55th Annual AARES National Conference

2011

Modeling the Impact of New Information on Consumer Preferences for Specialty Meat Products

Xi Wang

Department of Resource Economics

University of Nevada, Reno

Kynda Curtis

Department of Applied Economics

Utah State University

Klaus Moeltner

Department of Resource Economics

University of Nevada, Reno

I. Introduction

As the demand for organic and natural food grows in the U.S., studies show that consumers would and do pay more for these foods than their traditional counterparts (Umberger, McFadden and Smith, 2009). However, the question remains as to whether consumers really understand the differences between organic and natural products versus traditional products. According to the USDA Consumer Brochure[1], "Organic food is produced by farmers who emphasize the use of renewable resources and the conservation of soil and water to enhance environmental quality for future generations. Organic meat, poultry, eggs, and dairy products come from animals that are given no antibiotics or growth hormones. Organic food is produced without using most conventional pesticides; fertilizers made with synthetic ingredients or sewage sludge; bioengineering; or ionizing radiation." However, there is no official definition or certification for "naturally" produced products. Normally, natural meat products are not given growth hormones or antibiotics, and are not exposed to chemical pesticides and fertilizers. The general lack of knowledge among consumers concerning organic and natural products can be misleading, thus, there is a need for a better understanding of how knowledge and information regarding organic and natural produced meat influences consumers' purchasing behavior.

In this study, we research the effect of providing consumers with information regarding organic and natural production processes in four separate stages on their chosen bid for various natural/organic meat products. Through the use of survey data collected in-person during the fall of 2007 in Reno and Carson City, NV, in which 597 surveys were completed, we examine the impact of consumer perceived knowledge of organic and natural grass-fed production processes on their chosen bid, whether or not new information/knowledge will modify their chosen bid, and the degree of modification across meat types and cuts. Meats examined vary from high-end to low-end cuts and across various meat types such as pork and beef. The purpose of our research is twofold. First, we wish to observe whether or not advertising

[1] Consumer Brochure, USDA National Organic Program, http://www.ams.usda.gov/nop/Consumers/brochure.html

and other promotional methods truly influence consumers' demand and willingness to pay for these specialty meat products. These results will likely be important to the role of marketing and the way in which information is provided to consumers on organic and natural production methods and the potential positive effects of those methods. Additionally, the paper will show how consumers' purchasing experiences and preexisting knowledge might influence their reaction to the same information.

The paper is constructed as follows: In the first section, we present the literature which focuses on the effects of information on consumer willingness to pay (WTP) for environmental goods. In the second section, we explain the data collection process and survey design. In the third section, we discuss the implications of the consumers' preexisting knowledge before taking the survey and their meat purchasing habits. In the fifth section, the meat preferences on different attributes are presented. We will group the meat preferences into several indicators by using factor analysis. In the sixth part of this paper, we will discuss the frequency distributions of consumers' choices on their chosen bid for various meat products. The results of the above questions will provide us with a general prediction on the effects of information. Thus, in the last section, a multivariate choice model will be presented.

II. Literature Review and Background

In previous research, many papers examined the effects of information on consumers' WTP for environmental goods. In the absence of relevant knowledge of information about the economic value of public goods, consumers' WTP tended to rely on "common sense," and moral considerations came into their minds when they evaluated the value of the goods (Ajzen and Driver, 1992). Thus, information on environmental goods is extremely important and may have a significant effect on respondents' WTP. An example of such research is presented by Bergstrom, Dillman and Stoll (1985). This study concluded that positive information regarding a good is likely to significantly increase consumer stated values for that good. In another study, Bergstrom, Stoll and Randall (1989) developed a conceptual model in their paper

to provide insight into how information affects willingness to pay for environmental commodities. In their research, the additional service information which describes the possible uses of a commodity increases recreationists′ WTP for wetlands protection. They discovered that additional service information described beneficial consumption services or attributes, if true, generates a desirable information effect for researchers. However, additional service information about negative consumption services may induce reduction in WTP for wetlands. Thus, the results of this research present that additional service information does not always imply the increase WTP for an environmental commodity.

In addition to examining the effects of new information on consumers′ perceived value of organic and natural products, some studies also focus on factors that may influence the extent to which new information affects consumers′ perceived value of said products. The efforts of the respondents as well as the personal relevance of the information are both important factors. Cameron and Englin (1997) suggest that information effects are likely to be strongest for goods for which respondents do not have clear prior preferences or are unfamiliar with products and/or their attributes. Boyle (1989) found that new information has less influence on predominantly use-value goods with which the respondent is highly familiar. One paper relates the degree of influence of new information to personal relevance (Ajzen, Brown, and Rosenthal, 1996). WTP was found to increase with the quality of arguments used to describe the good, especially under conditions of high personal relevance. This is consistent with the view that information about a public or private good can function as a persuasive communication device. It is concluded that the nature of the information provided in CV surveys can profoundly affect WTP estimates. In a more recent study (Berrens et al, 2004), researchers investigated the issues of information access and respondent effort. In their study they developed measures of respondent effort in accessing optional information, through the technology of Web-based surveys. Respondent effort is shown to be positively and significantly related to WTP.

Although a number of information effects are examined in these early papers, they primarily focus on public or environmental goods. There are few studies of these effects for food products, especially meat

products. In this paper we want to examine the following questions: "Does consumer perceived knowledge of organic and natural grass-fed production processes affect their willingness to pay (chosen bid) for organic and natural grass-fed beef and pork? Is the effect different across various types of beef and pork cuts? If consumers are provided with additional information regarding organic and natural grass-fed production processes, will this new information modify their choices for organic and natural grass-fed beef and pork?" To answer these questions, it is important to examine the factors that may alter consumers' valuation of the food products. Since consumers have become more concerned about the nutrition, health, and safety of food they eat, the willingness to pay for organic and natural produced food relies more on consumers' preferences and their concerns about health.

There are a number of papers devoted to studies in this area. For instance, previous research shows that willingness to pay for organic products might be influenced by the individual's lifestyle rather than the usual socio-economic variables. Gil, Gracia and Sanchez (2000) concluded in their paper that consumers concerned about the environment and a healthy diet are willing to purchase organic food with a high premium. They also affirmed that lifestyles and attitudes towards environmental issues are key factors in explaining organic food consumption, and have to be considered when designing appropriate promotion strategies by producers or marketers." Some researches include consumers' knowledge of organic food as a potential explanatory variable for their willingness to pay. However, only a few papers attempt to analyze the main effect of consumers' knowledge and how it influences their willingness to pay. Gil and Soler (2006) used the method of experimental auctions to explore the determinants of consumer knowledge. They concluded that socio-economic variables are the main determinants of consumer knowledge and that consumer attitude, lifestyle and knowledge have a strong influence on the decision of willingness to pay for organic olive oil.

In this paper we will focus on how information is provided to consumers on organic and natural production methods and the potential positive effects of those methods. Instead of using auction

experiments, we will use choice experiments to test the information effect. This will likely be important to the role of marketing and will provide an essential guide for producers of specialty meat products on whether advertising and other promotional methods will truly influence consumers' demand and their willingness to pay for such products. Moreover, the results will indicate whether advertising will have a different effect on consumers who have good background knowledge about special meat products versus ones who have a little knowledge about those products.

III. Data Collection and Structure of the Questionnaire

An in-person consumer survey was carried out in the fall of 2007. The interviewers were instructed to ask respondents if they would like to take a survey concerning meat consumption and a Sharpie pen was given as a gift for taking the survey. If the interviewee said yes, the interviewer gave him the survey and assisted the respondent in its completion. The survey was conducted at two Hispanic festivals in Reno and Carson City in the state of Nevada. There were 31 interviewers working at the onsite interview, and 597 surveys were completed in total.

There are 20 versions of the survey in total, and the surveys are identical except for the price choices on willingness to pay for different meats. This design allows for a consistent structure in our surveys for different consumers, and meanwhile, allows us to readily examine respondents′ willingness to pay according to different price levels. Each version of the survey is comprised of five sections. The first section, which was comprised of a total four questions, related to respondents′ shopping preferences (question 1 to question 4). These questions included consumers′ previous meat consumption habits, locations, and their preferences of meat characteristics, such as leanness, marbling, etc. The second section includes ten true or false questions designed to examine consumers′ knowledge about organic and natural grass-fed meat products (question 5 to question 14). These questions were designed to illustrate respondents′ understanding of organic and natural grass-fed meat production processes. A knowledge

index will be generated according to the percentage of questions answered correctly. The third section (questions 15 to 19), presents the meat purchasing history of respondents over the last 30 days. In the fourth section (question 20 to question 47) consumers were asked to choose one choice out of three for different meat products. Each choice was comprised of two meat attributes: the price and the production method (traditional, organic, natural grass-fed). Only the price varied along different versions of the survey. The last section asked questions about individual socio-economic information (such as gender, age, ethnicity, income, etc.). These responses will be used in the regression models to test the factors that may influence respondents' choices on different meat production methods. Table 1 presents the general information of respondents' characteristics. The majority of our sample are full-time employed (63.52%) and 61.62% of our respondents consume meat at home 1-5 times each week.

To lessen the effects of hypothetical bias on respondents' valuations for different meat, we inserted a short "cheap-talk" note before the fourth section. Before proceeding to the fourth section, interviewers read the notes out aloud to the respondents. In total, there are four treatments in the fourth section. The questions are exactly the same in each treatment; however, before each treatment, respondents received new knowledge/information about the different types of meat. In the first treatment, there was no extra information presented to the respondents; the respondents answered the questions based on their own perceived knowledge or previous purchasing experiences. Starting at the second treatment, new knowledge/information about organic and natural grass-fed meat was presented before respondents answered the willingness to pay questions. By using a multivariate choice experiment model, we can examine the influence of information on consumers' decision of meat consumption. If more information does have an effect on people's choices, this indicates that the information changes people's original knowledge on organic and natural-fed meat products and potentially alters respondents' chosen bid for different meat products. Thus, we need to incorporate consumers' knowledge on different meat products and their purchasing habits into the model.

