The Chicken Wears No Skin: Ordering Effects in Elicitation of Willingness to Pay for Multiple Credence Attributes in Ethical and Novel Food Products[1]

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Abstract

We investigate whether consumer preferences for food products embodying multiple credence attributes are easily satiated. Results from two treatments of an experiment suggest choices are not affected by the order in which attributes are presented. Initial evidence suggests diminishing marginal utility in the number of attributes included in food products embodying multiple credence attributes. However, further testing reveals that preferences are consistent with constant marginal utility in the number of product attributes, suggesting that preferences are not easily satiated.

1 Introduction

Food marketers increasingly emphasize attributes of the production process (e.g. organic food products, enhanced animal welfare) as well as social marketing attributes (e.g. fair trade). However, products can exhibit more than one of these attributes, for example, free-range, organic, locally produced foods. While the literature has devoted considerable attention to the assessment of consumer preferences over single goods reflecting a production based attribute (e.g. Gil et al. 2000; Canvari et al. 2002; Corsi and Novelli 2002; Krystallis and Chryssohoidis 2005; Tonsor et al. 2009), attention has also focused on preferences for food products with multiple attributes (e.g. Didier and Lucie 2008; Batte et al. 2007; Loureiro and Hine 2002). Given the importance of new production practices it is important for researchers to understand how consumers perceive goods with multiple attributes. This paper investigates whether consumer preferences vary depending on the nature of the product attributes, the number of product attributes, and the order in which they appear. Further, we examine whether consumer preference over product attributes is easily satiated.

Given that there are few goods currently available with multiple credence attributes, it is difficult, if not impossible, to use revealed preference and/or transaction based data to analyze consumer preferences for these products. To overcome these limitations, stated preference methods are often used. The advantage of stated preference methods is that the researcher can experimentally control the number of attributes and attribute levels included in the study.

In the context of products with multiple credence attributes, the use of stated preference methods and choice experiments can be a challenge. In particular, one might worry that the ordering and number of attributes will influence a subject's choice. In this respect, a number of questions come to mind:

- Does the number of attributes influence the choice an individual makes?

- Does the ordering of attribute presentation affect consumer choice of a product with multiple attributes?

This research seeks to understand whether there is an attribute loading bias or an attribute ordering bias. An attribute loading bias implies that a consumer's valuation of a particular attribute is affected by the number of other attributes attached to a product (i.e. there is attribute satiation). An attribute ordering bias implies that the order in which attributes appear influences choice.

These issues have not gone unnoticed in the literature. Complexity of the choice task, the number of attributes (and their levels), the number of choice sets and ordering of attributes have all been explored. The impact of complexity in design of stated choice experiments has yielded several interesting results. In particular, the number of attributes can increase variability of choice (i.e. makes choices less consistent) (Caussade et al 2005), while the number of changes in the level of attributes (from the status quo) can also influence choice (Boxall et al 2008). While choice overload has been shown to have mixed effects on the choices consumers make (see Scheibehenne et al. 2010 for a meta-analytic study), Gao and Schroeder (2009) report that addition of attributes to a choice experiment has a non-monotonic effect on consumer WTP (first decreasing WTP then increasing WTP). Moreover, omitting potentially important attributes can lead to consumer inferences that affect willingness-to-pay (Tonsor 2011).[2]

Bech et al. (2011) found that the number of choice sets had no effect on response rates, but did affect WTP measures; the latter was also reported by Chung et al (2010). As well, varying the number of options per choice set has been shown to affect WTP (Chung et al. 2010). The order in which a price attribute appears in a discrete choice experiment has

[2]Witt et al (2009) recognize the potentially negative impact of having many attribute levels in a choice design and develop an approach (which they call blocked attribute design) that allows for them to split the number of attributes to which subjects are exposed and then pool the resulting data for analysis

been shown to influence price sensitivity (Kjær et al 2006)[3], as well as choice and subsequent welfare measurement (Boxall et al. 2009; Day et al. 2012), while others report the ordering of choice sets do not affect choice and lead to insignificant differences in WTP (Rulleat and Dachary-Bernard 2012).

