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Consumer characteristics and willingness to pay for locally produced rib-eye steaks: A case study of consumers at farmers' markets

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Abstract

This study examined crucial product attributes, consumer characteristics, and corresponding willingness to pay (WTP) for locally produced rib-eye steaks. We focused on consumers at farmers' markets because the rising trend of buying local is believed to have generated higher sales for local producers in recent years. This paper is the first demand-side study to focus solely on high-value beef cut in the state of South Dakota. We conducted an experimental survey study, and the data suggested a significantly higher WTP for locally produced rib-eye steaks. The results also indicated that all product attributes selected for inclusion in this study contributed to a higher WTP for shoppers at farmers' markets, especially in terms of juiciness and color of the steaks. We also found that two consumer characteristics — household beef intakes and health knowledge — significantly contributed to higher WTP.

We recommend that local producers continue improving the quality of their meat; however, producers should be aware that improving quality would possibly result in diminished profits. Our study also indicates that although consumers at

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farmers' markets are willing to spend a higher price premium for better steaks, the additional WTP vanishes once the product's quality reaches a certain level. To improve profitability, we suggest that local producers develop effective market strategies to target and recruit customers who are willing to pay higher premiums for locally produced food.

Keywords
beef, conjoint analysis, farmers' markets, local food, rib-eye steaks, willingness to pay, WTP

Introduction

Recent years have seen consumers' increasing willingness to pay (WTP) rise for locally grown agricultural products. Although consumers' definition of "local" often varies by product and geographic location, studies have demonstrated significant price premiums for products labeled as locally produced (Darby, Batte, Ernst, & Roe, 2008; Giraud, Bond, & Bond, 2005; Patterson, Olofsson, Richards, & Sass, 1999; Schneider & Francis, 2005; Thilmany, Grannis, & Sparling, 2003). For example, Thilmany, Grannis, and Sparling (2003) compared three geographical regions of Colorado and found that approximately 25 percent of Western Slope respondents preferred to buy beef directly from producers — a rate three times higher than that of consumers in the urban Front Range region. In addition, Patterson et al. (1999) and Jekanowski, Williams, and Schiek (2000) found that consumers generally believed locally produced products to be of higher quality than those produced out of state, and this perceived higher quality resulted in consumers' willingness to pay higher premiums. A similar conclusion reached by Zepeda and Li (2006) suggested that consumers often purchased locally grown food primarily for its perceived freshness and higher quality. However, the intertwined connections between "locally produced" and other product attributes have made an accurate estimation of WTP rather difficult. For instance, Wolf and Thulin (2000) selected 413 sample respondents in Luis Obispo, California, and reported that attributes such as price, value, quality, leanness, and healthiness were more likely (than being local) to affect consumers' preferences of local food products. To avoid unnecessary complication, the authors focused this paper on soliciting the value of WTP for locally produced rib-eye steaks for consumers at farmers' markets, while emphasizing how specific consumer characteristics contribute to the variations in estimated WTPs. Although we also examined WTPs for other product attributes such as color, juiciness, and feed type, the objective of the study was to identify the value of "being local" for rib-eye steaks. We chose to study rib-eye steak because we believe that, particularly in the northern Great Plains, this product's high value and stable supply provide local small- and midscale producers great opportunities to establish value-added niche markets. In addition, while beef is a highly consumed agricultural product in the United States, Midwesterners consume beef at a notably higher rate than the national norm. Indeed, the average annual beef consumption per capita in the Midwest was 73 pounds (33.1 kg.) per person in 2005, or approximately 7 pounds (3.2 kg.) more than the national average (Davis & Lin, 2005).

In addition to the attributes of a product, the attributes of its consumers are also important in determining consumer preferences and WTP (Smith, 1956). In this study, we focused on consumers at farmers' markets because some studies found shoppers at farmers' markets often share similar consumer attributes and a potentially higher WTP for local food (Chang, Xu, Underwood, Mayen, & Langelett, 2013; Crow & Henneberry, 2013; Giraud, Bond & Bond, 2005; Govindasamy, Schilling, Sullivan, Turvey, Brown, & Puduri, 2004; Nganje, Hughner, & Lee, 2011; Thilmany, Bond, & Bond, 2008). The rising sales at farmers' markets in recent years reflects not only consumers' increasing demand for locally produced food, but also their interest in learning more about the source of their food. Farmers' markets provide consumers with both a sense of community and the opportunity to interact with local producers as well as with other consumers. Consequently, such venues have demonstrated great sales in recent years (Brown, Miller, Boone, Boone, Gartin, & McConnell, 2007; Frenzen & Davis, 1990; Oberholtzer & Grow, 2003). On the other hand, under the pressure of increasing input costs and global competition, beef

producers are constantly seeking effective marketing and production strategies. We believe shoppers at farmers' markets represent an important business opportunity for South Dakota's local beef producers to generate higher profit margins. Based on the information gathered from our discussions with local producers and stakeholders, we endeavored to answer the following three questions:

(1) What product attributes would generate higher profits?
(2) What types of consumers were more willing to pay for better quality beef?
(3) Did an emphasis on "locally produced" result in consumers' higher WTP for local beef products?

We organized this paper as follows. In the next section we provide a brief literature review. We then discuss the research methods and empirical model. We introduce the experimental survey design and data collection process, and then discuss the data and study results and some limitation of the study; finally, we offer a conclusion that examines the implications of the study.

Literature Review

Empirical data indicate that sales of local food and at farmers' markets have contributed an increasing portion of local producers' total income (Frenzen and Davis, 1990; Hunt, 2007). For example, a report published by the U.S. Department of Agriculture (USDA National Agriculture Statistics Service, 2006) suggested that products sold in farmers' markets made up about 25 percent of vendors' incomes. Another USDA survey study estimated that in 2000, at the 2,863 identified farmers' markets in the United States, approximately 66,700 farmers and 2,760,000 customers participated in transactions per week (Payne, 2002). The same study also estimated average annual sales of US$11,773 for vendors at farmers' markets during the same time (Payne, 2002). Due to the lack of empirical records for potential sales and profit margins for locally produced beef at farmers' markets in South Dakota, this study included shoppers at five local farmers' markets to estimate their WTP for locally produced rib-eye steaks.

Previous studies have identified potential WTP for beef's intrinsic attributes, including fat content, taste, nutritional value, and tenderness (Bond, Thilmany, & Bond, 2008; Killinger, Calkins, Umbeger, Feuz, & Eskridge, 2004; Platter, Tatum, Belk, Koonz, Chapman, & Smith, 2005; Purcell, 1993; Unnevehr & Bard, 1993), and extrinsic attributes, including GMO, organic production, and fairness (Carlsson, Frykblom, & Lagerkvist, 2007; Loureiro & Umberger, 2003, 2007; Maynard, Burdine, & Meyer, 2003; Umberger, Feuz, Calkins, & Killinger-Mann, 2002; Wolf & Thulin, 2000; Ziehl, Thilmany, & Umberger, 2005). However, most of these studies have focused either on different cuts of beef or on a broader product category (for example "beef" or "meat"). A careful review of the literature also suggests a shortage of demand-side studies for beef products in the northern Great Plains. To the best of our knowledge, consumers' price premiums for high-end beef cuts (such as rib-eye steaks) in this geographic region have never been formally reported in the literature. Therefore we believe this study contributes to the literature from the following three aspects: its focus on a particular cut of beef, its concentration on consumers in the northern Great Plains, and its effort to identify the key consumer characteristics that affect consumers' WTP.

