THREE ESSAYS ON THE ELICITATION OF WILLINGNESS-TO-PAY

By

LIJIA SHI

A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

2012

To my parents

ACKNOWLEDGMENTS

I would like to express my gratitude to my committee members: Dr. Lisa A. House, Dr. Zhifeng Gao, Dr. Kim Morgan and Dr. Chunrong Ai for their generous help and support in the completion of this dissertation.

Most gratefully, I thank Dr. Lisa House and Dr. Zhifeng Gao for their generous help and continuous encouragement. They have been among the best mentors in the department and all my achievement during the last four years would not be possible without their support.

Moreover, I want to thank Dr. Kim Morgan and Dr. Chunrong Ai for their valuable comments and suggestions. They are both respected professionals. I believe their help will also benefit me in my future studies.

I would also appreciate the support from my fellow graduate students. They made my graduate life full of wonderful memories.

Last but not least, I would like to take this opportunity to thank my family, especially my parents for their endless supports and love. Without them, my study would not be possible.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

HB	Hierarchical Bayesian
WTP	Willingness-to-pay

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy

THREE ESSAYS ON THE ELICITATION OF WILLINGNESS-TO-PAY

By

Lijia Shi

August 2012

Chair: Lisa A. House
Cochair: Zhifeng Gao
Major: Food and Resource Economics

An online survey was designed to explore consumers' blueberry consumption behavior. A large amount of information is collected, including consumption habits, attitudes and demographics. A choice experiment designed to elicit consumers' willingness-to-pay (WTP) for several blueberry attributes was also included in the survey. Additionally, a non-hypothetical method: experimental auction was conducted to measure consumers' WTP for organic and local blueberries. This dissertation used the data from the two value elicitation methods: choice experiment and experimental auction for empirical model comparisons and studies of consumer behavior.

In the first essay, a stated preference experiment is conducted to elicit consumers' WTP for various blueberry attributes. A mixed logit model estimated by the hierarchical Bayesian approach (HB) is employed to account for consumer heterogeneity and the distributions of WTPs are directly specified. The results show that locally produced blueberries are preferred over U.S. produced blueberries by most respondents. By contrast, less than 50 percent of the respondents demonstrate positive premiums for organic blueberries. Additionally, hardly any relationship between demographics and WTPs is detected.

In the second essay, three specifications of the mixed logit model are compared. The first is specified in the preference space with all parameters random. The second is specified in the preference space with the coefficient of price fixed. The third is specified in the WTP space with all parameters random. The data is from the choice experiment eliciting consumers' perception of several blueberry attributes: freshness, local and organic. The purpose is to see whether fixing the price coefficient in the preference space can narrow down the gap (i.e., difference in model fits and estimated coefficients) between the preference space model and the WTP space model and how such constraint affects the individual-level WTP estimates.

The third paper discusses consumers' bidding behavior in the BDM auctions. The impact of consumers' purchase intention on their bidding behavior is investigated. Additionally, the auction was conducted at multiple types of stores to capture a more representative sample of consumers.

CHAPTER 1
INTRODUCTION

1.1 Blueberry Market Review

Blueberry is widely known as a healthy fruit. The consumption of blueberries has experienced a dramatic change during the last few decades in the United States. In the late 1990s, scientific research revealed special health benefits of blueberries. According to the USDA, the total imports of fresh blueberries increased from 17.5 million pounds in 1993 to 192.5 million pounds in 2008 (Figure 1-1). At the same time, per capita consumption of fresh and frozen blueberries in the U.S. increased (Figure 1-2), from 0.62 pounds in 1992 to 1.71 pounds in 2010 (USDA, Economics, Statistics, and Market Information System). We can see that per capita consumption of fresh blueberries has been increasing dramatically since 2000, but that of frozen blueberries has not demonstrated any obvious increasing trend since 1992. While per capita consumption of frozen blueberries is greater than that of fresh ones during the 1990's, the consumption of fresh blueberries has been dominating the non-processed blueberry market since 2002.

It's projected that per capita consumption level of blueberries in the United States can reach 44 ounces by 2015 (U.S. Highbush Blueberry Council). In spite of the overall growing consumption level, there is still quite large undeveloped domestic market. Consumption may be further motivated by the education of the health benefits of blueberries among consumers and effective promotion strategies. As a leading blueberry producer in the world, the blueberry segment in the United States will encounter thriving commercial opportunities with the expanding national consumption level. At this critical time of development, retailers should set up corresponding

promotion plan based on a comprehensive understanding of the structure of blueberry market.

The quantity of literature on the consumption of blueberries is quite limited, especially on the consumption of non-processed (fresh+ frozen) blueberries. To our knowledge, the only literature on consumer preference for blueberries is from Hu, Woods, and Bastin (2009), which focused on processed blueberry products. According to the data from USDA, the percentage of the fresh use among total utilized production of blueberries increased from 27.1% in 2000 to 54.6% in 2011 (Figure 1-3). The percentage is expected to keep rising as more people have realized the health benefits of blueberries. Also, non-processed blueberries usually possess higher market values and consumer acceptance. Therefore, we will conduct a systematic study about the consumption behavior of non-processed blueberries, such as how do consumers tradeoff different blueberry attributes and how much they would pay for the credence attributes like organic. Our results will serve as reference for the setup of effective marketing strategies, which is crucial for potential expanding of the blueberry market.

1.2 Consumer Willingness-to-Pay for Fruit Attributes

With the rising concern about health and environment among consumers, the production method or production location of food has received plenty of attention. Researchers have come up with various methods to elicit consumers' willingness-to-pay (WTP) for value-added food attributes, such as organic and local. In economics, WTP is known as the maximum amount of money people would be willing to pay for a good or an attribute. Different from people's attitude or perception, which cannot be quantified, WTP can be measured with some economic methods (i.e. choice experiment or experimental auctions). Thus, WTP enables researchers to quantify and compare

consumers' attitudes toward some products or attributes. WTP has been one of the hottest discussed topics in agricultural marketing literature. Research includes WTP for a product or a product attribute, such as organic or genetically modified. A review of the literature on WTP is conducted in Chapter 2 and Chapter 4.

1.3 Value Elicitation Method

Value Elicitation methods, such as contingent valuations and experimental auctions, are critical for the valuation of non-market goods and new product development. Choice experiments are one of the most widely used contingent valuation approach in social sciences (Hanley, Wright, and Adamowicz 1998; Birol, Karousakis, and Koundouri 2006; Alfnes et al. 2006 etc.). They are easy to implement and can be used to value products that may not exist in the market.

However, in spite of the numerous merits of choice experiments, literature has revealed the exaggerated WTP estimates due to their hypothetical valuation context (Lusk and Schroeder 2004; List and Shogren 1998). Therefore, researchers began to rely on the non-hypothetical method, such as experimental auction (EA), to elicit consumers' WTP for products or additional attributes (Fox et al. 1998; Rozan, Stenger, and Willinger. 2004; Huffman et al. 2003 etc.). Some commonly used experimental auction mechanisms include 2nd price auction, BDM auction, random N^{th} price auction etc., among which BDM is conducted at point of purchase locations while the others are usually conducted in labs.

Along with the development of these methods to measure consumers' attitudes and evaluate market share, various findings that violate the economic theory are observed and some methodological problems are discussed in literature. Additionally, even though the value elicitation methods are proved to be incentive-compatible,

problems can still arise in the data analysis process. For the same dataset, different models can yield significantly different results.

The objective of the dissertation will be to conduct a systematic study on U.S. consumers' blueberry consumption behavior, which is expected to send blueberry producers and retailers important messages about the efficient promotion of blueberries. Meanwhile, some problems in the value elicitation methods are discussed. Specifically, several estimation methods for the choice experiment data will be compared empirically and how to obtain a better interpretation of the results will be discussed. In addition to the hypothetical method, the dissertation will also discuss some issues in conducting an on-site auction. The second and third chapters will focus on the model estimation method with the data from a choice experiment. In the second chapter, we hypothesize that the mixed logit model estimated in the WTP space for the choice experiment data may help researchers obtain more reasonable WTP estimates and the estimation results should be interpreted at the individual level. In the third chapter, several estimation methods are compared and the hypothesis is that imposing some constraints on the utility coefficients might narrow the gap between the preference space model and the WTP space model (Hensher and Greene 2011). Different from Chapter 2 and Chapter 3, which focus on the hypothetical value elicitation methods, Chapter 4 will address some issues in the implementation of a non-hypothetical value elicitation method: BDM auction (Becker, Degroot, and Marschak 1964). We intend to discover the potential influence of purchase intention and the choice of auction location on the auction results.

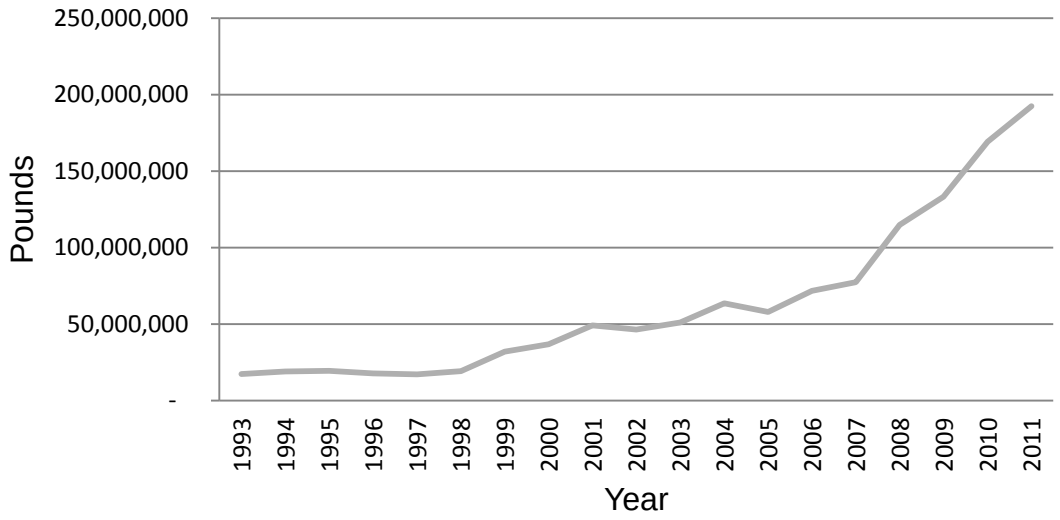


Figure 1-1. Total imports of fresh blueberries in the United States from 1993 to 2011

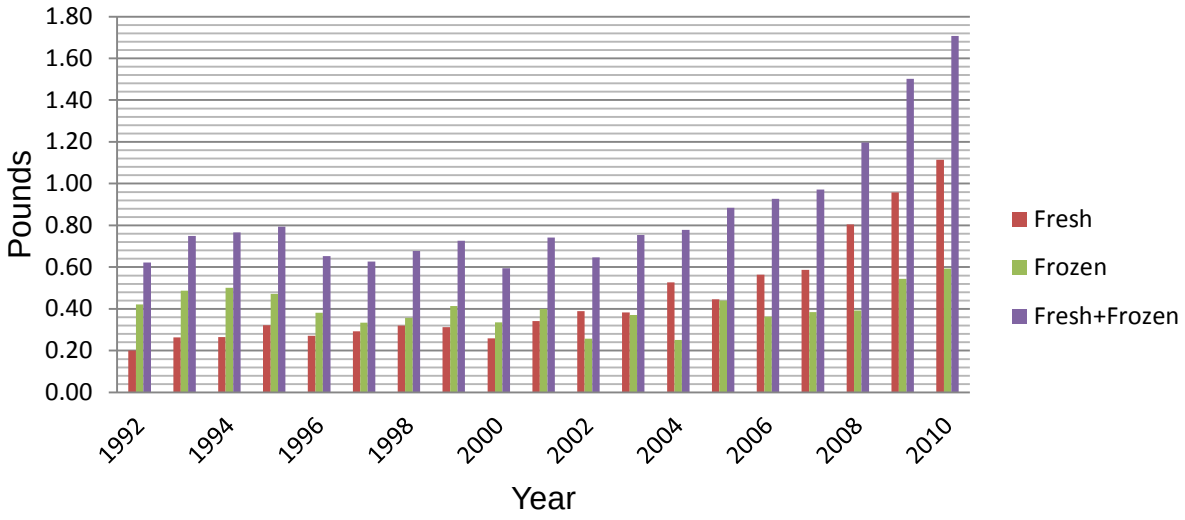


Figure 1-2. Per capita consumption of fresh plus frozen blueberries in the United States from 1992 to 2010

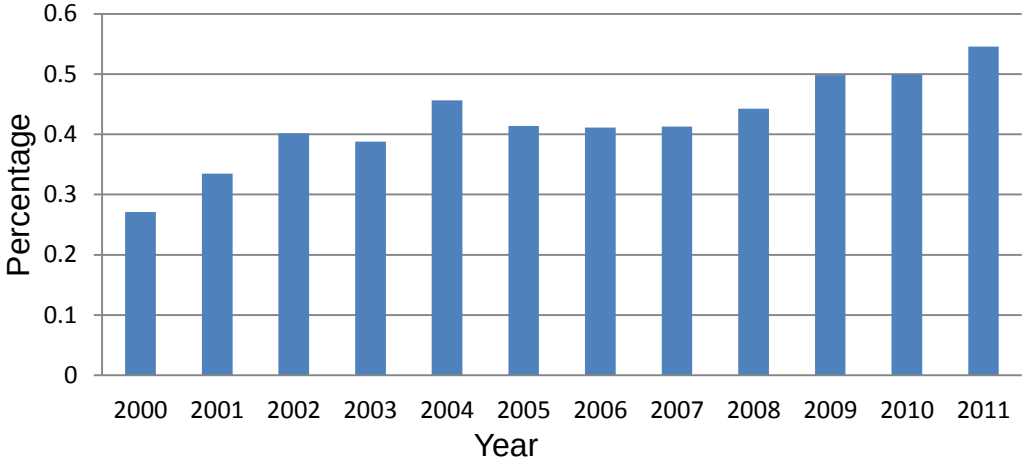


Figure 1-3. Percentage of fresh use among total utilized production of blueberries from 2000 to 2011

CHAPTER 2
CONSUMER WILLINGNESS-TO-PAY FOR BLUEBERRY ATTRIBUTES: A HIERARCHICAL BAYESIAN APPROACH IN THE WILLINGNESS-TO-PAY SPACE

2.1 Introduction

Per capita consumption of fresh blueberries has increased dramatically since 2000 (United States Department of Agriculture, Economic Research Service [USDA/ERS]). This growth reflects both increased consumer awareness of the importance of healthy diets and the proactive effort by the U.S. blueberry industry in publicizing the benefits from blueberry consumption. Faced with such rapid growth of this new market, a systematic study about consumer behavior in blueberry consumption is critical.

Consumer choice of fruit has become complicated, as even the same type of fruit, for example, blueberries, can have multiple attributes. Market segmentation is used to reach different consumer segments. In a market rapidly growing market such as the one for blueberries, understanding consumer choice of these attribute combinations is perhaps even more critical. Production method, origin of production, and form of the fruit (i.e., frozen versus fresh) are among a number of attributes (appearance, flavor, price, etc.) that consumers consider when purchasing fruit. Consumers' choices depend highly on their preferences. Some consumers may prefer fresh blueberries over frozen ones, while other consumers may prefer frozen blueberries because of their long shelf-life. As for the credence attributes, such as production method (i.e., organic) and production location (country of origin), consumers' perception also demonstrates large variance. Some consumers may consider country of origin of blueberries a more important attribute than whether the product is fresh or frozen, while to others, country of origin may not be important. Some consumers prefer organic production and thus are willing to pay more for organic blueberries. Though this preference choice has been shown to

exist for other fruits (i.e., Lin, Smith, and Huang, 2008; Batte et al., 2007; Yue and Tong, 2009; Loureiro, McCluskey, and Mittelhammer, 2001), it is important to explore the size of the consumer segments specifically for blueberries. Different consumers appreciate different attributes, thus, marketing strategies that fail to take consumer heterogeneity into account are destined to be less efficient.

The explanatory power of demographics for consumption behavior is limited (Frank, Massy, and Boyd, 1967; Yankelovich, 1964), especially for small purchases such as one pint of blueberries in a highly competitive fruit market. This study will compare the importance of different attributes on consumer willingness-to-pay (WTP) for blueberries at the individual-level. If consumers have a diversity of opinions regarding fruit attributes, especially given the large amount of substitutes in the fruit market, a single marketing strategy might not be ideal. Studying the impact of attributes on different consumers will aid blueberry producers to target different consumers with different marketing strategies.

The objective of this study is to compare consumers' attitudes toward four blueberry attributes and differentiate consumers in terms of their individual-level WTP estimates (i.e., WTP estimates for each respondent). Our work contributes to the literature in two aspects. First, we examine consumers' perception of the attributes of non-processed (fresh) and frozen blueberries. To our knowledge, the literature on blueberry consumption (Hu, Woods, and Bastin, 2009; Hu et al., 2011; etc.) mainly focused on the attributes of processed blueberry products. Non-processed blueberries possess much higher market values and consumer recognition. Additionally, the percentage of fresh use among utilized production of blueberries increased from 27.1%

in 2000 to almost 54.6% in 2009 (USDA).[1] The percentage is expected to keep rising as more people realize the health benefits of fresh blueberries.

