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Consumer Willingness to Pay for Tennessee Certified Beef

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Abstract

Beef producers in Tennessee have expressed interest in the creation of an in-state certified beef program. Therefore, an online choice experiment was conducted to evaluate Tennessee consumer preferences and willingness to pay (WTP) for Tennessee Certified Beef and other beef attributes that are likely to appear on Tennessee beef. Tennessee Certified Beef is defined as beef originating from animals born, raised, finished, and harvested in Tennessee. Results of two treatments, a Control Treatment in which consumers were not given the attribute definitions, and an Information Treatment in which consumers were given the attribute definitions, were compared for both steak and ground beef. Data was analyzed using a random parameters logit model. Results of both treatments indicate steak consumers valued Tennessee Certified Beef more highly than all other individual attributes including Certified Angus Beef, grass fed, no hormones administered, and Master Quality Raised Beef. Results for ground beef showed consumers most highly valued the attributes no hormones administered and Tennessee Certified Beef. Results suggest that Tennessee beef consumers would be willing to pay a premium for Tennessee branded beef.

Key Words: Beef Cattle Attributes; Consumer Willingness to Pay, Choice Experiment

Area: Livestock Economics, Consumer Choice

JEL Code: Q10, Q13

Introduction

The Tennessee cattle and calf industry generated \$825.1 million in revenue in 2014 making it the largest agricultural commodity in the state in terms of cash receipts (Tennessee Department of Agriculture, 2015). Beef cattle production in the state is primarily comprised of cow-calf and stocker cattle operations resulting in most calves and feeder cattle being transported to feedlots in the Mid-West and Western United States to be finished and harvested (Lewis et al., 2016).

In December 2012, Tennessee's Governor Haslam challenged policymakers and state agricultural leaders to develop a plan to grow the agricultural and forestry industries in the state. One approach identified by the Governor's task force, titled the Governor's Rural Challenge (Johnson, Upchurch, and Arrington, 2012), was to expand marketing opportunities for Tennessee producers which includes cattle producers. With an understanding of current beef cattle production and marketing practices utilized in Tennessee, cattle producers, policy makers, and industry leaders have shown interest in the feasibility of the Tennessee cattle industry capturing additional value by finishing and harvesting cattle in the state. In order to determine if value can be added to the Tennessee cattle industry by expanding marketing opportunities to the finishing and harvesting sectors, it is essential to evaluate both producer and consumer preferences. From the producer side, it is important to evaluate additional costs associated with production, producer willingness to participate, and producer ability to supply a certain quality product.

From the consumer standpoint, it is integral to evaluate consumer preferences and determine willingness to pay (WTP) for certain attributes associated with beef products. The results of this evaluation can provide important pricing information to Tennessee beef producers who are considering supplying beef with particular attributes, including in-state production, grass fed, no hormones administered, Certified Angus Beef, and Master Quality Raised Beef. This

could provide Tennessee beef cattle producers and the harvesting/processing industry with a better understanding of whether consumers are willing to pay a premium for beef born, raised and harvested in Tennessee, as well as WTP for other potentially premium beef attributes. If these premiums exist, then by adopting in-state finishing and harvesting, producers would have the potential to capture the value-added that could be achieved by finishing their beef in Tennessee rather than sending them out-of-state to be finished.

The purpose of this study is to evaluate consumer preferences for beef branded as Tennessee Certified Beef. Tennessee Certified Beef is defined as beef originating from animals born, raised, finished, and harvested in Tennessee. This study will also evaluate consumer preferences for other beef attributes likely to appear on Tennessee branded beef for retail. The objective of this research is to estimate consumer WTP for Tennessee Certified Beef and the beef attributes grass fed, no hormones administered, Certified Angus Beef, and Master Quality Raised Beef (label indicating producers completed the Beef Quality Assurance and the Advanced Master Beef Producer educational programs).

Previous Studies

Several studies have examined consumer preferences for desirable attributes on beef products. Carlberg, Froehlich, and Ward (2007) surveyed consumers to determine WTP for four hypothetical branded beef attributes (guaranteed tender, premium, breed-specific, and organic) and found a premium ranging from \$1.12 to \$1.83 per steak. Franken, Parcell, and Tonsor (2011) found Missouri consumers place importance on locally produced and U.S. produced as well as natural and grass-fed/lean attributes. Mennecke et al. (2007) found the attribute garnering the highest consumer utility was region of origin followed by animal breed, traceability, animal feed,

and beef quality. Grannis, Hooker, and Thilmany (2000) found that in reference to steak and ground beef, consumers placed the most value on hormone free beef.