Additionally, while previous studies aimed to reveal the connection between consumers' characteristics and their preferences for local beef, the conclusions were inconsistent, which created difficulty for producers in utilizing the resulting information. For instance, some studies' results implied that consumers, regardless of their similarities or differences, tended to have very comparable preference for specific product attributes. Additionally, Patterson et al. (1999) and Jekanowski et al. (2000) found that consumers generally believed locally produced products to be of higher quality than those produced out of state, and this perceived higher quality was the reason for consumers' willingness to paying higher premiums. A similar conclusion by Zepeda and Li (2006) suggested that consumers often purchased locally grown food primarily for its perceived freshness and higher quality. In contrast, other studies suggested that

consumers' preference and WTP can be notably different. For instance, Rao and Monroe (1988) suggested that the variations in rural consumers' preferences and WTP were due to gaps in their respective incomes, rather than their prior knowledge (or lack thereof) of the products. Two studies by Dentoni, Tonsor, Calantone, and Peterson (2009) and by James, Rickard, and Rossman (2009) suggested that consumers who have better knowledge of a product actually had less preference and WTP for that product's credibility attributes.

Yu and Gao (2010) suggested that variations in study methods, the selection of product and consumer attributes, the study time period, and the geographic locations all contributed to the inconsistency of estimating WTP for beef cuts. For instance, while Maynard et al. (2003) found that consumers were willing to pay a higher premium for locally produced beef, the authors did not specify to what cut of beef their estimated WTP applied. Moreover, even consumers who demonstrated a preference for locally produced products did not necessarily demonstrate a higher WTP for locally produced beef (Empacher, Gotz, & Schultz, 2002; Ziehl et al., 2005). Oftentimes various factors, such as the geographic location selected for study or consumers' definition of "local," can create varying results in consumers' WTP (Burnett, Kuethe, & Price, 2011).

To reduce the potential inconsistency and heterogeneity, we focused on consumers' preferences for only one specific, high-end cut of beef (rib-eye) and its attributes with a survey sample of shoppers collected strictly from local consumers in South Dakota. In particular, we wanted to study the price premium that rural consumers at South Dakota farmers' markets would pay for locally produced, high-end rib-eye steaks, compared to their valuation of other product attributes, such as color, juiciness, fat content, and feed type. In addition, we were interested in examining how specific consumer attributes created variations in their preferences and WTP.

Research Methods

Based on the random utility theory (Lancaster, 1966) and suggestion of Louviere (1988), Louviere and Woodworth (1983), and Louviere, Hensher, and Swait (2000), this study applied the Choice-Based Conjoint (CBC) technique that enabled us to control and design the survey questionnaire to collect essential information for the study. An increasing number of consumer and marketing researchers have applied conjoint experiment analysis to study the values of agricultural products and their attributes in recent years (Carlsson, Frykblom, & Lagerkvist, 2005; Darby, Batte, Ernst, & Roe, 2006, 2008; Darby et al., 2008; Wirth, Stanton, & Wiley, 2011; Manalo, 1990; Wang & Sun, 2003). With a careful control of the survey design and experiment procedure, the conjoint experiment method can elicit respondents' perceived importance of each attribute by their stated preference. Thus, researchers can predict consumers' choice of products and the trade-off between attributes to assist cost-sensitive, local producers in designing production and marketing plans that are more efficient.

According to Lancaster (1966), the utility for consumer i is a function of selected attributes for product j:

$$U_{ij} = U \text{ (Price, brand, other attributes)} \quad (1)$$

We assume that consumer i will make a discrete choice among j mutually exclusive alternatives in each choice set to maximize her or his utility (Louviere et al., 2000; Mayen, Marshall, & Lusk, 2007; Nganje, Hughner, & Lee, 2011). Given that ε_{ij} is a stochastic random error, Equation (1) can be written as:

$$U_{ij} = \beta\chi_{ij} + \varepsilon_{ij} \quad (2)$$

where β is a vector of unknown parameters to be estimated and χ_{ij} is a vector of attributes listed on the right-hand side of Equation (1), random utility theory allows us to separate the utility of individual i for a specific product into two components. The first term (i.e., χ_{ij} in Equation (2)) is a systematic component that will be used to include the utilities obtained from attributes χ_{ij}. The second term is the random term (i.e., ε_{ij} in Equation (2)) that contains the uncertainty resulting from both the unobservable influences of attributes and measurement errors.

We apply conditional logit and mixed logit models to estimate the coefficient values of $\beta's$ for Equation (2) (Louviere et al., 2000).[1] After finding values of $\beta's$, we calculated the corresponding WTP to show our sample consumers' WTP in order to obtain the benefits of the change in a specific product attribute j. For example, a consumer's WTP for a locally produced steak (brand attribute), as compared to a steak bearing a national brand label, is the price difference between the locally produced and the national brand steaks. Mathematically, we can measure the WTP by applying the following formula (Mayen et al., 2007):

$$WTP_j = \frac{\beta_{j=1} - \beta_{j=0}}{-\beta_{price}} \quad (3)$$

where $\beta_{j=1}$ is the estimated coefficient for the attribute j at the desired level, $\beta_{j=0}$ is the coefficient for the attribute j at the base level, and β_{price} is the coefficient value for price. For example, compared to the same product under a national brand, the WTP for a locally produced steak is $(\beta_{local} - \beta_{national})/(-\beta_{price})$. We expect this WTP to be positive if consumers prefer to eat locally grown beef. For other attributes with omitted levels, the coefficient value of $\beta_{j=0}$ will be set as zero. Moreover, if zero lies within the corresponding confidence interval of any estimated WTP (by applying Equation (3)), we should conclude this WTP as statistically insignificant (i.e., indifferent from zero). However, we suggest readers to be cautious in interpreting any estimated WTP that is statistically indifferent from zero.

Experimental Survey Design

Attribute Selection

The first step in designing a CBC survey questionnaire is to select suitable product attributes (i.e., χ_{ij} in Equation (2)). To improve the quality of experiment design, we conducted one preliminary study with different versions of the survey questionnaire given to a small number of interviewees. Combining results from the preliminary study and the information gathered from local producers, we chose the following five beef attributes (in addition to price): brand, fat content, organic production (as opposed to natural[2] or conventional production), color, and juiciness.[3]

The first two attributes, price and brand, are necessary to measure consumers' WTP for locally grown steaks. After collecting shelf prices from various supermarkets, we set four discrete levels for the price attribute ranging from US$4.99 to US$10.39, based on a unit weight of one 8 oz. (0.2 kg.) rib-eye steak. We assigned the brand attribute to four different levels: national brand (Omaha Steaks), regional brand (South Dakota Certified), locally grown, and an opt-out option (none). We used the brand variable to create the profiles (choice sets) for respondents to choose. Combining brand and price attributes to the linear function based on Equation (2), we were able to estimate the monetary value of consumers' preference for a "locally produced" product.