Table 1: Respondents' Socio-economic Characteristics (n=597)

Characteristics	Percentage (%)
Number of members in the household	
1-2	36.95
3-4	33.98
5-6	24.34
7 or more	4.73
Residence location	
Arizona	1.28
Nevada	98.36
New Mexico	0.36
If there are any children under 18 in the household	
Yes	56.37
No	43.63
Marital Status	
Married	59.54
Single	40.46
Income	
Less than $ 30,000	24.82
$ 30,001 to $ 45,000	24.11
$ 45,001 to $ 60,000	15.78
$ 60,001 to $ 75,000	7.45
$ 75,001 to $ 100,000	7.45
Above $ 100,000	8.16
Prefer not to answer	12.23
Education	
Middle school	8.98
High school	29.58
Some college	24.3
2-year degree	16.2
4-year degree	11.09
Graduate degree or higher	9.86

Table 2: Respondents' Socio-economic Characteristics (n=597) (continue)

Characteristics (continue)	Percentage (%)
Employment Status	
Full-time employed	63.52
Part-time employed	10.99
Unemployed	5.41
Homemaker	3.14
Retired	11.69
Student	5.24
Gender	
Male	46.9
Female	53.1
Age	
18-25	22.22
26-35	20.63
36-45	22.4
46-55	15.52
56-65	9.17
66-75	7.76
over 75	2.29
Ethnicity	
African-American	1.62
Asian/Hawiian/Pacific Islander	1.26
Caucasian	31.42
Hispanic	58.71
Middle Eastern	0.36
Native American	1.44
Other	3.59
Prefer not to answer	1.62
If the respondent is the primary shopper	
Yes	74.37
No	25.63
How often do you consume meat products each week	
Never	1.85
1-5 times	61.62
5-10 times	28.28
10-15 times	5.39
More than 15 times	2.86

IV. Consumers' Knowledge (on Traditional, Organic and Natural grass-fed Meat) Index

There does not exist much research focusing on the relationship between consumers′ knowledge and their willingness to pay in the case of organic food. In order to understand the respondents′ knowledge of organic and natural grass-fed meat production processes, in the second part of the survey, consumers are given ten true or false questions. From the answers of those questions we are given a general idea of their preexisting knowledge about meat production processes. The description of the questions is provided in Appendix 1. Five questions are related to organic production and the other five questions are related to natural grass-fed production. The questions involve antibiotics, the certifications of production methods, hormones, chemical pesticides, etc.

1. Correct Rate for the Knowledge Test

Table 2 presents a frequency distribution of respondents′ answers on the perceived knowledge test. Each column represents the different questions given concerning basic knowledge of traditional, organic, and natural grass-fed methods, and each row shows the percentage of the answers (true of false) on each question. **Valid** is the sum of true and false responses. The row labeled "missing" represents the questions that were not completed by respondents. In most questions, the rate answered correctly was above 60%. However, the questions on antibiotics for natural grass-fed meat and certification of natural grass-fed meat and feedlots had a much lower percentage of correct answers. The missing rate was also relatively high in those questions. The results indicate that respondents have less or incorrect knowledge about naturally produced livestock. The question on the certification on natural grass-fed meat had a rate of 15.55% answered correctly, which shows that the majority respondents have a misunderstanding on the certification of the natural grass-fed meat, which may lead them to form incorrect judgments about naturally produced livestock. In Appendix 2, the chart shows us the percentage of correct and incorrect answers given by consumers on meat-related questions using only valid responses. Without considering the missing value, the correct rates increase slightly compared to the correct rate on the total data.

However, the questions on certification of natural grass-fed meat still received a very low rate of correct answers (16.755%).

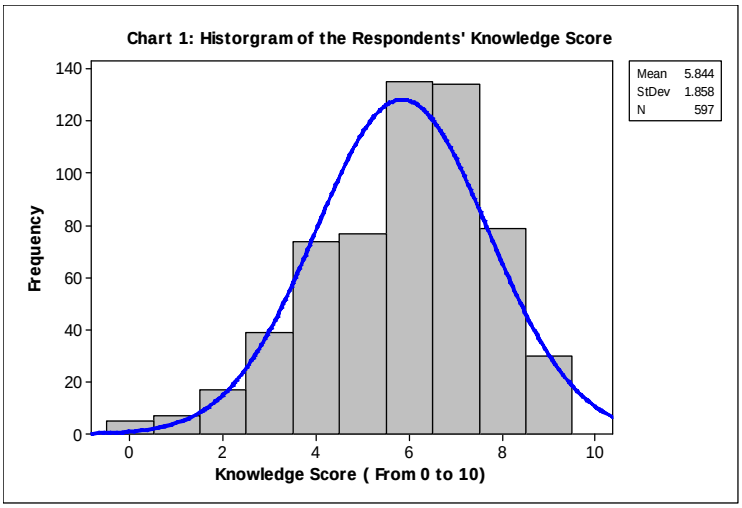
Table 2: Frequency Distributions of the Respondents' Answers on the Knowledge of Organic and Natural Produced Meat (%)

	Organic	Grass-fed	Antibiotics for Organic	Antibiotics for Natural	Hormones	Certification of Natural Meat	Certification of Organic Meat	Traditional	No Feedlots	Chemical Pesticides
TRUE	73.24	72.74	61.71	46.15	72.07	78.09	72.58	39.97	47.49	72.07
FALSE	23.08	21.24	33.61	47.66	22.74	15.55	20.23	51	42.31	20.23
VALID	96.32	93.98	95.32	93.81	94.81	93.64	92.81	90.97	89.80	93.3
MISSING	3.68	6.02	4.68	6.19	5.18	6.35	7.19	9.03	10.2	7.69
TOTAL	100	100	100	100	100	100	100	100	100	100
Std.Dev	0.427	0.419	0.478	0.500	0.427	0.372	0.413	0.497	0.500	0.414
Correct Answer	True	True	True	False	True	False	True	False	False	True

2. General Knowledge Score

A general knowledge score is generated according to the number of questions that respondents answered correctly. The score ranges from 0 (no correct answers) to 10 (all the ten answers are correct). The knowledge score can provide us with the preexisting knowledge level for each respondent. The higher the scores respondents have the more preexisting knowledge they have. Chart 1 presents the histogram of the frequency distribution of the knowledge scores to the respondents. The mean of the knowledge score is 5.89, which shows that on average, each respondent can answer about half the questions correctly. About 45% of the respondents received a score 6 or 7, and there was no respondent who answered all ten questions correctly[2].

[2] Appendix 4 present the table for the frequency distribution of the knowledge scores for the whole sample.



V. Consumers' Meat Preferences

1. Different Meat Features

Most research on consumers' valuation for specially produced meat or food focuses on the socio-economic factors that may influence consumers' decisions. However, it is not well documented whether or not the valuation is altered by a specific product attribute. One such paper is by Grannis, Hooker and Thilmany (2000). They analyzed the absolute and relative consumer rankings of several specific product attributes related to natural production methods. They found that whether or not a product was locally produced was not a significant factor in their experiment; conversely, the quality of having no hormones and antibiotics ranked the highest in importance. In our survey, we not only include the production attributes for meat, but also include the inherent attributes for meat, such as tenderness, flavor, texture, etc. The importance ranking for each attribute has five levels (from not important to extremely important). Table 3 presents the distribution of these five levels on several different meat attributes. The attribute "food safety" received the highest percentage on the "extremely important" level, and the attribute of "sales or promotion" received the lowest percentage, which was only 13.5%. Surprisingly, 32.31% of respondents stated that organic was not important, and only 14.51% respondents agreed that this attribute was extremely important.

Table 3: Percentage for Different Importance Level for Each Meat Feature

Features	Percentage for different importance level for each meat feature (%)				
	Not important	**Slightly important**	**Somewhat important**	**Very important**	**Extremely important**
Fresh	3.75	2.68	5.54	37.14	50.89
Tenderness	5.24	5.06	14.61	40.07	35.02
Marbling	20.08	12.72	24.25	24.65	18.29
Muscle texture	17.86	12.9	24.21	26.39	18.65
Leanness	9.71	6.8	18.64	33.2	31.65
Taste and flavor	5.14	2.86	4.76	32.95	54.29
Brand name	29.77	14.59	24.71	16.93	14.01
Cut type	12.81	11.47	22.56	32.7	20.46
Food safety	4.41	5.17	6.9	26.05	57.47
Packaging (packaging material and size)	13.37	9.69	21.9	30.23	24.81
Sales or promotion	27.01	15.26	18.4	25.83	13.5
Organic	32.31	17.4	19.5	16.63	14.51
Natural	20.42	11.91	18.9	26.65	22.12
Origin of product	25.64	14.2	25.25	20.32	14.6
Environmentally friendly production	15.13	12.97	23.18	27.31	21.41
Humane treatment of animal in production	14.87	11.74	18	28.38	27.01
Feed type (grain or grass)	22.67	14.53	21.51	21.51	19.77
Price	7.85	7.85	15.7	30.28	38.32

2. Factor Analysis

The term factor analysis refers to several related analytic methods. In this paper, we only use one of the analyses—called principal axis factoring (PAF). We evaluate whether the scores on a set of individual measured variables can be explained by a small number of latent variables called factors. This method is a well known method on "data reduction" or "dimension reduction." In the consumer survey, we have 18 questions about concerning meat attributes. For each attribute, respondents need to choose a number on a scale from one to five to express the importance of each meat attribute (1=Not important to 5=extremely important). Although there are 18 measurable variables here, it is very possible that some indicate the same underlying factors. In our multiple regression model setting, directly putting those variables as independent variables may cause multicollinearity. For this reason we use factor analysis to reduce the variables to the primary underlying variables.

