bid for ALL products listed.**

CDS	CDS	CDS	CDS	CDS	CDS	CDS	Grapes
BID: $_____	BID: $_____	BID: $_____	BID: $_____	BID: $_____	BID: $_____	BID: $_____	BID: $_____

Did you feel there were enough choices for you to make your bids? Yes___No___

1

STAGE 5: Eight Fruit Product Bidding

INSTRUCTIONS: Please indicate the maximum amount that you would be willing to pay for each of these items. Write the amount of your bid (in dollars and cents) in the "Bid" column in the chart below. **Please be sure to write a bid for ALL products listed.**

CDS	CDS	CDS	CDS	CDS	CDS	CDS	CDS	Grapes
BID: $_____	BID: $_____	BID: $_____	BID: $_____	BID: $_____	BID: $_____	BID: $_____	BID: $_____	BID: $_____

Did you feel there were enough choices for you to make your bids? Yes___No___

1

APPENDIX C

STATA CODE

```
*-------------------------------------------------------
*DO FILE TO ANALYZE INFORMATION FROM STRAWBERRIES AUCTION
*-------------------------------------------------------

*Legend

*rv = round.variety
*Rounds
*         =1 Baseline
*   =2 Two strawberries
*   =3 Three strawberries
*   =4 Four strawberries
*         =5 Five strawberries
*   =6 Six strawberries
*   =7 Seven strawberries
*   =8 Eight strawberries

* Varieties
*    =1 Albion ABN
*    =2 Festival FST
*    =3 Benicia BNC
*    =4 San Andres SCP
*    =5 Chandler DHC
*    =6 Camarosa CMR
*    =7 Driscoll's SLD
*    =8 Driscoll's CDS
*    =9 Grapes

*-------------------------------------------------------
* BEGINNING DO FILE
*-------------------------------------------------------

clear
cd "C:\Users\dchavez\Documents\Dropbox\1 TAMU\RA\Thesis\Strawberry.Data"
log using berries_data, replace

use berries_data
```

```
*Reshape data for wtp
reshape long wtp, i(id) j(rv)
keep if wtp<.

*Reshape data for ratings
reshape long ovrp, i(id) j(rv)
keep if ovrp<.

*-----------------------------------------------------------
*GENERATED VARIABLES
*-----------------------------------------------------------
*Generate indicators for strawberry varieties
use berries_data_rv
gen V1:.= rv==11|rv==21|rv==31|rv==41|rv==51|rv==61|rv==71|rv==81
gen V2:.= rv==12|rv==22|rv==32|rv==42|rv==52|rv==62|rv==72|rv==82
replace V2 = 2 if V2==1
gen V3:.= rv==13|rv==23|rv==33|rv==43|rv==53|rv==63|rv==73|rv==83
replace V3 = 3 if V3==1
gen V4:.= rv==14|rv==24|rv==34|rv==44|rv==54|rv==64|rv==74|rv==84
replace V4 = 4 if V4==1
gen V5:.= rv==15|rv==25|rv==35|rv==45|rv==55|rv==65|rv==75|rv==85
replace V5 = 5 if V5==1
gen V6:.= rv==16|rv==26|rv==36|rv==46|rv==56|rv==66|rv==76|rv==86
replace V6 = 6 if V6==1
gen V7:.= rv==17|rv==27|rv==37|rv==47|rv==57|rv==67|rv==77|rv==87
replace V7 = 7 if V7==1
gen V8:.= rv==18|rv==28|rv==38|rv==48|rv==58|rv==68|rv==78|rv==88
replace V8 = 8 if V8==1
gen V9:.= rv==19|rv==29|rv==39|rv==49|rv==59|rv==69|rv==79|rv==89
replace V9 = 9 if V9==1
egen var = rowtotal(V1 V2 V3 V4 V5 V6 V7 V8 V9)
gen V7_1:.= rv==27|rv==37|rv==47|rv==57|rv==67|rv==77|rv==87
replace V7_1 = 7 if V7_1==1
gen VD:.=
