Discrete Choice Modeling of Consumer Preferences for Sustainably Produced Steak and Apples

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Abstract "Sustainably produced" food labels have rapidly grown in popularity over the past decade (Batte 2011). Moreover, because there is no government agency overseeing certification of these production methods, consumers are generally confused about the production attributes that may or may not be present in a sustainable food system. This paper analyzes data from a hypothetical choice experiment to better understand consumer purchasing behavior when faced with competing food production attributes such as "organic" and "local". We seek to estimate preferences for "sustainably produced" food products and determine how they may be affected by varying degrees of information about sustainable agricultural systems. Additionally, the willingness to pay measurements estimated in this paper provide insight into the trade-offs perceived between current eco-labeling schemes, and the potential for differentiating "sustainably produced" products from their "organic" and "local" counterparts.

Keywords: Sustainably Produced Food, Choice Experiment, Consumer Preferences

JEL classification: Q01; Q13; Q11

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1 Introduction

Sustainability, as a concept, remains elusive to many. The word ”sustainable” has been attributed to everything from the foods we eat, to the structures we build, to the way we raise our families and run our businesses. While there is certainly a breadth of literature on sustainability, exploring how it is measured and managed, there are surprisingly few studies examining sustainability attributes in the context of food production. Two studies, to our knowledge, address consumer attitudes and preferences towards sustainability attributes of food. First, Saunders et al (2010) use a discrete choice model to investigate consumer decisions to purchase sustainably labeled foods, by displaying information about reduced carbon emissions. Alternatively, Clonan et al (2010) assess attitudes towards sustainably produced food products through a questionnaire about previous purchases and a Likert scale ranking of preferences. Both studies were used to inform the choice of sustainable farming attributes addressed in our survey. This work addresses a gap in the literature by evaluating preferences for sustainably labeled food products within the context of a choice experiment with varying degrees of information on sustainable agricultural systems.

Alternative agricultural production systems generate value-added food attributes that are used for product differentiation and provide consumers with a means by which to control their ecological footprint through their consumption choices. ”Sustainably produced” food labels have rapidly grown in popularity over the past decade (Batte 2011). However, because there is no government agency overseeing certification of these production methods, consumers are generally confused about the production attributes that may or may not be present in a sustainable food system. This paper analyzes data from a hypothetical choice experiment to better understand consumer purchasing behavior when faced with competing food production attributes such as ”organic” and ”local”.

Choice experiments have a long history in the measurement of passive use values in environmental economics. Specifically, passive use value refers to the economic value derived from a change in environmental quality that may not be directly observable in market behavior. That is, changes in food production attributes create an additional dimension of consumer utility, which may be traded for other quality indicators, such as price and certification. In real markets, consumers are faced with consumption choices over bundles of attributes that can be modeled in a stated preference framework.

Marketing, transportation, and psychology literature led the field for some time in the adaptation of choice experiments. The method arose from conjoint analysis, but differs in the choice task to be completed. Unlike conjoint analysis, which utilizes scaled ranking or rating systems, choice experiments more closely mirror the attribute bundles of competing alternatives that are found in real markets. Choice experiments are compatible with random utility theory and are thus useful for determining the share of preference a given attribute has in a particular market. Therefore, hypothetical choice experiments provide a richer description of the attribute trade-offs that consumers are willing to make, than more traditionally used contingent valuation methods.

In the past, choice experiments have been used successfully by economists to measure the effect of environmental improvements and the value of quality differentiation (Boxall and Adomowitz (1998)). Other economists have also employed choice experiments to value food attributes such as local, organic and natural as well as more intrinsic values in the realm of food nutrition and safety such as traceability, animal welfare and genetic modification. These studies generally show that, on average, consumers are willing to pay positive price premiums for food produced outside of the conventional agricultural model. For example, Lusk, Norwood and Pruitt (2006) find positive price premiums associated with a ban on sub-therapeutic antibiotics in the pork production industry and Liljenstolpe(2010) finds that consumers indicate preference for food safety and animal welfare dimensions of value-added pork attributes. Additionally, Onazaka et al (2008) find supporting evidence of higher price premiums on organically certified and locally grown produce. Most closely related to this work, Clonan et al (2010) find that stated purchasing behavior demonstrates that free range and local products have higher market preference over other sustainability attributes.