Numerous studies have examined consumer WTP for local products. Adalja et al. (2015) estimated consumer WTP for locally produced ground beef and determined Maryland consumers were willing to pay a premium of \$2.71 per pound for beef raised within 100 miles and \$2.39 per pound more than they would for the non-local product if it was raised within 400 miles. Carpio and Isengildina-Massa (2008) found consumers in South Carolina would pay an average premium of 27% for local produce and 23% for local animal products. Maynard, Burdine and Meyer (2003) studied consumer WTP in Kentucky for various locally produced meats including ground beef and beef steaks. In reference to beef steak, about 20% of respondents stated they were willing to pay a 40% premium for local and 52% of respondents stated they were willing to pay a 20% premium. When asked about WTP for locally produced ground beef, 15% of the survey participants indicated they were willing to pay the 40% premium and 64% indicated they would pay a 20% premium.

Several studies have examined Tennessee consumers' preferences for local products. Eastwood, Brooker, and Orr (1987) found in the case of produce, Knoxville, Tennessee consumers were willing to pay more for a local designation if the product exhibited increased freshness. Brooker et al. (1988) found the price elasticity of demand for locally grown tomatoes in Knox County, Tennessee is inelastic when price of tomatoes is increased by up to \$0.30 per pound. Dobbs et al. (2016) studied metro consumers' WTP for steaks and ground beef produced in Tennessee and found Tennessee consumers are willing to pay a premium of 54.39% for ribeye beef steaks and 49.67% for 85% Lean/15% Fat ground beef if produced in the state. While previous studies lend credence to consumers' increased WTP for locally produced beef, they

have either examined other products or were limited to metro consumers. This current study will not only measure overall (metro and non-metro) Tennessee beef consumers' WTP for locally produced beef, but also other potentially premium beef attributes.

State-branded beef programs have been evaluated in several prior studies. These studies assessed product differentiation that has the potential to help create a specialized product garnering a premium in states such as New Mexico, Tennessee, Missouri, and Texas (Crawford et al., 2008; Menard, Jensen, and English, 2012; Franken, Parcell, and Tonsor, 2011; Hanagriff, Rhoades, and Wilmeth, 2009). Crawford et al. concluded a state or regional branding program combined with a certification process would have a high chance of success in regards to adding value to the New Mexico beef market due to low cost of implementing such a program and the high chance of obtaining a loyal customer base. Menard, Jensen, and English (2012) determined the premium consumers in Tennessee were willing to pay could range from \$1.00 to \$2.56 per pound more depending on beef product differentiation. Franken, Parcell, and Tonsor (2011) determined consumers were willing to pay the highest premium for a Kansas City Strip Steak with the attribute of grass-fed/lean and that locally produced garnered a higher premium than nature friendly, low carbon footprint, and U.S. produced. Hanagriff, Rhoades, and Wilmeth (2009) found 59% of the participants indicated the attribute "locally grown in Texas" was either moderately or always important.

In addition to consumer interest in specific beef attributes, locally produced products, and state-branded programs, many consumers have vocalized the desire to know the production practices utilized to produce food products. Though several studies have been dedicated to beef attributes, locally produced, and state branded beef programs, a better understanding of the

interactions between these different marketing attributes and WTP for beef production practices is warranted.

Methodological Background

A choice experiment was utilized in order to determine consumer WTP for USDA Choice boneless ribeye beef steaks and USDA Choice 85% Lean/15% Fat ground beef with various attributes. Previous literature states choice experiments, or stated preference methods, are a useful method for eliciting consumer preferences in accordance with the random utility theory (Adamowicz et al., 1998). Choice experiments garner a more accurate representation of consumer preferences due to the ability to pinpoint specific desired attributes in a set of controlled decision scenarios (Adamowicz, Louviere, and Swait, 1998). Adamowicz, Louviere, and Swait (1998) also state the objective of the choice experiment design is to minimize the number of choice sets that need to be given to the survey participant, but still give statistically valid consumer preferences. According to Savage and Waldman (2008), minimizing the number of choice sets is especially important when conducting surveys because consumers tend to become fatigued when asked too many questions and may begin to not fully contemplate their options.