Our contribution is to focus on ordering and loading (i.e. satiation) effects in the domain of a food product reflecting credence (or production) based attributes. We find that ordering of attributes plays a limited role, if any, in the choices individuals make. At first blush our evidence also suggests diminishing marginal utility in the number of attributes (after controlling for the nature of attributes as well as respondent characteristics). However, we cannot, in general, reject the null of constant marginal utility in the number of attributes. This suggests that respondent preferences are not easily satiated in the number of credence attributes.

2 Experimental Design

Building on an existing literature that utilizes a number of production based attributes (e.g. Gil et al. 2000; Krystallis and Chryssohoidis 2005; Innes and Cranfield 2009; Onken et al. 2011), we use a stated preference choice experiment to elicit contingent valuation for boneless, skinless chicken breast with one or more of the following non-price attributes: organically produced, free-range, and locally produced. Respondents were asked to choose between conventional chicken (which had none of the non-price attributes), and enhanced chicken (which had one or more of non-price attributes). The price of conventional chicken was set at a price of $6.49 per pound, in line with typical supermarket prices in the area, while the price of the enhanced chicken was set at $7.78 per pound. Respondents were provided attribute definitions, and an information script related to the credence attributes.

[3]Placing the price attribute last in the list of attributes led to a statistically significance higher price sensitivity

To assess both of our research questions, two different treatments were employed. In treatment 1 respondents faced one choice task, and were asked whether or not they would purchase chicken breast that had one, two or three of the non-price attributes. Specifically, respondents were randomly assigned to one of seven different cells, each of which had different attributes attached to the chicken breast. The possible options were: organically produced; locally produced; free-range; organically and locally produced; organically produced and free range; locally produced and free-range; or organically produced, locally produced and free-range. We hypothesize that across randomly assigned respondents, we will observe diminishing response to the increase in the number of product attributes, and that the marginal contribution of any given attribute will diminish conditioned on how many other attributes have been presented.

In treatment 2, respondents faced three choice tasks. In the first task respondents chose either conventional chicken or chicken with one non-price attribute, in the second task respondents chose either conventional chicken or chicken with two non-price attributes, and in the third task respondents chose either conventional chicken or chicken with all three one non-price attributes. Respondents were randomly assigned to one of six different cells. The cells varied in terms of the product attribute(s) included and the ordering of these attributes, as shown in table 1.

Table 1: Attributes involved in the choice tasks in the second treatment

Cell	First task	Second task	Third task
1	Free-range	Free-range and organic	Free-range, organic and local
2	Free-range	Free-range and local	Free-range, local and organic
3	Organic	Organic and free-range	Organic, free-range and local
4	Organic	Organic and local	Organic, local and free-range
5	Local	Local and organic	Local, organic and free-range
6	Local	Local and free-range	Local, free-range and organic

Our hypothesis in the second treatment is that the probability of choice would continue to

increase as more attributes were added, but at a decreasing rate, an effect that would result in diminishing marginal utility across the number of attributes, which points to attribute saturation. As such, we hypothesize that multiple-attribute products will be relatively more likely to be chosen at a given price when attributes are introduced sequentially in the second treatment, compared to when they are introduced simultaneously in the first treatment.

3 Survey & Data

An in-person, mall intercept survey was used to gather data for this analysis. The surveys (one for treatment 1 and one for treatment 2) were undertaken in a mall in the City of Guelph (a medium sized city in southern Ontario) in February and March 2012. Trained student enumerators were instructed to approach people in the sample frame (see below) and asked if they would like to participate in a brief survey about chicken. If the respondent said yes, screening questions were used to ensure the respondent fell into our selection criteria. Eligible subjects were then asked to read an informed consent document. If they agreed to participate, they signed the consent and proceeded to the survey. Surveys in treatments 1 and 2 were implemented using electronic tablets with wireless connection to the *Qualtrics*[4] server. Upon completion of the survey, respondents were given a $5 Tim Horton's Gift Card as an incentive payment. Some difficulties were encountered with our wireless connection. Consequently, some of the data was collected using a traditional paper method. This was noted in the data collection and accounted for in our analysis.[5]