We seek to estimate preferences for "sustainably produced" food products in a discrete choice modeling framework and to determine how preferences may be affected by varying degrees of information about sustainable agricultural systems. If there is a prevalence of confusion about the attributes implied by sustainable labeling schemes, it is important to know if providing information about specific sustainable production attributes can lessen this uncertainty. Moreover, if information is successful in decreasing uncertainty over choice, it could be used towards better market differentiation between sustainable and organic principles. Additionally, the willingness to pay measures estimated in this paper provide insight into the trade-offs perceived between current eco-labeling schemes, and the potential for differentiating "sustainably produced" products from their "organic" and "local" counterparts.

2 Data Collection

The data used for this analysis were gathered in a 2010 national web-based survey of 1000 households. Two survey versions were developed; one for apples and one for steak. All respondents in the sample were randomly assigned to complete only one product version of the survey. The choice experiment portion of the survey was preceded by questions about perceived importance of varying sustainable farming attributes using a best-worst framework (this data is not analyzed in this paper), as well as several Likert scale ranking tasks assessing previous knowledge of agricultural production system characteristics and food consumption history. This combination of respondent information provides our analysis with a comprehensive assessment of the perceptions and preferences related to sustainability attributes and can be used to further examine consumer heterogeneity in the extension of this work. Immediately prior to the hypothetical choice experiment each respondent was provided with information about sustainable agriculture.

Half of the respondents were randomly assigned to receive general information about sustainable agriculture from the USDA website. This information treatment outlined general principles of sustainability such as, "resource conserving", "socially supportive", and "economically viable". Alternatively, the remaining half of respondents received information about sustainable agricultural practices that are components of a sustainable certification scheme from a third party certifier, Food Alliance. This information treatment provided eight detailed standards of sustainable agriculture such as energy conservation and waste recycling, reduced use of chemical inputs, and fair and ethical treatment of workers and livestock. Please see the Appendix for full information treatments.

Following the information treatment, a brief cheap talk script was included to mitigate the problems associated with hypothetical bias. The effectiveness of cheap talk scripts has been repeatedly confirmed in the literature. Notably, Aadland and Caplan (2006) suggest neutral scripts that avoid assumptions about positive bias, as different subsamples may react differently dependent on factors such as market familiarity. However, Tonsor and Shupp (2011) utilize a large national survey and split-sample experimental design, finding that cheap talk scripts may not only influence the level of willingness to pay estimated for representative consumers, but also, in general, produce more reliable estimates.

2.1 Discrete Choice Experiments

In a discrete choice modeling framework, all alternatives must satisfy the following criteria: 1) alternatives are exhaustive, 2) alternatives are mutually exclusive, and 3) the number of alternatives is finite. All respondents are assumed to be utility maximizers, facing a choice among competing alternatives that return different levels of utility. The analyst cannot directly observe respondent utility, but can observe attributes about the competing alternatives. Specifically, define a random utility function (U_{ij}) as the ith consumer's utility of choosing option j. Then,

$$U_{ij} = V_{ij} + \epsilon_{ij} \tag{1}$$

where V_{ij} is the deterministic component and ϵ_{ij} is the stochastic error (Adomowicz et al (1998)). Thus the probability that consumer i chooses alternative j is given by,

$$Prob(V_{ij} + \epsilon_{ij} \geq V_{ik} + \epsilon_{ik}; \forall k \in C_i) \tag{2}$$

where C is the choice set of alternative bundles faced by consumer i. This choice experiment was constructed from alternative bundles of three attributes (label, certification, and price) with varying levels.

The label attribute took four levels; sustainable, organic, local, or typical. Each label was defined to describe the type of agricultural system within which the food was produced. The certification attribute took one of three levels; USDA, Private Third Party or Self. The "typical" product was reported to have no certification. All certifications referred to verification of all processes used in production and claims made by an accompanying labeling scheme. Private third party certification was verified by an independent entity unrelated to the farm of origin or retailer of the product. "Self" certification referred to labeling claims made by the farmer producing the food. The price attribute took one of three discrete levels: (0.99/lb, 1.49/lb, or 1.99/lb) for apples and (5.99/lb, 8.99/lb, or 11.99/lb) for ribeye steak, as determined by the market at the time of the survey design. For full descriptions and definitions please refer to the Appendix.