The method used to collect the data for the choice experiment was an online survey using Qualtrics software, which was distributed to 1,100 Tennessee consumers selected from a panel. Each participant was required to be 18 and older, and they had to be a purchaser of beef for their household. Two treatments were included in the choice experiments: the Control Treatment and the Information Treatment. In the Control Treatment, participants were given a cheap talk script prior to seeing the choice sets (Appendix A) following Tonsor and Schupp (2011). The cheap talk script was used to decrease hypothetical bias known to occur in online or hypothetical

surveys. Chang et al. (2013) determined South Dakota consumers were willing to pay a premium of \$0.71 per pound for local beef when the consumers were informed of the definition of cheap talk prior to taking the survey. When the definition was not presented to the participants the premium was \$1.55 per pound which is significantly higher. Thus, informed consumers make different choices than uninformed consumers. Prior to beginning the choice sets in the Information Treatment, survey participants were provided with the cheap talk script and a definition pertaining to each different beef attribute studied (Tennessee Certified Beef, grass fed, no hormones administered, Certified Angus Beef, and Master Quality Raised Beef). The definitions given to the participants can be found in Appendix A. The definitions were given in order to determine if the informed consumer would be willing to pay a different amount than the consumer who has no knowledge of the attributes before answering the questions.

Choice Experiment

Each participant was presented with choice sets allowing them to choose between two alternatives with different attributes. The participants were also presented with the option to choose neither of the products shown. The alternatives were between two boneless ribeye beef steaks grading USDA Choice or two one pound packages of 85% Lean/15% Fat ground beef that graded USDA Choice. Each of the products were deemed visually identical and identical pictures were included to reinforce this point, however, the beef products differed in the following attributes; price, Tennessee Certified Beef, Certified Angus Beef, grass fed beef, no hormones administered, or Master Quality Raised Beef. Figures 1 and 2 show examples of the choice sets presented to consumers. There were four price levels (\$/lb) for steak and four for ground beef. The price levels were chosen based on the market price of beef, provided by the USDA National

Retail Report for Beef (2016), when the survey was launched. The product attributes being examined, the prices, and the different attribute levels are shown in Table 1.

[Insert Figure 1 here]

[Insert Figure 2 here]

[Insert Table 1 here]

The choice sets presented to each individual taking the survey were determined by the program NGene (ChoiceMetrics, 2014). This software was used to generate an efficient design with interactions generated using priors which were obtained from a survey pre-test given to 80 Tennessee beef consumers age 18 and older. The survey design contained two blocks and twelve choice sets in each block for both the ground beef and the ribeye steak. When constructing the choice sets, the D-error was minimized. Each survey participant answered twelve choice sets and the choice sets that were given were evenly randomized. Prior to the choice sets, participants were asked whether they purchased steak, ground beef, both, or neither. If they responded steak, they were randomly assigned to one of the steak choice sets and if they responded ground beef, they were randomly assigned one of the ground beef choice sets. Consumers choosing both ground beef and steak were randomly assigned to either choice set. Consumers choosing neither were not allowed to continue with the survey. The distribution of random assignments was equally distributed with each choice set having $n=204$ survey participants between the four treatments. The reasoning behind only giving each participant 12 choice sets to contend with was to avoid them from becoming fatigued and possibly choosing to quit answering questions or just answering quickly without carefully considering each option just to finish the survey (Savage and Waldman, 2008). In order to ensure ordering of the questions within the choice sets did not

have an impact on consumer answers, the questions within the choice sets were also randomized (Loureiro and Umberger, 2007).

Model Estimation: Random Parameters Logit model

A Random Parameters Logit (RPL) model, also known as a Mixed Logit model, was utilized to ascertain consumer preferences and utility for locally produced Tennessee Certified Beef as well as for the formerly mentioned attributes. The RPL model differs from the probit model and the standard logit model. Unlike the probit, the RPL is not confined to normal distributions and it differs from the standard logit in three ways; it allows for random taste variation, it accounts for correlation in unobserved factors over time, and it permits unrestricted substitution patterns (Train 2002, Revelt and Train 1997).