The survey included screening questions based on age (we recruited subjects 18 years of age and older), whether the subject was the primary grocery shopper for the home or shared that responsibility with someone else in the home, and whether they ate chicken in

[4]Qualtrics is a supplier of electronic data collection and analysis

[5]Interestingly, we find respondents to be systematically more likely to purchase the enhanced product when taking the survey on an electronic tablet. Where significant, we control for this effect.

the last six weeks. Eligible subjects then faced question related to their consumption of food in general, and chicken in particular. Subjects were then asked question relating to their awareness of organic, local and animal welfare issues and their shopping behaviour for foods embodying those attributes. Subjects were then asked to indicate the importance of food safety, animal welfare, freshness, price and taste when making food purchase decisions. The survey then provided an information script related to free-range, local and organic aspects of chicken production. This information script was followed by the choice question(s). Lastly, a variety of questions were asked to gather demographic and socio-economic characteristics of the respondent and their household.

We received 288 valid responses from treatment 1 and 219 valid responses from treatment 2.[6] We removed 34 responses due to incomplete surveys. Descriptive statistics for the choice tasks are provided in tables 2 and 3. Our key result can be seen directly from the statistics in the preceding tables, and is highlighted more clearly in figure 1. When the number of attributes increased in treatment 1 we see a muted response, which we will later show to be insignificant, even after suitable controls are added. In contrast, in treatment 2 there is a large increase in the willingness to purchase the enhanced product as the number of attributes is increased. This is consistent with our hypothesis regarding how additional attributes will be viewed when presented sequentially rather than simultaneously.

Before the choice task(s) respondents were asked a series of questions regarding their past purchases and the attitudes towards the attributes of interest. The results of these questions are shown in table 4. Of the three attributes that will appear in the choice task, respondents are most aware of, and mostly likely to have previously purchased, locally produced products. However, the difference between locally produced and organically produced is relatively small, while the differences between these two attributes and animal welfare is larger. Finally,

[6]Since the first task in treatment 2 is exactly equivalent to certain cells in treatment 1, we include a random subsample of treatment 2 respondents in treatment 1.

Table 2: Responses to choice task in treatment 1

Attribute	Yes	No	DK (Don't know)
Free-range (n=40)	0.40	0.42	0.18
Organic (n=40)	0.42	0.55	0.02
Local (n=40)	0.57	0.38	0.05
Free-range and organic (n=41)	0.37	0.51	0.12
Organic and local (n=42)	0.45	0.33	0.21
Free-range and organic (n=40)	0.55	0.30	0.15
Free-range, organic, and local (n=45)	0.53	0.31	0.16
Average	0.47	0.40	0.13

Table 3: Responses to choice tasks in treatment 2

	Task 1			Task 2			Task 3		
Cell	Yes	No	DK	Yes	No	DK	Yes	No	DK
Cell 1 (n=34)	0.38	0.47	0.15	0.59	0.32	0.09	0.68	0.26	0.06
Cell 2 (n=34)	0.41	0.47	0.12	0.56	0.38	0.06	0.82	0.18	0.00
Cell 3 (n=36)	0.31	0.61	0.08	0.39	0.56	0.06	0.58	0.39	0.03
Cell 4 (n=34)	0.59	0.41	0.00	0.71	0.24	0.06	0.74	0.24	0.03
Cell 5 (n=35)	0.40	0.40	0.20	0.60	0.29	0.11	0.66	0.23	0.11
Cell 6 (n=40)	0.50	0.38	0.12	0.78	0.17	0.05	0.82	0.10	0.07
Average	0.43	0.46	0.11	0.60	0.33	0.07	0.72	0.23	0.05

we can note that price is a significant factor in most respondents purchase decision.

4 Results

4.1 Treatment 1

In treatment 1 respondents had one choice task: to indicate whether they would purchase a chicken breast that had one, two or three of the non-price attributes. This treatment was designed to test if the number of non-price attributes included in the product description affected the proportion of respondents indicating they would purchase the enhanced product.