Table 1: Attributes and Levels Used in the Choice Experiment

Attribute	**Levels**
Label	Sustainable Organic Local Typical
Certification	USDA Private Third Party Self
Product Specific Prices	
Price (Apple)	0.99/lb 1.49/lb 1.99/lb
Price (Steak)	5.99/lb 8.99/lb 11.99/lb

An alternative specific design was utilized to capture labeling scheme tradeoffs. In a more commonly used general design, the respondent is faced with a choice of the status quo against one or more competing alternatives in which all attributes are allowed to vary across all levels. Whereas, in an alternative specific design, each choice scenario presents each of the level alternatives of a given attribute (Label) while allowing the remaining attributes to vary across all levels. The respondents of our survey were faced with a number of choice scenarios, and asked to choose between the product labeled sustainable, the product labeled organic, the product labeled local, and the typical product. The first three labeled products varied in certification and all products varied in price in each choice scenario. Additionally, each choice scenario presented the option of not buying any of the products presented. The inclusion of opt-out more realistically mirrors true market opportunities. By allowing respondents to opt-out of each choice scenario, we remove the assumption of market participation which will reduce potentially "forced" choices.

To maintain orthogonality and independence across our experiment a main effects factorial design was employed. In a main effects factorial design, a subset of the full factorial design is selected such that all linearly additive utility terms are identifiable. Additionally, the design utilized in this study is balanced, that is, each level of the non-alternative specific attributes (price and certification) occurs with equal frequency across the entire choice set. Therefore, each attribute has equivalent statistical power in explaining preference. The main effects factorial design identified eighteen choice scenarios for inclusion. For the sake of brevity, and to lower the complexity of the overall task, the respondents were randomly assigned to answer one of two blocks of nine questions. An example of a question faced by all apple survey respondents follows:

Which one of the following apple displays listed below would you choose to purchase from?

Label	Sustainable	Organic	Local	Typical	I choose not to purchase any of these options.
Certification	Private 3rd Party	USDA	Self		
Price	\$1.49 /lb	\$1.99 /lb	\$0.99 /lb	\$1.49 /lb	
	☐	☐	☐	☐	☐

3 Model Specification

The choice experiment structure allowed each respondent to select from five options: (1) sustainably labeled, (2) organically labeled, (3) locally labeled, (4) unlabeled, or (5) opt-out of the purchase. This data can be analyzed using a random utility framework. In each scenario, the choice of an alternative represents a discrete choice from a set of competing alternatives. Each alternative in a given choice scenario can be represented with a utility function that contains a deterministic and a stochastic component. An individual will choose a given alternative only if the utility representing that alternative is greater than all other options in the choice scenario. If the stochastic component ϵ_{ij} is distributed i.i.d. extreme value then Adomiwicz et al (1998), Boxall and Adamowicz (2002) and Lusk et al (2003) have shown that the probability of consumer i choosing alternative j is equal to

$$Prob(j) = \frac{e^{sV_{ij}}}{\sum_{k \in C} e^{sV_{ik}}} \tag{3}$$

where s is a scale parameter. In a single sample the scale parameter cannot be directly identified and is thus assumed to be 1, according to Lusk et al (2003). However, if data is collected from more than one sample, the relative scale parameter can be calculated and accounts for the difference in the variation of unobserved effects on error variance heterogeneity. To test whether data from the two information treatments (USDA versus Food Alliance) can be pooled, we estimate the relative scale parameter, across the two data sets to control for potential differences in variance. A likelihood ratio test of parameter equality, after controlling for scale, is undertaken to determine if pooling is appropriate for the following parametric analysis. The parameters contributing to the probability of choice are then estimated in a multinomial logit model (MNL).