Second, our results are based on the individual-level estimates, which provide valuable information about the variety of consumer attitudes, such as diversified attribute importance ranking. Such information is extremely valuable when demographic information is not available or the explanatory power of demographics is marginal. Most previous literature reported only aggregate WTP estimates (i.e., the average WTP) or the distribution of WTPs across consumers, which are much less informative for the implementation of differential marketing. Individual-level estimates provide us with valuable information about individual consumption behavior, which is indispensable for differential marketing strategies. For example, price-cut strategies are expected to be more effective for consumers who are more sensitive to price. Organic labeling may only attract those who prefer organic production. In this light, supermarkets can issue different types of coupons to different consumers based on their individual preferences (Rossi, McCulloch, and Allenby, 1996). In addition, since all kinds of WTP elicitation methods have some shortcomings, the accuracy of the WTP estimate cannot be guaranteed. The comparison of the relative importance of various attributes might be of more practical value. The individual-level estimates enable us to calculate the proportion of consumers that prefer one attribute over another. Such information cannot be obtained from the two estimated distributions of WTPs for the two attributes.

[1] The number is based on the production and utilization data of Maine, Michigan, New Jersey, North Carolina, Oregon, Washington, Alabama, Arkansas, Florida, Georgia, Indiana, New York, California and Mississippi.

2.2 Consumer Attitudes for Food Attributes

There is a large amount of literature on the valuation of food attributes. For example, country of origin is among the most popularly discussed food attributes in recent years and is an important characteristic in consumers' purchasing decisions. Umberger et al. (2003) showed that most consumers were willing to pay premiums for the "USA Guaranteed" label on steak. The food safety concerns and belief in higher quality of U.S. products are generally believed to be one of the main reasons for consumers' recognition of U.S. products. In addition to the country of origin label, the "locally grown" attribute of fruits or vegetables has been gaining popularity. Dentoni et al. (2009) found that the attribute of "locally grown" directly affected consumers' purchasing behavior for apples. In the study of Hu, Woods, and Bastin (2009), consumers in Kentucky were found to demonstrate higher WTP for "locally produced (within the state of Kentucky)" than for organic and sugar-free attributes of processed blueberry products. Darby et al. (2006) also concluded that consumers were willing to pay more for locally grown strawberries than for those just with "produced in the U.S." label.

In addition to country of origin, there is extensive literature on the choice between organic and conventional products. Wang and Sun (2003) concluded that the organic market had a large consumer base and it's future was promising. Batte et al. (2007) considered multi-ingredient processed organic foods with four levels of organic content under the National Organic Program (100% organic, 95% organic, 70-95% organic, <70%organic). Their results indicated that customers were willing to pay a premium for food with organic content, even those that were not totally organic. Loureiro, McCluskey, and Mittelhammer (2001) showed that consumers with similar perceptions

of food security and environmental issues tended to choose the organic apples over the eco-labeled apples when these two types of apples were both available and sold at the same price. Yue and Tong (2009) found that the WTP for organic and that for local were almost the same. However, Hu, Woods, and Bastin (2009) concluded that although organic foods were believed to be one of the solutions for food safety, supporters of organic foods were not so broad and were limited to a certain proportion of consumers. The reason might be that the price of organic foods is generally much higher than that of conventional foods. Other discussions on consumers' perception of the organic attribute can be found in Brooks and Lusk (2010); Bond, Thilmany, and Bond (2008); Lin, Smith, and Huang (2008); Janssen, Heid, and Hamm(2009); Managi et al. (2008); etc.

2.3 The Choice Experiment and the Data

A stated preference experiment was conducted and distributed online to random consumers living in the Northeast and Southeast regions of the United States. Each respondent was asked to make choices over a series of choice situations. Since multiple observations per respondent were collected, individual-level information can be inferred.

The stated preference experiment approach has been widely used by researchers (i.e., Brooks and Lusk, 2010; Gao and Schroeder, 2007; Alfnes, 2004; Carlsson, Frykblom, and Lagerkvist, 2004). Although there might be some potential problems associated with the stated preference approach, such as exaggerated WTP estimates (Brooks and Lusk, 2010; Johansson-Stenman and Svedsäter, 2008), there are four main reasons for it to be the suitable approach for the study of consumer purchase of blueberries. First, it is not usual for consumers to have access to a great variety of

blueberries (all possible sources, forms, or prices) in the same section of the grocery store or other places when they are shopping for blueberries, so this gives reasons to question the dependability of the WTP estimates even if we have real transaction data. For example, people might actually prefer frozen blueberries, but end up buying fresh ones because they fail to find the frozen ones. Second, one of the attributes included in this experiment is organic, but organic blueberries may not be very common in most marketplaces. Third, the stated preference experiment is relatively simple to conduct, and its convenience in obtaining measurement of the tradeoffs between product attributes is noticeable. Fourth, multiple observations for each respondent are obtained in the stated preference experiment, so estimates for each individual are made possible.

Both main effects and first-order interaction effects are included in the model. The purpose is to see whether the WTP for an attribute will be affected by the existence of other attributes.

We set freshness (fresh and frozen), production method (organic and conventionally produced), price, and place of origin (whether they are produced locally, in the United States or imported from other countries) as attributes of blueberries. Four different prices are used for the price attribute: $1.50/pint, $2.50/pint, $3.99/pint, and $5.99/pint. We define “locally produced” blueberries as those produced within the state in which the respondent resides.

Different combinations of the levels of the four attributes form a choice alternative. Each choice situation is designed to contain three alternatives, including “neither” as one alternative. The purpose of including “neither” as one option is to make the choice experiment more similar to real purchase situations where consumers can simply

choose not to buy any of the described blueberries. A constant to be estimated is assigned to the utility associated with the “neither” option in the model. Thus, there are two kinds of blueberry specified in each choice situation (no matter whether they exist in reality or not). Respondents choose one kind from these two or they can choose “neither”. A fractional factorial design was used and 12 choice situations were included in the experiment to achieve the maximum D-efficiency. Each respondent in the survey was asked to make choices in these 12 hypothetical situations. The prices are made negative in the estimation process, so that the coefficients of the prices will have positive signs. This ensures that the estimated scale parameters also have positive signs. All the attributes and their corresponding levels included in the experiment are listed in Table 2-1. For identification purpose, we set frozen, imported, and conventional as the base and omit them in the model estimation.

Data collection began in December 2010 and ended in January 2011, with approximately 400 participants recruited, for a total of 772 responses each month. Since the choice experiment is based on hypothetical comparison, we do not expect the time of year (seasonality) to impact answers.

2.4 The Model

Previous research in the field of food marketing has taken into account the diversity of consumer preference. However, most of the literature reported only aggregate estimates. The traditional aggregate estimates (population-level estimates) of WTPs are not very informative as they cannot provide the information of each respondent. In this study, a mixed logit model is estimated by the hierarchical Bayesian (HB) approach. The Bayesian method, which is well-suited to update estimates based on each individual’s choice information, is a powerful tool for marketing. The HB

approach also has irreplaceable advantages in finite sample inference (Rossi, Allenby, and McCulloch, 2005) and can generate the individual-level estimates as byproducts (Allenby and Rossi, 1998). To obtain more sensible and accurate WTP estimates, we estimate the mixed logit model in the WTP space.[2]

The latent utility in the WTP space is:

$$\frac{U_{nit}^{'}}{s_n} = -\frac{\mathbf{X_{nit}W_n}}{s_n} + \frac{P_{nit}}{s_n} + \frac{\upsilon_{nit}}{s_n} \tag{2-1}$$

Where P_{nit} is the price of alternative *i* in situation *t* face by individual *n*. $\mathbf{X_{nit}}$ is the vector of other attributes, except price. $\mathbf{W_n}$ is the vector of WTPs for attributes of individual *n* and υ_{nit} is the error term. If respondents demonstrate a certain degree of randomness (i.e., the attention they paid to the task varied) in the decision process over the choice situations, it is necessary to divide both sides of the equation by the scale parameter s_n ($s_n>0$) to account for this level of variation (Train and Weeks, 2005).

The joint posterior for $\boldsymbol{\theta}_1, \boldsymbol{\theta}_2, \mathbf{W_n}, \frac{1}{s_n}, \forall n$ can be expressed as follows according to the Bayes' rule:

$$L(\boldsymbol{\theta}_1, \boldsymbol{\theta}_2, \mathbf{W_n}, \frac{1}{s_n}, \forall n \mid \mathbf{Y}) \propto \prod_n \prod_t [\frac{\exp(-\mathbf{X_{ny_{nt}t}W_n} / s_n + p_{ny_{nt}t} / s_n)}{\sum_i \exp(-\mathbf{X_{nit}W_n} / s_n + p_{nit} / s_n)} \phi(\mathbf{W_n}, \frac{1}{s_n} \mid \boldsymbol{\theta}_1, \boldsymbol{\theta}_2)] \kappa(\boldsymbol{\theta}_1, \boldsymbol{\theta}_2) \tag{2-2}$$

W is assumed to be multivariate normally distributed and assuming that $\frac{1}{s}$ is distributed as log-normal ensures positive values of the scale parameters. The prior distribution for the population mean ($\boldsymbol{\theta}_1$) of the multivariate normal distribution is

[2] In the WTP space, WTP is directly estimated instead of derived by the ratio of the coefficients of the attribute and price, as is done in the preference space.

assumed to be diffuse multivariate normal, and that for the population variance ($\boldsymbol{\theta_2}$) is assumed diffuse inverted Wishart. Nonzero covariance is allowed between the elements of **W** and $\frac{1}{s}$.

The HB approach relies on the Gibbs sampler to obtain the draws of $\mathbf{W_n}, \frac{1}{s_n}$, based on which population-level parameter estimates are calculated. Thirty thousand iterations are taken during the burn-in period (before convergence) and 5,000 every other tenth draw[3] are retained after burn-in to calculate the parameter estimates. Detail of the Gibbs sampler can be found in Robert and Casella (2004) or Casella and George (1992). The HB method is used because it gives out the individual-level estimates as byproducts, so no additional procedures are needed (Allenby and Rossi, 1998). Details of the Bayesian method can be found in Rossi, Allenby, and McCulloch (2005) and Train (2003).

2.5 Results

Table 2-2 lists the demographic information of the choice experiment respondents. Among the respondents, 65.0% of them are females. The average age is approximately 47 and the average household income is about $53,403 approximately. 83.7% of the respondents are Caucasian, 3.2% are Hispanic and 11.7% are Black, or African American. The rest are Asian, American Indian, native Hawaiian or Pacific Islander, etc. 23.6% of the respondents have a high school degree or equivalent, 58.0% have a four-year college degree or some college, and 11.1% have attained a postgraduate degree.

[3] In this way, correlation between subsequent retained draws can be reduced.

69.6% of the respondents don't have children at home and 24.9% of them have one or two children.

2.5.1 Mixed Logit Estimation Result

The estimation results of the mixed logit model are presented in Table 2-3. Most of the estimated population means of the WTPs are significant at the 5% level. The variances of the WTP distributions of all attributes are significantly different from zero at the 5% level. Thus, we conclude that consumer heterogeneity does exist. The estimated population means of the WTPs are significantly positive for fresh, locally produced, and U.S. produced. This is consistent with our expectation that U.S. consumers generally pay more for fresh blueberries than for frozen ones and pay more for local and U.S. blueberries than for imported ones. However, the mean WTP estimate of organic is not significantly different from zero, which indicates that consumers in general might be indifferent about whether the blueberries are organic or not.

The estimated means for all interaction terms are negative and are significant except for the interaction between fresh and organic. The negative signs of the interaction terms can be explained as the outcome of the concavity of the utility function.

2.5.2 Consumers' WTPs for Blueberry Attributes

The proportions of respondents who fall in a certain range of WTP values for each attribute are shown in Tables 2-4 and Table 2-5. This method of summarizing individual-level WTPs is used because of its robustness to extreme values.

The comparison of estimated WTPs for local and U.S. produced blueberries are shown in Table 2-4. While the proportions of positive WTPs for local and U.S. produced do not show much difference, the proportions of WTP estimates above $3/pint are all bigger for local than for U.S. produced. These figures indicate that most U.S.

consumers hold the identical attitude that U.S produced blueberries are superior to imported ones and, at the same time, some consumers are willing to pay more for local than for simply U.S. produced. The last column of Table 2-4 lists the percentage of respondents whose WTPs for local are bigger than that for U.S. produced. All of the percentages exceed 65.7%, with the largest reaching nearly 89.1%. Therefore, the majority of the respondents prefer local over simply U.S produced blueberries. We conclude that locally produced blueberries can attract a larger price premium than simply U.S. produced blueberries. This is also indicated by the larger population mean of W_{local} compared to $W_{U.S.}$ in Table 2-3.

Although the population mean of W_{org} (Table 2-3) is not significantly different from zero, 24.6% to 45.6% of the respondents are willing to pay a positive premium for organic blueberries, depending on the other attributes (Table 2-5). The largest proportion (45.6%) is for frozen and imported blueberries. Thus, the organic blueberries are most attractive when the other favorable blueberry attributes (fresh and U.S. produced) are not available. Although a certain proportion of respondents are demonstrating positive WTPs for organic attribute, only a small proportion are willing to pay more than $2/pint.

In addition to the stated preference questions, participants answered questions designed to elicit their attitudes towards organic fruits and vegetables. Only 51.9% of the respondents agreed or strongly agreed to the statement of “I trust fruits and vegetables labeled as organic” and only 28.8% of the respondents agreed or strongly agreed to the statement of “I will pay more for fruits and vegetables with an organic label.” Therefore, it is not surprising that there are a relatively low proportion of positive

WTPs for organic. The result from the stated preference experiment is consistent with the result from the attitude statement questions. Based on the average WTP for each attribute across the other attribute combinations, we find that 95.1% of the respondents are willing to pay more for U.S. produced blueberries than for organic ones and the proportion is 96.4% when we compare local and organic blueberries. Thus, the results indicate that consumers place more emphasis on the country of origin attribute than they do on organic.

One finding from the Bayesian estimates worth attention is that there are a large proportion of negative individual-level WTP estimates for organic. One of the reasons might be the assumption of normal distribution for **W**, which does not impose any restrictions on the signs of the WTP estimates. The other reason might be that some respondents ignored the attribute of organic because of indifference, especially when they saw other more favorable attributes in the choice sets. Therefore, we might interpret the result as the outcome of a simplified mechanism behind respondents' judgments in the choice experiment.

A final example of the individual differences found is shown in Table 2-6. WTP values of three respondents (numbers 9, 65, and 618) are shown. In this case, the differences among the participants are clearly seen. For example, participant 65 is willing to pay more for fresh blueberries and respondent 618 is willing to pay more for organic blueberries, while respondent 9 places the highest value on the country of origin attribute. From this simple illustration, differences among consumers and the weights they place on each attribute are demonstrated. Although the average WTP for organic

blueberries across all the respondents is nearly zero, there are still respondents who demonstrate substantial positive WTPs for organic blueberries.

2.5.3 The Reliability of the Individual-Level Estimates

To check the reliability of the individual-level estimates, we compute the mean absolute error (MAE) for the within-sample prediction using the population WTP mean and individual-level WTPs separately. The MAE[4] calculated from the population WTP mean is 0.2959 and that from the individual-level WTPs is 0.0592. The in-sample fit improves dramatically by the use of disaggregate information. Therefore, the individual-level estimates have the better performance in terms of in-sample fit.

Moreover, in the experiment, we find that there are 57 respondents who always chose “neither” over the 12 choice situations. These respondents might not be interested in the experiment at all, so we denote them as “nonparticipants.” The other respondents are denoted as “participants.” It is trivial to expect that the variation and magnitude of the scale parameters of the nonparticipants are smaller than those of the participants. Figure 2-1 compares the individual scale parameter estimates for non-participants and participants. We can see that the scale parameters of non-participants are much smaller than those of participants and there is not much variation in the non-participants’ scale parameters (represented by an almost horizontal line). In addition, from the choices of the respondents, we identify five “organic lovers” who always chose organic blueberries whenever the choice situation included both conventional blueberries and organic blueberries, no matter what other attribute combinations were included. Their averages across the six conditional WTPs for organic, which range from

[4] A MAE value of 0 indicates that the choices are perfectly predicted.

$3.69/pint to $4.00/pint, are also the biggest among all the respondents. Therefore, although the number of observations for each respondent is not big enough (t=12), the updated Bayesian individual-level estimates are fairly informative.