Figure 1: Willingness to purchase in Treatment 1 and Treatment 2

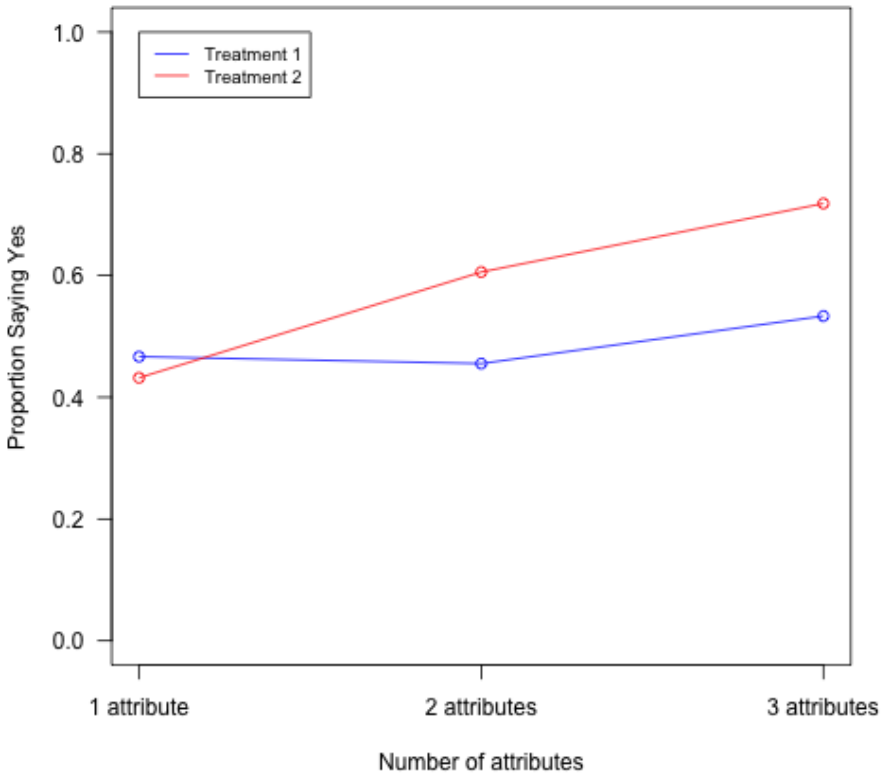


Figure 2 shows the percent of within cell respondents who indicted they would purchase the chicken breast with associated production based attributes.[7] ANOVA failed to find significant differences in response rates both across cells (p-value=.31), and across the number of attributes included in the choice question (p-value=.38).

To explore further whether the particular attributes or number of attributes influenced the choice made, data from treatment 1 were pooled and a discrete choice probit model estimated. Explanatory variables include dummy variables for the attributes to which the

[7]In figure 2, L='Locally produced chicken', O='Organically produced chicken', and F='Chicken is from a free range production systems'.

Table 4: Responses to purchase, attitudinal and socio-demographic questions

	Treatment 1		Treatment 2	
	Mean	St. dev.	Mean	St. dev.
Frequency of:				
Eating chicken (scale of 1-5)[a]	2.41	0.86	2.46	0.84
Purchasing boneless, skinless chicken breast (scale of 1-3)[b]	1.79	0.72	1.77	0.73
How aware are are you of the following attribute (scale of 1 - 5)[c]:				
Organic	3.08	1.36	3.22	1.30
Local	3.22	1.35	3.23	1.29
Animal welfare	2.94	1.41	3.07	1.38
How often do you purchase products with the following attributes (scale of 1-7)[d]:				
Organic	3.52	1.75	3.62	1.75
Local	3.98	1.94	4.03	1.93
Animal welfare	2.57	1.90	2.70	2.01
How important are the following characteristics in your purchase decision (scale of 1-5)[e]:				
Price	4.31	0.87	4.35	0.89
Taste	4.49	0.77	4.47	0.78
Freshness	4.57	0.76	4.64	0.69
Food safety	4.42	0.92	4.43	0.88
Animal welfare	3.54	1.17	3.69	1.19
Socio-demographic variables				
Male	0.52	–	0.51	–
Age	40.00	55.48	35.86	18.23
Children in home	0.78	–	0.74	–
Education (scale of 1-5)[f]	3.08	1.15	2.95	1.13
Income (scale of 1-5)[g]	2.69	1.50	2.62	1.50