Before running a factor analysis, we run the correlation (see Table 4) for all 18 measure variables. This step gives us a general idea of which variables can be grouped into indicator variables. The correlation shows us that people's preferences for freshness, tenderness, marbling, leanness and taste may share one factor, and people's preferences on natural production, origin, environmental awareness, humaneness and feed may share another one. To confirm this assumption, we need to run a factor analysis.

Table 4: Correlations Among Meat Preferences Questions

	fresh	tender	marbling	muscle	leanness	taste	brand	cut	safety	packag~g	sale	organic	natural	origin	environ~t	humane	feed
fresh	1																
tender	0.668	1.000															
marbling	0.332	0.412	1.000														
muscle	0.291	0.381	0.420	1.000													
leanness	0.478	0.536	0.428	0.409	1.000												
taste	0.655	0.584	0.376	0.339	0.515	1.000											
brand	0.231	0.320	0.419	0.386	0.372	0.260	1.000										
cut	0.407	0.383	0.470	0.356	0.444	0.392	0.565	1.000									
safety	0.580	0.484	0.351	0.333	0.474	0.667	0.262	0.391	1.000								
packaging	0.316	0.381	0.387	0.361	0.409	0.369	0.427	0.466	0.453	1.000							
sale	0.139	0.262	0.362	0.247	0.340	0.195	0.472	0.394	0.233	0.389	1.000						
Organic	0.176	0.204	0.267	0.302	0.245	0.219	0.303	0.228	0.257	0.364	0.356	1.000					
natural	0.289	0.330	0.305	0.363	0.310	0.315	0.362	0.365	0.409	0.447	0.344	0.605	1.000				
origin	0.269	0.319	0.290	0.307	0.250	0.259	0.326	0.278	0.306	0.376	0.314	0.641	0.521	1.000			
environment	0.319	0.323	0.334	0.313	0.387	0.354	0.265	0.313	0.452	0.409	0.326	0.566	0.622	0.562	1.000		
humane	0.285	0.314	0.301	0.264	0.426	0.349	0.243	0.237	0.445	0.382	0.198	0.434	0.429	0.412	0.689	1.000	
feed	0.238	0.304	0.333	0.312	0.311	0.246	0.364	0.359	0.303	0.351	0.303	0.527	0.465	0.586	0.580	0.531	1.000
price	0.365	0.355	0.228	0.204	0.306	0.395	0.255	0.275	0.342	0.288	0.359	0.148	0.205	0.236	0.238	0.226	0.211

Table 5: Factor Analysis on All the Meat Preferences Variables (unrotated)

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	6.20795	4.68500	0.7648	0.07648
Factor 2	1.52295	0.74782	0.1876	0.9524
Factor 3	0.77515	0.46140	0.0955	1.0479
Factor 4	0.31373	0.07292	0.0387	1.0866
Factor 5	0.24081	0.08632	0.0297	1.1162
Factor 6	0.15449	0.05109	0.019	1.1353
Factor 7	0.10340	0.09872	0.0127	1.148
Factor 8	0.00469	0.01849	0.0006	1.1486

Factor 9	-0.01381	0.01642	-0.0017	1.1432
Factor 10	-0.03023	0.03229	-0.0037	1.1469
Factor 11	-0.06252	0.01856	-0.0077	1.1355
Factor 12	-0.08108	0.03239	-0.0100	1.1255
Factor 13	-0.11347	0.02857	-0.0140	1.1115
Factor 14	-0.14204	0.00262	-0.0175	1.094
Factor 15	-0.14467	0.0283	-0.0178	1.0762
Factor 16	-0.17297	0.03009	-0.0213	1.0549
Factor 17	-0.20306	0.03915	-0.025	1.0298
Factor 18	-0.24221	.	-0.0298	1.000

By running a factor analysis on the 18 measure variables (question 4 on page 2 of the survey) we get the eigenvalues of the factors of each of the 18 variables. Next, we will determine which factors we are going to keep based on the following criterion: we keep the factors that have an eigenvalue greater than one, and rotated factor loadings of 0.7 or better. Table 6 presents the results of the factor analysis. As can be observed, only factor 1 and factor 2's eigenvalues are greater than 1. In total, the number of observations is 598, the retained factors are 8.

Table 6: Rotated Factor Loadings (pattern matrix) and Unique Variances

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Uniqueness
fresh	0.1225	0.7599	0.0685	0.0473	-0.0264	-0.0145	-0.0307	-0.0122	0.3986
tender	0.1418	0.6814	0.1772	0.2246	-0.0524	0.0663	-0.0669	-0.0183	0.4218
marbling	0.2019	0.3272	0.3395	0.4621	0.0312	0.0093	-0.0209	0.0158	0.5217
muscle	0.1856	0.3329	0.3284	0.4628	0.0004	-0.002	0.0403	-0.0131	0.5309
leanness	0.1986	0.5138	0.2823	0.1918	0.1597	0.0609	0.0299	0.0356	0.5487
taste	0.184	0.6736	0.1633	0.0579	0.0618	0.0514	0.0399	0.0273	0.4736
brand	0.2461	0.1619	0.614	0.1715	-0.0164	0.0242	-0.0317	-0.0038	0.505
cut	0.203	0.3274	0.5952	0.1255	0.0547	-0.0245	0.0138	-0.0022	0.4778
safety	0.2745	0.6258	0.148	-0.0006	0.1255	-0.0121	0.1631	0.0017	0.4686
packaging	0.3547	0.3133	0.4002	0.0924	0.0354	0.0469	0.1887	0.0158	0.5681
sale	0.2833	0.0869	0.4675	0.0655	-0.0331	0.2879	0.0656	0.0151	0.6008
organic	0.7172	0.052	0.12	0.0843	-0.1655	0.0091	0.0894	0.0346	0.4247
natural	0.6445	0.1761	0.1915	0.0835	-0.0834	0.0266	0.2177	-0.0035	0.4549
origin	0.6866	0.1569	0.1691	0.0263	-0.1535	0.0346	-0.0656	0.3223	0.4455
environment	0.7483	0.224	0.0943	0.0381	0.2191	0.0845	0.0421	-0.0186	0.3223
humane	0.6569	0.2192	0.0757	0.0571	0.3388	0.0102	-0.0211	0.005	0.396
feed	0.6735	0.1212	0.2247	0.1178	0.0237	-0.0392	-0.1853	0.0035	0.4309

price	0.1629	0.3129	0.3126	-0.0352	0.0834	0.2854	-0.032	-0.0144	0.6869

Our next step is to determine the rotated factor loadings of the factors that are significant (i.e. have eigenvalues greater than one) for each of the 18 original variables. In our case we're looking at 2 factors and their respective rotated factor loadings for the 18 variables. We need to retain variables that have rotated factor loadings of 0.7 or better. We also want to make sure that each variable has only one rotated factor loading above 0.7. Table 7 shows the result of rotated factor loadings. We combine the variables that have rotated factor loadings of 0.7 or greater in each of the 2 factors and create our own 2 underlying indices. According to the results of our factor analysis on the 18 trust variables, the following grouping will be performed:

1) Trust toward environment production (organic, natural, origin, environment, humane, feed)
2) Preference for freshness and taste (Fresh, tender, leanness, taste)

VI. Information and Consumer Choice Across Meat Types

1. Information Effect

The section on consumers' willingness to pay has four treatments. Except for the first treatment, information about different production methods is presented before consumers make a decision on their chosen bid. It is well documented that providing information about the benefits, characteristics or attributes of a new specific product may influence consumers' acceptance and further valuation of that product. For instance, Lusk et al (2004) observed that information on environmental benefits and health benefits decreases the value of genetically modified food that consumers purchase. Another study by Gil and Soler (2006) also made a similar conclusion that information has a significant effect on respondents' bids in their auction experiment. In this paper, we try to analyze the effect of information on consumers' choices of different production methods and types of meat products. We not only examine the effect of information on the chosen bid for different products, but also analyze the correlation between the new information and consumers' preexisting knowledge and the preferences of meat attributes. Although past

research manipulated the auction experiment to analyze this problem, we will use a choice experiment in our paper. The advantage of using a choice experiment survey is that respondents have to choose the offered bid and the production method at the same time, because in reality, consumers always make their purchasing decision while considering both the price and the attribute of the product. Appendix 3 presents the mean chosen bid for each type of meat and production method. In the first round, during which there is no information offered, some meat types have a higher mean chosen bid for the naturally produced product than organic (such as tri-tip steak, pork chops and leg of lamb). However, organic ground beef average values were greater than the natural ground beef average value in the first round. For prime rib, both the natural and organic products received the same mean chosen bid. Although the mean WTP have different starting points according to the meat types and produced methods, after all four rounds, for all the meat types, naturally produced meat's value is higher than that of the organic products. It seems that information has a significant effect on respondents' choices and chosen bid for different meat products.

Appendix 4 presents the mean chosen bid for naturally produced and organic meat. Regardless of the meat type, the table provides a general trend of the changes on chosen bid in the four rounds. After the fourth round of information, the mean chosen bid for natural produced meat increases. However, for organic meat, the chosen bid is less in the last round than in the first round. In the second round, when consumers first received information, the chosen bid for both naturally and organically produce meat increased. This result lends support to the information effect on the mean chosen bid, and in a further study, we will examine the information effect in our model.

2. Consumers' Choice Frequency

Except for chosen bid, the information effect may also have a significant effect on consumers' choices regarding meat products. In our survey, the questions and price setting are sequenced in each round, but the information given to the respondents is different from round to round. This design helps us to research the direct effect of information on the consumers' decisions. In the first round, no information is given to the consumers. They make a choice based on their own preferences and knowledge about organic and

naturally produced meat. In the second round, consumers are provided information about the differences on feeding for conventional, natural and organic meat products. In the third round, more information about differences in livestock production in these three methods is presented. The description also focuses on whether the method involves using chemical pesticides or antibiotics. In the last round, aside from the information we provided in the first two rounds, the differences among certification for organic and naturally produced products are also emphasized.