rv==27|rv==37|rv==47|rv==57|rv==67|rv==77|rv==87|rv==28|rv==38|rv==48|rv==58|rv
==68|rv==88|rv==88
replace VD = 8 if V8==8
replace VD = 7 if V7_1==7
generate dup = VD>0

*Generate indicators for rounds and variety per round
gen R1:. = (10<rv) & (rv<20)
gen R2:. = (20<rv) & (rv<30)
replace R2 = 2 if R2==1
```

```
gen R3:. = (30<rv) & (rv<40)
replace R3 = 3 if R3==1
gen R4:. = (40<rv) & (rv<50)
replace R4 = 4 if R4==1
gen R5:. = (50<rv) & (rv<60)
replace R5 = 5 if R5==1
gen R6:. = (60<rv) & (rv<70)
replace R6 = 6 if R6==1
gen R7:. = (70<rv) & (rv<80)
replace R7 = 7 if R7==1
gen R8:. = (80<rv) & (rv<90)
replace R8 = 8 if R8==1
egen round = rowtotal(R1 R2 R3 R4 R5 R6 R7 R8)

*Generate indicators for sessions
gen S1:.= (100<id) & (id<200)
gen S2:.= (200<id) & (id<300)
gen S3:.= (300<id) & (id<400)
gen S4:.= (400<id) & (id<500)
gen S5:.= (500<id) & (id<600)
gen S6:.= (600<id) & (id<700)
gen S7:.= (700<id) & (id<800)
gen S8:.= (800<id) & (id<900)
gen S9:.= (900<id) & (id<1000)
gen S10:.= (1000<id) & (id<1100)

*Clone wtp for means test
clonevar wtpv1 = wtp if var==1
clonevar wtpv2 = wtp if var==2
clonevar wtpv3 = wtp if var==3
clonevar wtpv4 = wtp if var==4
clonevar wtpv5 = wtp if var==5
clonevar wtpv6 = wtp if var==6
clonevar wtpv7 = wtp if var==7
clonevar wtpv8 = wtp if var==8
clonevar wtpv9 = wtp if var==9
clonevar wtpv7_1 = wtp if V7_1==7
egen wtp_b = rowmean(wtpv1 wtpv2 wtpv3 wtpv4 wtpv5 wtpv6 wtpv7 wtpv8)
egen wtp_d = rowmean(wtpv7_1 wtpv8)

*Clone ratings for means test
clonevar ovrpv1 = ovrp if V1==1
clonevar ovrpv2 = ovrp if V2==1
clonevar ovrpv3 = ovrp if V3==1
```

```
clonevar ovrpv4 = ovrp if V4==1
clonevar ovrpv5 = ovrp if V5==1
clonevar ovrpv6 = ovrp if V6==1
clonevar ovrpv7 = ovrp if V7==1
clonevar ovrpv8 = ovrp if V8==1
clonevar ovrpv9 = ovrp if V9==1

*Generate variables for treatments
gen AM:.= (S5==1)|(S6==1)|(S7==1)|(S8==1)
gen AFF:.= (S2==1)|(S4==1)|(S6==1)|(S8==1)|(S10==1)
gen Eval:.= (S1==1)|(S2==1)|(S5==1)|(S8==1)|(S9==1)|(S10==1)

use "C:\Users\dchavez\Dropbox\1
TAMU\RA\Thesis\Strawberry.Data\analysis\Berries_data_rv 2.dta"

set more off

/*recode wfood 1-8 for actual values*/
recode wfood (1=24.5) (2=74.5) (3=124.5) (4=174.5) (5=224.5) (6=274.5) (7=349.5)
(8=400)

/*recode educ 1-4 1=no school; 2=hs; 3=college; 4=grad*/
recode educ (2=1) (3=2) (4=3)
tabulate educ, generate(educ)

/*recode race 1-5; 1=hisp, 2=white, 3=black, 4=asian, 5=other */
recode race (4=3) (5=3)
tabulate race, generate(race)

/*recode income 1-8; 1=<20k, 2=20-29, 3=30-39, 4=40-49, 5=50-59, 6=60-69, 7=70-79,
8=80-89, 9=90-99, 10=100-150, 11=150*/
recode income (1=9.5) (2=24.5) (3=34.5) (4=44.5) (5=54.5) (6=64.5) (7=74.5) (8=84.5)
(9=94.5) (10=124.5) (11=150)

/* make aff from 0-1 instead of 0-100*/
generate naff=aff/100

/* rename panel to panelid*/
rename panel panelid

/* rename AFF - uppercase for whether they received affinity treatment*/
rename AFF afft

/* corecting for coding*/
```

```
replace V1=0
replace V1=1 if rv==11 | rv==21 | rv==31 | rv==41 | rv==51 | rv ==61 | rv==71 | rv==81