In the MNL framework, the left hand side variable represents choice and is coded as a dummy variable, taking the value of 1 indicating the product was chosen and 0 otherwise. Therefore each choice scenario yields five data observations for every respondent corresponding to the four competing product alternatives plus opt-out. The right hand side variables reflect the attribute levels of each product that is available for purchase. To avoid the assumption of equal marginal trade-offs, certification enters the model as an effects-coded variable. For the purposes of this study, we allowed USDA to act as the base-case since consumers are likely most familiar with USDA certification and labeling. Thus, two variables were included for certification, for self and private third party, respectively. Each certification variable took a value of -1 to indicate USDA certification, 1 to indicate certification accordingly and 0 otherwise. The remaining right hand side variables are alternative specific dummy variables corresponding to each of the four label attributes. Price was coded as a continuous variable. Therefore, the logistic regression to be estimated for each alternative j is as follows

$$V_{ij} = \beta Price_j + \delta_1 CertP_j + \delta_2 CertS_j + \gamma_1 LabelS_j + \gamma_2 LabelO_j + \gamma_3 LabelL_j + \gamma_4 LabelT_j \tag{4}$$

The parameter on price (β) approximates mean marginal utility of income and the parameters on each certification variable (δ_1 and δ_2) indicate the marginal (dis)utility associated with a change from USDA certification to Private Third Party certification or Self certification, respectively. The parameters on each label variable (γ_1, γ_2, γ_3, and γ_4) indicate the marginal utility gained from the labeling claim (or lack thereof) on each product relative to opt-out.

Thus, average willingness to pay for each label attribute, ceteris paribus, can be calculated as

$$WTP(Label_i) = \frac{\gamma_i}{\beta} \tag{5}$$

and the price premium that can be captured on average for each labeling scheme, relative to the typical (non-labeled product) is

$$Premium(Label_i) = \frac{(\gamma_i - \gamma_4)}{\beta} \tag{6}$$

The estimated parameters will reflect the increased (or decreased) probability of choice accompanying a one unit change in the attribute level of each variable. Thus, it is anticipated that price and certification variables will exhibit negative coefficient estimates, as increased price and certification other than USDA should provide disutility to the consumer under our model assumptions. It should be noted that multinomial logit models assume that all respondents share the same coefficients for a given attribute, an assumption of consumer homogeneity across preferences. This assumption is likely unrealistic if there is an expectations that consumer preferences are in fact heterogeneous.

There are two primary strategies for addressing consumer heterogeneity in random utility models that differ in their assumptions about the distribution of preferences (Sagebiel (2011)). The first is to employ a random parameters logit estimation on the same data set. The random parameters logit model (RPL) allows consumer heterogeneity to be continuous across respondents. In contrast, the latent class logit model is a semi-parametric version of the RPL, deriving heterogeneity from different classes of consumers, each having its own set of parameters. The latter model does not require any assumption on the distribution of parameters, and is thus considered more flexible by some (Greene and Hensher (2003)).

The conditional logit specification can model heterogeneity by incorporating interaction terms of case-specific demographic variables or perception rankings. The drawback with this method is that the interaction terms introduced are motivated by the researcher's choice, and therefore are more exploratory in nature. Each of these alternative specifications can be compared with the multinomial logit model by means of a likelihood ratio test to determine the best fit to the data. This paper does not examine consumer heterogeneity explicitly. However, the extension of this analysis will include a more in depth consideration of alternative models for measuring consumer heterogeneity in the natural progression of this research.