Increased concern for one's health (e.g., fat and cholesterol content) has certainly become one of the most important determinants of U.S. consumers' demand for beef products (Lusk & Schroeder, 2004; Menkhaus, Colin, Whipple, & Field, 1993; Ward, 2004; Ward, Lusk, & Dutton, 2008). Evidence showed that consumers are willing to pay a higher price for reduced fat content in

[1] See Appendix A for a brief discussion of conditional logit and mixed logit models. For the rationale of choosing logit and mixed logit models, read chapter 6 of Louviere et al. (2000).

[2] USDA (2013) defines "natural" as "a product containing no artificial ingredient or added color and is only minimally processed. Minimal processing means that the product was processed in a manner that does not fundamentally alter the product." (USDA, 2013, "Natural," para. 1).

[3] Although there are many factors we could look at, the decision for choosing these five attributes to use in this study was made based on the requests of local producers and stakeholders. We would also like to express our gratitude for Dr. Keith Underwood for his suggestion in attribute selection for this study. While previous studies have recognized WTPs for attributes similar attributes to the ones included in this study, none of these study results can be applied to explain consumers' price premium for the rib-eye steaks produced in South Dakota.

beef. For instance, Ward et al. (2008) found that consumers would pay a premium (ranging from US$0.18/lb. to US$1.39/lb.) for ground beef with at least 96 percent leanness, compared to the same beef cut with 95 percent to 80 percent leanness. Brester, Lhermite, Goodwin, & Hunt (1993) used the hedonic price method to study wholesale beef markets and found that consumers would pay a premium of approximately US$0.02/lb. to increase 1 percent leanness of ground beef. Parcell and Schroeder (2007) applied a similar method to consumers' self-reported records from the Meat Panel Diary data and concluded that a 1 percent increase in leanness would incur an increase of US$0.039/lb. in consumers' WTP for ground beef. Therefore, we included four levels of leanness (80 percent to 95 percent) in this study to estimate consumers' WTP for reduced fat content in rib-eye steaks, assuming that consumers were able to distinguish the difference between marbling (fat within the lean sections of meat) and fat on the exterior of steaks.

As American consumers' concern for their health has increased, so too has their concern about *how* their food is produced; thus organic foods have enjoyed an outstanding increase in market demand over the past two decades. From 2004 to 2007, organic food sales in the U.S. increased from US$11 billion to US$27 billion (USDA-ERS, 2013). The annual growth rates of organic food sales were around 10 percent to 15 percent from 2004 until the financial crisis hit the U.S. economy in 2009 (USDA-ERS, 2013). Nevertheless, even a 7.4 percent growth rate in 2012 was more than double the annual growth rate for all food sales in the same year (USDA-ERS, 2013). However, a product's "organic" designation does not necessarily ensure a stable profit margin. For instance, James et al. (2009) applied the stated choice method in a survey study and found that a better knowledge of agricultural production would actually *reduce* consumers' WTP for organic products. Furthermore, the stiff market competition associated with the organic food industry has created obstacles for local producers to start up a business in organic production. Because industrial-scale farming and long-distance shipping methods have gradually permeated the organic food markets, small and medium-sized local producers cannot compete (Cloud, 2007).[4] In addition, the procedure for getting USDA organic certification can be so costly that many small and medium-sized producers simply choose not to do so.

Since altering the fat content or the production type (i.e., organic, natural, or conventional) of an agricultural product can be extremely costly, this study included these two attributes to determine whether rural consumers (those who frequent farmers' markets in South Dakota) would pay a sufficient price premium to offset the higher costs of producing such products. We also included the attributes of color and juiciness in the survey questionnaires to gather potential price premium information for these attributes, as requested by local producers in the region. Table 1 summarizes all product attributes and the levels of each attribute included in this study.

Experiment Design and Cheap Talk

The second step in creating our study's survey was to design a questionnaire to which respondents could easily and correctly respond (Mayen et al., 2007). The questionnaire in this study contained two parts. The first part of the questionnaire collected required information with which to study consumers' preference and WTP. We applied fractional-factorial design technique with only main effects of the attributes included in this part of the questionnaire. To maintain the best quality of the experimental design, we created an original design with 144 choice sets and applied the blocking technique to assign eight choice sets to each participant (Kuhfeld, 2010).[5] Table 2 shows one of the eight choice sets in the first part of the questionnaires. Each of the first three rows is a choice option representing a set of attributes at specific levels listed on the subsequent columns. The levels for the attributes randomly varied across choices

[4] While we have quoted Mr. Cloud's article here to support our argument, the authors also drew a similar conclusion from the information gathered by personal interviews with local producers who prefer to remain anonymous.

[5] See Kuhfeld (2010) for further information regarding the methods of experimental design and the SAS coding for "blocking" technique.

Table 1. Summary of Selected Product Attributes and Levels

Attributes	Levels
Brand	• National Brand (Omaha Steaks) • State-Level brand (South Dakota Certified) • Locally Grown • None (Opt-Out)
Price	• US$4.49 per lb. • US$6.79 per lb. • US$8.59 per lb. • US$10.39 per lb.
Color	• Red • Cherry Red • Brown
Juiciness	• Very Juicy • Juicy • Not Juicy
Leanness	• 80% • 85% • 90% • 95%
Organic	• Organic • Natural • Conventional Feed

characteristics affected the variations of estimated WTP.

We followed the method suggested by Dillman (2000) in administering the survey. The cover letter explained the research objectives and included an example as well as an explanation of how to answer the questionnaire. In addition, the cover letter contained a color picture of an 8 oz. (0.2 kg.) rib-eye steak in order to provide a consistent image for survey participants. A potential problem of applying CBC studies lies in that respondents tend to overestimate their stated WTP, which could damage the implementation and the usefulness of the study results (Carlsson et al., 2005; Carlsson & Martinsson, 2001; Lagerkvist, Carlsson & Viske, 2006). Therefore, this study included a "cheap talk" treatment in the cover page to reduce the problem of such hypothetical bias (Bulte, Gerking, List, & de Zeeuw, 2005; Cummings & Taylor, 1999).[6] To close the cover letter, we provided the

Table 2. Sample Choice Set Used in the Conjoint Experiment

Brand	Price	Color	Juiciness	Fat Content	Production Type
Omaha Steaks	US$6.79	Brown	Juicy	95% leanness	Natural
S.D. Certified	US$4.99	Brown	Juicy	85% leanness	Organic
Locally Produced	US$10.39	Cherry Red	Not Juicy	85% leanness	Conventional
None					

following the principles of Fractional Factorial design. The last row of each choice set is an opt-out option (i.e., "None").