2.5.4 Willingness-to-pay and Demographics

To investigate the relationship of demographics with individual-level WTP estimates, averages of the conditional WTPs across all types of blueberries are calculated for each respondent. A series of scatterplots that relate income, education, and age to the individual-level WTP estimates for organic and locally produced blueberries are shown in Figure 2-1. The magnitude of the numbers on the horizontal axis stands for the level of income, education, and age and the magnitude of numbers on the vertical axis stands for the WTP estimates. The relationship between demographic information and WTP for organic blueberries is marginal, so is the relationship between demographics and WTP for locally produced blueberries. Upon further investigation, other demographic information, such as race and gender, is also not found to have a significant relationship. Overall, demographics provide little contribution in explaining consumers' WTPs for these blueberry attributes.

2.6 Conclusion and Discussion

In this study, we applied a mixed logit model to the data from a stated preference experiment to explore consumers' willingness-to-pay (WTP) for different blueberry attributes. Our results show that locally produced blueberries elicited the largest WTP values among all the attributes considered. Somewhat surprising is the result that, generally, consumers were indifferent to the production method (organic versus conventional) for blueberries. Less than 45.6% of the respondents in the experiment had a positive WTP for organic blueberries and more than 95.0% of the respondents

placed more emphasis on the origin attribute than they did on organic. Though potentially surprising when compared to other fruits, this result is supported by the responses to the attitude statement questions. It can also be interpreted as the result of a quickly growing market, in which consumers have not adapted fast enough to demand organic blueberries yet. As a validation method, we estimated the model using additional data (data from the same experiment but different sample of respondents) and the results (i.e., overall ranking of the importance of attributes, estimated parameters) are almost identical.

Consumer preferences and attitudes are highly diversified. The traditional method of relying on demographic information to explain consumer behavior may not always be effective, especially for small purchases like fruits or vegetables. While the purchases of houses or cars might somehow reflect people's economic or educational condition, the choices of fruits might not be well differentiated by demographic characteristics. Our results show that although there are big differences among respondents' WTPs, demographic information makes little contribution in explaining tradeoffs for blueberry attributes.

The individual level WTP estimates provides us with valuable dis-aggregate information that can help retailers differentiate consumers and set up more effective marketing strategies. With the rapid growth in information technology, supermarkets can issue different coupons or leaflets to different consumers based on their individual attitudes instead of distributing them indiscriminately (Rossi, McCulloch, and Allenby, 1996). Coupons or brochures with sales featuring imported blueberries might only work with consumers who do not have a strong bias toward imported fruits (i.e., respondent

65 if compared with the other two respondents in Table 2-6). Retailers can also issue coupons of different values, depending on the price sensitivities of consumers. Such differential promotion strategies can expand sales volume while increasing retailers' profits. Moreover, consumer preference may not always be stable. The dynamic change in consumer preference or perception can also be captured by Bayesian estimation.

There are several limitations of our study. First, our experiment was constrained by the limited space of the survey and concern on respondent burn-out, so the number of observations per respondent was not enough to make an unbiased estimation of the individual-level WTP estimates, though the estimates already enabled us to compare respondents' valuation of blueberry attributes. Second, only within-sample prediction criterion was used to compare the performances of individual-level estimates and population-level estimates. Out-of-sample prediction should also be conducted for a more comprehensive performance comparison.

Table 2-1. Blueberry attributes and levels in the choice experiment

Attribute	Level 1	Level 2	Level 3	Level 4
Freshness	Fresh	Frozen		
Place of origin	Locally produced	U.S. produced	Imported	
Production method	Organic	Conventional		
Price ($/pint)	$1.50	$2.50	$3.99	$5.99

Table 2-2. Demographics of choice experiment participants

Independent Variables	Percentage
Female	65.0%
Age (18-34)	29.2%
Age(35-60)	44.2%
Age(above 60)	26.7%
Caucasian	83.7%
Hispanic	3.2%
Asian	1.8%
Black or African American	11.7%
Other races	3.0%
Income($34,999 or below)	37.4%
Income($35,000-$99,999)	54.4%
Income($100,000 or above)	2.7%
Income(don’t know)	5.4%
Postgraduate	11.1%
College	58.0%
High school	23.6%
Other education level	7.3%
No child at home	69.6%
One or two children	24.9%
More than two children	5.6%

Note: The median of age is used.

Table 2-3. Estimation results of the mixed logit model in the WTP space

WTP(**W**)	Distribution	Mean	Variance
Fresh	Normal	2.78**	9.42**
		(0.20)	(1.34)
Organic	Normal	0.01	1.72**
		(0.20)	(0.44)
Local	Normal	3.94**	12.43**
		(0.19)	(1.52)
U.S.	Normal	3.02**	8.47**
		(0.17)	(1.17)
Fresh_org	Normal	-0.38	1.10**
		(0.28)	(0.35)
Fresh_local	Normal	-0.69**	17.23**
		(0.29)	(2.65)
Fresh_us	Normal	-0.73**	15.21**
		(0.33)	(2.23)
Org_local	Normal	-0.85**	1.52**
		(0.14)	(0.38)
Org_us	Normal	-0.58**	2.81**
		(0.22)	(0.51)
Constant	Normal	-1.63**	15.31**
		(0.20)	(2.56)
1/s	Lognormal	4.48	53.77
Simulated Log-likelihood		-5801.7	

Notes: ** and * indicate that the parameter is significant at 5% level and 10% level respectively. Figures in the parenthesis are standard errors. The mean and variance of 1/s are for the simulated distribution of 5000 exponentiated random draws from N (0.84, 1.32), which is the estimated distribution of log(1/s).

Table 2-4. Summary statistics of respondents' WTPs for local and U.S. produced

Other Attributes	Positive WTP for Local (%)		Positive WTP for U.S. Produced (%)		Respondents who Prefer "Local" over "U.S. Produced" (%)
	>3 $/pint	>0 $/pint	>3 $/pint	>0 $/pint	
Fresh and Conventional	49.35	83.63	35.81	81.15	89.12
Frozen and Conventional	49.47	84.92	44.40	84.57	77.20
Fresh and Organic	38.16	79.03	30.39	66.55	65.67
Frozen and Organic	37.81	80.80	29.45	89.28	66.84

Table 2-5. Summary statistics of respondents' WTPs for organic

Other Attributes	Positive WTP for Organic (%)		
	$(0,2]$ (%)	$(2,+\infty)$ (%)	Total (%)
Fresh and Imported	28.27	5.54	33.80
Fresh and Local	18.37	6.24	24.62
Fresh and U.S.	22.50	7.66	30.15
Frozen and Imported	42.64	2.94	45.58
Frozen and Local	21.55	3.53	25.09
Frozen and U.S.	29.56	7.18	36.75

Note: The unit of the ranges is dollars/pint.

Table 2-6. WTPs of three respondents

Respondent #	WTP($/pint)			
	Organic	Local	U.S. Produced	Fresh
65	0.04	1.90	0.56	5.04
9	-0.97	4.14	3.36	1.19
618	3.69	2.98	2.17	1.51

Note: The WTP values are the averages across the corresponding conditional WTPs.

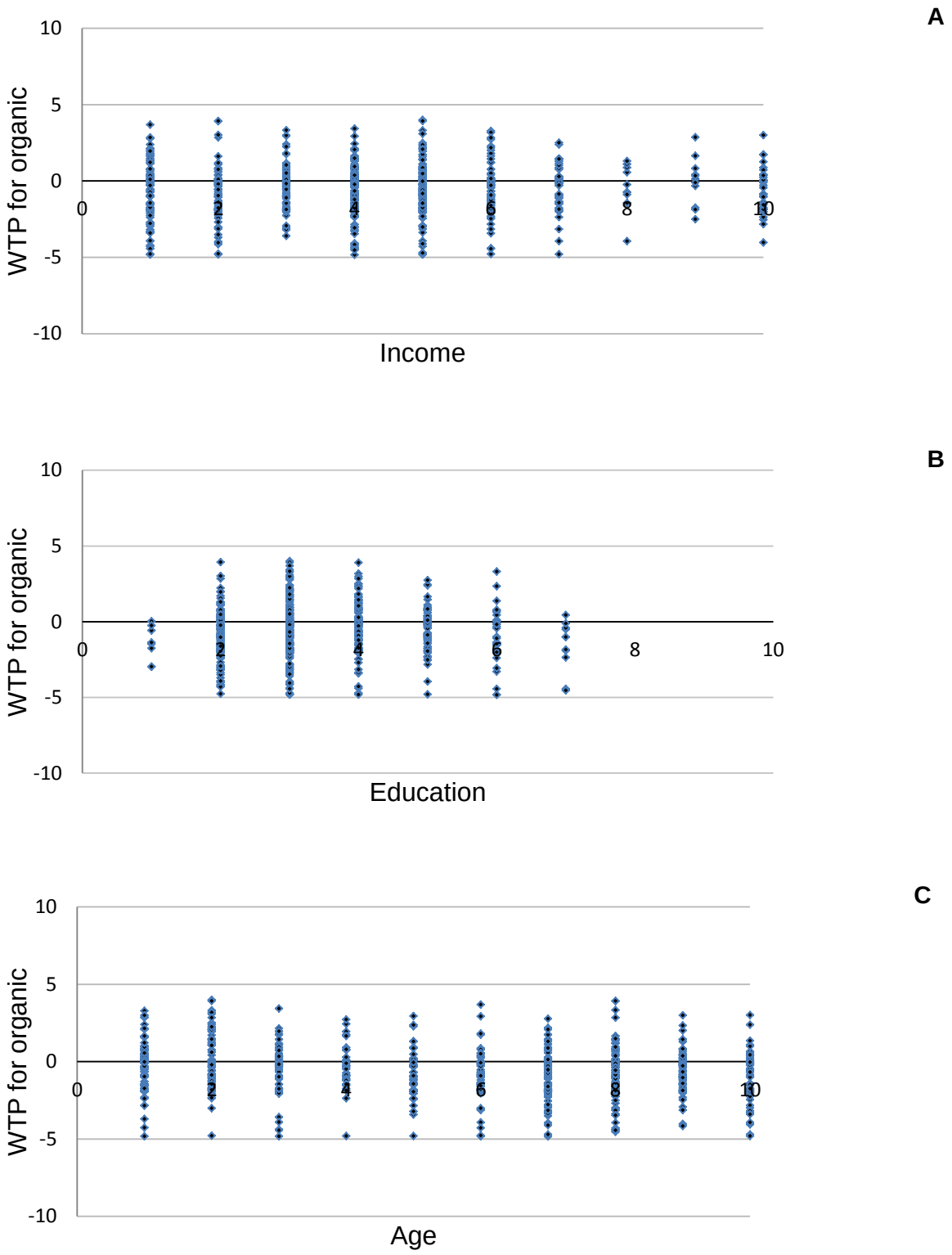
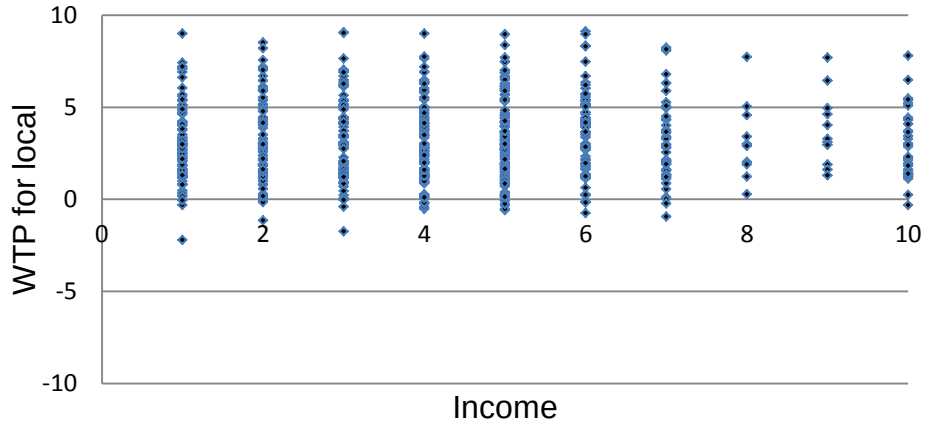
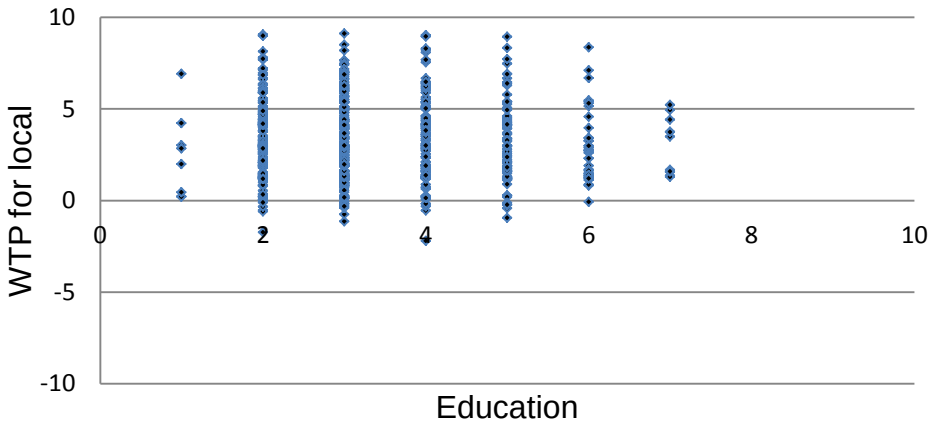


Figure 2-1. Scatterplots of WTP estimates versus demographic information. A) Organic versus income. B) Organic versus education. C) Organic versus age. D) Local versus income. E) Local versus education. F) Local versus age.

D



E



F

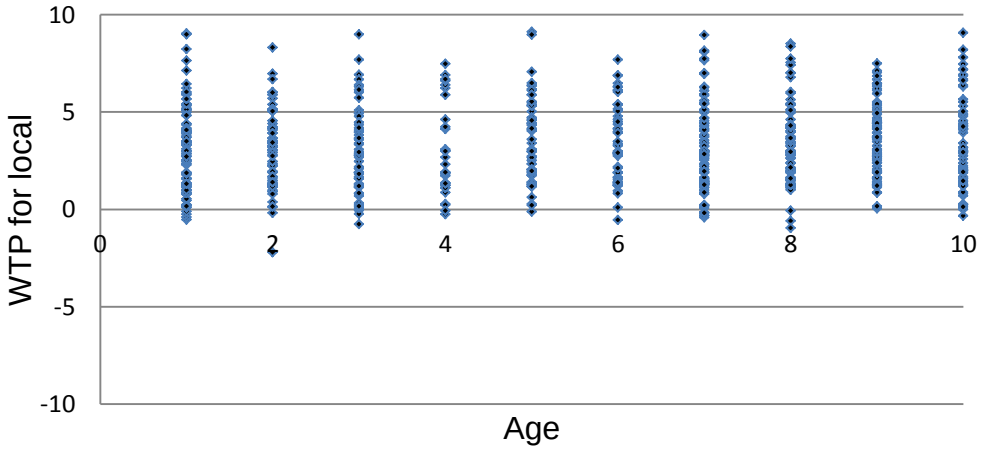


Figure 2-1. Continued

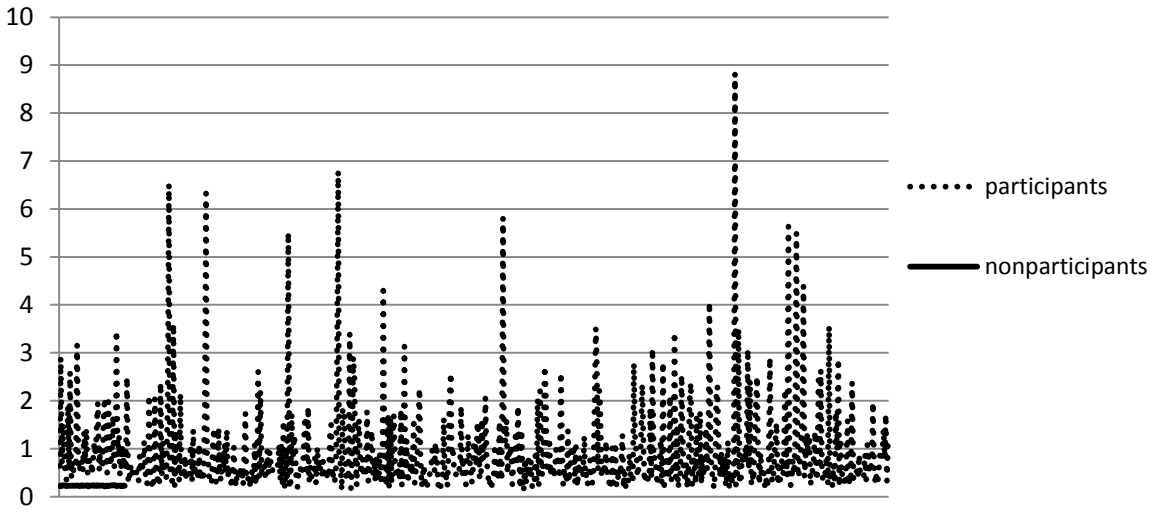


Figure 2-2. Comparison of scale parameters for participants and non-participants

CHAPTER 3
ON MODEL SPECIFICATION OF THE MIXED LOGIT: THE CASE OF CONSUMER PERCEPTION ON BLUEBERRY ATTRIBUTES

3.1 Introduction

The mixed logit model, which can account for consumer heterogeneity, has been used by many researchers in the study of consumer preference. The specifications of the mixed logit model have also been widely discussed. Train and Weeks (2005) and Sonnier, Ainslie, and Otter (2007) discussed two ways of placing distributional assumptions in modeling consumers' heterogeneous tastes. The first is to place distributional assumptions on the coefficients in the utility function and then derive the distributions of willingness-to-pay (WTP). The other is to place distributional assumptions directly on WTP by transforming the utility function. Numerous studies have found that the WTP space model provides more plausible WTP estimates than the preference space model (Train and Weeks, 2005; Scarpa, Thiene, and Train, 2008 etc.). As a results, the WTP space specification is now used more frequently due to its advantages in WTP estimation (Özdemir, Johnson, and Hauber, 2009; Scarpa and Willis, 2010; Thiene and Scarpa, 2009; Balcombe, Fraser, and Harris, 2009 etc.)