a. 1=Daily; 2=More than once a week, but not every day; 3=At least once a week; 4=At least once a month, but less than once a week; 5=Less than once a month

b. 1=At least once a week; 2=At least once a month, but less than once a week; 3=Less than once a month

c. 1=Very aware; 5=Very unaware

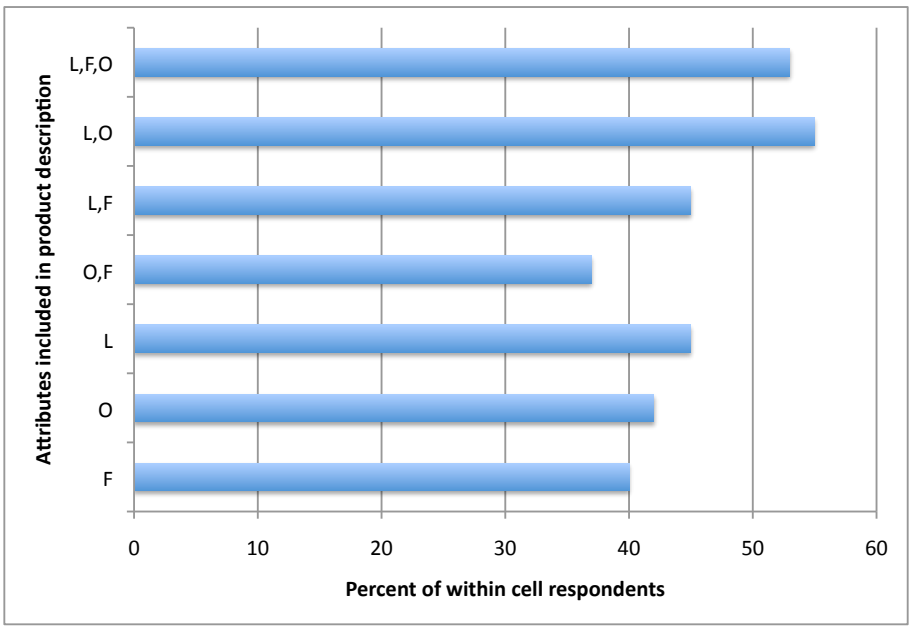
d. 1=Daily; 2=More than once a week, but not everyday; 3=At least once a week; 4=At least once a month, but less than once a week; 5=Once a month or less; 6=I do not consume this type of product; 7=Don't know

e. 1=Very important; 5=Very unimportant

f. 1=Less than high school; 2=High school; 3=College diploma/degree; 4=Undergraduate degree; 5=Post-graduate degree

g. 1=<$25000; 2=$25000-$44,999; 3=$45000-$69999; 4=$70000-$99999; 5=>$99999

Figure 2: Percent of within cell respondents who indicated they would purchase a chicken breast product from a production system embodying the respective production based attributes, treatment 1



respondent was exposed and the number of attributes embodied in that product (using organic production and three product attributes as the reference group, respectively).[8] Table 5 shows results (estimated with heteroskedastic consistent standard errors) from a series of regressions, where our interest focuses on the significance of the coefficients on dummy variables for the product attributes and number of product attributes to which subjects were exposed.

The results for model 1 (which only include dummy variables for the experimentally controlled variables) point to a poor fit of the model (i.e. a low pseudo-r2 and low p-value for the test of jointly zero coefficients), and lack of significance of the estimated coefficients. Marginal effects for this model, evaluated at the means of the data, were also not significant.

[8]Preliminary analysis showed no significant differences across surveys in treatment 1 that were completed with the table versus paper.