In addition to basic demographic and socio-economic information gathered in the first section of the questionnaire, the second part acquired information regarding respondents' health condition, nutrition-related knowledge, and shopping behaviors. The questionnaire also requested respondents to disclose their monthly food budget, spending on beef and other meats, and food preferences. This study included these questions to collect information to identify our sample consumers' characteristics. We then utilized this information to investigate how consumer

administrators' contact information to answer any questions that participants may have had.

We chose to deliver the questionnaires through in-person contacts at local farmers' markets. We personally distributed 716 questionnaires at five different farmers' markets during the months of July and August 2011. Of these five markets, one was located in the Sioux Falls metropolitan area, and the rest were located in small, rural towns in eastern South Dakota. We visited each farmer's market twice during the survey period and stayed the entire time period that the market was open on that day. During each visit, research team members

[6] See Appendix B for the script of the "cheap talk" treatment.

stood at the entrances and exits of the market and greeted shoppers. After verbally explaining the purpose and procedure to participate in the survey, we asked participants to complete and return the surveys before a given due date. To increase the sample size, we tried to reach as many shoppers as possible and did not limit our contacts to specific types of shoppers. We also informed participants that their responses would enter them in a drawing to win one of ten US$100 gifts. At this point, we would like to note a potential problem in sample selection bias within this study: since the participants in the study were voluntary, it is very possible that only shoppers who were interested in our study would respond to our request. In addition, although we tried to contact as many shoppers as possible, the sample observations were limited to those shoppers who visited the farmers' market on the same days that the research teams visited the markets.

Results and Discussion

Of the 716 questionnaires delivered, we received 251 returned surveys; however, of these only 212 surveys were usable for analysis. The overall usable response rate for the study was 29.6 percent. We also separated the sample responses gathered in Sioux Falls (denoted as *City*) from those gathered in the small eastern SD towns (denoted as *Rural*) to examine whether significant differences exist between characteristics preferred by city or rural respondents. Table 3 lists the mean value and resulting chi-square value from the Kruskal-Wallis test (titled "Kruskal-Wallis Test/Chi-Square") for each variable.[7] The resulting chi-square value from the Kruskal-Wallis test enables us to test the null hypothesis of no significant difference between *City* and *Rural* groups. For example, the resulting chi-square value for the Kruskal-Wallis for variable *Gender* is 0.415, indicating that we cannot reject the null hypothesis that both groups of consumers have similar gender distribution.[8]

Although we expected more disparity in the characteristic preferences to be demonstrated between city and rural groups, Table 3 suggests there are only a few statistically significant differences. Overall we found a surprisingly similar nature in the demographic and socio-economic backgrounds between *City* and *Rural* groups. Both groups have considerably more female than male respondents, and more than 80 percent of the participants in the survey are the primary shoppers for their households. Both groups also contain a large percentage of Caucasians (98 percent for the *City* group and 95 percent for the *Rural* group), which indicates a lack of diversity among consumers in South Dakota farmers' markets. Indeed, Table 3 shows the only variables that revealed significant differences between two groups are *Age, Bloodpressure, Fambeef,* and *Famchicken.* Therefore, we combined the samples from *City* and *Rural* groups into one group for the following analysis to enhance the quality of the empirical study results. However, readers should avoid assuming that shoppers within the *City* group were all from the Sioux Falls metropolitan area, because some shoppers at the Sioux Falls farmers' market might have travelled from nearby small towns. Conversely, urban residents were less likely to travel 50 miles (80 km.) or more to small-town farmers' markets, especially if they had better shopping options available in the city in which they resided.

Willingness to pay (WTP)

Using the estimated coefficient for each attribute from the results of conditional logit and mixed logit models, we were able to generate consumers' WTP by applying Equation (3).[9] Table 4 shows the estimated WTP and the corresponding 95 percent confidence interval for each level of the selected attributes. If zero lies somewhere inside the confidence interval for an estimated WTP, we considered this WTP is indifferent from zero and

[7] Appendix C provides a summary table of sample consumers' demographic, socio-economic, dietary, and selected behavior-related variables, along with the results of Kruskal-Wallis test.
[8] We choose Kruskal-Wallis test over the conventional one-way ANOVA test because the latter method does not acquire the assumption of normal distribution for the variables. In addition, Kruskal-Wallis tests often generate relatively reliable results when the sizes of the subgroups are not the same.
[9] See Appendix D for the information regarding the estimation results and estimate coefficients from conditional and mixed logit models.

Table 3. Variable Definition and Means of Consumer Attributes

Variable	Definition	Mean Values (Standard Deviation)			Kruskal-Wallis Test/Chi-Square
		Full Sample	*City*	*Rural*	
Gender	Male=1; Female=0	0.30 (0.46)	0.27 (0.45)	0.32 (0.47)	0.415
Married	Married/Live with partner	0.74 (0.44)	0.75 (0.44)	0.72 (0.45)	0.660
Shopper	Primary shopper for the household (Yes=1)	0.86 (0.35)	0.82 (0.39)	0.89 (0.31)	0.130
Caucasian	Yes=1	0.96 (0.19)	0.98 (0.14)	0.94 (0.23)	0.201
High school	Highest degree (Yes=1)	0.10 (0.31)	0.08 (0.27)	0.13 (0.33)	0.285
College	Highest degree (Yes=1)	0.51 (0.50)	0.55 (0.50)	0.48 (0.50)	0.325
Age	1: <16; 2: 16–25; 3: 26–35; 4: 36–45; 5: 46–55; 6: 56–65; 7: ≥66	5.07 (1.47)	4.91 (1.40)	5.21 (1.53)	0.080*
Dependents	Number of dependents in the household/ 1: zero dependents; 2: 1 dependent; 3: 2 dependents; 11: 10 dependents or above (none of the respondents chose "11")	1.35 (0.86)	1.45 (0.91)	1.27 (0.80)	0.129
Employed	Yes=1; No=0	0.77 (0.42)	0.82 (0.39)	0.73 (0.44)	0.128
FamIncome	See Table 3/Household/1: ≤US$15,000; 2: US$15,000–30,000; 7: ≥US$90,000	4.91 (2.10)	5.17 (1.94)	4.67 (2.21)	0.116
Overweight	Number of family members who were overweight or obese	1.94 (0.93)	1.86 (0.86)	2.01 (0.98)	0.249
BloodPressure	Number of family members who have high blood pressure	1.51 (0.82)	1.39 (0.58)	1.62 (0.97)	0.065*
Cholesterol	Number of family members who have high cholesterol	1.65 (1.00)	1.56 (0.83)	1.73 (1.12)	0.333
Fambeef	Beef is the most consumed meat in the household (Yes=1)	0.46 (0.50)	0.36 (0.48)	0.54 (0.50)	0.007***
Famchicken	Chicken is the most consumed meat in the household (Yes=1)	0.39 (0.49)	0.52 (0.50)	0.26 (0.45)	0.0002***
MeatRatio	% of family food budget on meat	2.02 (0.81)	1.99 (0.78)	2.05 (0.83)	0.557
Localbeef	Purchase beef from local producers or self-produced beef (Yes=1)	0.21 (0.41)	0.17 (0.38)	0.24 (0.42)	0.2038
Groclocal	Often purchases groceries at local stores (Yes=1)	0.10 (0.30)	0.08 (0.27)	0.12 (0.32)	0.3813
Knowledge	Number of correct answers from 6 nutrition-related questions	4.09 (0.98)	4.04 (1.00)	4.14 (0.97)	0.3968
Exercise	Frequency of exercise per week/1: none; 2: once 3: 2–3 times; 4: 4–5 times; 5: more than 5 times	2.94 (1.26)	2.92 (1.24)	2.96 (1.27)	0.7417
Better	Participant believes he or she is making better food choice than his or her parents/ 1: strongly agree; 5: strongly disagree	0.69 (0.46)	0.72 (0.45)	0.67 (0.47)	0.4284
Encourage	Family encouraged to eat a healthy diet/ 1: strongly agree; 5: strongly disagree	3.75 (1.04)	3.77 (1.11)	3.73 (0.97)	0.6745