The meat types include prime rib, tri-tip steak, ground beef, pork chops and leg of lamb. Three production methods are conventional, natural grass-fed products and organic meat products. The price of the conventional method is treated as the baseline price. Additionally, this baseline price is consistent for the same type of meat no matter which version of our survey is being used. However, other prices vary by different versions of the survey. The range of the percentage change is from -30% to 100% and ten values in this range are given in each version.

Table 8 below shows the general valid response and choice frequency distribution for each of the production methods during each round of the survey. Only valid responses are included, and traditionally produced meat has the highest choice percentage in the first round. However, with more information provided in subsequent rounds, the percentage of respondents who choose traditional meat continued to decline. Conversely, the purchasing rate of the other two meat types increased as the survey continued. Especially for natural grass-fed meat, after the fourth round, natural grass-fed meat became the largest purchase for respondents, comprising 38.14% of the total. The organic meat purchasing did not change much during the first three rounds, but increased by almost 2% in the last round. These results support our assumption that information concerning meat products may influence the choices consumers make.

Table 8: Irrespective of Meat Choice Frequency Distribution in Four Rounds (%)

	1st round	2nd round	3rd round	4th round
Conventional	42.57	40.23	37.83	37.17
Natural	35.67	38.32	39.43	38.14
Organic	21.75	21.45	22.74	24.69
Total	100	100	100	100

Table 9: Two-Way Chi-Squares Test on the Irrespective of Meat Choice Frequency in Different Rounds

Different round information	Chi-Square	P-value
Round 1 and Round 2	14.095***	0.001
Round 1 and Round 3	12.099**	0.002
Round 1 and Round 4	7.54*	0.023
Round 2 and Round 3	0.579	0.749
Round 2 and Round 4	1.643	0.44
Round 3 and Round 4	0.57	0.752

[3]

To confirm our observations from Table 8, we used a two-way Chi-Square test on the choice frequency. The null hypothesis is: H_o = respondents′ choices (traditional, natural and organic meat) are independent of the different rounds of our survey questions. Because the only part that varied from round to round was the information we provided to consumers, the null hypothesis can be translated as: respondents′ choices are independent of different information provided. The degree of freedom is 2 and results are presented in Table 9 above. The critical value for Chi-Square distribution at 5% significance level is 5.99. The Chi-square value in the first three rows is larger than 5.99. We can reject the null hypothesis for those three groups. This result proves that there is a significant information effect on respondents′ choices between the first round (baseline information) and other rounds. Information about the meat attributes changes respondents′ original knowledge about meat and further influences their decision on meat choices. However, among the rounds in which new information was provided, the effect was not significant. For instance, after providing consumers with information about livestock feed in the second round, we presented more information about antibiotics and hormones in the third round.

[3] We use the*** to represent the significant level for Chi-square, * represents the significant level at 5%, ** represents the significant level at 1%, *** represents the significant level at 0.1%.

However, between these two rounds, the information didn't have a significant effect on changing respondents' choices.

In the following part, we will study the general response frequency by respondents for each type of meat. This will help us to observe whether or not information has some impact on the answers and whether the design of the survey is efficient. Although there were seven types of meat in our survey, in the paper we will focus only on three types of meat: prime rib, ground beef and pork chops. These three types of meat were chosen because they are very commonly purchased. Moreover, these three types of meat are sold at different price levels in the market which gives us a more general observation.

Among the meat types, conventional meat accounted for the largest proportion of choices in the first round while organic meat held the smallest proportion. By the fourth round, with the exception of Tri-tip steak, natural grass-fed meat came to account for the largest proportion of across all meat types. Conventional product remained the most prominent choice among respondents in making a purchasing decision on tri-tip steak. The proportion of natural grass-fed and organic meat saw a continued increase during the four rounds, while the proportion of conventional meat declined.

Table 10: Choice Frequency Distributions of Different Meat Types in Four Rounds

	1st round	2nd round	3rd round	4th round
Prime rib				
conventional	43.69%	39.81%	36.72%	36.18%
natural	33.59%	38.45%	39.63%	39.02%
organic	22.72%	21.75%	23.63%	24.80%
Total	100%	100%	100%	100%
Ground beef				
conventional	42.15%	40.58%	37.99%	37.72%
natural	37.55%	38.46%	39.84%	38.82%
organic	20.31%	20.96%	22.18%	23.55%
Total	100%	100%	100%	100%
Tri-tip				
conventional	43.71%	41.23%	37.99%	39.96%
natural	35.78%	38.15%	39.01%	36.14%
organic	20.50%	20.62%	23%	23.90%
Total	100%	100%	100%	100%

Pork chops				
conventional	43.86%	39.79%	39.82%	37.26%
natural	33.80%	38.14%	39.39%	38.54%
organic	22.33%	22.06%	20.79%	24.20%
Total	100%	100%	100%	100%
Lamb				
conventional	38.88%	39.57%	36.54%	34.15
natural	37.94%	38.39%	39.26%	38.33%
organic	23.19%	22.04%	24.20%	27.52%
Total	100%	100%	100%	100%

Table11: Two-Way Chi-Square Test on the Choice Frequency of Prime Rib in Different Rounds

Different round information	Chi-Square	P-value
Round 1 and Round 2	2.724	0.256
Round 1 and Round 3	5.574	0.062
Round 1 and Round 4	6.053*	0.048
Round 2 and Round 3	1.105	0.576
Round 2 and Round 4	1.899	0.387
Round 3 and Round 4	0.174	0.917

Table 11 presents the result of a two-way Chi-square test on the choice frequency of prime rib. Only in the group "Round 1 and Round 4" does the Chi-square value exceed the critical value at a 5% significance level. Thus, we can reject the null hypothesis and draw a conclusion that for prime rib, the information presented during the last round is related to the choice changes from the first round to the last round. From Table 12 to Table 15, the Chi-square tests the choice frequency for tri-tip steak, ground beef, pork chops and lamb. However, there was no group here that could reject the at 5% significance level. This result shows us that for ground beef, tri-tip steak, pork chops and lamb, information and the choice frequency may be independent of each other.

Table 12-15: Two-Way Chi-Square Test on the Choice Frequency of Ground Beef, Tri-tip Steak, Pork Chops, and Lamb in Different Rounds

Ground Beef	Chi-Square	P-value
Round 1 and Round 2	0.266	0.875
Round 1 and Round 3	1.842	0.398
Round 1 and Round 4	2.573	0.276
Round 2 and Round 3	0.722	0.697
Round 2 and Round 4	1.305	0.521
Round 3 and Round 4	0.287	0.866

Tri-tip Steak	Chi-Square	P-value
Round 1 and Round 2	0.769	0.681
Round 1 and Round 3	3.428	0.18
Round 1 and Round 4	2.18	0.336
Round 2 and Round 3	1.37	0.504
Round 2 and Round 4	1.606	0.448
Round 3 and Round 4	0.87	0.647

Pork Chops	Chi-Square	P-value
Round 1 and Round 2	2.266	0.322
Round 1 and Round 3	3.225	0.199
Round 1 and Round 4	4.441	0.109
Round 2 and Round 3	0.272	0.873
Round 2 and Round 4	0.876	0.645
Round 3 and Round 4	1.629	0.443

Lamb	Chi-Square	P-value
Round 1 and Round 2	0.161	0.923
Round 1 and Round 3	0.484	0.785
Round 1 and Round 4	2.826	0.243
Round 2 and Round 3	0.956	0.62
Round 2 and Round 4	4.166	0.125
Round 3 and Round 4	1.239	0.538

The two-way Chi-Square test and the choice frequency distribution provide us with a good reference for understanding the effect of information on respondents′ choices. We can observe the frequency change after more information was provided to the respondents. The information effect was stronger when respondents possessing no new information received new information; once they already received some information, providing additional information didn′t have a significant effect. The last round′s information was the most complete information presented in the survey. Consumers′ decisions were made after new knowledge was accumulated in the past rounds. Thus, we will focus on the first round and last round in our model. Although the information effect is tested only for prime rib under the Chi-Square test, this does not mean that new information for other meat types is irrelevant because in our survey, the consumer choices for different meat attributes and prices are not separated; respondents have to make a decision on choosing the meat production method and price at the same time. To investigate the information effect more precisely, we need to use an attribute-based method such as the Multinomial Probit Model. In the following section, such a model will be outlined.

VII. Model Setup

1. The Random Utility Model

A Multinomial Probit Model (MNP) can be applied in situations where individuals have to choose from more than 2 unordered choices. In our case, each individual has three unordered choices (traditional, organic and naturally grass-fed meat). Thus, we will use MNP in examining the information effect on the survey results.

In our survey, we will consider three types of meat: Prime Rib, Ground Beef, and Pork. We assume that an individual's choices are independent across the three meat types, and run three separate models. We include two types of independent variables: alternative-specific variables and case-specific variables. The major advantage of a Multinomial Probit Model is that by introducing correlations across error terms in the utility function, this model allows us to relax the property of independence of irrelevant alternatives (IIA) which is a characteristic of the Multinomial Logistic Model.