Table 5: Probit regression results for treatment 1[a]

Variable	Model 1	Model 2	Model 3
Constant	-0.275	-0.457	-1.171
	(-0.70)	(-1.02)	(-2.36)
Free-range	0.093	0.038	0.073
	(0.47)	(0.19)	(0.34)
Locally produced	0.267	0.213	0.307
	(1.34)	(1.07)	(1.51)
One attribute	-0.034	-0.184	-0.106
	(-0.11)	(-0.56)	(-0.30)
Two attributes	-0.076	-0.117	-0.069
	(-0.31)	(-0.46)	(-0.26)
Controls for:			
Demographics	No	Yes	Yes
Awareness	No	No	Yes
Pseudo-R2	0.009	0.018	0.057
p-value[b]	0.500	0.542	0.034

a. z-scores shown in parentheses below estimates
b. For the null of no joint significance

Additional controls were added to see if results were sensitive to specification. Model 2 included controls for respondent income, education and gender, and whether children under 18 years of age were in the respondent's home. Results for model 2, albeit a better fitting model, were no different from model 1; none of the estimated coefficients of interest (or marginal effects) were significant. We then included three additional controls that reflected respondent self-declared awareness of animal welfare, local, and organic production (measured on a five-point scale where 1='Very unaware' and 5='Very aware') in model 3. While the model fit improved significantly, the coefficients on the attribute and number of attributes dummy variables (and marginal effects) were not significant. These results suggest that respondents treated the choice attributes as near-perfect substitutes, and derived little marginal utility from the inclusion of additional attributes, consistent with our a priori expectation that in a single-shot question, respondents are primarily aware of being asked

to consider an 'ethical' product rather than sensitive to the number of ethical production attributes being offered.

Additional analysis was undertaken to explore sensitivity of results to the choice of estimator; in particular, the model was also estimated assuming a logit model, as well as a heteroskedastic probit model. Compared to the probit model results, qualitatively identical results were obtained with the logit model. In the heteroskedastic probit model, we conditioned the variance of the error term on sociodemographic variables (such as income, education, and households with children), as well as consumer taste parameters (such as their awareness of, and past purchase of local, organic and enhanced animal welfare products). Convergence issues were encountered with a number of these models (i.e. when the error term was conditioned on more than two variables), but when the models did converge, none of the models had significant coefficients on the product attribute and number of attributes dummy variables.

4.2 Treatment 2

In treatment 2, the same non-price attributes were added into the choice decision in a sequential order but with random assignment to subjects. Respondents faced three choice tasks: the first choice task centred on a chicken breast with one non-price attribute, the second choice task centred on a chicken breast with two non-price attributes, and the third choice task centred on a chicken breast with all three non-price attributes. This treatment was designed to test for the presence of attribute satiation effects, as indicated by diminishing marginal utility as more attributes were added.

We found that 43 percent of those surveyed responded positively to the first choice question (which involved only one attribute), 61 percent responded positively to the second choice question, and 72 percent responded positively to the third choice question. There was, however, significant variation in the responses to all three questions across cells. One concern

with this approach is that responses to the final question depended on the attributes included in the first two questions (a conditioning, or ordering, effect). To test this we regressed responses to the final choice question on dummy variables that captured the attributes the respondent encountered in the first and second question (these results are not reported for brevity). Only one production based attribute variable (a dummy variable equal to one if local was the attribute added in the second question) was found significant, suggesting there was little in the way of a conditioning effect.

We next examined if there were significant differences in response rates based on the particular attributes included in the choice task and the number of attributes included in that task. To test this, we used a random effects probit model to regress the responses from all three questions on dummy variables similar to treatment 1. However, to better assess whether diminishing marginal utility was present in the number of attributes, we used products that have two attributes as the omitted group for the number of attributes dummy variables. This allows us to test for non-constant marginal utility by testing the null that the coefficients on the dummy variable for a product with one attribute has equal value but opposite sign as the coefficient on the dummy variable for a product with three attributes. Results from this regression are shown in table 6

Results under the column 'Model 1' included effects for product attributes and the number of attributes, and random effects across respondents (reflecting the pooled nature of the data). The model carries statistically significant explanatory power (as measured using the Wald test of joint zero coefficients). Coefficients on dummy variables for organic and locally produced chicken were significant. Consequently, we find that choice questions involving free-range chicken induced fewer positive responses than questions involving organically or locally produced chicken. As well, coefficients on dummy variables for products with one or three attributes were significant. Since the coefficient on the dummy for one attribute was negative, while that for a product with three attributes positive, it would appear as though