Table 2: Demographic Variables and Summary Statistics of Survey Participants

Variable	Definition	Apple	Steak
Gender	1= Male; 2 = Female	1.476	1.516
	Total Participants	500	502
Age	Average Age in Years	51.48	50.92
Adults	Number of Adults in Household	2.062	2.048
Children	Number of Children in Household	0.48	0.51
Meals	Number of Meals/ week with Product	6.64	3.19
Shop	% of Total Shopping at Location		
	Grocery Store	81.97	81.16
	Health Food Store	8.49	9.20
	Food Co-op	2.05	1.90
	Convenience Store	3.0	4.42
	Farmers Market	3.72	5.24
	Butcher	4.38	2.92
Assistance	1 = On Food Assistance; 2 = Otherwise		
	1 = On Food Assistance	13.2 %	11.95 %
	2 = Not on Food Assistance	86.8 %	88.05 %
Education	Highest Level Completed		
	1 = Did not graduate from high school	2.2 %	2.59 %
	2 = Graduated from high school, no college	17.8 %	18.12 %
	3 = Attended college, no degree earned	28.8 %	33.67 %
	4 = Attended college, associates or trade degree earned	15.4%	12.55 %
	5 = Attended college, Bachelors degree earned	24.6 %	22.52 %
	6 = Graduate or advanced degree earned	11.2 %	10.56 %
Household Income	Range of Pre-tax Income		
	1 = Less than $20,000	20.8%	19.12 %
	2 = $20,000 - $39,999	26.4%	28.88 %
	3 = $40,000 - $59,999	18.4 %	21.51 %
	4 = $60,000 - $79,999	17.6 %	11.95 %
	5 = $80,000 - $99,999	8.2 %	7.57 %
	6 = $100,000 - $119,000	3.8 %	4.98 %
	7 = $120,000 - $139,999	1.8%	2.39 %
	8 = $140,000 - $159,999	1.4 %	1.20 %
	9 = More than $160,000	1.6%	2.39 %

4 Results

Table 2 displays demographic population statistics. As all demographic information was elicited using a multiple-choice format, income and education were defined within bracketed levels. The demographic variable, ”Meals”, indicates how many meals, out of twenty-one each week, the respondent reported eating the given food product (apples or steak).

4.1 Information Treatment Tests

To specify our final model, we first estimated two separate multinomial logit models corresponding to each of the information treatments. The sum of the log likelihood function values across the two apple models was −11192.1897. The sum of the log likelihood function values across the two steak models was −10513.9581. Then the pooled data was used to estimate the same model, where utility parameters were constrained to be equal across information treatments. The resulting log likelihood function value for the pooled apple model was −11198.391 and the resulting log likelihood function value for the pooled steak model was −10517.906. The test for parameter equality yields a test statistic that is calculated as follows (Lusk (2006)),

$$\lambda = -2(LL_p - (LL_u + LL_f)) \tag{7}$$

where LL_p is the log likelihood value of the pooled model after controlling for scale, LL_u is the log likelihood value of the USDA information treatment model and LL_f is the log likelihood value of the Food Alliance information treatment model. The test statistic, λ is distributed χ^2 with $K(M-1)$ degrees of freedom, where K is the number of restrictions (seven) and M is the number of information treatments (two).

Comparing the two likelihood function values using the likelihood ratio test resulted in likelihood ratio test statistics of 12.4026 and 7.8958, for apples and steak respectively. The associated two-tailed p values are 0.08807252 for apples and 0.34187185 for steak, indicating that the null hypothesis of parameter equality across information treatments cannot be rejected at any standard level of significance.

The likelihood ratio test results imply that information had no effect on choices made in the hypothetical choice experiment across labeling schemes. Consumers with more specific information about the production standards required for third party certification exhibited preferences similar to those that received more general information about sustainable principles from the USDA. An interesting extension of this analysis could have included a third subsample, randomly assigned to receive no information, as was done in Lusk, Norwood and Pruitt (2006). The insignificance of the information treatment may be due to competing preconceptions about sustainability attributes, or it may be the persistence of general confusion over how these sustainable principles are implemented in practice.

Tables 3 and 4 present our primary estimation results. The CE results are as expected, as bid coefficients are negative and significant, certification parameters are negative and significant (with the exception of CertS for the USDA Apple sample), and label parameters are positive and significant.

Table 3: Demand for Sustainably Produced Apples: MNL Estimates from Choice Experiment

Variable	Pooled	Treatment USDA	Treatment FA
Price	-2.140	-2.118	-2.161
	(0.537)*	(0.076)*	(0.076)*
CertP	-0.250	-0.206	-0.291
	(0.031)*	(0.043)*	(0.044)*
CertS	-0.076	-0.157	-0.058
	(0.030)**	(0.043)*	(0.042)
LabelS	1.803	1.820	1.784
	(0.079)*	(0.113)*	(0.113)*
LabelO	1.884	1.811	1.949
	(0.079)*	(0.113)*	(0.113)*
LabelL	2.071	1.984	2.152
	(0.080)*	(0.114)*	(0.113)*
LabelT	0.603	0.547	0.656
	(0.085)*	(0.121)*	(0.119)*