/*create delta variables of differences in duplicate variable*/
by id round, sort : egen float ddupl = total((wtp*V7)-(wtp*V8)) if round!=1
replace ddupl=. if V7!=1
by id round, sort : gen float ddup14 = ddupl if round>=1 & round<=4
by id round, sort : gen float ddup58 = ddupl if round>=5

/*create delta variables of differences in duplicate variable*/
by id round, sort : egen float dctrl = total((wtp*V7)-(wtp*V9)) if V9==1|V7==1
replace dctrl=. if V9==1
by id round, sort : gen float dctr14 = dctrl if round>=1 & round<=4
by id round, sort : gen float dctr58 = dctrl if round>=5

/*create round variables for split analysis*/
by id round, sort : gen float alt14 = round if round>=1 & round<=4
by id round, sort : gen float alt58 = round if round>=5

/*create WTPV7 variables for breakpoint analysis*/
by id round, sort : gen float wtpv711 = wtpv7 if round==1
by id round, sort : gen float wtpv728 = wtpv7 if round>1

by id round, sort : gen float wtpv712 = wtpv7 if round<=2
by id round, sort : gen float wtpv738 = wtpv7 if round>2

by id round, sort : gen float wtpv713 = wtpv7 if round<=3
by id round, sort : gen float wtpv748 = wtpv7 if round>3

by id round, sort : gen float wtpv714 = wtpv7 if round<=4
by id round, sort : gen float wtpv758 = wtpv7 if round>4

by id round, sort : gen float wtpv715 = wtpv7 if round<=5
by id round, sort : gen float wtpv768 = wtpv7 if round>5

by id round, sort : gen float wtpv716 = wtpv7 if round<=6
by id round, sort : gen float wtpv778 = wtpv7 if round>6

by id round, sort : gen float wtpv717 = wtpv7 if round<=7
by id round, sort : gen float wtpv788 = wtpv7 if round>7

*Means of control over #alternatives*
ranksum wtpv9 if round==1|round==2, by(round) porder
ranksum wtpv9 if round==1|round==3, by(round) porder
```

```
ranksum wtpv9 if round==1|round==4, by(round) porder
ranksum wtpv9 if round==1|round==5, by(round) porder
ranksum wtpv9 if round==1|round==6, by(round) porder
ranksum wtpv9 if round==1|round==7, by(round) porder
ranksum wtpv9 if round==1|round==8, by(round) porder

ranksum wtpv9 if round==2|round==3, by(round) porder
ranksum wtpv9 if round==2|round==4, by(round) porder
ranksum wtpv9 if round==2|round==5, by(round) porder
ranksum wtpv9 if round==2|round==6, by(round) porder
ranksum wtpv9 if round==2|round==7, by(round) porder
ranksum wtpv9 if round==2|round==8, by(round) porder

ranksum wtpv9 if round==3|round==4, by(round) porder
ranksum wtpv9 if round==3|round==5, by(round) porder
ranksum wtpv9 if round==3|round==6, by(round) porder
ranksum wtpv9 if round==3|round==7, by(round) porder
ranksum wtpv9 if round==3|round==8, by(round) porder

ranksum wtpv9 if round==4|round==5, by(round) porder
ranksum wtpv9 if round==4|round==6, by(round) porder
ranksum wtpv9 if round==4|round==7, by(round) porder
ranksum wtpv9 if round==4|round==8, by(round) porder

ranksum wtpv9 if round==5|round==6, by(round) porder
ranksum wtpv9 if round==5|round==7, by(round) porder