Several studies have compared the preference space and the WTP space models. The five major studies are listed in Table 3-1. Train and Weeks (2005) used lognormal distribution for the price coefficient and lognormal or normal distribution for the other attribute coefficients depending on whether the attribute is favorable or not. Sonnier, Ainslie, and Otter (2007) and Scarpa, Thiene, and Train (2008) also assumed lognormal distribution for the price coefficient but only normal distributions for the other coefficients. They all concluded that the WTP estimates from the WTP space models were more reasonable in terms of magnitude and dispersion than those from the

preference space because additional transformation led to excessive extreme values. Balcombe, Chalak, and Fraser (2009) estimated 20 models, which included models with fixed parameters , models with parameters with various random distributions, models in the WTP space or in the preference space and models with and without misreporting. They compared the models based on logged marginal likelihoods and concluded that the WTP space model with lognormal distribution for the price coefficient and normal distribution for all the other parameters is the best among the 20 models. The best model in the preference space is lognormal for price coefficient and censored normal for the other parameters. They found no support for fixing the price coefficient. Hensher and Greene (2011) compared four models: preference space model and WTP space model both with unconstrained triangular distributions for the random parameters, preference space model with constrained triangular distributed random parameters and a generalized mixed logit in the preference space that also used unconstrained triangular distributions for all the random parameters. They concluded that imposing constrained distributions on the random parameters in the preference space model reduced the gap between the WTP estimates from the preference space model and the WTP space model.

Among the five studies, Train and Weeks (2005), Sonnier, Ainslie, and Otter (2007) and Hensher and Greene (2011) found better statistical fit for the WTP space model while Balcombe, Chalak, and Fraser (2009) and Scarpa, Thiene, and Train (2008) reached an opposite conclusion in terms of model fit.

Ruud (1996) argued that a fully random specification of the model was barely identified. Revelt and Train (2000) suggested that the randomness of the price

coefficient would make the distribution of the WTPs hard to evaluate (e.g. Normal distribution for attribute coefficients and lognormal for the price coefficient will make the calculation of WTPs the ratio of normal and lognormal random variables). They also proposed that the distributions commonly specified for the price coefficient had various problems, such as positive price coefficient estimates from normal distributions and extremely small price coefficients from log-normal distributions, which made the derived WTP estimates poorly behaved.

Since additional transformation of the estimated parameters in the preference space models with a fully random specification is one of the reasons for the relatively poor performance of the estimates in WTP estimation, one of the solutions might be to fix the price coefficient in the preference space. In this way, the WTP estimates will have the same distribution in these two spaces and differ just in their estimation methods. Many researchers have made such assumptions in their studies (Hensher, Shore, and Train, 2005; Layton and Brown, 2000; Lusk, Nilsson, and Foster, 2007; Lusk and Schroeder, 2004; Provencher and Bishop, 2004; Revelt and Train, 1998, etc.). However, although fixing the price coefficient might be a good alternative so that no additional transformation would be needed in calculating WTPs, such constraint may lack face validity since the marginal utility of price is not always constant (Scarpa, Thiene, and Train, 2008).

Although the WTP space model has advantages over the traditional preference space model, the estimation of WTP space models is not as straightforward as that of the preference space model. Additional transformation is needed and the scale parameter needs to be introduced to avoid fixing the price coefficient as one.

Balcombe, Chalak, and Fraser compared twenty widely used specifications of mixed logit models and ranked the models based on the values of maximum likelihood. According to this criteria, the model with fixed price coefficient and the one with random log normal price coefficient in preference space ranked number eight and sixteen, respectively and the model with random lognormal price coefficient in WTP space ranked the first. However, economists are more interested in the welfare measures such as WTP derived from the econometric models rather than the maximum likelihood values. In this article we attempt to explore the impact of mixed logit model specification on estimation results with a focus on their efficiency in estimating WTP. We compare three specifications of the mixed logit model: fixed price coefficient preference space model (all other coefficients are random); fully random preference space model; and fully random WTP space model, in terms of statistical fit, aggregate WTP estimates and individual-level WTP estimates using the data from a stated preference experiment. According to Hensher and Green (2011), constrained distributions for the random parameters in the preference space can help reduce the gap between the WTP estimates from the preference space and the WTP space models. Our study differs from the study of Hensher and Greene (2011) by placing a constraint only on the price coefficient instead of on all the parameters. The preference space models with fixed price coefficient have been widely used by many applied researchers, but the efficiency of WTP estimates from such models has not been evaluated comprehensively. If this constraint of fixing the price coefficient does narrow the gap, using the prefrence space model with fixed price coefficient instead of using the WTP space model is suggested

because using preference space models help avoid the additional steps in WTP space models.

3.2 The Model

The latent utility in the WTP space can be expressed as (Train and Weeks, 2005):

$$U_{nit} = X_{nit}\beta_{n1} + P_{nit} \times \beta_{n2} + \varepsilon_{nit} \tag{3-1}$$

P_{nit} is the price and X_{nit} is the vector of attributes, except price, of alternative *i* in situation *t* face by individual *n*. β_{n1} and β_{n2} are the utility coefficients of individual *n*.

In the mixed logit model, the utility coefficients are assumed random while in the traditional conditional logit model, the coefficients are specified as constant over the consumers. For the mixed logit model in the preference space, the probability that individual *n* would choose alternative *j* in choice situation *t* is:

$$P_{njt} = \int \left(\frac{\exp(X_{njt}\beta_{n1} + \beta_{n2} \times P_{nit})}{\sum_i \exp(X_{nit}\beta_{n1} + \beta_{n2} \times P_{nit})}\right)\phi(\beta_{n1}, \beta_{n2} \mid \theta_1) d(\beta_{n1}, \beta_{n2}) \tag{3-2}$$

$\phi(\beta_{n1}, \beta_{n2} \mid \theta_1)$ is the distributional assumption for the utility coefficients β_{n1}, β_{n2}. θ_1 is called the population-level parameter (hyper-parameter) as it describes the distribution of β_{n1}, β_{n2} over the whole population (Train, 2003). Many distributional assumptions can be used for β_{n1}, β_{n2} depending on the behavioral assumption on consumers.

The mixed logit model in the WTP space is obtained by dividing both sides of Equation (3-1) by the coefficient of price:

$$\frac{U_{nit}}{\beta_{n2}} = \frac{X_{nit}\beta_{n1}}{\beta_{n2}} + P_{nit} + \frac{\varepsilon_{nit}}{\beta_{n2}} = -X_{nit}W_n + P_{nit} + \upsilon_{nit}$$

$$\Rightarrow \frac{U_{nit}'}{s_n} = -\frac{X_{nit}W_n}{s_n} + \frac{P_{nit}}{s_n} + \frac{\upsilon_{nit}}{s_n} \tag{3-3}$$

W_n is the vector of WTPs for attributes of individual *n*. If respondents demonstrate a certain degree of randomness (i.e., the attention they paid to the task varied) in the decision process over the choice situations, it is necessary to divide both sides of the equation by the scale parameter s_n ($s_n>0$) to account for this level of variation for each individual (Train and Weeks, 2005).

The probability that individual *n* would choose alternative *j* in choice situation *t* in the WTP space is as follows:

$$P_{njt} = \int \left(\frac{\exp(-X_{njt}W_n / s_n + p_{njt} / s_n)}{\sum_i \exp(-X_{nit}W_n / s_n + p_{nit} / s_n)} \right) \phi(W_n, \frac{1}{s_n} | \theta_2) d(W_n, \frac{1}{s_n}) \quad (3\text{-}4)$$

where θ_2 is the population parameter and $\phi(W_n, \frac{1}{s_n} | \theta_2)$ is the joint distributional assumption for W_n and $\frac{1}{s_n}$. Therefore, WTP estimates do not need to be derived by the ratio of two random parameters as is done in the preference space. It is directly specified in the WTP space.

In Equation (3-2), β_{n1} is assumed multivariate normal and β_{n2} is assumed log-normal to ensure the positive sign of the coefficient of $(-P_{nit})$. In Equation (3-4), W_n is assumed to be multivariate normally distributed and assuming that $\frac{1}{s_n}$ is distributed as log-normal ensures positive values of the scale parameters and thus the coefficient of ($-P_{nit}$).

The Hierarchical Bayesian method is used to estimate the mixed logit model because the HB approach has irreplaceable advantages in finite sample inference (Rossi, Allenby, and McCulloch, 2005) and can generate the individual-level estimates

as byproducts (Allenby and Rossi, 1998). The prior distributions for the population mean of the parameters β_{n1}, W_n, $log(1/s_n)$ and $log(\beta_{n2})$ are assumed to be diffuse multivariate normal, and that for their population variance is assumed diffuse inverted Wishart. Nonzero covariance is allowed between the coefficients in each model.

The joint posterior for $\theta_1, \beta_{n1}, \beta_{n2}, \forall n$ in the preference space can be expressed as follows according to Bayes' rule:

$$L(\theta_1, \beta_{n1}, \beta_{n2}, \forall n \mid Y) \propto \prod_n \prod_t [\frac{\exp(X_{\mathbf{ny}_{nt}t}\beta_{n1} + \beta_{n2} \times \mathrm{P}_{ny_{nt}t})}{\sum_i \exp(X_{nit}\beta_{n1} + \beta_{n2} \times \mathrm{P}_{nit})} \phi(\beta_{n1}, \beta_{n2} \mid \theta_1)] \kappa(\theta_1) \tag{3-5}$$

The joint posterior for $\theta_2, W_n, \frac{1}{s_n}, \forall n$ in the WTP space can be expressed as follows:

$$L(\theta_2, W_n, \frac{1}{s_n}, \forall n \mid Y) \propto \prod_n \prod_t [\frac{\exp(-X_{\mathbf{ny}_{nt}t}W_n / s_n + p_{ny_{nt}t} / s_n)}{\sum_i \exp(-X_{nit}W_n / s_n + p_{nit} / s_n)} \phi(W_n, \frac{1}{s_n} \mid \theta_2)] \kappa(\theta_2) \tag{3-6}$$

If the price coefficient is assumed fixed, β_{n2} in Equation (3-5) is constant over n, so no distributional assumption is needed.

In this study, 30,000 iterations were taken during the burn-in period (before convergence) and 5,000 every other tenth draw[5] were retained after burn-in to calculate the parameter estimates with the Gibbs sampling. Detail of the Gibbs sampling can be found in Robert and Casella (2004) or Casella and George (1992). The HB method is used because it gives out the individual-level estimates as byproducts, so no additional procedures are needed (Allenby and Rossi, 1998). Details of the Bayesian method can be found in Rossi, Allenby, and McCulloch (2005) and Train (2003).

[5] In this way, correlation between subsequent retained draws can be reduced.

3.3 Case Study: Consumer Preference for Blueberry Attributes

In the late 1990s, scientific research revealed special health benefits of blueberries, including high levels of antioxidant properties. Likely as a result of this, and of other factors, per capita consumption of fresh blueberries has increased dramatically since 2000 (USDA, 2010).

Consumer choice of fruit has become complicated, as even the same type of fruit, for example, blueberries, can have multiple attributes. Production method, origin of products, and form of the fruit (i.e., frozen versus fresh) are among a number of attributes (appearance, flavor, price, etc.) that consumers consider when purchasing fruit. Consumers' choices highly depend on their preferences. Some consumers may prefer fresh blueberries over frozen ones, while other consumers may prefer frozen blueberries because of their long shelf-life. As for the credence attributes, such as production method (i.e., organic) and production location (country of origin), consumers' preference also demonstrates large variance. Some consumers may consider country of origin of blueberries an important attribute, while others may think organic attributes as the most important. A stated preference experiment was conducted to explore consumers' perception of blueberry attributes. Although there might be some potential problems associated with the stated preference approach, such as exaggerated WTP estimates (Brooks and Lusk, 2010; Johansson-Stenman and Svedsäter, 2008), it has been widely used by researchers (e.g., Brooks and Lusk, 2010; Gao and Schroeder, 2007; Alfnes, 2004; Carlsson, Frykblom, and Lagerkvist, 2004). There are several reasons for it to be the suitable approach for the study of consumer choices of blueberries. For example, it is not usual for consumers to have access to a great variety

of blueberries (all possible sources, forms, or prices) in the same section of grocery stores when they are shopping for blueberries.

Therefore, real transaction data may not be reliable. Additionally, using non-hypothetical valuation methods such as experimental auction is difficult because some products are hard to find in the market and non-hypothetical methods are too costly for collecting large sample data.

Table 3-2 lists all the attributes and their corresponding levels included in the choice experiment. We set freshness (fresh and frozen), production method (organic and conventionally produced), price and place of origin (whether they are produced locally, in the United States or imported from other countries) as attributes of blueberries. Per capita consumption of fresh blueberries in the U.S. has increased substantially since 2000 (USDA). However, the increasing trend for per capita consumption of frozen blueberries is marginal over the years (USDA, Economic Research Service Calculations). Therefore, fresh and frozen blueberries are included in the stated preference experiment to detect the price premiums of fresh blueberries over frozen ones. Organic and local are two widely discussed fruit attributes in agricultural economics literature (Batte et al., 2007; Loureiro, McCluskey, and Mittelhammer, 2001; Dentoni et al., 2009 etc.) we include them in the experiment for comparison purposes. Four commonly seen blueberry prices in grocery stores$1.50/pint, $2.50/pint, $3.99/pint, and $5.99/pint are used as the price levels. In addition, “locally produced” blueberries are defined as those produced within the state in which the respondent resides.

A main effect fractional factorial design is used to generate 12 choice sets in the choice experiment. Each respondent in the survey was asked to make one choice from

each of these 12 hypothetical choice sets. In the choice experiment, different combinations of the levels of the blueberry attributes form a choice alternative. Those alternatives are used to construct a choice set. Each choice set consists of two blueberry products and a NONE option. The purpose of including NONE option is to make the choice experiment more similar to real purchase situations where consumers can simply choose not to buy any of the described blueberries.

When estimating the three models previously discussed, a constant is assigned to the utility associated with the NONE option in the models. The prices are made negative in the estimation process to ensure that the results have positive signs for the estimated scale parameters. For identification purpose, we set frozen, imported, and conventional as the base and omit them in the model estimation.

3.4 Results

A survey containing the stated preference experiment was distributed online to consumers living in the Northeastern and Southeastern regions of the United States. Data collection began in December 2010 and ended in January 2011 with approximately 400 participants recruited on a monthly basis. After deleting unqualified or incomplete responses, 772 responses were used for the analysis.

The demographic information of the respondents is the same as it in Chapter 2 since the same data is used.

Estimates of coefficients for the three models are presented in Table 3-3. In the first model (Model 1), all the coefficients are random in the preference space. The coefficient of price is assumed to have a lognormal distribution and all the other coefficients are normally distributed. The second model (Model 2) is also specified in the preference space. The coefficient of price is assumed fixed while all the other

coefficients are random and normally distributed. The third model (Model 3) is the WTP space model with all the parameters being random. The coefficient of the price conforms to lognormal distribution as the scale parameter is positive and all the other parameters are normally distributed.

The estimated coefficients of fresh, U.S. produced and local are significantly positive and the relative attribute importance rankings are consistent in all the three models. Surprisingly, the coefficients of organic are significantly negative in all three models. The reason might be that consumers are still unfamiliar with organic blueberries and the impact of the local attribute surpasses the impact of being organic. The variances of the parameter distributions for all the attributes are significantly different from zero at the 5% level in all the three models. Thus, the models reach the same conclusion that heterogeneous preference among consumers exist.

According to the results, consumers regard the local production of blueberries the most favorable attribute. The next two favorable attributes are U.S. produced and fresh. Based on the results of Model 3, on average, consumers are willing to pay $3.45/pint and $2.49/pint to exchange imported blueberries for locally produced and U.S. produced ones, respectively. The price premium of fresh blueberries over frozen ones is $2.24/pint. However, these numbers may be exaggerated as previous studies have found exaggerated WTP estimates from hypothetical contexts (List and Gallet, 2001; Lusk and Schroeder, 2004; List and Shogren, 1998; Lusk and Fox, 2003 etc.).