(*) and (**) significant at 0.01 and 0.05 levels, respectively

Table 4: Demand for Sustainably Produced Steak: MNL Estimates from Choice Experiment

Variable	Pooled	Treatment USDA	Treatment FA
Price	-0.379	-0.358	-0.402
	(0.010)*	(0.013)*	(0.014)*
CertP	-0.321	-0.305	-0.337
	(0.033)*	(0.047)*	(0.048)*
CertS	-0.191	-0.155	-0.228
	(0.032)*	(0.046)*	(0.047)
LabelS	1.853	1.685	2.029
	(0.085)*	(0.119)*	(0.122)*
LabelO	1.847	1.702	1.998
	(0.085)*	(0.119)*	(0.122)*
LabelL	1.866	1.694	2.048
	(0.085)*	(0.119)*	(0.123)*
LabelT	0.818	0.672	0.972
	(0.089)*	(0.124)*	(0.127)*

(*) and (**) significant at 0.01 and 0.05 levels, respectively

4.2 Pooled Model Results

Moving forward with the pooled model estimates, the results indicate that on average, as determined by the relative magnitudes of the coefficient estimates, the preference ordering for labeling claims on apples are as follows in descending order: 1) Local 2) Organic 3) Sustainable and 4) Typical. All MNL parameters on Label are positive and significant at the 1% level. For beef, the results indicate that on average, as determined by the relative magnitudes of the coefficient estimates, the preference ordering for labeling claims on ribeye steaks are as follows in descending order: 1) Local 2) Sustainable 3) Organic and 4) Typical. Similar to the apple results, all MNL parameters on Label are positive and significant, again at the 1% level.

The negative and statistically significant estimates on private third party certification and self certification indicate that consumers receive disutility from either of these certification schemes relative to USDA certification, ceteris paribus. Accordingly, the relative magnitude of the two certification coefficients reveals that for both apple and beef samples, Self certified products are least favorable, holding all other quality attributes constant. Also, as expected the price coefficient is negative and significant for both apple and steak samples.

Applying a simple welfare measurement to the parameter estimates, we find that consumers are willing to pay $\$0.84/lb$ on average for sustainably labeled apples and $\$4.89/lb$ on average for sustainably labeled ribeye steak. Relative to the typical (unlabeled) product, we also report average price premiums. All WTP estimates are displayed in Table 5.

Table 5: WTP Estimates and Associated Price Premiums for Labeling Scheme Attributes

Welfare Measure	Apple WTP	Steak WTP
WTP LabelS	$0.84/lb	$4.89/lb
WTP LabelO	$0.88/lb	$4.87/lb
WTP LabelL	$0.97/lb	$4.92/lb
WTP LabelT	$0.28/lb	$2.16/lb
Premium(LabelS)	$0.56/lb	$2.72/lb
Premium(LabelO)	$0.60/lb	$ 2.71/lb
Premium(LabelL)	$0.69/lb	$2.76/lb

All welfare measurements should be interpreted relative to opt-out. That is, the willingness to pay on each label attribute is the amount of money the average consumer is willing to pay for each labeled product after choosing to participate in the market, holding all else constant and assuming no uncertainty regarding choice. It is interesting to note that all willingness to pay welfare estimates are less than the lowest price attribute level, for both apple and steak surveys. Combining this observation with a simple count check on the raw data, accounting for the number of opt-out responses, indicates that price was likely a strong driving factor leading people to leave the market. This may indicate that overall price attribute levels were considered too high by this consumer sample even though the price levels were determined using true market prices at the time of the survey development.

However, the positive willingness to pay estimates on all labels imply that all of the products individually are preferred to not buying any. On average, consumers are willing to pay the most for locally produced apples and steak. Following the preference for locally grown and produced apples and steak, organic and sustainably labeled products have the next highest willingness to pay, for apples and steak respectively. However, in both cases the willingness to pay welfare measurements are close in magnitude, which could easily lead to a reversal of the preference ordering for these two label attributes if this experiment was replicated with another population. This result suggests that organic and sustainably produced labels may not be differentiable to consumers, as currently marketed.