In our data, there are $i = 1 \cdots N$ individuals ("cases"). Each individual faces two choice situations, or "period", p=1, 2. The first period is pre-info, the second period is post-info. Let us index "information" variable I=0,1. . I=0 represents pre-info and I=1 represents post-info. In each period, an individual chooses from among three production process of meat: conventional, natural, and organic. We can index them with j=1, 2, 3. We will call the conventional type the base alternative. Each individual also faces the price of three types of meat, and the price varies across both cases and alternatives. Let us index the price as p_{ij} , and this variable is an alternative-specific variable. Another independent variable we have is the knowledge score, which will be represented as k_i . This variable is also a case specific variable. Then we have two variables of consumers' past purchasing experience: One is trust on environmental production; the other is preference on freshness. We can index them as t_i and f_i. We also want to include respondents' socio-economic variables, such as income, gender, education, etc. Let q be the number of

socio-economic variables and define a corresponding vector of coefficients is a 1 by q vector δ_{qj}. δ_{qj} = $\lfloor \delta_{1j} \quad \delta_{2j} \quad \dots \quad \delta_{qj} \rfloor$ The MNP model is often motivated using a random-utility consumer choice framework. Equation (1) represent the utility that consumer i received from the choice j. The consumer will finally choose the option that the utility is the highest. The frame work of Random Utility Modeling (RUM) is as followed:

$$U_{ij} = \beta_{0j} + \beta_1 p_{ij} + \alpha_{1j} k_i + \alpha_{2j} t_i + \alpha_{3j} f_i + \delta_{qj} S_i + \alpha_{5j} I_i + \varepsilon_{ij} \qquad \text{(j=1, 2, 3)} \quad \varepsilon_i \sim n(0, \Sigma) \tag{1}$$

We can then express the model baseline, i.e.

$$U_{i1} = \beta_{01} + \beta_1 p_{i1} + \alpha_{11} k_i + \alpha_{21} t_i + \alpha_{31} f_i + \delta_{q1} S_i + \alpha_{51} I_i + \varepsilon_{i1} \qquad \text{(j=1)} \tag{2}$$

Step1: Now, we can express the model in terms of utility differences from the baseline

$$U_{ij}^* = \beta_{0j} + (p_{ij} - p_{i1})\beta_1 + k_i(\alpha_{1j} - \alpha_{11}) + t_i(\alpha_{2j} - \alpha_{21}) + f_i(\alpha_{3j} - \alpha_{31}) + S_i(\delta_{qj} - \delta_{q1}) + I_i(\alpha_{5j} - \alpha_{51}) + \varepsilon_{ij}^* \tag{3}$$

(j=2, 3)

The system of J-1 random utility differences for person i can be written as

$$U_{i2}^* = \beta_{02} + p_{i2}^* \beta_1 + \gamma_1 k_i + \gamma_2 t_i + \gamma_3 f_i + \gamma_4 S_i + \gamma_5 I_i + \varepsilon_{i2}^* \tag{4}$$

$$U_{i3}^* = \beta_{03} + p_{i3}^* \beta_1 + \lambda_1 k_i + \lambda_2 t_i + \lambda_3 f_i + \lambda_4 S_i + \gamma_5 I_i + \varepsilon_{i3}^* \tag{5}$$

Step 2: Compute the variance matrix for the differenced errors.

Because J=3 (including the baseline), declare a (J-1) by (J-1) identity matrix and add the extra column of "-1" in the original baseline alternative. The Differencing Matrix becomes

$$D = \begin{bmatrix} -1 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix} \tag{6}$$

The differenced errors follow the distribution $\begin{bmatrix} \varepsilon_{i2}^* \\ \varepsilon_{i3}^* \end{bmatrix} = \varepsilon_i^* = D\varepsilon_i \sim n(0, \Sigma^*)$ $\Sigma^* = D\Sigma D'$

Step 3: For each respondent we can relate the observed choice index, y_i, to latent utility differences:

$$y_i = 1 \text{ if } \max\{U_{ij}^*\}_{j=2}^{J} < 0 \tag{7}$$

$$y_i = k \text{ if } \max\{0, \{U_{ij}^*\}_{j=2}^{J}\} = U_{ik}^* \quad (k=2,3) \tag{8}$$

If we observe that $y_i = 2$, which means respondent chooses Natural grass-fed product

$$\Pr(y_i = 2) =$$

$$\Pr\begin{pmatrix} U_{i2}^* > 0 \\ U_{i2}^* > U_{i3}^* \end{pmatrix} = \begin{bmatrix} \varepsilon_{i2}^* > -(\beta_{02} + p_{i2}^*\beta_1 + \gamma_1 k_i + \gamma_2 t_i + \gamma_3 f_i + \gamma_4 a_i + \gamma_5 I_i) \\ \varepsilon_{i2}^* - \varepsilon_{i3}^* > -(p_{i2}^* - p_{i3}^*)\beta - (\gamma_1 - \lambda_1)k_i - (\gamma_2 - \lambda_2)t_i - (r_3 - \lambda_3)f_i - (\gamma_4 - \lambda_4)a_i - (\gamma_5 - \lambda_5)I_5 \end{bmatrix} \tag{9}$$

$$= \Phi(0, D_2 \Sigma^* D_2'; R_2)$$

If we observe that $y_i = 3$, this means respondent chooses Organic product

$$\Pr(y_i = 3) =$$

$$\Pr\begin{pmatrix} U_{i3}^* > 0 \\ U_{i3}^* > U_{i2}^* \end{pmatrix}$$

$$= \begin{bmatrix} \varepsilon_{i3}^* > -(\beta_{03} + p_{i3}^*\beta_1 + \lambda_1 k_i + \lambda_2 t_i + \lambda_3 f_i + \lambda_4 a_i + \lambda_5 I_i) \\ \varepsilon_{i3}^* - \varepsilon_{i2}^* > -(p_{i3}^* - p_{i2}^*)\beta - (\lambda_1 - \gamma_1)k_i - (\lambda_2 - \gamma_2)t_i - (\lambda_3 - \gamma_3)f_i - (\lambda_4 - \gamma_4)a_i - (\lambda_5 - \gamma_5)I_5 \end{bmatrix} \tag{10}$$

$$= \Phi(0, D_3 \Sigma^* D_3'; R_3)$$

If we observe that $y_i = 3$, this means respondent chooses Natural grass-fed product

If we observed that $y_i = 1$, this means respondent chooses Conventional product

$$\Pr(y_i = 1) = \Pr\begin{pmatrix} U_{i2}^* < 0 \\ U_{i3}^* < 0 \end{pmatrix} = \begin{bmatrix} \varepsilon_{i2}^* < -(\beta_{02} + p_{i2}^*\beta_1 + \gamma_1 k_i + \gamma_2 t_i + \gamma_3 f_i + \gamma_4 S_i + \gamma_5 I_i) \\ \varepsilon_{i3}^* < -(\beta_{03} + p_{i3}^*\beta_1 + \lambda_1 k_i + \lambda_2 t_i + \lambda_3 f_i + \lambda_4 S_i + \lambda_5 I_i) \end{bmatrix} \tag{11}$$

$$= \Phi(0, \Sigma^*; R_1)$$

Step 4: the likelihood contribution for ith individual

$$l_i(\beta, \gamma, \Sigma^*) = p(y_i \mid p_{ij}, \beta, k_i, I_i, S_i, f_i) = \sum_{j=1}^{J} (\Phi(0, D_j \Sigma^* D_j'; R_j) I(y_i = j)) \tag{12}$$

The sample likelihood is as follows:

$$L = pr(y \mid p, \beta, k, I, S, f, \Sigma, \gamma) = \sum_{j=1}^{J} (\Phi(0, D_j \Sigma^* D_j^{'}; R_j) I(y_i = j)) \tag{13}$$

2. Empirical Models for Each Meat Type

Because prime-rib, tri-tip steaks, ground beef and pork chops are the most common meat in the market, we only examine the MNP model on these meat types. The Alternative-specific Multinomial Probit Model not only allows us for correlated errors, but also allows us to include two types of independent variables: alternative-specific variables and case-specific variables. In our survey, price is the alternative-specific variables because it changes across different respondents and the attribute of meat. However, there are some variables, such as socio-economic variables, that only change through different respondents. The dependent variable is the respondents' choices on the meat survey, and the independent variables are listed in the following Table 16**.** The independent variables include the socio-economic characteristics of respondents, the knowledge score, the meat preferences score from the factor analysis, and a dummy variable which represents whether respondents receive new information. The experiment is a special unordered choice experiment because respondents have to make a decision by considering both prices and the meat attribute at the same time. In the first step, we want to use a MNP model to examine the different factors bearing influence on people's choices on meat selection. Especially, the empirical models will examine if the updated information has any effect on respondents choices. Further, in the following step, we will examine if the same factors in the first step have the same impact on people who have different knowledge on tradition, organic and natural grass-fed meat.

2.1 MNP Models on Different Meat Types and Results

From the early analysis, Random Utility Modeling is as followed:

$$U_{ij} = \beta_{0j} + \beta_1 p_{ij} + \alpha_{1j} k_i + \alpha_{2j} t_i + \alpha_{3j} f_i + \delta_{qj} S_i + \alpha_{5j} I_i + \varepsilon_{ij} \quad \text{(j=1, 2, 3)} \quad \varepsilon_i \sim n(0, \Sigma) \tag{14}$$

For prime rib and ground beef, the socio-economic variables S_i in the models include: White, Smallfam, Highedu, Precollege, Male, Marry, Child, Attribute, Trust, Expprime or Exptri, Information, Knscore, Midincome, Lowincome, Unemp and Mid. For the tri-tip steak, the model does not include the family size since this variable is not significant. However, because pork chops is more common among Hispanic respondents, the model for the pork chops include the dummy variable of Hispanic instead. Table 17-19 presents the results of MNP models on three types of beef. Except the pork chops, price has a negative effect on respondents' choices for all the other meat types. The social economic attributes influence respondents' decisions differently according to the meat types.