Note: For each variable, the Kruskal-Wallis is applied to test the null hypothesis of no significant difference in mean values between City and Rural groups.
* indicates that we rejected the null hypothesis with a 90 percent confidence level. ** indicates that we rejected the null hypothesis with a 95 percent confidence level. *** indicates that we rejected the null hypothesis with a 99 percent confidence level. No star indicates that we could not reject the null hypothesis.

Table 4. Comparing Results of Willingness to Pay and Confidence Interval Using Two Models: Conditional Logit and Mixed Logit Models (all values in US$)

	Conditional Logit Model		Mixed Logit Model	
Changes in Attributes	*WTP (per lb.)*	*Confidence Interval*	*WTP (per lb.)*	*Confidence Interval*
SD Certified to Locally Produced	$0.68	$0.20–$1.16	$0.15†	–$2.54–$2.57
Omaha Steaks to Locally Produced	$3.47	$2.70–$4.23	$0.02†	–$2.04–$2.34
Brown to Cherry Red	$2.56	$1.85–$3.24	$2.52	$1.83–$3.21
Brown to Red	$2.53	$1.82–$3.23	$2.48	$1.78–$3.18
Not Juicy to Very Juicy	$3.97	$3.10–$4.84	$3.98	$3.10–$4.85
Not Juicy to Juicy	$3.65	$0.43–$1.90	$3.62	$2.98–$4.25
80% to 85% Leanness	$1.17	$0.07–$0.20	$1.18	$0.45–$1.91
80% to 90% Leanness	$1.57	$0.83–$2.31	$1.58	$0.84–$2.32
80% to 95% Leanness	$1.86	$1.08–$2.64	$1.86	$1.09–$2.64
Conventional to Natural Feed	$1.60	$0.93–$2.27	$1.60	$0.93–$2.27
Conventional to Organic Feed	$1.59	$0.96–$2.23	$1.52	$0.89–$2.14
Omaha-Local-Shop Local	—	—	$1.33†	–$3.21–$0.55
SD-Local-Shop Local	—	—	$1.09†	–$2.73–$0.55
Omaha-Local-Beef	—	—	$1.36	$0.22–$2.50
SD-Local-Beef	—	—	–$0.04†	–$0.97–$0.90
Omaha-Local- Knowledge	—	—	$0.63	$0.06–$1.21
SD-Local-Knowledge	—	—	$0.15†	–$0.34–$0.63
Omaha-Local-Meat Budget	—	—	$1.21†	–$0.96–$3.39
SD-Local-Meat Budget	—	—	$0.18†	–$1.44–$1.81

† Denotes any estimated WTP different from zero.

concluded that consumers do not pay to change from one level to another level of this specific attribute. We used the superscript † for any estimated WTP that is indifferent from zero.

The results from conditional logit model analysis suggest that our sample shoppers at farmers' markets obtain a higher WTP (approximately US$3.47) to replace national brand products with steaks produced in South Dakota or in neighboring communities.[10] However, the comparatively small WTP between South Dakota (SD) Certified and locally produced steaks (US$0.68) indicates that our sample consumers do not differentiate between steaks produced in South Dakota and steaks labeled as produced in neighboring communities. This result suggests that our sample consumers define products that are "locally produced" as being produced within the state of South Dakota and not limited to their local communities.

The mixed logit model enables us to identify the variations of WTP for brand preference for the following four types of consumers: (1) consumers whose families eat more beef than other types of meats; (2) consumers who designate a greater portion of their grocery budget for meat purchases

[10] The weight unit for our estimate WTP is 8 oz. (0.2 kg.).

(as compared to other food items); (3) consumers who posses significant nutrition-related knowledge; and (4) consumers who often shop at local grocery stores.[11] Notably, the mixed logit model results show estimated WTP for *SD Certified to Locally Produced* and *Omaha Steaks to Locally Produced* (US$0.15 and US$0.02, respectively) are both trivial and indifferent from zero, indicating consumers' WTP for locally produced steaks is dominated by factors other than the brand preference when the consumer characteristics are included in the analysis. On the other hand, the coefficient for *Omaha-Local-Beef* (US$1.36) suggests that households in which more beef is consumed at home than any other meat also have higher price premiums for locally produced rib-eye steaks. In addition, the coefficient of *Omaha-Local-Knowledge* (US$0.63) shows that consumers with greater health knowledge also exhibit a higher WTP than consumers with poor health knowledge. These results indicate that household beef consumption and health knowledge contribute to the heterogeneity in WTP for locally produced steaks for consumers at farmers' markets. However, the influences of these two consumer characteristics on the brand preference are limited to a national brand versus other options. Again, no price premium exists between steaks labeled as produced by local communities or produced in South Dakota.

To our surprise, a higher inclination to shop locally does *not* affect consumers' willingness to pay, as all related WTP in Table 4 (US$1.33 for *Omaha-Local-Shop Local* and US$1.09 for *SD-Local-Shop Local*) are statistically insignificant from zero. This finding seems to be inconsistent with the findings from other studies. For example, Keeling Bond, Thilmany, & Bond (2006) studied the survey data collected from 3,170 grocery shoppers and found that patrons who frequently participated in direct markets often demonstrated a higher WTP for locally grown food, a conclusion shared by Stephenson and Lev (2004) in their study of consumers in Oregon. However, our study results suggest that consumers at farmers' markets do *not* necessarily pay a higher premium for locally produced steaks. Indeed, Ziehl et al. (2005) suggested that rural consumers often expressed a preference for locally produced products but were also unwilling to pay any premiums for their preferences. Our study result seems to support Ziehl's finding.