5 Conclusions

The objectives of this paper were to employ a stated preference approach, utilizing a choice experiment framework, for measuring value associated with quality changes in sustainable agricultural production practices, and to determine if providing information about sustainable agricultural practices affects willingness to pay estimates for sustainably labeled food products. Our results support previous studies of food attribute valuation (Bond et al (2008), Lusk and Briggeman (2009)) and illustrate the higher preference for locally grown and produced foods (Detoni and Tonsor (2009)). Moreover, our analysis provides evidence of weak market differentiation between organic and sustainably labeled products, which may further exacerbate uncertainty regarding the attributes associated with these credence labeling schemes. Abram et al (2010) found similar results when evaluating perceptions of ”all natural” claims against organic. Providing varying levels of information on sustainable agricultural practices yielded similar preferences across respondents of our survey.

Our analysis demonstrates that positive price premiums can be captured by sustainably produced labeling claims, relative to similar unlabeled and conventionally produced food products. However, the price premiums calculated in our model reveal that there is a comparable tradeoff in quality associated between organic and sustainably labeled food products. Furthermore, detailed information about sustainable certification guidelines had no significant impact on choosing the sustainably labeled products. Thus, we conclude that, based on our results, consumer demand for sustainably produced food is not distinctly differentiable from its organic counterpart. Overall, these findings suggest that profitable marketing opportunities may exist for firms interested in selling sustainably produced food products, however there needs to be considerable effort put into leveling information asymmetries about product quality if sustainable label claims are to be differentiated from more recognizable organic principles.

We acknowledge that consumers are likely to have heterogeneous preferences over food value attributes. The multinomial logit framework used in this paper assumed homogeneous preferences, and thus the willingness to pay estimates can only be interpreted for the average consumer. In natural progression with this research, the next stage of analysis will compare and contrast results of modeling a random parameters logit and a latent class logit on this same data set. It is anticipated that the RPL and LCM models will add depth to the interpretation of estimation results and will contribute significant discussion on the potential factors driving food choice in the context of sustainable labeling claims.

The extension of this work will yield a statistical comparison of the two models, allowing for heterogeneous preferences, using measures of fit, conditional WTP values and choice probabilities. Furthermore, the next chapter in this research seeks to incorporate perception measurements, modeled in a best-worst framework, into the choice modeling to examine how varying levels of importance across sustainable agricultural production attributes may alter choice probabilities and welfare measurements.

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7 Appendix

7.1 USDA Information Treatment

Please consider the following information [provided by the United States Department of Agriculture]:

The word *sustain* from the Latin sustinere (sus, from below and tenere, to hold), to keep in existence or maintain, implies long-term support or permanence. As it pertains to agriculture, sustainable describes farming systems that are capable of maintaining their productivity and usefulness to society indefinitely. Such systems must be resource-conserving, socially supportive, commercially competitive, and environmentally sound. Sustainable agriculture was addressed by Congress in the 1990 Farm Bill and the Food, Agriculture, Conservation, and Trade Act of 1990 (FACTA). Under that law, the term sustainable agriculture means an integrated system of plant and animal production practices having a site-specific application that will, over the long term:

1. Satisfy human food and fiber needs
2. Enhance environmental quality and the natural resource base upon which the agricultural economy depends
3. Make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls
4. Sustain the economic viability of farm operations
5. Enhance the quality of life for farmers and society as a whole

Consumers are increasingly demanding on the ethical dimension of food quality. This relates to the process of production and trade and its broad impacts on society and the environment. It includes a wide range of social, environmental or cultural issues such as the treatment of workers, a fair return to producers, environmental impacts and animal welfare. Guidelines about what specific practices meet long-term environmental, economic and social goals and constitute sustainable agriculture is still under debate. However, a handful of groups have attempted to develop standards and/or provide certification services based upon their own guidelines.