Table 16: Description of the Explanatory Variables

Independent Variables	Description
primerib	price of the prime rib
tritipprice	price of the tri-tip steak
ground	price of the ground beef
chop	price of the pork chops
White	Dummy variable which values 1 if the respondent is Caucasian
Hispanic	Dummy variable which values 1 if the respondent is Hispanic
Smallfam	Dummy variable which values 1 if the respondents' household members are 1 or 2 (including the respondents)
Bigfam	Dummy variable which values 1 if the respondents' household members are 5 or more (including the respondents)
Highedu	Dummy variable which values 1 if the respondents completed a 4 year degree, graduate degree or higher
Precollege	Dummy variable which values 1 if the respondents only completed Middle School or High School
Male	Dummy variable which values 1 if the respondents is a male
Marry	Dummy variable which values 1 if the respondents is married
Child	Dummy variable which values 1 if there are any children under 18 in the respondents' household
Attribute	A count variable from the factor analysis which represents respondents' preferences for Fresh, tender, leanness, taste
Trust	A count variable from the factor analysis which represents respondents' trust toward environment production
Expprime	A dummy variable which values 1 if respondents purchased prime-rib more than 5lbs in the last 30 days
Exptri	A dummy variable which values 1 if respondents purchased tri-tip steak more than 5lbs in the last 30 days
Expground	A dummy variable which values 1 if respondents purchased ground beef more than 5lbs in the last 30 days
Expchop	A dummy variable which values 1 if respondents purchased pork chops more than 5lbs in the last 30 days
Information	A dummy variable which values 1 if respondents received the new information before that round of survey
Knscore	A count variable from the 10 test questions on the survey to represents the respondents' current knowledge
Midincome	A dummy variable which values 1 if respondents' household annual income is from $30,001 to $75,000
Lowincome	A dummy variable which values 1 if respondents' household annual income is less than $30,000
Unemp	A dummy variable which values 1 if respondents is unemployed currently (does not include the retired or students)
emp	A dummy variable which values 1 if respondents is employed currently

Mid	A dummy variable which values 1 if respondents is in the median age which is between 36-55 years old.

For prime rib, new information provided in the survey makes the respondents more willing to choose natural grass-fed meat over traditional meat. However, new information does not have a significant effect on people's decision for the organic product. Male respondents are less likely to choose the natural or organic product. And consumers' preferences have a significant influence on the choice decision. The more the respondents have trust about the environmental product certification the more chances that respondents may choose the natural grass-fed and organic prime rib. However, the more respondent cares about the taste, leanness, tender and fresh attributes of meat the less likely they are to consume the natural and organic prime rib.

Table 17: Result of Alternative-specific Multinomial Probit Model on the Prime Rib

prime rib	**Coef**	**Std.Err**
prime rib price	-0.0886***	0.0237
natural		
white	0.1028	0.1877
smallfam	0.3054	0.2158
highedu	0.4112*	0.206
precollege	0.0192	0.1698
male	-0.3107*	0.1535
marry	0.4996**	0.1509
child	-0.1528	0.1916
attribute	-0.2962**	0.0991
trust	0.4012***	0.0984
exptri	0.4876*	0.2127
information	0.2798*	0.1399
knscore	0.1453	0.0438
midincome	0.4017*	0.1686
lowincome	0.2436	0.202
unemp	0.4149	0.3447
constant	-0.8926	0.5037
organic		
white	0.3565	0.1895
smallfam	0.6378**	0.2462
highedu	0.2444	0.1836
precollege	-0.2616	0.1726

male	-0.3714*	0.1685
marry	0.1985	0.1456
child	0.1159	0.1747
attribute	-0.2902*	-0.114
trust	0.5064**	0.1603
exptri	-0.3486	0.2629
information	0.2782	0.1434
knscore	-0.0523	0.0406
midincome	0.1672	0.1488
lowincome	-0.1009	0.1861
unemp	0.5452	0.3329
constant	-0.5447	0.4782

The education level, past purchasing experiences, married status and income level have a positive effect on consumers' choices on natural grass-fed prime rib. However, surprisingly, the knowledge score does not have a significant effect on the people's choices on traditional, organic and natural grass-fed prime rib.

Table18: Result of Alternative-specific Multinomial Probit Model on the Ground Beef

ground beef	**Coef**	**Std.Err**
ground beef price	-0.2135**	0.0641
natural		
white	-0.4384*	0.1876
smallfam	0.0451	0.2308
highedu	-0.0558	0.2311
precollege	0.3663*	0.1756
male	-0.2601	0.1661
marry	0.3508*	0.1639
child	-0.4238*	0.2014
attribute	-0.2107*	0.1022
trust	0.4243***	0.1092
expground	0.4966**	0.1669
information	0.0731	0.1505
knscore	0.0148	0.0449
midincome	0.0928	0.1782
lowincome	0.1217	0.2073
unemp	0.089	0.3469
constant	-0.6818	0.5322

organic		
white	-0.1515	0.4068
smallfam	0.5598	0.4068
highedu	0.3944	0.3597
precollege	-0.1823	0.321
male	-0.628	0.3464
marry	-0.06623	0.2569
child	-0.1508	0.285
attribute	-0.2685	0.1669
trust	0.6716*	0.2981
expground	0.0378	0.2719
information	0.331	0.2535
knscore	-0.0425	0.0674
midincome	0.008	0.2509
lowincome	-0.0507	0.2509
unemp	0.286	0.4769
constant	-1.4536	1.2064

From the results of the model, smaller families are more willing to choose organic prime rib. This can be explained as the budget constrain for the bigger family. Because prime rib is an expensive meat type, and normally the living cost for a bigger family is higher, it is more affordable for a smaller family to buy the organic prime rib.

Table 18 presents the result of MNP model on ground beef. Information does not have any effect on both organic and natural produced ground beef. Although ground beef is a relatively inexpensive beef type, price still has a significant effect on respondents' choice decision. If the respondent has a middle school or high school degree, he is less likely to buy organic or natural produced ground beef. Respondents' meat preferences affect the final choice the same direction as on prime rib. The result is consistent with the result on prime rib, the more respondents trust on the environmental product and the certifications, the more likely respondents may choose natural and organic ground beef. The experiences of purchasing ground beef also have a positive influence on respondents' choices on different attribute of ground beef. Respondents who purchase more ground beef in the past week would prefer to choose

natural grass-fed ground beef than the traditional ground beef. Income, the original knowledge about the organic and natural meat, and employment status do not have any effect on respondents' choices.

For tri-tip steak, male is a negative factor on respondents' choice decision. If the family has a child that is under 18 years old, they also would prefer to purchase traditional tri-tip steak. This is opposite from the conclusion from Gil & Soler (2006). They suggested that participants with children under 16 living in the household are more worried about nutrition and they have more knowledge about organic food. However, in our study, we asked about tri-tip steak, this is normally not the main food for a child under 18 years old. Thus, the family may want to spend more money on the organic and natural product that their children consumer more, than the tri-tip steak. Participants who have a household income between $30,001 to $75,000 are more likely to buy organic and natural produced steak. This is different from the normal assumption that the more money people earned the more they would like to spend on health or environmental good.

Table 19: Result of Alternative-Specific Multinomial Probit Model on the Tri-tip Steak

Tri-tip Steak	**Coef**	**Std.Err**
Tri-tip price	-0.1512***	0.0423
natural		
white	-0.1674	0.1865
bigfam	-0.3174	0.1732
highedu	0.0182	0.2210
precollege	0.1570	0.1780
male	-0.3315*	0.1507
marry	0.1833	0.1595
child	-0.3231	0.1666
attribute	-0.3195**	0.0978
trust	0.4721***	0.0947
exptri	-0.0891	0.2105
information	0.0795	0.1444
knscore	0.0350	0.0445
midincome	0.3925*	0.1763
lowincome	0.2225	0.2033
mid	-0.0543	0.1675
unemp	-0.4076	0.3213

constant	-0.0867	0.5146
organic		
white	0.1193	0.2224
bigfam	-0.0735	0.2129
highedu	0.3357	0.2636
precollege	-0.2114	0.2412
male	-0.5446*	0.2164
marry	0.0906	0.1888
child	-0.4033	0.2111
attribute	-0.4570**	0.1499
trust	0.7269***	0.1891
exptri	-0.8135*	0.3516
information	0.2848	0.1859
knscore	-0.0304	0.0538
midincome	0.4498*	0.2294
lowincome	0.1309	0.2480
mid	0.3405	0.2174
unemp	-0.0176	0.3770
constant	-0.4060	0.6517

Table 20: Result of Alternative-Specific Multinomial Probit Model on the Pork Chops

Pork Chops	**Coef**	**Std.Err**
Pork Chops Price	-0.0004	0.0011
natural		
hispanic	0.6197***	0.1703
bigfam	-0.4093*	0.1724
highedu	-0.3096	0.2118
precollege	0.4368**	0.1682
male	0.1307	0.1447
marry	0.1084	0.1557
child	-0.3394*	0.1677
attribute	-0.2058*	0.0987
trust	0.3175***	0.0767
expchop	0.4842**	0.1863
information	0.2045	0.1389
knscore	0.0347	0.0414
midincome	0.1493	0.1791
lowincome	0.357	0.2039
mid	-0.1181	0.1532
unemp	0.1048	0.3109

constant	-0.1571**	0.4935
organic		
hispanic	-0.0000376	0.0005
bigfam	0.0002295	0.0008
highedu	0.0002	0.0007
precollege	-0.0007	0.0022
male	-0.0009	0.0027
marry	0.0003	0.0008
child	-0.0008	0.0024
attribute	-0.0006	0.0017
trust	0.0012	0.0035
expchop	-0.0013	0.0038
information	0.0004	0.0011
knscore	-0.0001	0.0004
midincome	0.0001	0.0006
lowincome	0.0001	0.0006
mid	0.0007	0.0021
unemp	-0.0003	0.0012
constant	-0.0007	0.0022

The last meat type is pork chops, which is not as common as the first three types. Besides, compare to Caucasian family, it is more common in Hispanic family to consume pork chops. Price effect is not significant in pork chops. None of the socio-economic variables are significant for the choice of organic pork chops. However, the Hispanic dummy variable has a positive effect on the consumer's choice on natural produced pork chops. The middle school and high school respondents would more willing to purchase natural produced pork chops. Additionally, the participations' trust on environmental product is also significant when participants decide whether to choose natural produced pork chops or traditional one. Experiences in the past purchasing behavior also have a significant effect on participants' decision. The more pork chops respondents bought, the more likely, they will buy the natural product.