Table 6: Regression results for treatment 2^a

Variable	Model 1	Model 2	Model 3
Constant	-2.769	0.440	-8.186
	(-2.15)	(0.19)	(-2.04)
Organic	4.140	1.939	2.855
	(4.30)	(1.57)	(1.90)
Locally produced	2.841	1.236	2.027
	(3.05)	(1.09)	(1.36)
One attribute	-4.186	-5.788	-4.357
	(-4.66)	(-5.11)	(-3.13)
Three attributes	1.735	3.745	2.695
	(1.87)	(3.32)	(2.05)
Controls for:			
Demographics	No	Yes	Yes
Paper versus tablet	No	Yes	Yes
Awareness	No	No	Yes
$\ln(\sigma_U^2)^b$	4.958	5.177	4.945
	(0.256)	(0.258)	(0.330)
Wald p-value^c	0.000	0.001	0.001
CMU p-value^d	0.072	0.183	0.231

a. z-scores shown in parentheses below estimates
b. Standard errors shown in parentheses below estimates
c. For the null of no joint significance
d. For the null of constant marginal utility

utility is increasing in the number of attributes, but at a decreasing rate. This would suggest diminishing marginal utility and potential attribute satiation.

However, the p-value for our test of constant marginal utility suggests a conclusion of diminishing marginal utility is sensitive to the chosen level of significance (see table 6). Moreover, results appear sensitive to inclusion of respondent demographic controls and a control for whether a paper versus tablet version of the survey was taken (i.e. Model 2). In particular, coefficients on the organic and local product attributes are no longer significant, while those on dummy variables for the number of attributes remain significant. Indeed, coupled with the signs of the latter, results for model 2 would again suggest diminishing

marginal utility. However, the p-value for the null of constant marginal utility suggests that we fail to reject this null. A similar conclusion is drawn when controls for respondent awareness of local, organic and animal welfare were added (i.e. model 3).[9]

While not reported, qualitatively identical results were obtained when we varied the omitted group for the product attributes. That is, regardless of whether we used Free-run, Organic or Local as the omitted group, the null of constant marginal utility could not be rejected. Moreover, this result was true when demographic, paper versus tablet and awareness controls were added. Lastly, the coefficients on the product attribute dummy variables remained insignificant when the omitted group for product attribute was varied.

5 Conclusions

Increasingly, food products are marketed in a manner that reflects the nature of the production system for the underlying agricultural commodity. As new production methods emerge the market for such products will be explored by researchers attempting to ask fundamental questions such as 'Does a market exist for this good?'. Answering this question for emerging products that are yet on the market requires the use of stated preference methods to elicit preferences over products embodying production and/or credence based attributes. Quite often, such products reflect more than one production based attribute.

In such circumstances, one might worry that the ordering and number of attributes will influence a subject's choice. In this respect, a number of questions come to mind:

- Does the number of attributes influence the choice an individual makes?
- Does the ordering of attribute presentation affect consumer choice of a product with multiple attributes?

[9]We do note that the coefficient on the organic dummy variable become significant in model 3, but only marginally so

We sought to understand whether there is an attribute loading bias or an attribute ordering bias. An attribute loading bias implies that a consumer's valuation of a particular attribute is affected by the number of other attributes attached to a product (i.e. there is attribute satiation). An attribute-ordering bias implies that the order in which attributes appear influences choice.

Results from two treatments of an experiment suggested that choices were not affected by the order in which attributes were presented to subjects. Initial evidence suggested diminishing marginal utility in the number of attributes included in food products embodying multiple credence attributes. However, further testing revealed that preferences were consistent with constant marginal utility in the number of product attributes, suggesting that preferences were not easily satiated. This stands in stark contrast to the results of the first experiment, in which additional attributes beyond the first appeared to provide little or no additional utility. This gives raise to the concern that when only asked to consider a product with enhanced 'ethical' production attributes compared to a default option of one without any, consumers do not pay much attention to the nature of number of these attributes unless forced to compare.

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