ranksum wtpv9 if round==5|round==8, by(round) porder

ranksum wtpv9 if round==6|round==7, by(round) porder
ranksum wtpv9 if round==6|round==8, by(round) porder

ranksum wtpv9 if round==7|round==8, by(round) porder

*Means of baseline over #alternatives*
ranksum wtpv7 if round==1|round==2, by(round) porder
ranksum wtpv7 if round==1|round==3, by(round) porder
ranksum wtpv7 if round==1|round==4, by(round) porder
ranksum wtpv7 if round==1|round==5, by(round) porder
ranksum wtpv7 if round==1|round==6, by(round) porder
ranksum wtpv7 if round==1|round==7, by(round) porder
ranksum wtpv7 if round==1|round==8, by(round) porder

ranksum wtpv7 if round==2|round==3, by(round) porder
ranksum wtpv7 if round==2|round==4, by(round) porder
```

```
ranksum wtpv7 if round==2|round==5, by(round) porder
ranksum wtpv7 if round==2|round==6, by(round) porder
ranksum wtpv7 if round==2|round==7, by(round) porder
ranksum wtpv7 if round==2|round==8, by(round) porder

ranksum wtpv7 if round==3|round==4, by(round) porder
ranksum wtpv7 if round==3|round==5, by(round) porder
ranksum wtpv7 if round==3|round==6, by(round) porder
ranksum wtpv7 if round==3|round==7, by(round) porder
ranksum wtpv7 if round==3|round==8, by(round) porder

ranksum wtpv7 if round==4|round==5, by(round) porder
ranksum wtpv7 if round==4|round==6, by(round) porder
ranksum wtpv7 if round==4|round==7, by(round) porder
ranksum wtpv7 if round==4|round==8, by(round) porder

ranksum wtpv7 if round==5|round==6, by(round) porder
ranksum wtpv7 if round==5|round==7, by(round) porder
ranksum wtpv7 if round==5|round==8, by(round) porder

ranksum wtpv7 if round==6|round==7, by(round) porder
ranksum wtpv7 if round==6|round==8, by(round) porder

ranksum wtpv7 if round==7|round==8, by(round) porder

/*Evaluate structural changes in pooling*/
set more off
tobit wtpv7 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

tobit wtpv711 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

tobit wtpv728 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

tobit wtpv712 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

tobit wtpv738 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

tobit wtpv713 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic
```

```
tobit wtpv748 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

tobit wtpv714 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

tobit wtpv758 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

tobit wtpv715 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

tobit wtpv768 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

tobit wtpv716 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

tobit wtpv778 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

tobit wtpv717 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

tobit wtpv788 age educ2 educ3 hhsize fem married race1 race3 income wfv, ll(0)
estat ic

outsheet using "C:\Users\dchavez\Dropbox\1
TAMU\RA\Thesis\Strawberry.Data\analysis\bdata.csv", comma replace
```