The simulated log-likelihood value is the highest (-5722.0) for Model 1 and is the lowest (-6111.6) for Model 2. These results are consistent with Train and Weeks (2005) and Sonnier, Ainslie and Otter (2007) in that the fully random preference space model

fits the data better than the fully random WTP space model with stated preference data. In addition, our results show that the fully random WTP space model fits the data better than the fixed price preference space model, which indicates that imposing constraints on parameters decreases the model fit more than transforming the model from the preference space to the WTP space. However, Model 2 and Model 3 give more efficient estimates of parameters because the standard errors of the parameters from those two models are smaller than those from Model 1.

Table 3-4 gives the means and variances of the individual-level WTP estimates for each attribute in each model. It's clear that the mean WTPs for all the attributes from Model 1 are much larger than those from Model 2 and Model 3. The mean WTP estimates from Model 2 and Model 3 are quite similar. In addition, the variances of the individual-level WTP estimates from Model 1 are much larger than those from the other two models, indicating more efficient estimates of WTPs from Model 2 and Model 3. The estimates of variances for WTPs from Model 2 and Model 3 do not demonstrate much difference. Therefore, our results indicate that Model 2 and Model 3 produce quite similar results regarding WTP estimates. This is consistent with the conclusion of Hensher and Green (2011) that the difference between the estimates from the preference space and the WTP space narrows when a constraint is imposed on the preference space model (Hensher and Greene assumed a constrained triangular distribution for the random coefficients in the preference space).

Wedel et al. (1999) and Rossi, McCulloch, and Allenby (1996) both suggested the importance of individual-level purchase information in marketing, so the comparison of WTP at the individual-level becomes critical. Table 3-5 shows the correlation of the

individual-level WTP estimates from the three models. The individual-level WTP estimates for each attribute in the preference space are obtained by taking the ratio of β_{n1} and β_{n2}, where β_{n2} is the coefficient of price, for each individual in each iteration. Such method helps reduce the occurrence of extreme values of the derived WTP estimates (Hensher, Green, and Rose, 2006). Clearly, all the correlations are significant and the correlation between WTP from Model 2 and Model 3 is the strongest. Almost all the correlations are above 0.90 except for “USA produced”, which has a correlation coefficient of 0.893. Therefore, the gaps of WTP estimates between the preference space model with fixed price parameter and the WTP space model with fully random parameters are not only small in terms of population level estimates, but also in terms of individual-level estimates. As a result, Model 2 might serve as a good substitute for Model 3 in estimating WTPs in stated preference experiments. The advantage of such practice is that Model 2 is simpler to estimate and is not subject to the identifiability concerns (Ruud, 1996).

3.5 Conclusion and Discussion

In this study, we compare three different mixed logit models using the data from a stated preference experiment. We find that when the price coefficient is fixed in the preference space, the preference space model (all the other parameters are random) and the fully random WTP space model produce quite similar results, at both population level and individual-level WTP estimates. However, there are large differences between the WTP estimates from the two spaces when the price coefficient is assumed random. Our result is consistent with previous literature in that the WTP estimates in the WTP space are more reasonable than those from the preference space in terms of magnitude and dispersion when all the parameters are random. The narrowed gap between results

from the preference space with fixed price parameter and WTP space indicates that the fixed price preference space model might be a better option than the fully random preference space model. In addition, our results indicate that the fixed price preference space model might be used as an alternative to the WTP space model since the model specification in the WTP space needs extra steps. Further justification of using a fixed price preference space model are that this model produces more accurate parameter and WTP estimates, and the mean WTPs for all attributes are lower than those from a fully random preference space model. Considering that stated preference surveys usually suffer from the problem of overestimation of consumer WTP, the lower estimates of WTP from fixed price preference space and fully random WTP space models imply that those two models can, to some extent, alleviate the problem of hypothetical bias.

Although our model is estimated by HB method, Huber and Train (2001) concluded that the classical and Bayesian methods resulted in almost equivalent individual-level estimates. Therefore, we expect that our results will also hold when the model is estimated with the classical procedure (Maximum simulated likelihood method). However, whether our results can be extended to other cases is still subject to more empirical validation.

Table 3-1. Literature comparing models from preference space and WTP space

Literature	WTP space		Preference space		Better Fit
	Price	Others	Price	Others	
Hensher and Greene (2011)	unconstrained triangular	unconstrained triangular	unconstrained, constrained triangular	unconstrained, constrained triangular	P
Balcombe, Chalak, and Fraser (2009)	lognormal, triangular	normal, Censored normal	fixed, normal, lognormal, triangular	fixed, normal, censored normal	W
Scarpa, Thiene, and Train (2008)	lognormal	normal	lognormal	normal	W
Sonnier, Ainslie, and Otter (2007)	lognormal	normal	lognormal	normal	P
Train and Weeks (2005)	lognormal	lognormal normal	lognormal	lognormal, normal	P

Note: P represents preference space. W represents WTP space.

Table 3-2. Blueberry attributes and levels in the stated preference experiment

Attribute	Level 1	Level 2	Level 3	Level 4
Freshness	Fresh	Frozen		
Place of origin	Locally produced	U.S. produced	Imported	
Production method	Organic	Conventional		
Price ($/pint)	$1.50	$2.50	$3.99	$5.99

Table 3-3. Estimation results of the three models

Parameter	Distribution	Model 1		Model 2		Model 3	
		Mean	StDv	Mean	StDv	Mean	StDv
Price	lognormal	-0.09	1.71**	0.90**		0.42**	1.17**
		(0.08)	(0.24)	(0.03)		(0.07)	(0.16)
		2.13	**4.15**			**2.67**	**3.91**
Fresh	Normal	2.86**	8.82**	2.21**	5.56**	2.24**	5.76**
		(0.17)	(1.02)	(0.12)	(0.58)	(0.14)	(0.59)
Organic	Normal	-0.70**	5.87**	-0.67**	3.88**	-0.64**	3.50**
		(0.12)	(0.65)	(0.09)	(0.39)	(0.10)	(0.37)
Local	Normal	4.32**	10.48**	3.23**	7.21**	3.45**	8.90**
		(0.20)	(1.22)	(0.15)	(0.73)	(0.16)	(0.92)
U.S	Normal	3.18**	7.26**	2.42**	4.04**	2.49**	5.19**
		(0.17)	(0.94)	(0.12)	(0.49)	(0.13)	(0.57)
Constant	Normal	-3.69**	65.40**	-1.59**	17.16**	-2.11**	14.40**
		(0.51)	(7.86)	(0.19)	(1.71)	(0.18)	(1.64)
Simulated Log-likelihood		-5722.0		-6111.6		-5993.0	

Note: The numbers in bold are the mean and variance of price coefficients implied by the estimated distribution parameter. Use 5000 draws from the corresponding normal distributions, exponentiate each of them and then calculate the mean and variance. Model 1: All random (Preference space); Model 2: Fixed price (Preference space); Model 3: All Random (WTP space); ** indicates significance at 5% level. The numbers in the parenthesis are the standard errors.

Table 3-4. Means and variances of the individual-level WTP estimates

Attribute	Model 1			Model 2			Model 3		
	Mean	Median	Vari-ance	Mean	Median	Vari-ance	Mean	Median	Vari-ance
Fresh	3.33	1.79	5.29	2.46	2.15	2.08	2.24	2.02	1.84
Organic	-1.05	-0.32	4.2	-0.74	-0.86	1.77	-0.64	-0.62	1.46
Local	5.1	2.73	6.13	3.59	3.19	2.33	3.45	3.16	2.35
USA Produ-ced	3.79	1.97	4.84	2.69	2.42	1.68	2.49	2.28	1.76

Note: Model 1: All random (Preference space); Model 2: Fixed price (Preference space); Model 3: All Random (WTP space)

Table 3-5. Correlation between individual-level WTP estimates among the three models.

WTP	Model 1 and Model 2	Model 2 and Model 3	Model 1 and Model 3
Fresh	0.70**	0.94**	0.73**
	(0.00)	(0.00)	(0.00)
Organic	0.76**	0.98**	0.75**
	(0.00)	(0.00)	(0.00)
Local	0.66**	0.90**	0.66**
	(0.00)	(0.00)	(0.00)
USA produced	0.64**	0.89**	0.63**
	(0.00)	(0.00)	(0.00)

Note: The numbers in the parentheses are p-values of the correlation coefficients.
** indicates significance at 5% level.

CHAPTER 4
CONSUMERS' WILLINGNESS-TO-PAY FOR ORGANIC AND LOCAL BLUEBERRIES: A MULTI-STORE BDM AUCTION CONTROLLING FOR PURCHASE INTENTIONS

4.1 Introduction

The Becker-DeGroot-Marschak method (BDM) is well suited for field experimental auctions (Becker, Degroot, and Marschak, 1964), and as a result, has been increasingly used by researchers in the area of consumer behavior to elicit consumers' valuation of food (Wertenbroch and Skiera, 2002; Carrigan and Rousu, 2008; Silva et al., 2007; Rozan et al., 2004; Rousu et al., 2005 and Lusk et al., 2001 etc.). The most common location for conducting a BDM auction focusing on consumers' valuation of food is grocery stores and the procedure is relatively simple compared with other auction formats. In a typical BDM auction, the participant places a bid for the auctioned product and then draws a random price. If the randomly drawn price is greater than the bid, the participant does not "win" the product and pays nothing. If the randomly drawn price is below the bid, the participant "wins" the product and pays the price he/she draws.

The bidding behavior of participants is affected by many factors. Consumers' cognitive structure is complex and a lot of questions still remain unanswered. Many researchers have accepted the theory that instead of having fixed or previously formed values, consumers often construct different assessment contingent on different spots or choice contexts (Tversky and Simonson 1993; Payne, Bettman, and Johnson 1992; Bettman, Luce, and Payne 1998). Horowitz (2006) argued that people's valuation of an item is correlated with the circumstances in which he/she is going to pay for it.

People go to grocery stores to buy food, so whether they intend to buy the auctioned products when the auction is conducted might be a factor that would affect

the participants' bids. Since real money is usually involved in the auction process, if auction participants do not plan to purchase the auctioned products, they may bid less than they usually pay for the product and use the money for the products that they plan to purchase. Corrigan and Rousu (2008) argued that purchase intention critically determined consumers' willingness-to-pay (WTP) for perishable goods. They found that auction participants who planned to buy the auctioned products that day submitted bids equal to their perceived market prices of the products while participants who did not have such plan submitted bids less than the market prices. People report valuation according to their goals at that time, task environment, description of the task and product information etc. (Bettman et al. 1998). In this regard, it's necessary to control more factors, though many of which might be difficult to measure, that can influence consumers' bidding behavior.

Another important point worth attention for BDM auctions is the choice of auction locations. One of the biggest advantages of BDM auctions over the other auction formats is its point-of-purchase locations, which offer participants a more realistic choice situation (Carson et al. 1994). However, the locations should be chosen with caution and the potential impact of location choices on auction results should be considered. There are many types of marketing outlets that feature different types of food (e.g. organic, local etc.). Food quality, availability and price expectations may differ depending on the location of purchase. The co-existence of different marketing outlets indicates that consumers have different demands and expectations for food. These different attitudes toward food may drive a consumer to select an outlet they believe to satisfy their demand for specific attributes. For example, people who prefer organic food

may go to a high-end grocery store that features organic food, or to outlets like farmers' markets. People who prefer locally produced food may shop at a farmers' market. Differences in prices, food quality or availability of organic or local fruit across different locations may cause differences in people's valuation of food products sold at these locations. Since there are numerous types of marketing outlets that attract different consumer groups, the generalizability of a BDM auction result conducted at only one store, or one store type, is questionable. For example, if one were to investigate the WTP for a local food product, but conducted BDM auctions at a grocery store, they might be missing a segment of the population that values local higher and purchases their good from farmers markets. On the other hand, if the auction is only conducted at the farmer's market, the valuation might represent a subset that values the attribute more than the average consumer. Thus, if a broader, more complete picture of consumer demand for attributes is wanted, reaching more consumer types than found at one type of location may be needed.

In this study, we extend previous literature in two directions. First, we extend the study by Corrigan and Rousu to explore the effect of purchase intentions on partial bids (e.g. for a value-added attribute of the products) in addition to full bids (for the whole products). Researchers are often interested in consumers' WTPs for product attributes instead of the whole product. As such, it is important to understand the impact of purchase intention on consumers' partial bids for product attributes in experimental auctions to provide a recommendation for the need to control for this variable in studies that focus on attributes over whole products.

Second, we conduct BDM auctions in three different types of marketing outlets: grocery stores that focus on delivering products at the lowest price (price-conscious), grocery stores that focus on high quality (quality-focused), and farmers' markets. Although previous literature did explore the impact of conducting auctions at the point of purchase, such as grocery stores (Lust and Fox 2003; Shogren et al. 1999 etc.), the experiment was usually conducted only in one type of location. Although there are studies that determined the difference in consumers' attitudes toward food product attributes in different countries (Lusk et al. 2004; Lusk, Roosen, and Fox 2003), little research has been conducted using auctions to consider whether such differences also exist across different types of marketing outlets. If such difference does exist, it may be recommended that field auctions be conducted in multiple locations or locations with consumers who are more representative of the population being studied so that the auction results can be generalized.

The study seeks to answer the following questions:

1. How does participants' purchase intention affect their bidding behavior for partial bids and full bids?

2. Will the BDM auction yield different results at different marketing outlets?

4.2 Literature Review

Literature has revealed exaggerated willingness-to-pay (WTP) estimates due to the hypothetical nature of some valuation methods. For example, List and Gallet (2001) suggested that on average, preference in the hypothetical setting was inflated by a factor of 3. Therefore, researchers began to rely on non-hypothetical methods, such as experimental auctions (EA), to elicit consumers' WTP for products or additional

attributes (Rozan et al. 2004; Jaeger et al. 2004; Melton et al. 1996; Huffman et al. 2003, Hayes et al. 2002, Bernard and Bernard 2009, Hayes et al. 1995, Umberger et al. 2002, Alfnes and Rickertsen 2003 etc.).

Over time, locations of experimental auctions were no longer limited to labs and have been extended to more realistic contexts, such as grocery stores, or other point of purchase locations (Rozan et al. 2004; Rousu et al. 2005; Lusk and Fox, 2003; Lusk et al. 2001; Silva et al. (2007); List 2001 and List and Lucking-Reiley 2000 etc.). While lab auctions have been used widely to elicit people's attitudes toward non-market goods (i.e., environment conservation, food safety and novel good), field auctions have been gaining popularity in the valuation of market goods and empirical consumer behavior studies. Auctions conducted in a retail context have a number of advantages over lab auctions, such as a more realistic circumstance for participants, a better capture of the target population and reduced compensation and recruiting fees for the investigator (Lust and Fox 2003; Lusk et al. 2001). Carson et al. (1994) argued that the choice context of value elicitation should be as close as possible to the real purchase situation. Wertenbroch and Skiera (2002) found that different from hypothetical methods, there was no overbidding in BDM auctions. Carrigan and Rousu (2008) concluded that participants in the BDM auction understood that the auction was demand revealing, which indicated that their bids were unbiased.

However, literature has reported value elicitation results that are inconsistent with basic preference theories. For example, in a sports card auction conducted in a sports card show, List (2002) found that the superior bundle was preferred when juxtaposed with the inferior bundle. However, when in isolation, the inferior bundle was valued

much higher. The paper argued that the dichotomous choice questions might be challenged and various other nonmarket valuation methods should be examined. Thaler (1985) showed that people's stated WTP for the same product (cold beer) differed dramatically across different points of purchase (a run-down grocery store and a fancy hotel). Additionally, despite many studies that concluded with exaggerated WTP estimates in hypothetical context (Lusk and Schroeder 2004; List and Shogren 1998; Shogren et al. 1999 etc.), Lusk and Fox (2003) found that auctions conducted in stores yielded larger bids than lab auctions, given that participants were happy to participate and were not constrained by cash (not having enough cash to pay for the auctioned product if they win).

More research is needed to understand the inconsistencies that have been found. Irwin et al. (1993) argued that people actually do not have an exact monetary value for goods, except for those very simple and familiar. As a way to explain the gap between theory and action, numerous studies have been done to test the generalizability of previous findings by controlling more consumer-side, environment-side, or methodology-side factors that might deviate from theoretical assumptions and affect consumer behavior in research experiments. For example, on the consumer-side, Lusk and Fox (2003) analyzed auction results controlling for "unengaged bidders (participants that bid zero for all the products)". Corrigan and Rousu (2008) analyzed the effect of purchase intentions on consumers' bidding behavior. List (2001) studied the use of "cheap talk" (an explicit warning or explanation why it is important to bid the true WTP value) on reducing hypothetical bias in elicitation procedures. The results were shown to depend on participants' experience with the auctioned good. Additionally, List and Gallet

(2001) argued that the extent of over-statement of preferences was related to the distinction between public and private goods, WTP and willingness-to-accept (WTA) and different elicitation methods. Such empirical findings serve as useful warnings for researchers that unobserved factors might impact consumers' reported valuation of products, and should be controlled for when possible in experimental auctions.