2.2 Further research on information effects on different participants with different original knowledge

In the following research, we will examine how the new information influences consumers differently according to their different original knowledge. Based on the knowledge score about different producing

method of meat, we use two subsamples: one is the participants who received a high knowledge score (from 7 to 9); another sample is the participants who received a low score (from 0 to 4). Because in the first step models, information has significant effect on the prime rib model, we will examine the subsamples updated information effects on the meat choices for prime rib. The experiment results are displayed in the Table 21 and Table 22.

For those participants who have a high knowledge about the organically and natural produced meat, price, their experience in the past, and the trust on environmental meat products are important factors when they make a choice on traditional, organic, and natural grass-fed meat. Both high education level of and low education level have positive effect on the choices of natural produced prime rib. This is opposite from the past research that education level represents the knowledge about the organic and natural produced product, and finally influence consumers' WTP. However, because the sample we use here is the participants that have a high knowledge score, the result can be explain from other way. The education level represents a person's knowledge in general. However, the degree of their education cannot totally represent the participants' knowledge about organic or natural produced product. For the participants who already have great amount knowledge of organic and natural produced product, education level cannot influence consumers' choices differently. The factor of new information is not significant in the model, which declares that for the participants who already had decent amount knowledge about the organic and natural product, the new information in the survey cannot change their choice decision.

Table 21: Alternative-specific Multinomial Probit Model on the Choices of Traditional, Natural, and Organic Prime Rib for High Knowledge Score Participants

	Coef	Std.Err
Prime Rib Price	-0.1516***	0.0419
natural		
white	0.3548	0.3074
highedu	0.8271**	0.3186
precollege	0.7025*	0.3202
male	-0.411	0.2505

marry	0.3418	0.2489
attribute	-0.2872	0.1778
trust	0.5338**	0.1798
expprime	1.1744**	0.4375
information	0.3823	0.2292
midincome	0.3051	0.2345
mid	-0.7199*	0.2954
constant	-1.0019	0.7257
organic		
white	1.0914	0.5815
highedu	0.8908	0.5184
precollege	-0.4991	0.6521
male	-0.5354	0.4057
marry	0.014	0.383
attribute	-0.4369	0.3073
trust	1.0339*	0.4841
expprime	-0.3875	0.9782
information	0.348	0.359
midincome	0.0784	0.3441
mid	0.2159	0.484
constant	-2.4827	1.7567

Table 22 presents the same model of the subsample of participants who have little knowledge of organic and natural grass-fed meat. Price is not a significant factor to influence respondents' choice decision anymore. And high education is not a significant variable either. Low education level has a negative effect on the choices between natural produced and organic prime rib. This result is different from the subsample of the participants who have great amount of knowledge.

Table 22: Alternative-specific Multinomial Probit Models on the Choices of Traditional, Natural, and Organic Prime Rib for Low Knowledge Score Participants

	Coef	Std.Err
Prime Rib Price	-0.0249	0.0531
natural		
white	-0.2412	0.4061
highedu	0.477	0.4167
precollege	-0.887**	0.286
male	-0.4098	0.3073

attribute	-0.2632	0.1585
trust	0.5614***	0.1342
expprime	0.0842	0.3278
information	0.3939	0.2436
midincome	0.1216	0.2716
mid	0.788**	0.2874
constant	-0.4687	0.7048
organic		
white	-0.0731	0.4866
highedu	0.3853	0.4328
precollege	-0.8895**	0.345
male	-0.5995	0.5059
attribute	-0.3251	0.2187
trust	0.6375*	0.2513
expprime	-0.1847	0.5377
information	0.4363	0.2932
midincome	0.1311	0.2999
mid	0.6986*	0.3072
constant	-0.482	0.8057

For participants who do not have much knowledge of organic and natural produced meat, education level is an important factor for their choice decision on prime rib. The lower education level means the less knowledge they may have about organic and natural produced meat, thus, make the participants less likely to choose organic and natural produced prime rib. Respondents' trust on environmental product and certification still has a positive effect on choices of organic and natural produced prime rib. This result is consistent with both the total sample and subsample model. Middle age (from 36 to 55) respondents have a positive effect on choosing organic and natural produced product. This result is totally opposite with the model that only includes high knowledge score participants. Middle age has a negative effect on the choice to natural produced product when the participants have significant amount knowledge of organic and natural produced meat.

I. Conclusion

In this paper, we present results from an unordered choice experiment used to attain the effect of new updated information on respondents' choice making among traditional, natural and organic meat products. A consumer survey was used, and the updated information on the description of natural and organic meat products is supplemented before the WTP choices. Results from this survey allow us analysis the relationship between participants' choice decision and their original knowledge, new updated information, meat preferences, purchasing experience and socio-economic characteristics. To achieve this goal, an Alternative-specific Multinomial Probit Model is applied.

There are several conclusions from our results. First, the unordered choice experiment is a very useful method to estimate the choice decision of consumers. In the earlier research, auction was a common methods used to estimate the WTP decision for a participant. However, our study allows respondents consider both meat price and attribute simultaneously. This is more likely happen in the reality. During our experiment, we use two steps to examine the effects of different factors on the choice making. The first is "Does the updated information have an important effect on the choice decision?" The answer depends on the meat type. For prime rib, we find that updated information has a significantly positive effect on the choice of natural grass-fed product. However, for other meat types, this effect is not significant. The next step is to examine if the updated information has the same effect on the choice decision for respondents who have different amount of knowledge on organic and natural produced food. To achieve this, we used the subsample of respondents, who had low knowledge score and high knowledge score, and the meat type we use here is prime rib. It is interesting to observe that the updated information does not have a significant effect on the choice decision of participants who have little or a large amount of knowledge. In our case, both participants who have little knowledge and a great amount of knowledge are hard to be influenced by new information when they try to make a choice decision. This is not a surprising result because first, organic and natural grass-fed meats still are a relatively new product and providing information in a short time may not change their impression for the products.

Second, the participants who already have much knowledge about organic and natural grass-fed meat may insist on their original decision more, because new updated information will not change the knowledge they already have.

In spite of the effect of new information, the socio-economic variables also have different effects across different meat types. High education level has a significant positive effect on the choice of natural produced prime rib; however, this variable is not significant in other meat type models. Middle level income also has a positive effect on the choice of natural produced prime rib and tri-tip steak, but we cannot examine the same effect on other meat types. This result is not surprising, because the prime rib and tri-tip steak is relatively pricy compare to other meat types, thus the household who have a better income may afford the meat more. Purchasing experience has a strong positive effect on almost every types of meat. And participants' preferences for freshness, tenderness, marbling, leanness and taste had a negative effect on the choice of natural and organic produced meat. How much the participants trust about the organic and natural products' certification and their preferences on the environmental product also have a significant influence on their final choices.

References

Ajzen, Icek and B. L. Driver. (1992). "Contingent Value Measurement: On the Nature and Meaning of Willingness to Pay." *Journal of Consumer Psychology* **1**(**No. 4 (1992)**): 297-316.

Ajzen, Icek, Thomas Brown and Lori H. Rosenthal. (1996). "Information Bias in Contingent Valuation: Effects of Personal Relevance, Quality of Information, and Motivational Orientation." *Journal of Environmental Economics and Management* **30**(**1**): 43-57.

Alberini, Anna, Paolo Rosato, Alberto Longo and Valentina Zanatta. (2005). "Information and Willingness to Pay in a Contingent Valuation Study: The Value of S. Erasmo in the Lagoon of Venice." *Journal of Environmental Planning and Management* **48**(**2**): 155-175.

Bateman, Ian J and James Mawby. (2004). "First Impressions Count: Interviewer Appearance and Information Effects in Stated Preference Studies." *Ecological Economics* **49(2004)**: 47-55.

Bateman, Ian J., Brett H. Day, Diane P. Dupont and Stavros Georigiou. (2009). "Procedural Invariance Testing of the One-and-One-Half-Bound Dichotomous Choice Elicitation Method." *The Review of Economics and Statistics* **91**(**4**): 806-820.

Bergstrom, John C., B. L. Dillman and John R. Stoll. (1985). "Public Environmental Amenity Benefits of Private Land: The Case of Prime Agricultural Land." *Southern Journal of Agricultural Economics* **17**(**1985**): 139-150.

Bergstrom, John C., John R. Stoll and Alan Randall. (1990). "The Impact of Information on Environmental Commodity Valuation Decisions." *The American Journal of Agricultural Economics* **72**: 614-621.

Berrens, Robert P. (2000). "Reluctant Respondents and Contingent Valuation Surveys." *Applied Economics Letters* **7**(**No. 4**): 263-266.

Berrens, Robert P., Alok K. Bohara, Hank Jenkins-Smith, Carol S. Silva and David W. Weimer. (2004). "Information and Effort in Contingent Valuation Surveys: Application to Global Climate Change Using National Internet Samples." *Journal of Environmental Economics and Management* **47**(**2**): 331-363.

Blomquist, Glenn C. and John C. Whitehead. (1998). "Resource Quality Information and Validity of Willingness to Pay in Contingent Valuation." *Resource and Energy Economics* **20**(**1998**): 179-196.

Boyle, Kevin J. (1989). "Commodity Specification and the Framing of Contingent-Valuation Questions." *Land Economics* **65**(**1**): 57-63.