APPENDIX D

NLOGIT CODE

```
IMPORT;FILE=" C:\Users\dchavez\Dropbox\1
TAMU\RA\Thesis\Strawberry.Data\analysis\bdata.csv"$

NAMELIST ; ALLX = ONE, V1, V2, V3, V4, V5, V6, V8, V9, AGE, EDUC2, EDUC3,
HHSIZE, FEM, MARRIED, RACE1, RACE3, INCOME, WFV $
NAMELIST ; ALLX9 = ONE, V1, V2, V3, V4, V5, V6, V8, AGE, EDUC2, EDUC3,
HHSIZE, FEM, MARRIED, RACE1, RACE3, INCOME, WFV $
NAMELIST ; NOCON = V1, V2, V3, V4, V5, V6, V8, V9, AGE, EDUC2, EDUC3,
HHSIZE, FEM, MARRIED, RACE1, RACE3, INCOME, WFV $
NAMELIST ; NOCON9 = V1, V2, V3, V4, V5, V6, V8, AGE, EDUC2, EDUC3,
HHSIZE, FEM, MARRIED, RACE1, RACE3, INCOME, WFV $
NAMELIST ; NOCONVAR = AGE, EDUC2, EDUC3, HHSIZE, FEM, MARRIED,
RACE1, RACE3, INCOME, WFV $
NAMELIST ; NOVAR = ONE,AGE, EDUC2, EDUC3, HHSIZE, FEM, MARRIED,
RACE1, RACE3, INCOME, WFV $
NAMELIST ; RPX = V1, V2, V3, V4, V5, V6, V8, V9 $
NAMELIST ; RPX9 = V1, V2, V3, V4, V5, V6, V8 $

SETPANEL ; Group = id ; Pds = panelid $

/*Mean WTP for different alternatives*/
TOBIT
; Lhs = wtpv7
; Rhs = R1, R2, R3, R4, R5, R6, R7, R8
; Het
; Hfn =  round
; Maxit = 10000
; Partial Effects
$

TOBIT
; Lhs = wtpv7
; Rhs = R1, R2, R3, R4, R5, R6, R7, R8
; Partial Effects
$

/*Model 1a: RPM Tobit wtpv7*/
TOBIT
```

```
; Lhs = wtpV7
; Rhs = novar, ROUND
; RPM
; Fcn = round(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
; Partial Effects
 $

/*Model 1b: RPM Tobit wtpv7 for 1-4 alternatives*/
TOBIT
; Lhs = wtpV7_14
; Rhs = novar, ROUND
; RPM
; Fcn = round(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
; Partial Effects
 $

/*Model 1c: RPM Tobit wtpv7 for 5-8 alternatives*/
TOBIT
; Lhs = wtpV7_58
; Rhs = novar, ROUND
; RPM
; Fcn = round(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
; Partial Effects
 $

/*Model 2a: Tobit wtpv7 w/het scaler*/
TOBIT
; Lhs = wtpv7
; Rhs = NOVAR
; Het
; Hfn =  round
; Maxit = 10000
```

```
; Partial Effects
$

/*Model 2b: Tobit wtpv7 1-4 alternatives w/het scaler*/
TOBIT
; Lhs = wtpv7_14
; Rhs = NOVAR
; Het
; Hfn =  round
; Maxit = 10000
; Partial Effects
$

/*Model 2c: Tobit wtpv7 5-8 alternatives w/het scaler*/
TOBIT
; Lhs = wtpv7_58
; Rhs = NOVAR
; Het
; Hfn =  round
; Maxit = 10000
; Partial Effects
$

/*Model 3a1: RPM Linear differences wtp base-duplicate 1-8 alternatives*/
REGRESS
; Lhs = DDUPL
; Rhs = ROUND, NOVAR
; RPM
; Fcn = ROUND(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
; Partial Effects
 $

/*Model 3a2: RPM Linear differences wtp base-duplicate 1-8 alternatives NOCON*/
REGRESS
; Lhs = DDUPL
; Rhs = ROUND, NOCONVAR
; RPM
; Fcn = ROUND(n)
; Panel
; Pts = 500
```

```
; Halton
; MAXIT=10000
; Partial Effects
 $

/*Model 3b1: RPM Linear differences wtp base-duplicate 1-4 alternatives*/
REGRESS
; Lhs = DDUP14
; Rhs = ROUND, NOVAR
; RPM
; Fcn = ROUND(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
; Partial Effects
 $

/*Model 3b2: RPM Linear differences wtp base-duplicate 1-4 alternatives NOCON*/
REGRESS
; Lhs = DDUP14
; Rhs = ROUND, NOCONVAR
; RPM
; Fcn = ROUND(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