The estimated WTP in Table 4 suggests that our sample shoppers are willing to pay for most of the product attributes listed in our survey (i.e., X_{ij} in Equation (2)). The nearly identical results from conditional logit and the mixed logit models indicate that our respondents have very consistent WTP for these attributes, regardless of the differences in consumer characteristics. Among all of the attributes, our sample consumers hold higher price premiums for juiciness and the color of their steaks than other attributes. Table 4 shows the coefficients for *Not Juicy to Very Juicy* (US$3.97 for conditional logit model and US$3.98 for mixed logit model) and *Not Juicy to Juicy* (US$3.65 for conditional logit model and US$3.65 for mixed logit model) are significant and, in fact, are the highest among all other product attributes. The coefficients for *Brown to Red* (US$2.56 for conditional logit model and US$2.52 for mixed logit model) and *Brown to Cherry-Red* (US$2.53 for conditional logit model and US$2.48 for mixed logit model) also suggest that consumers demonstrate a high price premium for better-looking color in their steaks. These results suggest that when choosing high-end cuts of steak, consumers in South Dakota farmers' markets mainly seek a colorful appearance and a superior eating experience.

Table 4 shows that health concerns also created price premiums for related attributes, although the resulting WTP is not as significant as the WTP for improved color and juiciness of steaks. Compared to the omitted 80 percent leanness level, the WTP for three different, higher levels of leanness generate price premiums between US$1.17 and US$1.86. Interestingly, Table 4 shows diminishing price premiums toward the higher leanness level: producers enjoy a US$1.17 price premium to increase leanness from 80 percent to 85 percent, while producers obtain only US$0.69

[11] We selected these four attributes based on the results discussed in Appendix D as well as on our discussions with local beef producers.

(=US$1.86 minus US$1.17) to improve leanness from 85 percent to 95 percent, as Table 4 suggests. In addition, steaks produced from both naturally and organically fed beef generate a price premium of approximately US$1.60 over steaks produced from conventionally fed beef, which suggests that consumers at farmers' markets are not necessarily concerned about the feed type when purchasing high-end cuts of steak. Of particular note, Table 4 indicates that consumers' preference and WTP for specific product attributes can vary significantly even for products within the same category. Compared to our study results, Chang et al. (2013) conducted a survey study in South Dakota and found that consumers in supermarkets obtained the highest WTP to reduce fat content (instead of improving color and juiciness) for ground beef.

Overall, our study results suggest that South Dakota consumers at farmers' markets generally are willing to pay a premium for locally produced steaks. However, the small difference in WTP between steaks produced in-state or in nearby communities implies that these consumers generally define "local" as anywhere in the entire state of South Dakota. Furthermore, the results from mixed logit model analysis suggest that the higher price premium for buying locally comes primarily from consumers whose households consume more beef than other meats and whose nutrition-related knowledge is excellent. In addition, data show that although consumers at farmers' markets express an explicitly higher WTP for better quality steaks, a large portion of their WTP is attributable to avoiding the purchase of low-quality meat (e.g., a prefererence for red or cherry-red colored steaks to brown steaks). For example, Table 4 shows that our sample shoppers are willing to pay US$2.56 to replace steak color from *Brown* to *Cherry Red* and US$2.53 to replace color from *Brown* to *Red*. The difference in WTP between Cherry Red and Red is only US$0.03. In other words, the rewards for beef producers to improve quality of steaks (to sell their products to shoppers at farmers' market) become trivial once the quality reaches a certain high level.

Limitations of the Study

Although this study accomplished its objectives, we also recognize some limitations on which we would like to elaborate before reaching the study conclusions.[12] First, because our sample observations were collected strictly from farmers' markets, we caution readers not to apply this study's results to all consumers. Second, because our sample size was rather small (212 survey respondents), we encourage further research to include a larger sample from which to draw more statistically significant conclusions. Third, while we expected more differences in characteristics between *City* and *Rural* groups, Table 3 indicates that sample shoppers in these two groups were quite similar. However, it is also possible that some sample observations included in the *City* group were actually shoppers who lived in nearby small towns and drove to the metropolitan farmers' market to shop during the weekend. Therefore, we suggest future studies to incorporate questions in their surveys to help researchers to identify where participants reside. Fourth, because the decision to participate the study was voluntary, we admit potential problems of sample selection bias.

Conclusions and Implications

This study applied the CBC analysis to study consumers' preferences and WTP for locally produced rib-eye steaks. We selected shoppers at five different farmers' markets to participate in the survey study in order to acquire information regarding which consumers at farmers' market might potentially pay higher price premiums for locally produced rib-eye steaks. The study results apply to consumers who shop at farmers' market or who prefer to purchase local food.

The study results suggest that all product attributes selected for inclusion in this study contribute to higher WTP for shoppers at farmers' markets. Among all of the attributes included, juiciness and color were the most important product attributes in generating higher price premiums. Likewise, other attributes, including brand difference, fat content, and feed methods, also contributed to consumers' higher WTP, although these attributes did not affect their WTPs as significantly as taste and appearance did. In

[12] We appreciate anonymous reviewers' suggestions.

addition, this study revealed that while being "locally produced" has a notable effect on WTP for shoppers at farmers' markets, only those with high family beef consumption or an excellent knowledge of nutrition demonstrate a significant price premium for locally produced rib-eye steaks.

We recommend that local beef producers in South Dakota continue to improve the quality of their products, as our study results suggested a higher premium for better quality steaks. However, because improving product quality increases production costs, we suggest that beef producers carefully review and prioritize their efforts. For example, Table 4 suggests that juiciness (taste) and color (appearance) of steaks are the most inconsistent yet also the most potentially profitable attributes for beef producers who sell rib-eye steaks at farmers' markets. On the other hand, although these consumers would pay a premium price to reduce exterior fat and to switch from conventional to natural or organic meat, the resulting profit margins are not as high as when producers improve the color and juiciness of their steaks. Our study results also found that while shoppers at farmers' markets are willing to pay for higher quality meat, the profit margins (WTPs) diminish once the quality of steaks improves to a specific (high) level. Therefore, we recommend that local beef producers carefully examine both costs and benefits when making any decision to upgrade product quality.

Based on the differences between our results and an earlier study by Chang et al. (2013), we recommend that future studies on the costs and WTP of beef products focus on a particular beef cut and on a small geographic location in order to generate results that are more precise and to avoid heterogeneity issues. In addition, our study results indicate that consumers with some specific characteristics are more likely to pay higher premiums for locally produced steaks. To help local producers to identify the relationship between consumer characteristics and potential profit margins, we also recommend further research and efforts to include a larger sample pool to generate results that are more robust.

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Appendix A. A Brief Discussion of Conditional Logit and Mixed Logit Models

This appendix provides a brief discussion of the econometric methods we applied in this study. See Greene (2000) for more details regarding conditional logit and mixed logit models.