4.3 Auction Procedure

A series of BDM auctions were conducted in July and August 2011 in Pittsburgh, Pennsylvania and Orlando, Florida. In each city, two grocery stores (one price-conscious and one quality-focused) and a farmers' market were selected. Approximately 70 observations were collected in each location, with a total number of qualified observations of 356. The auctions were set up at the entrance to the stores and near the beginning of the farmers' markets. Consumers to the outlets were randomly stopped and asked whether they would like to participate in an experiment about food consumption. Qualified consumers (adult, blueberry consumers without food allergies) were asked to fill out a questionnaire about purchase intention, demographics etc.

Four types of blueberries (organic and locally produced blueberries, conventional and locally produced blueberries, organic blueberries produced in the U.S. and conventional blueberries produced in the U.S.) were auctioned. Before the auction, each participant was given a sheet explaining the auction procedure. The auctioneer then explained the auction procedure to the participants and answered questions from the participants about the procedure.

The auction procedure had four steps:

1. Each participant was endowed with $7 cash, which they were told could be used to purchase the blueberries if they won the auction or was theirs to keep if they did not win. The participants were asked to bid simultaneously for four types of blueberries in one-pint clamshell packages. The auctioneer explained to the participant that it was his/her best interest to bid exactly what he/she was willing to pay for each blueberry package.

2. After the participants placed the bids, they randomly drew a letter to determine which blueberry was actually auctioned. Therefore, they only had the opportunity to buy one type of blueberries.

3. Once the auctioned blueberry type was determined, participants were asked to draw a random price.

4. If a participant's bid for the randomly selected blueberries was higher than the price drawn for those blueberries, the participant purchased the blueberries at the randomly drawn price. If a participant's bid for the blueberries was lower than the drawn price, the participant did not purchase the blueberries.

4.4 Results

A demographic summary of participants at each marketing outlet is shown in Table 4-1. Demographics does differ by location, with the price-conscious marketing outlet featuring consumers who tended to be younger, had lower income, had a lower education level, and were more likely to be Black or African American. They also tended to have more children than consumers at the other two marketing outlets. The participants at the farmers' markets have the highest average income and education level. The variation in demographics at different marketing outlets indicates that the auctions may produce different full bids and partial bids at different locations.

Summary statistics for the four bids for the four types of blueberries at each marketing outlet are shown in Table 4-2. The bids for organic, local blueberries (bid1); conventional, local blueberries (bid2); and conventional, U.S. produced blueberries (bid4) are the highest in the farmers' markets and the lowest in the price-conscious stores. The bids for organic, U.S. produced blueberries (bid3) are the highest in the quality-focused stores and the lowest in the price-conscious stores.

4.4.1 Partial Bids for Organic and Local Blueberries at Different Marketing Outlets

In the survey before the auction, information on attitudes toward organic and local fruits was collected. Significant differences are found among the answers from participants at different locations. Specifically, participants at the quality-focused grocery stores demonstrate more trust in organic fruits than participants at the price-conscious grocery stores. They are more likely to agree to a statement that they will pay more for fruits with an organic label than participants at the price-conscious grocery stores (on a 5-point Likert scale). Participants from the two farmers' markets are generally more likely to indicate that they will purchase local blueberries than those from the other two locations (on a 5-point Likert scale).

The means and standard deviations of bids for organic and local blueberries at different marketing outlets are shown in Table 4-3. According to the Bonferroni multiple comparison test, participants at the quality-focused stores, which are known for selling organic food, have higher bids for organic blueberries than participants at the price-conscious grocery stores. For local blueberries, the farmers' markets have the highest bids among the three marketing outlets. The results are consistent with our expectation that the experiment will yield higher bids for organic blueberries in quality-focused

grocery stores and higher bids for local blueberries in farmers' market. Additionally, the bids for organic blueberries are larger than the bids for local blueberries, no matter where the auction was conducted. This indicates that consumers generally consider the organic production of blueberries a more important attribute than production location. However, the standard deviations of bids for organic blueberries are all bigger than those for local blueberries. Therefore, more divergence exists in consumers' attitudes toward the organic production of blueberries.

4.4.2 Impact of Purchase Intention

Since fresh blueberry is a highly perishable fruit, it's reasonable to expect that people will bid differently if they plan to buy blueberries on the day of auction. To control for such impact, participants were asked to indicate if they planned on purchasing fresh blueberries at the store/market. Participants from different marketing outlets but with the same purchase intentions are grouped together to test if purchase intentions impact bids. The Bonferroni multiple comparison test is used to detect pairwise differences for full bids as well as partial bids between different groups. The results are summarized in Table 4-4.

Significant differences exist between the full bids of participants with purchase intentions and the full bids of participants without purchase intension for all the four types of blueberries. The differences in the full bids between participants without purchase intention and those who are not sure if they planned to purchase are not all significant (Only the differences for bid3 and bid4 are significant). This result is consistent with previous findings that consumers who plan to buy the auctioned products tend to have higher bids than those who do not intend to buy the auctioned products. However, the partial bids for local or organic blueberries are not significantly

different across groups with different purchase intentions. Therefore, although purchase intention has effects on the full bids in the auction, it does not affect the revelation of the relative values among multiple auctioned products. This indicates that the impacts of purchase intention on products are in same direction and with similar scale such that the partial bids calculated as the difference between the full bids for various products do not vary among consumers with different purchase intentions.

4.4.3 The Tobit Model for Full Bids

To investigate the relationship between reported full bids and participants' demographics, attitudes, auction location and auctioned blueberry type, a Tobit model is used since the dependent variable (reported bids) is left censored at zero. The model is specified as follows:

If $Bid_i^* > 0$,

$$Bid_i = Bid_i^* = \alpha_0 + \alpha_1 X_i + \alpha_2 FM_i + \alpha_3 Qualityfocused_i + \alpha_4 Florida_i + \alpha_5 Organic + \alpha_6 Local + \alpha_6 Organic\_local + \mu_i > 0 \quad (4\text{-}1)$$

If $Bid_i^* \leq 0, Bid_i = 0$

Bid_i^* is the latent dependent variable and Bid_i is the observed dependent variable. X_i is the vector of demographic and attitude independent variables that include age, gender, income, race, education level, number of children in the household, how well participants like fresh blueberries, whether they had purchased fresh blueberries before and whether they intended to buy fresh blueberries that day. FM_i and $Qualityfocused_i$ are the dummy variables for the farmers' markets and the quality-focused stores respectively. $Florida$ is the dummy variable for Florida auction participants. $Organic$, $Local$ and $Organic\_local$ indicate the blueberry types. The dummy variables for price-

conscious stores and Pennsylvania are omitted for identification purpose. μ_i is the error term. The regression results are shown in Table 4-5.

For the demographic independent variables, age, Asian and college education are significant. Age and Asian are significantly negative, indicating that older participants bid less than younger participants and Asian participants bid less than African-American participants (African-American is omitted for identification purpose). Participants with college degrees bid significantly higher than those without a college degree. Surprisingly, no significant difference is found between the bids of postgraduates and participants without college education.

The coefficients of the variables indicating blueberry types are all significantly positive. Therefore, both value-added attributes (organic and local) of blueberries attract some price premiums from the auction participants. The result also shows that consumers are willing to pay more for organic blueberries than for locally produced blueberries.

Dummy variables for the marketing outlets are significant with the bids at the farmers' markets and the quality-focused stores significantly higher than those at the price-conscious stores. This result is as expected since these two stores are intended to attract more consumers who seek high-quality food and thus are relatively less price-conscious. Importantly, this holds after controlling for the demographic differences among marketing outlets and blueberry types, implying that participants' full bids do differ among different types of stores. In addition to marketing outlets, the location of the auctions was significant. Participants from Florida bid significantly lower than those from Pennsylvania.

As expected, how well the participants like fresh blueberries has a significant positive effect on the reported full bids. However, the purchase history (whether the participant had purchased fresh blueberries before) is not significant, which indicates that familiarity with blueberries does not affect participants' full bids. For purchase intention, participants planning to buy fresh blueberries on the day of auction bid significantly higher than those who did not have such plans. This is also consistent with the results in Table 4-2.

4.4.4 The OLS Regression for Partial Bids

To investigate how the independent variables in Equation (1) affect the partial bids, the same set of independent variables, with the exception of the dummy variables for blueberry types are regressed on partial bids for organic and local blueberries. The partial bids for organic are calculated as the difference between bids for organic, U.S. produced blueberries and conventional, U.S. produced blueberries and the partial bids for local are calculated as the difference between bids for conventional, local blueberries and conventional, U.S. produced blueberries. In both cases, there are both positive and negative signs, thus, we use a robust OLS regression. The models are specified as follow:

$$WTP_{iorg} = \beta_0 + \beta_1 X_i + \beta_2 FM_i + \beta_3 Qualityfocused_i + \beta_4 Florida_i + \varepsilon_i \quad (4\text{-}2)$$

$$WTP_{ilocal} = \gamma_0 + \gamma_1 X_i + \gamma_2 FM_i + \gamma_3 Qualityfocused_i + \gamma_4 Florida_i + \tau_i \quad (4\text{-}3)$$

WTP_{iorg} and WTP_{ilocal} are observed dependent variables. The regression results are illustrated in Table 4-6. Many variables that were significant in the model for full bids become insignificant in the model for partial bids. In the model for local blueberries, only age and the two store dummy variables are significant. As expected, the coefficients for

the two store dummy variables are significantly positive, which is a reasonable result since participants from these two types of marketing outlets are more quality-focused or more likely to care about place of origin of food. This result also holds when demographic differences among the stores are controlled for. For organic blueberries, only age, female and the dummy for quality-focused store are significant. Female consumers are more willing to pay premiums for organic blueberries than males, which suggests that females are more interested in organic food products than males. The significance of the coefficient for the quality-focused stores indicates that consumers in this type of store place more emphasis on the organic production of blueberries than consumers from the other two types of stores.

Purchase intentions are insignificant in both models. This also confirms our previous results that purchase intentions have no effect on partial bids. Additionally, purchase history does not affect participants' partial bids for the value-added attribute of "organic" or "local".

4.5 Conclusion

In this study, a series of BDM auctions were conducted to elicit consumers' valuation of organic and locally produced blueberries. We argue that the purchase intention of auction participants and the choice of auction location could impact participants' bidding behavior. We extend the study of Corrigan and Rousu (2008) by analyzing the effect of purchase intentions on partial bids as well as full bids. In addition, the auctions were conducted at three types of marketing outlets: price-conscious grocery stores, farmers' markets and quality-focused grocery stores to capture a more diverse sample of consumers.

Our results show that purchase intention on the day of the auction only affects full bids, but not partial bids (e.g. bids for a value-added attribute). Auction participants who planned to purchase the auctioned product reported higher bids than those who did not plan to purchase. However, the partial bids were consistent among participants with different purchase intentions. Therefore, future research on partial bids might be less dependent on participants' purchase intentions. However, future research is needed to determine if these results hold only for perishable goods, or for all types of products.

It was also found that there are differences in demographics among consumers, as well as their attitudes toward organic and local production of fruits at different marketing outlets. Even after controlling for the demographics and attitudes difference, bids for "organic" and "local" were significantly different at different marketing outlets. Specifically, consumers in the farmers' markets had the highest partial bids for local blueberries while consumers in the quality-focused stores had the highest partial bids for organic blueberries. Therefore, if the auction was conducted at only one type of marketing outlet, the bids might be underestimated or overestimated, even if demographics and intentions are controlled for. Our study also indicates that consumers' attitudes toward organic production of blueberries demonstrate more variation than their attitudes toward locally produced blueberries.

Table 4-1. Demographics of participants at each marketing outlet

Independent Variables	Price-conscious	Farmers' Market	Quality-focused
Female	79.4%	69.1%	78.1%
Age	40	45	50
Caucasian	38.2%	80.2%	82.8%
Hispanic	3.9%	2.4%	4.7%
Asian	2.0%	3.2%	2.3%
Black or African American	49.0%	5.6%	7.8%
Other races	6.9%	8.7%	2.3%
Income($34,999 or below)	46.1%	23.0%	18.8%
Income($35,000-$99,999)	44.1%	43.7%	47.7%
Income($100,000 or above)	6.9%	31.0%	28.9%
Income(don't know)	2.9%	2.4%	4.7%
Postgraduate	4.9%	26.2%	20.3%
College	50.0%	56.4%	60.2%
High school	33.3%	9.5%	12.5%
Other education level	11.8%	7.9%	7.0%
No child at home	43.1%	69.8%	69.5%
One or two children	42.2%	25.4%	25.0%
More than two children	14.7%	4.8%	5.5%

Note: The median of age is used.

Table 4-2. Summary statistics of bids

	Bid1($)	Bid2($)	Bid3($)	Bid4($)
Price-conscious stores	2.93 (1.71)	2.64 (1.25)	2.85 (1.67)	2.59 (1.27)
Farmers' market	4.13 (1.73)	3.39 (1.35)	3.43 (1.54)	2.79 (1.30)
Quality-focused stores	3.89 (1.51)	3.04 (1.26)	3.63 (1.50)	2.61 (1.29)

Note: Bid1: organic, local blueberries; Bid2: conventional, local blueberries; Bid3: organic, U.S. produced blueberries; Bid4: conventional, U.S. produced blueberries. The numbers in the parentheses are the standard deviations of the bids.

Table 4-3. Difference of mean bids across purchase intentions

Bids	Purchase Intention			Mean Difference		
	Yes	No	Not sure	Yes-No	Yes-Not sure	No-Not sure
Bid1($): organic, locally produced	4.26 (1.79)	3.46 (1.84)	3.81 (1.45)	0.80** (0.25)	0.45 (0.27)	-0.35 (0.20)
Bid2($): conventional, locally produced	3.41 (1.42)	2.94 (1.39)	3.04 (1.16)	0.47** (0.20)	0.37 (0.21)	-0.10 (0.16)
Bid3($): organic, U.S. produced	3.94 (1.49)	3.12 (1.70)	3.36 (1.44)	0.82** (0.23)	0.59** (0.25)	-0.23 (0.19)
Bid4($): conventional, U.S. produced	3.07 (1.17)	2.60 (1.33)	2.59 (1.26)	0.48** (0.19)	0.49** (0.20)	0.01 (0.15)
Partial bids for local($) (Bid2-Bid4)	0.33 (1.05)	0.34 (1.04)	0.45 (0.88)	-0.01 (0.15)	-0.12 (0.15)	-0.11 (0.12)
Partial bids for organic($) (Bid3-Bid4)	0.87 (1.25)	0.53 (1.63)	0.77 (1.52)	0.35 (0.23)	0.10 (0.24)	-0.24 (0.18)

Note: Tukey multiple comparison test is used. The numbers in the parentheses are standard errors. ** indicates significant results at 5% level.

Table 4-4. WTPs at different locations

Store Type	WTP for Organic		WTP for Local	
	Mean($)	Std. Dev	Mean($)	Std. Dev
Price-conscious (1)	0.26	1.57	0.05	0.92
Quality-focused (2)	1.02	1.64	0.42	0.91
Farmers' market (3)	0.64	1.34	0.60	1.06
Significant difference of means (Bonferroni test)	2>1		2>1,3>1	

Table 4-5. Tobit for reported bids

Independent Variables	Coefficient	Std. Err.	t	P>t
Age	-0.01**	0.00	-2.55	0.01
Female	0.17	0.10	1.69	0.09
Income($35,000-$99,999)	-0.01	0.11	-0.10	0.92
Income($100,000 or above)	0.18	0.12	1.41	0.16
Caucasian	-0.01	0.13	-0.09	0.93
Hispanic	-0.03	0.25	-0.14	0.89
Asian	-0.67**	0.28	-2.36	0.02
Others races	0.230	0.21	1.40	0.16
College	0.36**	0.10	3.41	0.00
Postgraduate	0.19	0.14	1.32	0.19
Number of Children	0.07	0.04	1.71	0.09
Farmers' market	0.48**	0.13	3.67	0.00
Quality-focused	0.38**	0.13	2.92	0.00
Florida	-0.44**	0.09	-4.82	0.00
Organic	0.64**	0.12	5.48	0.00
Local	0.42**	0.12	3.61	0.00
Organic_local	1.01**	0.12	8.69	0.00
Like	0.32**	0.06	5.00	0.00
History	0.13	0.17	0.76	0.45
Intention	0.43**	0.11	3.73	0.00
Intercept	0.70**	0.34	2.09	0.04
/sigma	1.52	0.03		
Model Fitting Statistics				
Number of Observation	1376			
Log-likelihood	-2470.92			
LR chi2(20)	214.25			
Prob > chi2	0.00			

Note: Dummies for income ($34,999 or below), Black, education level below college and the price-conscious stores are omitted for identification; Organic=1: the auctioned blueberry is organic; Local=1: the auctioned blueberry is local; Organic_local=1: the auctioned blueberry is both organic and local; Like: How well the participant likes fresh blueberries (1=dislike very much; 5=like very much); History=1: The participant has purchased fresh blueberries before; Intention=1: The participant intended to purchase fresh blueberries that day. ** indicates significance at 5% level.