; Partial Effects
 $

/*Model 3c: RPM Linear differences wtp base-duplicate 5-8 alternatives*/
REGRESS
; Lhs = DDUP58
; Rhs = ROUND, NOVAR
; RPM
; Fcn = ROUND(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
; Partial Effects
 $
```

```
/*Model 3c: RPM Linear differences wtp base-duplicate 5-8 alternatives NOCON*/
REGRESS
; Lhs = DDUP58
; Rhs = ROUND, NOCONVAR
; RPM
; Fcn = ROUND(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
; Partial Effects
 $

/*Model 4a: RPM Linear differences wtp base-control 1-8 alternatives*/
REGRESS
; Lhs = DCTRL
; Rhs = ROUND, NOVAR
; RPM
; Fcn = ROUND(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
; Partial Effects
 $

/*Model 4a: RPM Linear differences wtp base-control 1-8 alternatives NOCON*/
REGRESS
; Lhs = DCTRL
; Rhs = ROUND, NOCONVAR
; RPM
; Fcn = ROUND(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
; Partial Effects
 $

/*Model 4b: RPM Linear differences wtp base-control 1-4 alternatives*/
REGRESS
; Lhs = DCTR14
; Rhs = ROUND, NOVAR
; RPM
```

```
; Fcn = ROUND(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
; Partial Effects
 $

/*Model 4b: RPM Linear differences wtp base-control 1-4 alternatives NOCON*/
REGRESS
; Lhs = DCTR14
; Rhs = ROUND, NOCONVAR
; RPM
; Fcn = ROUND(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
; Partial Effects
 $

/*Model 4c: RPM Linear differences wtp base-control 5-8 alternatives*/
REGRESS
; Lhs = DCTR58
; Rhs = ROUND, NOVAR
; RPM
; Fcn = ROUND(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
; Partial Effects
 $

/*Model 4c: RPM Linear differences wtp base-control 5-8 alternatives NOCON*/
REGRESS
; Lhs = DCTR58
; Rhs = ROUND, NOCONVAR
; RPM
; Fcn = ROUND(n)
; Panel
; Pts = 500
; Halton
; MAXIT=10000
```

```
; Partial Effects
 $

/*Model 5a1: Heteroscedastic Linear of differences wtp base-control 1-8 alternatives*/
HREG
; Lhs=DCTRL
; Rhs=NOVAR
; Rh2=ROUND
; Maxit=10000
; Partial Effects
$

/*Model 5a2: Heteroscedastic Linear of differences wtp base-control 1-8 alternatives*/
HREG
; Lhs=DCTRL
; Rhs=NOCONVAR
; Rh2=ROUND
; Maxit=10000
; Partial Effects
$

/*Model 5b1: Heteroscedastic Linear of differences wtp base-control 1-4 alternatives*/
HREG
; Lhs=DCTR14
; Rhs=NOVAR
; Rh2= R1, R2, R3, R4
; Maxit=10000
; Partial Effects
$

/*Model 5b2: Heteroscedastic Linear of differences wtp base-control 1-4 alternatives
NOCON*/
HREG
; Lhs=DCTR14
; Rhs=NOCONVAR
; Rh2= R1, R2, R3, R4
; Maxit=10000
; Partial Effects
$

/*Model 5c1: Heteroscedastic Linear of differences wtp base-control 5-8 alternatives*/
HREG
; Lhs=DCTR58
; Rhs=NOVAR
```

```
; Rh2= R5, R6, R7, R8
; Maxit=10000
; Partial Effects
$

/*Model 5c2: Heteroscedastic Linear of differences wtp base-control 5-8 alternatives*/
HREG
; Lhs=DCTR58
; Rhs=NOCONVAR
; Rh2= R5, R6, R7, R8
; Maxit=10000
; Partial Effects
$

TOBIT
; Lhs = wtpv7_1/wtpv8
; Rhs = NOVAR
; Het
; Hfn =  ROUND
; MAXIT=10000
; Partial Effects
 $

TOBIT
; Lhs = wtpv9/wtpv7
; Rhs = NOVAR
; Het
; Hfn =  ROUND
; MAXIT= 10000
; Partial Effects
 $
```