Conditional Logit Model

The probability that any individual i will choose the j alternative over all other k options from a given choice set C is the probability that the utility of choosing that alternative is greater than the resulting utility from other k options (Mayen et al., 2007; McFadden, 1974):

$$P_{ij} = P\left(\beta\chi_{ij} + \varepsilon_{ij} > \beta\chi_{ik} + \varepsilon_{ik};\ j \neq k \in C\right) \tag{A1}$$

$$P_{ij} = P\left(\varepsilon_{ij} - \varepsilon_{ik} > \beta\chi_{ij} - \beta\chi_{ik};\ j \neq k \in C\right) \tag{A2}$$

We assume that all the error terms ε_{ij} are independent and identically distributed across all j alternatives, with an extreme value type I distribution and scale parameter to 1. Accordingly, the probability of an individual i choosing alternative j is given by (Mayen et al., 2007):

$$P_{ij}\{j \text{ is chosen}\} = \frac{\exp(\beta\chi_{ij})}{\sum_{k=1}^{J}\exp(\beta\chi_{ik})} \tag{A3}$$

By limiting the systematic component χ_{ij} to include product attributes, we estimate the probability of choice by applying the conditional logit model. The vector of coefficients β in Equation (A3) will be estimated to represent the effect of a specific attribute on the utility of the product of interest. For instance, if the law of demand holds, we would assume $\frac{\partial U}{\partial \mathrm{Price}} < 0$ under a perfect competitive market.

Mixed Logit Model

We added the mixed logit model to control the problem of independence of irrelevant alternatives (IIA) and to explore the unobserved heterogeneity of preference and WTP caused by specific consumer attributes (Carlsson, Frykblom, & Lagerkvist, 2007; Layton & Brown, 2000; Louviere et al., 2000; Train, 1998). By including both product and consumer attributes in the vector χ_{ij}, the mixed logit model allows some estimated coefficients β to be random variables and to vary across sampled individuals. For individual i, the coefficient vector β in equation (2) is defined:

$$\beta_i \sim \mathrm{D}\left(\theta, \nu\right) \tag{A4}$$

where D $(\cdot)$ is a probability distribution function with mean θ and variance ν. The mixed probit model allows us to define D $(\cdot)$ either as an individual distribution function for each element or as the same distribution for some or all of the elements in the vector β. Whether θ and ν are independent is determined by the specification of D $(\cdot)$. Given that $\delta(\beta)$ is the density function for random coefficients β, the probability of individual i to choose alternative j is given by:

$$P_{ij} = \int \frac{\exp(\chi_{ij}\beta)}{\sum_{K=1}^{J}\exp(\chi_{ik}\beta)}\delta(\beta)d\beta \tag{A5}$$

This specification enables the researchers to capture the potential heterogeneity in preferences among sample respondents, based on consumer characteristics of interest. Occasionally, if consumers are relatively homogeneous, the estimation results from applying the conditional logit model and the mixed logit model should be equivalent (Louviere et al., 2000).

Appendix B. Script of the Cheap Talk Treatment

Below is the script of the "cheap talk" treatment we included in the cover letter of the survey questionnaire. The purpose of applying this cheap talk treatment was to reduce hypothetical bias.

Before you start the survey, we want to share a major concern with you regarding the accuracy of this survey.

Previous studies have shown that people often respond in one way but act in another. To be specific, people tended to report a **higher** willingness to pay for products than what they really wanted to pay. We believe that the positive feeling associated with "supporting locally produced food products" may create an ideal amount of money that people may be willing to pay for locally produced food in the minds of survey respondents. When we hear about the concept of "supporting locally produced food products," it is only natural for our basic reaction to such a hypothetical setting to be: "Sure, I would be happy to pay more for the locally produced food." In addition, people tend to be more generous when they do not actually have to pay for the purchasing choices reflected in the survey.

However, when the scenario is real and people would actually <u>have</u> to pay for what they select in the survey, people tend to think quite differently. We still would like to support locally produced food products, but when we face the possibility of spending our <u>own</u> money, we start to think about other ways in which to spend the same amount of money. In addition, the limited amount of money we are able to spend will also affect our answers.

In any case, we would like to ask you to answer the following survey questions as if you were **really** going to pay for what you choose. Please keep in mind that a hypothetical high biased price may send the wrong information to local producers. They may invest more of their money and efforts into the business than they should, based on information that you provide in this survey.

Your answers are important because local farmers might make production and marketing decisions based on the results of this study. Your participation and your honesty may have a significant impact on both local food producers and on the community.

Appendix C. Table of Basic Descriptive Statistics for the Sample Consumers

Table C-1. Survey Data Descriptive Statistics

Variable	Mean (N=212) Full Sample	Mean Group 1 (N=100) *City*	Mean Group 2 (N=112) *Rural*
Gender			
Female	149 (70.28%)	73 (73%)	76 (67.86%)
Male	63 (29.72%)	27 (27%)	36 (32.14%)
Primary Shopper for the Household			
Yes	182(85.85%)	82 (82%)	100 (89.29%)
No	30 (14.15%)	18 (18%)	12 (10.71%)
Age			
Less than 26	6 (2.83%)	3 (3%)	3 (2.68%)
26–35	42 (19.81%)	20 (20%)	22 (19.64%)
36–45	20 (9.43%)	12 (12%)	8 (7.14%)
46–55	47 (22.17%)	25 (25%)	22 (19.64%)
56–65	57 (26.89%)	28 (28%)	29 (25.89%)
66 or above	40 (18.87%)	12 (12%)	28 (25.00%)
Married or Living with Partner			
Yes	156 (73.58%)	75 (75%)	81 (72.32%)
No	56 (26.42%)	25 (25%)	31 (27.68%)
Caucasian? (Yes)	204 (96.23%)	98 (98%)	106 (94.64%)
Employed (Yes)	164 (77.36%)	82 (82%)	82 (73.21%)
Education			
High School Graduate	22 (10.38%)	8 (8%)	14 (12.50%)
College Graduate	109 (51.42%)	55 (55%)	54 (48.21%)
Family Income			
Less than US$15,000	11 (5.19%)	4 (4%)	7 (6.25%)
US$15,001–30,000	17 (8.02%)	6 (6%)	11 (9.82%)
US$30,001–45,000	29 (13.68%)	13 (13%)	16 (14.29%)
US$45,001–60,000	29 (13.68%)	15 (15%)	14 (12.50%)
US$60,001–75,000	30 (14.15%)	12 (12%)	18 (16.07%)
US$75,000–90,000	28 (13.21%)	16 (16%)	12 (10.71%)
Higher than US$ 90,000	46 (21.70%)	26 (26%)	20 (17.86%)
Unknown	22 (10.38%)	8 (8%)	14 (12.50%)
% of Family Food Budget Spent on Meat			
≤ 20%	55 (25.94%)	26 (26%)	29 (25.89%)
> 20% and ≤ 40%	106 (50.00%)	53 (53%)	53 (47.32%)
> 40% and ≤ 60%	44 (20.75%)	18 (18%)	26 (23.21%)
> 60% and ≤ 80%	5 (2.36%)	2 (2%)	3 (2.68%)
> 80%	2 (0.94%)	1 (1%)	1 (0.89%)
Buy Beef from Butcher or Produce Beef by Oneself			
Yes	44 (20.75%)	17 (17%)	27 (24.11%)
No	168 (79.25%)	83 (83%)	85 (75.89%)

Appendix D. Estimates Results and Discussion from Condition and Mixed Logit Models