Table 4-6. Robust OLS for WTPs

Independent Variables	Local			Organic		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
Age	-0.02**	0.00	0.00	-0.02**	0.01	0.00
Female	0.18	0.13	0.18	0.45**	0.21	0.03
Income($35,000-$99,999)	-0.04	0.12	0.71	-0.16	0.20	0.42
Income($100,000 or above)	-0.17	0.16	0.29	-0.12	0.22	0.60
Caucasian	0.16	0.20	0.42	0.04	0.30	0.89
Hispanic	0.03	0.30	0.91	-0.36	0.54	0.50
Asian	-0.13	0.29	0.67	0.31	0.43	0.48
Others races	-0.22	0.24	0.35	0.07	0.35	0.83
College	0.19	0.13	0.14	-0.26	0.20	0.19
Postgraduate	0.28	0.18	0.13	-0.03	0.27	0.92
Number of Children	-0.01	0.05	0.82	0.12	0.08	0.17
Farmers' market	0.59**	0.17	0.00	0.58**	0.26	0.03
Quality-focused	0.51**	0.17	0.00	0.95**	0.28	0.00
Florida	-0.09	0.12	0.46	0.03	0.18	0.89
Like	0.02	0.06	0.71	0.05	0.10	0.66
History	-0.25	0.21	0.22	-0.25	0.28	0.37
Intention	-0.09	0.15	0.52	0.28	0.21	0.19
Intercept	0.57	0.39	0.14	0.74	0.52	0.16
Model Fitting Statistics						
Number of Observation	344			344		
R-squared	0.13			0.11		
Prob > F	0.00			0.03		

Note: Dummies for income ($34,999 or below), Black, education level below college and the price-conscious stores are omitted for identification; Like: How well the participant likes fresh blueberries (1=dislike very much; 5=like very much); History=1: The participant has purchased fresh blueberries before; Intention=1: The participant intended to purchase fresh blueberries that day. ** indicates significance at 5% level.

CHAPTER 5
CONCLUSION

Understanding consumers' preferences and attitudes is critical for new product development, labeling policy formulation or the prediction of product market shares. However, the measurement of preferences and attitudes could be difficult as they are both abstract concepts. Willingness-to-pay (WTP), as a measurable concept, has enabled people to have a one-to-one correspondence between preference and monetary values.

Studies that used different methodologies could yield different WTP values. Therefore, researchers have been exploring ways to get an unbiased WTP values. Some commonly used value elicitation methods include contingent valuation, experimental auctions etc. Although these methods have been used and discussed for a long time, research is still ongoing about methods that will give us more accurate measurement.

In this dissertation, attempts have been made to discover some problems and methodological improvement in the process of eliciting WTPs. Two value elicitation methods: choice experiment and experimental auction are discussed. The research subject is consumers' WTP for blueberry attributes. As a fruit containing high level of nutrients, the blueberry has an expanding consumer group but studies about consumers' attitude toward blueberry attributes are quite limited.

For the indirect methods to calculate WTPs, such as the choice experiment, the models used to estimate WTPs are among the hottest discussed topics. Researchers have found a lot of inconsistencies between various value elicitation methods. However, different models can also result in different results with the same data. In Chapter 2 of

this dissertation, a hypothetical method: a choice experiment, is used to compare consumers' attitudes toward three blueberry attributes: freshness, organic or not, and place of production (local, U.S. produced or imported). The all random WTP space mixed logit model is used for parameter estimation. The results indicate that consumers in the U.S. regard the local production of blueberries a more important attribute than whether they are organic or not. Even though there is a fair amount of consumers that are willing to pay positive premiums for organic blueberries, the majority of them don't have positive WTPs for the "organic" attribute. Additionally, we conclude that disaggregate information, which can be derived from the Bayesian estimation method, is more useful for target marketing.

In Chapter 3, three widely used specifications for mixed logit are estimated and compared. The results show that the divergence found in previous literature between the preference space model and the WTP space model can be narrowed when the price coefficient is assumed fixed in the preference space. The results suggest that the fixed price preference space model might be used as a substitute for the all random WTP space model, which is used in Chapter 2. This is an interesting finding as the all random WTP space model need extra steps in estimation and may also suffer from the identification problems suggested by Ruud (1996). This chapter reaches the same conclusion as Chapter 2 in terms of the attribute importance rankings of blueberries.

Although the choice experiment is relatively easy for researchers to implement and straightforward for consumers to understand, hypothetical bias has been one of its most questioned problems. For direct methods, such as experimental auctions, the problem of hypothetical bias has been dealt with, but the choices of the auction format, auction

locations and specific auction procedures are other problems that need serious consideration for the experiment to be incentive-compatible.

In Chapter 4, a non-hypothetical method: experimental auction is conducted for consumers' WTP for organic and local blueberries. The WTP estimates from the experimental auction are much smaller than those from the choice experiment. Therefore, our results are consistent with previous studies in that the choice experiment tends to provide exaggerated WTP estimates. Additionally, we find that auction participants' purchase intentions on the day of auction and the choice of auction locations have significant impact on participants' bidding behavior. Specifically, purchase intentions affect full bids, but not partial bids while the choice of auction locations affects both full bids and partial bids. Even though the experiment auctions might provide more plausible WTP estimates than choice experiments, the reliability of the results from experimental auctions has not been verified. A variety of observable or unobservable factors might impact consumers' bidding behavior in the auction process. More research should be done to discover and evaluate these factors so that a better reflection of consumers' preferences can be revealed.

Apart from the findings regarding methodologies, Chapters 2 and 3 and Chapter 4 give contradictory results on the importance comparison between "organic" and "local". Although most literature also found different WTP values with different value elicitation methods, little of them have found inconsistent attribute importance rankings. One of the reasons might be that in the choice experiment, the organic attribute was ignored because there were too many attributes to be compared in each choice situation. In the auction process, however, there were only two attributes: "organic" and "local". Another

reason might be that the comparison is based on WTP means, which are subject to the influence of extreme values. This contradiction might also indicate that the design of choice experiments needs extra caution or more studies should be conducted on the reliability of the estimates from choice experiments.

APPENDIX A
CHOICE SITUATIONS FOR THE CHOICE EXPERIMENT

Which of the following two choices for blueberries would you pick?

Choice 1	Choice 2	Choice 3
Fresh	Fresh	I would not choose either product
Imported	Imported	
Conventional	Organic	
$3.99/pint	$5.99/pint	

Q97

Which of the following two choices for blueberries would you pick?

Choice 1	Choice 2	Choice 3
Fresh	Fresh	I would not choose either product
Produced in United States	Produced locally (in your state)	
Organic	Conventional	
$5.99/pint	$2.50/pint	

Q98

Which of the following two choices for blueberries would you pick?

Choice 1	Choice 2	Choice 3
Frozen	Fresh	I would not choose either product
Produced locally (in your state)	Imported	
Organic	Conventional	
$5.99/pint	$5.99/pint	

Q99

Which of the following two choices for blueberries would you pick?

Choice 1	Choice 2	Choice 3
Fresh	Frozen	I would not choose either product
Imported	Produced in United States	
Organic	Conventional	
$3.99/pint	$3.99/pint	

Q100

Which of the following two choices for blueberries would you pick?

Choice 1	Choice 2	Choice 3
Frozen	Frozen	I would not choose either product
Produced in United States	Produced locally (in your state)	
Conventional	Conventional	
$3.99/pint	$3.99/pint	

Q101

Which of the following two choices for blueberries would you pick?

Choice 1	Choice 2	Choice 3
Frozen	Fresh	I would not choose either product
Produced locally (in your state)	Produced in United States	
Conventional	Conventional	
$3.99/pint	$1.50/pint	

Q102

Which of the following two choices for blueberries would you pick?

Choice 1	Choice 2	Choice 3
Frozen	Frozen	I would not choose either product
Imported	Produced in United States	
Organic	Organic	
$2.50/pint	$5.99/pint	

Q103

Which of the following two choices for blueberries would you pick?

Choice 1	Choice 2	Choice 3
Frozen	Frozen	I would not choose either product
Produced in United States	Produced locally (in your state)	
Organic	Organic	
$2.50/pint	$5.99/pint	

Q104

Which of the following two choices for blueberries would you pick?

Choice 1	Choice 2	Choice 3
Fresh	Frozen	I would not choose either product
Produced locally (in your state)	Produced in United States	
Conventional	Organic	
$2.50/pint	$2.50/pint	

Q105

Which of the following two choices for blueberries would you pick?

Choice 1	Choice 2	Choice 3
Frozen	Frozen	I would not choose either product
Imported	Imported	
Conventional	Organic	
$1.50/pint	$2.50/pint	

Q96

Which of the following two choices for blueberries would you pick?

Choice 1	Choice 2	Choice 3
Fresh	Fresh	I would not choose either product
Produced in United States	Produced locally (in your state)	
Conventional	Organic	
$1.50/pint	$2.50/pint	

Q106

Which of the following two choices for blueberries would you pick?

Choice 1	Choice 2	Choice 3
Fresh	Frozen	I would not choose either product
Produced locally (in your state)	Imported	
Organic	Conventional	
$1.50/pint	$1.50/pint	

APPENDIX B
BDM AUCTION QUESTIONNAIRE

Have you ever purchased fresh blueberries?

- ◯ Yes
- ◯ No

Approximately how much money did you spend on fresh blueberries in the LAST MONTH?

- ◯ Nothing, I did not purchase fresh blueberries last month
- ◯ Less than $4
- ◯ $4.00 - $9.99
- ◯ $10.00 - $14.99
- ◯ $15.00 - $19.99
- ◯ $20.00 - $29.99
- ◯ $30 or more

Is this the location where you typically purchase most of your fruit from?

- ◯ Yes
- ◯ No

Did you intend to purchase fresh blueberries here today?

- ◯ Yes
- ◯ No
- ◯ Not sure

Do you currently have any fresh blueberries at home?

- ◯ Yes
- ◯ No

What state do you currently live in (at least 6 months out of the year)?

- ◯ Florida
- ◯ Other _____

Please indicate how well you like the following types of blueberries:

	Dislike Very Much	Dislike	Neither Like nor Dislike	Like	Like Very Much
Fresh	○	○	○	○	○
Frozen	○	○	○	○	○
Dried	○	○	○	○	○
Canned	○	○	○	○	○
As an ingredient (e.g. blueberry muffin, blueberry smoothie)	○	○	○	○	○

If you wanted to purchase fresh blueberries, how likely are you to purchase them from the following sources, assuming the berries look the same, are the same size packages and are available at the same time, place, and price (e.g. the only difference is location where they are produced):

	Very Unlikely	Unlikely	Undecided	Likely	Very Likely
Produced in your state	○	○	○	○	○
Produced in the US, but not in your state	○	○	○	○	○
Imported (not from the US)	○	○	○	○	○

Please indicate how strongly you agree with the following statements: I eat blueberries for the...

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Health benefits	○	○	○	○	○
Taste	○	○	○	○	○
Convenience (easy to eat)	○	○	○	○	○
Diversity they add to my diet	○	○	○	○	○
Price	○	○	○	○	○
Please select Agree for this row	○	○	○	○	○
Other: _____	○	○	○	○	○

Please indicate what percent of FRUIT you purchase is:

Percent:	from a farmer's market	organic
0% (None)	◯	◯
10% or less	◯	◯
10-50%	◯	◯
50-99%	◯	◯
100% (all)	◯	◯

How important are the following factors when you make a decision to purchase fresh blueberries?

	Not at all Important	Somewhat Unimportant	Neither Important nor Unimportant	Somewhat Important	Extremely Important
Color	◯	◯	◯	◯	◯
Size of the blueberries	◯	◯	◯	◯	◯
Freshness	◯	◯	◯	◯	◯
Dryness/no mold on blueberries	◯	◯	◯	◯	◯
Price	◯	◯	◯	◯	◯
Firmness	◯	◯	◯	◯	◯
Container size	◯	◯	◯	◯	◯
Where the blueberries were grown	◯	◯	◯	◯	◯
Availability of samples	◯	◯	◯	◯	◯

Please indicate how strongly you agree with the following statements.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I trust fruits labeled as organic	◯	◯	◯	◯	◯
Organic blueberries are healthier than other blueberries	◯	◯	◯	◯	◯
I will pay more for fruits with an organic label	◯	◯	◯	◯	◯
I can regularly find organic blueberries	◯	◯	◯	◯	◯

The following questions are used to help us understand how different types of people have different tastes and preferences. Your responses are anonymous; we do not have anything that ties your names to your responses. We appreciate your honest answers to the following questions.

What is your gender?

◯ Male ◯ Female

What is your age? _____

What is your ethnicity/race (please select all that apply)?

◯ Caucasian
◯ Hispanic
◯ Asian
◯ Other _____
◯ Black or African American
◯ Native Hawaiian or Pacific Islander
◯ American Indian or Alaska Native

Please indicate you estimated annual household income:

◯ Less than $14,999
◯ $15,000 - $24,999
◯ $25,000 - $34,999
◯ $35,000 - $49,999
◯ $50,000 - $74,999
◯ $75,000 - $99,999
◯ $100,000 - $149,999
◯ $150,000 - $199,999
◯ $200,000 or above
◯ Do not know

What is your education level?

◯ Less than high school
◯ High school degree or equivalent
◯ Some college
◯ Postgraduate
◯ Trade/technical school
◯ Other _____

◯ Four-year college degree ◯ Don't know

What is your current employment status?

◯ Full time ◯ Part time ◯ Currently not working
◯ Retired ◯ Student ◯ Other

How many people including yourself live in your household?

◯ 1-2 ◯ 3-4 ◯ 5-6 ◯ 7-8 ◯ 9 or above

How many children age 18 or younger currently live in your household?

◯ None ◯ 1 ◯ 2 ◯ 3 ◯ 4 or more

Approximately how much per week does your family spend on food?

◯ Less than $49 ◯ $200-$249
◯ $50-$99 ◯ $250-$299
◯ $100-$149 ◯ $300 or more
◯ $150-$199

Please take this survey to an interviewer to complete the last portion of the interview and receive your gift card.

APPENDIX C
BDM AUCTION INSTRUCTIONS AND PROCEDURE

We are now interested in your preference for four packages of blueberries typically found at a grocery store. Now, we will conduct an 'auction' for the blueberries, where you will have the opportunity to purchase one package of blueberries. In case you do not have cash with you, we are providing you with $7 cash. This cash is yours to keep and is in addition to the $10 gift card you will receive at the end.

In a moment, you will be asked to write the most you are willing to pay for each package of blueberries in the spaces below. After you write these amounts, we will auction the blueberries like this:

1. We will randomly draw a letter to determine which blueberry package to actually auction. Even though you will bid on four products, only one will be auctioned. If we draw "A", we will auction the organic, local blueberries; "B" is for local blueberries; "C" is for organic, produced in the US; and "D" if for produced in the US. It is important to realize that even though you will bid on four products, you will only have the opportunity to buy one package of blueberries.

2. Once we determine which blueberry package will be auctioned, you will randomly draw a 'secret price' by selecting a number from this bowl.

3. If your bid for the randomly selected blueberry package is higher than the price from the bowl, then you will purchase the blueberries from me for a price equal to the price from the bowl. Note: payment will actually take place.

4. If your bid for the package is less than the price from the bowl, then you will not purchase the blueberries and will walk away with no blueberries. If you do not wish to purchase one of the blueberry packages, simply bid $0.00 for that package.

It is in your best interest to bid exactly what you are willing to pay. For example, if you bid less than it is worth to you to have the blueberries, you might end up not winning the auction even though you could have bought the blueberries at a price you were actually willing to pay. Or, if you bid more than it is worth to you to purchase the blueberries, you may end up having to buy them at a price higher than you really wanted to. Thus it is in your best interest to bid exactly what you are willing to pay. Do you have any questions?

The most I am willing to pay for…

A. Organic, Locally produced Blueberries is $_____

B. Locally produced Blueberries is $_____

C. Organic, produced in the US Blueberries is $_____

D. Blueberries produced in the US is $_____

LIST OF REFERENCES

Alfnes, F., A. G. Guttormsen, G. Steine, and K. Kolstad. “Consumers’ Willingness to Pay for the Color of Salmon: A Choice Experiment with Real Economic Incentives.” *American Journal of Agricultural Economics* 88(2006):1050-1061.

Alfnes, F. “Stated Preferences for Imported and Hormone-treated Beef: Application of a Mixed Logit Model.” *European Review of Agricultural Economics* 31(2004):19-37.

Alfnes, F. and K. Rickertsen. “European Consumers’ Willingness to Pay for U.S. Beef in Experimental Auction Markets.” *American Journal of Agricultural Economics* 85(2003):396-405.

Allenby, G. and P. Rossi. “Marketing Models of Consumer Heterogeneity.” *Journal of Econometrics* 89(1998):57-78.

Balcombe, K., A. Chalak, and I. Fraser. “Model Selection for the Mixed Logit with Bayesian Estimation.” *Journal of Environmental Economics and Management* 57(2009):226-237.