7.2 Food Alliance Information Treatment

Please consider the following information [provided by Food Alliance, an independent third party certifier of sustainably produced foods]:

The impacts of food production have become a mainstream concern. Expectations for traceability, transparency and accountability in agriculture and the food industry are increasing. Sustainable agriculture comprises the ability to produce safe, healthy, delicious, and affordable food to meet needs without degrading agricultural lands, the quality of life in our communities, or the resiliency of the broader ecosystems on which we all depend. Farms employing sustainability practices place important on issues including safe and fair working conditions, humane treatment of animals, and protection of the environment. Sustainable farms should be held to the following standards:

1. Protect, enhance, and conserve soil resources, water resources, and biodiversity

   Food production improves soil productivity, protects water quality and supply, and supports healthy native plant and animal communities.

2. Conserve energy, reduce and recycle waste

   Waste streams from food production are minimized while reuse, recycling, and composting of resources is maximized. Businesses invest in innovation and improvement to ensure efficient use and management of natural resources for energy and packaging, transport, and daily operations.

3. Reduce use of pesticides, and other toxic and hazardous materials

   Food businesses avoid use of chemicals that have adverse impacts on the health of ecosystems. Agriculture relies on a biologically based system of Integrated Pest Management. Materials used for sanitation, pest control, waste treatment, and infrastructural maintenance are chosen to reduce overall negative consequences.

4. Maintain transparent and sustainable chain of custody

   Farmers and food industry workers have secure and rewarding jobs that provide a sound livelihood. Throughout the entire supply chain, food is produced and handled in accordance with these Principle Values. Transparency is maintained independent standards, third-party audits and clear labeling.

5. Guarantee product integrity, no genetically engineered or artificial ingredients

   Foods are not produced using synthetic preservatives, artificial colors and flavors, genetically modified organisms (GMOs), or products derived from livestock treated with sub-therapeutic antibiotics or growth-promoting hormones.

6. Support safe and fair working conditions

   Employers respect workers rights and well-being, make safety a priority, maintain a professional workplace, and provide opportunities for training and advancement.

7. Ensure healthy, humane animal treatment

   Animals are treated with care and respect. Living conditions provide access to natural light, fresh air, fresh water, and a healthy diet, shelter from extremes of temperature, and adequate space and the opportunity to engage in natural behaviors and have social contact with other animals. Livestock producers minimize animal fear and stress during handling, transportation and slaughter.

8. Continually improve practices

   Food businesses are committed to continually improving management practices. Improvement goals are integrated into company culture, regularly monitored, and acknowledged when achieved. Food buyers are proactively engaged in the food system, and support companies that are transparent about their improvement goals and progress.

7.3 Choice Experiment Instruction, Definitions, and Cheap Talk Script

In the next section you will be presented with multiple different alternative packages of beef ribeye steak that could be available for purchase in a retail store where you typically shop. Besides the attributes listed below, each product possesses the same characteristics (e.g., similar color and freshness) and is produced in the U.S. Prices vary for each product and are all in $/lb. units. Please consider the following information to help you interpret alternative products.

Label: The package that contains the beef ribeye steak for your purchase may be labeled as follows:

- Sustainable: This beef was produced using sustainable practices.
- Organic: This beef was produced using organic practices.
- Local: This beef was produced for distribution and sale locally.
- Typical: This beef is not labeled to suggest it was produced using any of the criteria listed above.

Certification: The typical product has no certification label. Each labeled product can be certified in one of three ways:

- USDA: The processes used and all claims made by the product label have been verified by the USDA.
- Independent Third Party: The processes used and all claims made by the product label have been verified by a third party unrelated to the farm of origin or retailer.
- Self: The processes used and all claims made by the product label have been verified by the farmer producing the food.

The experience from previous similar surveys is that people often state a higher willingness to pay than what one is actually willing to pay for the good. For instance, a recent study asked people whether they would purchase a new food product similar to the one you are about to be asked about. This purchase was hypothetical (as it will be for you) in that no one actually had to pay money when they indicated a willingness to purchase. In the study, 80% of people said they would buy the new product, but when a grocery store actually stocked the product, only 43% of people actually bought the new product when they had to pay for it. This difference (43% vs. 80%) is what we refer to as hypothetical bias.

Accordingly, it is important that you make each of your upcoming selections like you would if you were actually facing these exact choices at a store; noting that buying a product means that you would have less money available for other purchases.