Table D-1. Estimated Coefficients Corresponding to Each Product Attribute

	Conditional Logit		Mixed Logit	
Variables	**Coefficient**	**Standard Error**	**Coefficient**	**Standard Error**
Omaha Steaks	0.248 ***	0.196	2.812***	0.498
SD Certified	1.010***	0.190	2.775***	0.465
Locally Produced	1.195***	0.192	2.817***	0.457
Price	–0.273***	0.018	–0.276***	0.019
Red	0.696***	0.087	0.696***	0.088
Cherry Red	0.689***	0.088	0.686***	0.089
Very Juicy	1.084***	0.091	1.100***	0.092
Juicy	0.996***	0.089	1.00***	0.090
Lean 85%	0.319***	0.100	0.326***	0.101
Lean 90%	0.428***	0.098	0.436***	0.010
Lean 95%	0.508***	0.102	0.516***	0.102
Natural	0.437***	0.087	0.443***	0.087
Organic	0.436***	0.083	0.420***	0.084
Heterogeneity in the Mean (Brand-Consumer Attribute)				
Shop local				
Omaha Steaks	—	—	–0.497*	0.287
SD Certified	—	—	–0.563**	0.257
Locally Produced	—	—	–0.865***	0.256
Beef is the Most Consumed Meat in the Household				
Omaha Steaks	—	—	1.128***	0.210
SD Certified	—	—	1.518***	0.190
Locally Produced	—	—	1.505***	0.186
Meat to Total Food Budget				
Omaha Steaks	—	—	–0.780***	0.296
SD Certified	—	—	–0.494**	0.212
Locally Produced	—	—	–0.444**	0.186
Nutrition-related Knowledge				
Omaha Steaks	—	—	–0.618***	0.102
SD Certified	—	—	–0.482***	0.093
Locally Produced	—	—	–0.442***	0.904
Log Likelihood	–2227.5		–2226.5	
Pseudo-R^2	0.128		0.162	

* Significant at the 90% confidence level; ** Significant at the 95% confidence level; *** Significant at the 99% confidence level. The null hypothesis assumes the estimated value is statistically indifferent from zero.

Table D-1 summarizes the estimated coefficient value for each attribute by applying conditional logit and mixed logit models. By analyzing the resulting coefficient, we are able to examine consumers' preference for each product attribute through the sign and magnitude of the corresponding coefficient value. Table D-1 shows that most brand-specific parameters (i.e., *Omaha Steaks*, *SD Certified*, and *Local)* are statistically significant, suggesting our sample shoppers at farmers' markets would choose any of the three brand choices rather than the opt-out option. The conditional logit model result also shows that the difference in coefficient values between *SD Certified* (1.01) and *Local* (1.195) is relatively small, which indicates our sample shoppers have similar preferences for beef produced either by state certified producers or by the nearby producers. Moreover, the coefficient value for *Omaha Steaks* (0.248) is notably smaller than other brand options. This result shows that our sample consumers at farmers' markets, compared to their preference for state certified or locally produced beef, obtain less satisfaction from national brand steaks.

We utilized the advantage of mixed logit model to study the influence of consumer characteristics on their brand preference. As indicated, the differences in the magnitude of coefficients for brand-related attributes disappear from the result of applying mixed logit model (2.812 for *Omaha Steaks*, 2.775 for *SD Certified*, and 2.817 for *Locally Produced)*. This finding implies that although consumers have an obvious preference for state or locally produced rib-eye steaks, the price premium of "being local" itself becomes irrelevant after controlling for consumers' differences in characteristics. In other words, not all consumers would pay a higher price premium for locally produced steaks.

Additionally, Table D-1 shows a similar pattern of consumer preference for color and production/feed differences. Compared to the omitted brown color, the estimated coefficients for *Red* (0.696 for both models) and *Cherry-Red* (0.689 for conditional model and 0.686 for mixed logit model) are both statistically significant. The similar estimated values from both models (conditional logit and mixed logit models) imply that all sample consumers at farmers' markets share a similar preference regarding color difference in rib-eye steaks. However, the small gap of coefficient values between *Red* and *Cherry Red* (i.e., approximate 0.01) also suggests that their utility does not increase by upgrading the color of steaks from red to cherry-red. Similarly, compared to the omitted conventional feed, the estimated coefficients for *Natural* (0.437 for Conditional Logit model and 0.443 for mixed Logit model) and *Organic* (0.436 for Conditional Logit model and 0.420 for mixed Logit model) are statistically significant and quite similar. The comparable values of these coefficients from conditional logit and mixed logit models suggest that our sample shoppers prefer to purchase steaks produced from natural or organic feed cattle, regardless of the differences in characteristics. The similar values of *Natural* and *Organic* also imply that consumers will not pay premium prices to switch from natural to organic steaks.

In addition to the color and feed attributes, Table D-1 shows consumers' utility increases steadily as the fat content decreases. Compared with the omitted 80 percent leanness, the coefficients for all three higher levels of leanness are significant and constantly rise as the leanness level increases. Both conditional and mixed logit models show an approximate 0.09 difference between the two levels of leanness (i.e., from 85 percent to 90 percent and from 90 percent to 95 percent of leanness). This result suggests that consumers' utility increases as the unwanted fat decreases. The similarity in the estimated coefficients for leanness between both models suggests that our sample respondents exhibited comparable preference towards fat content, regardless of their differences in characteristics.

To measure the potential heterogeneity of preferences caused by the selected four consumer characteristics, we applied mixed logit model to allow the preference for "being locally produced" to vary. As indicated in Table D-1, the tendency to shop locally (denoted as "*Shop Local*") has a significant effect on consumers' brand preference. Compared to *SD Certified/Shop Local* (–0.563), the estimated coefficient of *Local/Shop Local* (–0.865) suggests our sample respondents who reportedly prefer to shop locally also often enjoy a larger utility by consuming locally produced rib-eye steaks. In contrast, the heterogeneity in brand preference caused by household meat preference suggests that the difference in coefficients between *SD Certified* (1.518) and *Locally Produced* (1.505) is very small, indicating that families that eat more beef than other

meats enjoy a similar utility by consuming either SD Certified or locally produced steaks. Moreover, the heterogeneity caused by household meat budget as well as nutrition-related knowledge both demonstrate a similar pattern: consumers prefer a locally produced product, but the difference between SD Certified beef and locally produced beef — to most consumers — is trivial. On the other hand, the coefficients of *Price*, resulting from conditional logit (–0.273) and mixed logit models (–0.276), are nearly identical, indicating that differences in consumer characteristics do not affect our sample consumers' price sensitivity.

Finally, Table D-1 suggests that our sample respondents generally prefer SD Certified and locally produced steaks. However, the mixed model results indicates that the preference demonstrated by our sample shoppers for purchasing "locally produced" rib-eye steaks varies according to different consumer attributes. Additionally, the estimated coefficients of color and feed/production variables indicate that consumers' utility only increases by switching from low to middle or from low to high quality meat; however, the difference in utility between consuming middle and high quality steaks is negligible. Instead, the increasing coefficient values for leanness suggest that decreasing exterior fat in steaks will constantly advance consumers' utility. We find that for our sample shoppers at farmers' markets who demonstrate a significant preference for locally produced steaks, their definition of "locally produced products" simply means products produced in South Dakota.

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