Balcombe. K., L. Fraser, and L. Harris. “Consumer Willingness to Pay for In-flight Service and Comfort Levels: A Choice Experiment.” *Journal of Air Transport Management* 15(2009):221-226.

Batte, M. T., N. H. Hooker, T. C. Haab, and J. Beaverson. “Putting Their Money where Their Mouths are: Consumer Willingness to Pay for Multi-ingredient, Processed Organic Food Products.” *Food Policy* 32(2007):145-159.

Becker, G. M., M. H. Degroot, and J. Marschak. “Measuring Utility by a Single-response Sequential Method.” *Behavioral Science* 9(1964):226-232.

Bernard, J. C. and D. J. Bernard. “Comparing Parts with the Whole: Willingness to Pay for Pesticide-Free, Non-GM, and Organic Potatoes and Sweet Corn.” *Journal of Agricultural and Resource Economics* 35(2010):457-475.

Bettman, J. R., M. F. Luce, and J. W. Payne. “Constructive Consumer Choice Processes.” *The Journal of Consumer Research* 25(1998):187-217.

Birol, E., K. Karousakis, and P. Koundouri. “Using a Choice Experiment to Account for Preference Heterogeneity in Wetland Attributes: The Case of Cheimaditida Wetland in Greece.” *Ecological Economics* 60(2006):145-156.

Bond, C. A., D. D. Thilmany, and J. K. Bond. “What to Choose? The Value of Label Claims to Fresh Produce Consumers.” *Journal of Agricultural and Resource Economics* 33(2008):402-427.

Brooks, K. and J. L. Lusk. “Stated and Revealed Preferences for Organic and Cloned Milk: Combining Choice Experiment and Scanner Data.” *American Journal of Agriculture Economics* 92(2010):1229-1241.

Carlsson, F., P. Frykblom, and C. J. Lagerkvist. “Consumer Benefits of Labels and Bans on Genetically Modified Food- An Empirical Analysis Using Choice Experiment.”, 2004. Working Paper in Economics no. 129, Department of Economics, Gothenburg University.

Carson, R. T., J. J. Louviere, D. A. Anderson, P. Arabie, D. S. Bunch, D. A. Hensher, R. M. Johnson, W. F. Kuhfeld, D. Steinberg, J. Swait, H. Timmermans, and J. B. Wiley. "Experimental Analysis of Choice." *Marketing Letters* 5(1994):351-368.

Casella, G. and E. I. George. “Explaining the Gibbs Sampler.” *The American Statistician* 46(1992):167-174.

Corrigan, J. R. and M. C. Rousu. “Testing Whether Field Auction Experiments Are Demand Revealing in Practice.” *Journal of Agricultural and Resource Economics* 33(2008):290-301.

Darby, K., M. T. Batte, S. Ernst, and B. Roe. “Willingness to Pay for Locally Produced Foods: A Customer Intercept Study of Direct Market and Grocery Store Shoppers.” American Agricultural Economics Association Annual Meeting, Long Beach, California, July 23-26, 2006.

Dentoni, D., G. T. Tonsor, R. J. Calantone, and H. C. Peterson. “The Direct and Indirect Effects of “Locally Grown” on Consumers’ Attitudes towards Agri-Food Products.” *Agricultural and Resource Economics Review* 38(2009):384-396.

Fox, J. A., J. F. Shogren, D. J. Hayes, and J. B. Kliebenstein. “CVM-X: Calibrating Contingent Values with Experimental Auction Markets.” *American Journal of Agricultural Economics* 80(1998):455-465.

Frank, R. E., W. F. Massy, and H. W. Boyd. “Correlates of Grocery Product Consumption Rates.” *Journal of Marketing Research* 4(1967):184-190.

Gao, Z. and T. Schroeder. “Effects of Additional Quality Attributes on Consumer Willingness-to-pay for Food Lables.” AAEA, WAEA, and CAES Joint Annual Meeting, Portland, Oregon, July 29-August 1, 2007.

Hanley, N., R. E. Wright, and V. Adamowicz. “Using Choice Experiments to Value the Environment.” *Environmental and Resource Economics* 11(1998):413-428.

Hayes, D. J., J. F. Shogren, S. Y. Shin, and J. B. Kliebenstein. “Valuing Food Safety in Experimental Auction Markets.” *American Journal of Agricultural Economics 77*(1995):40-53.

Hensher, D. A., W. H. Greene, and J. M. Rose. “Deriving Willingness-to-pay Estimates of Travel-time Savings from Individual-based Parameters.” *Environment and Planning* 38(2006):2365-2376.

Hensher, D. A. and W. H. Greene. “Valuation of Travel Time Savings in WTP and Preference Space in the Presence of Taste and Scale Heterogeneity.” *Journal of Transport Economics and Policy* 45(2011):505-525.

Hensher, D. A., N. Shore, and K. Train. “Households’ Willingness to Pay for Water Service Attributes.” *Environmental and Resource Economics* 32(2005):509-531.

Horowitz, J. K. "The Becker-DeGroot-Marschak Mechanism is not Necessarily Incentive Compatible, even for Non-random Goods." *Economic Letters* 93 (2006):6-11.

Hu, W., T. Woods, and S. Bastin. “Consumer Acceptance and Willingness to Pay for Blueberry Products with Nonconventional Attributes.” *Journal of Agricultural and Applied Economics* 41(2009):47-60.

Hu, W., T. Woods, S. Bastin, L. Cox, and W. You. “Assessing Consumer Willingness to Pay for Value-Added Blueberry Products Using a Payment Card Survey.” *Journal of Agricultural and Applied Economics* 43(2011):243-258.

Huber. J. and K. Train. “On the Similarity of Classical and Bayesian Estimates of Individual Mean Partworths.” *Marketing Letters* 12(2001):259-269.

Huffman, W. E., J. F. Shogren, M. Rousu, and A. Tegene. "Consumer Willingness to Pay for Genetically Modified Food Labels in a Market with Diverse Information: Evidence from Experimental Auctions." *Journal of Agricultural and Resource Economics* 28(2003):481-502.

Irwin, J. R., P. Slovic, S. Lichtenstein, and G. H. McClelland."Preference Reversals and the Measurement of Environmental Values." *Journal of Risk and Uncertainty* 6(1993):5–18.

Jaeger, S. R., J. L. Lusk, L. O. House, C. Valli, M. Moore, B. Morrow, and W. B. Traill. “The Use of Non-hypothetical Experimental Markets for Measuring the Acceptance of Genetically Modified Foods.” *Food Quality and Preference* 15(2004):701-714.

Janssen, M., A. Heid, and U. Hamm. “Is There a Promising Market ‘in between’ Organic and Conventional Food? Analysis of Consumer Prefernces.” *Renewable Agriculture and Food Systems* 24(2009):205-213.

Johansson-Stenman, O. and H. Svedsäter. “Measuring Hypothetical Bias in Choice Experiments: The Importance of Cognitive Consistency.” *The B.E. Journal of Economic Analysis & Policy* 8(2008).

Layton, D. F. and G. Brown. “Heterogeneous Preferences Regarding Global Climate Change.” *The Review of Economics and Statistics* 82(2000):616-624.

Lin, B., T. A. Smith, and C. L. Huang. “Organic Premiums of US Fresh Produce.” *Renewable Agriculture and Food Systems* 23(2008):208-216.

List, J. A. “Do Explicit Warnings Eliminate the Hypothetical Bias in Elicitation Procedures? Evidence from Field Auctions for Sportscards.” *The American Economic Review* 91(2001):1498-1507.

List, J. A. “Preference Reversals of a Different Kind: The ‘More Is Less’ Phenomenon.” *The American Economic Review* 92(2002):1636-1643.

List, J. A. and C. A. Gallet. “What Experimental Protocol Influence Disparities between Actual and Hypothetical Stated Values?” *Environmental and Resource Economics* 20(2001):241–254.

List, J. A. and D. Lucking-Reiley. “Demand Reduction in Multiunit Auctions: Evidence from a Sportscard Field Experiment.” *The American Economic Review* 90(2000):961-972.

List, J. A, and J. F. Shogren. “Calibration of the Difference between Actual and Hypothetical Valuations in a Field Experiment.” *Journal of Economic Behavior & Organization* 37(1998):193–205.

Loureiro, M. L., J. J. McCluskey, and R. C. Mittelhammer. “Assessing Consumer Preferences for Organic, Eco-labeled, and Regular Apples.” *Journal of Agricultural and Resource Economics* 26(2001):404-416.

Lusk, J. L. and J. A. Fox. “Value Elicitation in Retail and Laboratory Environments.” *Economics Letters* 79(2003):27-34.

Lusk, J. L., J. A. Fox, T. C. Schroeder, J. Mintert, and M. Koohmaraie. "In-store Valuation of Steak Tenderness." *American Journal of Agricultural Economics* 83(2001):539–550.

Lusk, J. L., L. O. House, C. Valli, S. R. Jaeger, M. Moore, J. L. Morrow, and W. B. Traill. “Effect of Information about Benefits of Biotechnology on Consumer Acceptance of Genetically Modified Food: Evidence from Experimental Auctions in the United States, England, and France.” *European Review of Agricultural Economics* 31(2004):179-204.

Lusk, J. L., T. Nilsson, and K. Foster. “Public Preferences and Private Choices: Effect of Altruism and Free Riding on Demand for Environmentally Certified Pork.” *Environmental and Resource Economics* 36(2007):499-521.

Lusk, J. L. and B. Norwood. “Effect of Experimental Design on Choice-Based Conjoint Valuation Estimates.” *American Journal of Agricultural Economics* 87(2005):771-785.

Lusk, J. L., J. Roosen, and J. A. Fox. “Demand for Beef from Cattle Administered Growth Hormones or Fed Genetically Modified Corn: A Comparison of Consumers in France, Germany, the United Kingdom, and the United States.” *American Journal of Agricultural Economics* 85(2003):16-29.

Lusk, J. L. and T. C. Schroeder. “Are Choice Experiments Incentive Compatible? A Test with Quality Differentiated Beef Steaks.” *American Journal of Agricultural Economics* 86(2004):467-482.

Managi, S., Y. Yamamoto, H. Iwamoto, and K. Masuda. “Valuing the Influence of Underlying Attitudes and the Demand for Organic Milk in Japan.” *Agricultural Economics* 39(2008):339-348.

McFadden, D. L. and K. Train. “Mixed MNL Models for Discrete Response.” *Journal of Applied Econometrics* 15(2000):447-470.

Melton, B. E., W. E. Huffman, J. F. Shogren, and J. A. Fox. “Consumer Preferences for Fresh Food Items with Multiple Quality Attributes: Evidence from an Experimental Auction of Pork Chops.” *American Journal of Agricultural Economics* 78(1996):916-923.

Özdemir, S., F. R. Johnson, and A. B. Hauber. “Hypothetical Bias, Cheap Talk, and Stated Willingness to Pay for Health Care.” *Journal of Health Economics* 28(2009):894-901.

Payne, J. W., J. R. Bettman, and E. J. Johnson. "Behavioral Decision Research: A Constructive Processing Perspective." *Annual Review of Psychology* 43 (1992):87-131.

Provencher, B. and R. C. Bishop. “Does Accounting for Preference Heterogeneity Improve the Forecasting of a Random Utility Model? A Case Study.” *Journal of Environmental Economics and Management* 48(2004):793-810.

Revelt, D. and K. Train. “Mixed Logit with Repeated Choices: Households’ Choices of Appliance Efficiency Level.” *Review of Economics and Statistics* 80(1998):647-657.

Revelt, D. and K. Train. “Consumer-Specific Taste Parameters and Mixed Logit: Households’ Choice of Electricity Supplier.”, 2000. Working Paper No. E00-274, Department of Economics, University of California at Berkeley.

Robert, C. P. and G. Casella. *Monte Carlo Statistical Methods*. Springer, 2004.

Rossi, P. E. and G. M. Allenby. “Bayesian Statistics and Marketing.” *Marketing Science* 22(2003):304-328.

Rossi, P. E., G. M. Allenby, and R. E. McCulloch. *Bayesian Statistics and Marketing*. Wiley, 2005.

Rossi, P. E., R. E. McCulloch, and G. M. Allenby. “The Value of Purchase History Data in Target Marketing.” *Marketing Science* 15(1996):321-340.

Rousu, M. C., D. C. Monchuk, J. F. Shogren, and K. M. Kosa. “Consumer Willingness to Pay for ‘Second-Generation’ Genetically Engineered Products and the Role of Marketing Information.” *Journal of Agricultural and Applied Economics* 37(2005):647-657.

Rozan, A., A. Stenger, and M. Willinger. “Willingness-to-Pay for Food Safety: An Experimental Investigation of Quality Certification on Bidding Behaviour.” *European Review of Agricultural Economics* 31(2004):409-425.

Ruud, P. “Simulation of the Multinomial Probit Model: An Analysis of Covariance Matrix Estimation.”, 1996. Working Paper, Department of Economics, University of California.

Scarpa, R., M. Thiene, and K. Train. “Utility in Willingness to Pay Space: A Tool to Address Confounding Random Scale Effects in Destination Choice to the Alps.” *American Journal of Agricultural Economics* 90(2008):994-1010.

Scarpa, R. and K. Willis. “Willingness-to-Pay for Renewable Energy: Primary and Discretionary Choice of British Households' for Micro-Generation Technologies.” *Energy Economics* 32(2010):129-136.

Shogren, J. F., J. A. Fox, D. J. Hayes, and J. Roosen. “Observed Choices for Food Safety in Retail, Survey, and Auction Markets.” *American Journal of Agricultural Economics* 81(1999):1192-1199.

Silva, A., R. M. Nayga, Jr., B. L. Campbell, and J. L. Park. “On the Use of Valuation Mechanisms to Measure Consumers’ Willingness to Pay for Novel Products: A Comparison of Hypothetical and Non-Hypothetical Values.” *International Food and Agribusiness Management Review* 10(2007):165-180.

Sonnier, G., A. Ainslie, and T. Otter. “Heterogeneity Distributions of Willingess-to-pay in Choice Models.” *Quantitative Marketing and Economics* 5(2007):313-331.

Thaler. R. "Mental Accounting and Consumer Choice." *Marketing Science* 4(1985):199-214.

Thiene. M. and R. Scarpa. “Deriving and Testing Efficient Estimates of WTP Distributions in Destination Choice Models.” *Environmental and Resource Economics* 44(2009):379-395.

Train, K. *Discrete Choice Methods with Simulation*. Cambridge: Cambridge University Press, 2003.

Train, K. and M. Weeks. “Discrete Choice Models in Preference Space and Willingness-to-Pay Space.” Application of Simulation Methods in Environmental and Resource Economics. R. Scarpa and A. Alberini, eds. Dordrecht, The Netherlands: Springer Publisher, 2005, Chapter 1, pp. 1-16.

Tversky, A. and I. Simonson. "Context-dependent Preferences." *Management Science* 39(1993):1179-1189.

Umberger, W. J., D. M. Feuz, C. R. Calkins, and K. Killinger-Mann. “U.S. Consumer preference and Willingness-to-Pay for Domestic Corn-Fed Beef versus International Grass-Fed Beef Measured through an Experimental Auction.” *Agribusiness* 18(2002):491-504.

Umberger, W. J., D. M. Feuz, C. R. Calkins, and B. M. Sitz. “Country-Of-Origin Labeling of Beef Products: U.S. Consumers' Perceptions.” *Journal of Food Distribution Research* 34(2003):103-116.

USDA, Economics, Statistics, and Market Information System, Economic Research Service, U.S. Blueberry Industry. Available online at: http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1765 (Accessed June 02, 2010).

Wang, Q. and J. Sun. “Consumer Preference and Demand for Organic food: Evidence from a Vermont Survey.” 2003. Paper presented at American Agricultural Economics Association 2003 Annual Meetings, Montreal, Canada.

Wedel, M., W. Kamakura, N. Arora, A. Bemmaor, J. Chiang, T. Elrod, R. Johnson, P. Lenk, S. Neslin and C. S. Poulsen. “Discrete and Continuous Representations of Unobserved Heterogeneity in Choice Modeling.” *Marketing Letters* 10(1999):219-232.

Wertenbroch, K. and B. Skiera. “Measuring Consumers' Willingness to Pay at the Point of Purchase.” *Journal of Marketing Research* 39(2002):228-241.

Yankelovich, D. “New Criteria for Market Segmentation.” *Harvard Business Review* 42(1964):83-90.

Yue, C. and C. Tong. “Organic or Local? Investigating Consumer Preference for Fresh Produce Using a Choice Experiment with Real Economic Incentives.” *Hortscience* 44(2009):366-371.

BIOGRAPHICAL SKETCH

Lijia Shi received her Ph.D. in food and resource economics at the University of Florida in 2012. She also holds a master's degree in applied economics from the City University of Hong Kong and a bachelor's degree in environmental engineering from Shanghai Jiao Tong University. Lijia's research interests focus on market research, consumer behavior, survey design and quantitative methodologies.