Cameron, Trudy Ann and Jeffrey Englin. (1997). "Respondent Experience and Contingent Valuation of Environmental Goods." *Journal of Environmental Economics and Management* **33**(**3**): 296-313.

Cameron, Trudy Ann, and Jeffrey Englin. (1997). "Respondent Experience and Contingent Valuation of Environmental Goods." *Journal of Environmental Economics and Management* **33**(**3**): 296-313.

Gibbons, Robert D. and Donald Hedeker. (1997). "Random Effects Probit and Logistic Regression Models for Three-Level Data." *Biometrics* **53**(**No.4**): 1527-1537.

Gil, J. M., A. Gracia and M.Sanchez. (2000). "Market Segmentation and Willingness to Pay for Organic Products in Spain." *International Food and Agribusiness Management Review* **3**(**2000**): 207-226.

Gil, J. M. and F. Soler. (2006). "Knowledge and Willingness to Pay for Organic Food in Spain: Evidence from Experimental Auctions." *Food Economics* **3**: 109-124.

Grannis, Jennifer, Neal Hooker and Dawn Thilmany. 2000. "Consumer Preference for Specific Attributes in Natural Beef Products." in *Western Agricultural Economics Association Annual Meetings*. Vancouver, British Columbia.

Jorgensen, Bradley S., Geoffrey J. Syme and Blair E. Nancarrow. (2006). "The Role of Uncertainty in the Relationship Between Fairness Evaluations and Willingness to Pay." *Ecological Economics* **56**(**2006**): 104-124.

Lusk, Jayson L. (2003). "Effects of Cheap Talk on Consumer Willingness-to-Pay for Golden Rice." *American Journal of Agricultural Economics* **85**(**4**): 840-856.

Lusk, Jayson L., Lisa O. House, Carlotta Valli, Sara R. Jaeger, Melissa Moore, J. L. Morrow and W. Bruce Traill. (2004). "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**(**2**): 179-204.

Misra, Sukant K., Chung L.Huang and Stephen L. Ott. (1991). "Consumer Willingness to Pay for Pesticide-Free Fresh Produce." *Western Journal of Agricultural Economics* **16**(**2**): 218-227.

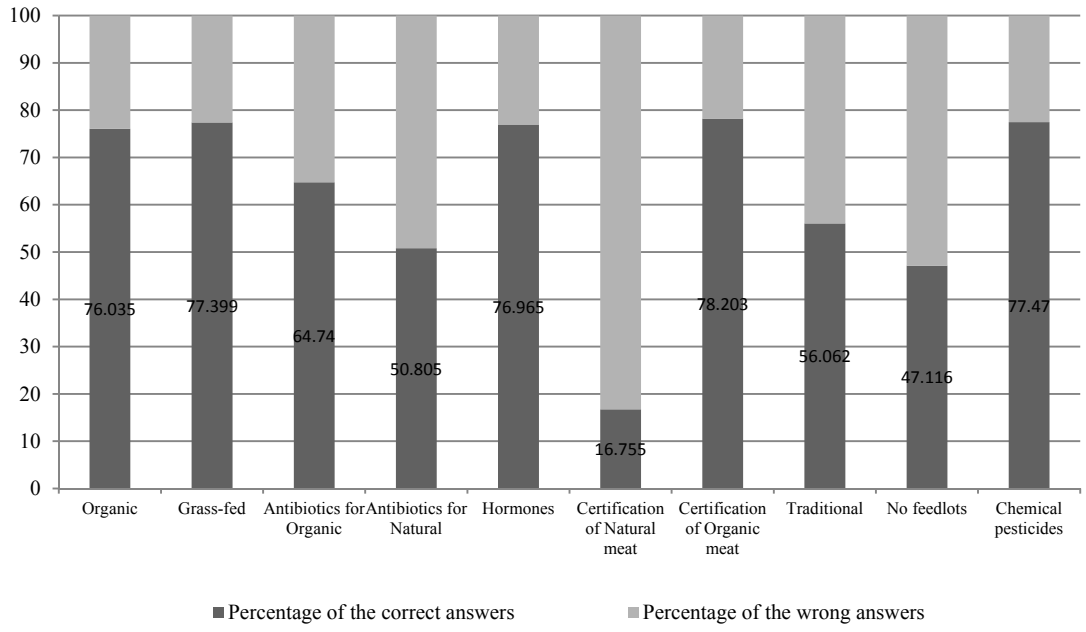
Umberger, Wendy J., Dawn D. Thilmany McFadden, Amanda R. Smith. (2009). "Does altruism play a role in determining U.S. consumer preferences and willingness to pay for natural and regionally produced beef?" *Agribusiness* **25**(**2**): 268-285.

Wallace E. Huffman, Jason F. Shogren, Matthew Rousu, and Abebayehu Tegene. (2003). "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**(**3**): 481-502.

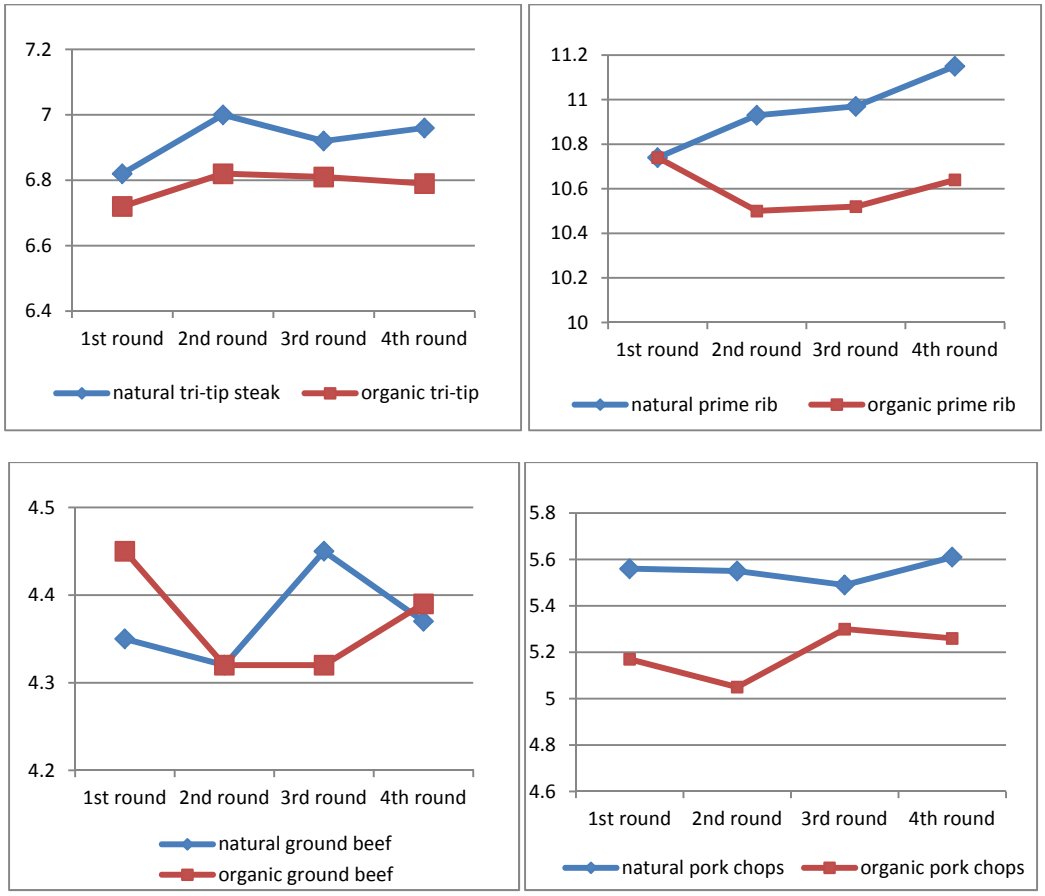
Appendix 1: Overview of Questions Assessing Consumers' Knowledge of Organic and Natural Grass-fed Meat

Quiz	Verbatim	Short name
1	In order for a meat product to be labeled organic, the animal it was produced from must have been given organic feed	Feeding for organic meat (organic feed)
2	In order for a meat product to be labeled Natural grass-fed, the animal it was produced from must have been fed at least an 80% ration of grasses and forbs	Feeding for Natural meat (Natural grass-fed)
3	In order for livestock to be considered organic, they must not be given antibiotics	Antibiotics for Organic meat
4	In order for livestock to be considered natural, they may be given antibiotics	Antibiotics for Natural meat
5	In order for livestock to be considered Organic or Natural they may not be given growth hormones	Hormones
6	Natural meat products must be certified by the USDA or a third-party certifier	Certification of Natural meat
7	Organic meat products must be certified by the USDA or a third-party certifier	Certification of Organic meat
8	Livestock raised through traditional methods are not fed grass or forage diets	Feeding for traditional meat (traditional)
9	Natural grass-fed livestock may be not sent to feedlots prior to slaughter	Feeding for Natural meat (no feedlots)
10	Organic and Natural livestock may not be exposed to chemical pesticides	Chemical pesticides

Appendix 2: The Percentageof the correct and incorrect answers on the valid answers of meat-related qustions



Appendix 3: Mean Chosen Bid for Each Type of Meat and Production Method



Appendix 4: The Mean Chosen Bid for Naturally Produced and Organic meat

Round		Mean	St. Dev	Median
1st round : No information provided (N=330)	natural	6.502	1.813	6.418
(N=199)	organic	6.539	2.06	6.192
2nd round: information about the feeding (N=321)	natural	6.691	1.981	6.697
(N=192)	organic	6.332	1.978	5.99
3rd round: information about the use of antibiotics and hormones (N=297)	natural	6.666	1.776	6.733
(N=174)	organic	6.459	1.732	6.345
4th round: 1. information about the overall differences among conventional, natural grass-fed and organic meat products (N=290)	natural	6.777	2.02	6.846
(N=184)	organic	6.482	1.633	6.345