A linear random utility framework was utilized to determine the utility each participant received from each beef alternative j , within each choice scenario c . Each survey participant n ($1, \dots, n$) faced a total of c ($c = 1, \dots, 12$) choice scenarios for USDA choice boneless ribeye beef steaks or USDA choice 85% Lean/15% Fat ground beef. Following Train (2003), the utility-maximizing derivation for each individual n for each beef alternative j , in each choice scenario c can be represented by:

$$U_{njc} = \beta_n X_{njc} + \varepsilon_{njc} \quad (1)$$

where X_{njc} are the observed variables that relate to the alternative j and decision maker n for each choice scenario c , β_n is a vector of coefficients of these variables for individual n which represents the person's tastes, and ε_{njc} is a random error term that is *independent and identically distributed (iid)* extreme value. The coefficients vary over individuals in the population with

density $f(\beta)$. The density, $f(\beta)$ is a function of the parameters θ which represent the mean and covariance for the β 's in the population when β is normally distributed (Revelt and Train, 2000).

By expanding equation (1) to incorporate the beef attributes being evaluated in this survey, we can use an equation to estimate the utility consumer n receives from each beef alternative j in each choice scenario c :

$$\begin{aligned}
 U_{njc} = & \beta_0 Price_{njc} + \beta_1 TCB_{njc} + \beta_2 CAB_{njc} + \beta_3 GF_{njc} + \beta_4 MQRB_{njc} + \beta_5 NH_{njc} + \\
 & \beta_6 TCB_{njc} * CAB_{njc} + \beta_7 TCB_{njc} * GF_{njc} + \beta_8 TCB_{njc} * MQRB_{njc} + \beta_9 TCB_{njc} * NH_{njc} + \\
 & \beta_{10} NONE_{njc} + \varepsilon_{njc}
 \end{aligned} \tag{2}$$

where $Price$ represents the price of one beef alternative j , TCB represents the dummy variable equal to one if the beef alternative j was labeled as *Tennessee Certified Beef* and zero if it was not, CAB represents the dummy variable equal to one if the beef alternative j was labeled as *Certified Angus Beef* and zero otherwise, GF represents the dummy variable equal to one if the beef alternative j was labeled as *grass-fed* and zero otherwise, NH represents the dummy variable equal to one if the beef alternative j was labeled as *no hormones administered*, and zero otherwise, and $MQRB$ represents the dummy variable equal to one if the beef alternative j was labeled as *Master Quality Raised Beef* and zero otherwise. This equation includes the interactions between *Tennessee Certified Beef* and each other possible attribute. An example of an interaction variable would $TCB * CAB$ which represents the dummy variable equal to one if the beef alternative j was labeled as both *Tennessee Certified Beef* and *Certified Angus Beef*, and zero if it was not. *None* is the dummy variable that is equal to one if the participant chose the “neither” option and zero otherwise.

Following from equation (1) and Train (2002), β_n is known to the decision maker only and unknown to the researcher following that the unconditional choice probability of individual n 's choice of alternative j in choice set c for the boneless ribeye beef steaks or ground beef is the following:

$$P_{ni} = \int \left(\frac{e^{\beta_n x_{nic}}}{\sum_j e^{\beta_n x_{njc}}} \right) f(\beta) d\beta \quad (3)$$

where j is the j^{th} choice for respondent n in choice set c and the variables are defined the same as in equation (2). P_{ni} is referred to as the mixed logit probability which is a weighted average of the logit formula evaluated at different values of β with the weights given by density function $f(\beta)$ (Train, 2002). For this research, the software NLogit was used to estimate the Random Parameters Logit model and obtain estimated parameter coefficients which were then used to determine consumer WTP.

Willingness to Pay

WTP for the non-interaction terms was calculated by dividing the specific attribute coefficient, β_k by the negative price coefficient, β_0 , where $WTP = \beta_k / -\beta_0$. In this instance $k = 1, \dots, 4$.

WTP for the interaction terms was calculated as $WTP_{Interaction} = (\beta_1 + \beta_2 + \beta_d) / -\beta_0$ where β_1 and β_2 are the coefficients of attribute one and two respectively, β_d is the coefficient of the interaction term of attributes one and two, and β_0 is the coefficient of the price. The WTP significance was then estimated following Daly, Hess, and Jong (2012).

Sample Characteristics

Qualtrics, an online survey tool, was used to survey participants in order to garner a population representative of Tennessee residents. Participants of the survey were residents of the state of Tennessee who were 18 years old or older, and who purchased beef products for their household.

A survey pretest was conducted prior to distributing the full survey. The pretest was distributed to 80 Tennessee beef consumers over the age of 18. Using the efficient design with interactions that was generated using priors from the pretest, the full survey was launched. There were 408 participants in each the Control Treatment and the Information Treatment. Contained within the two treatments was a choice set for each ground beef and steak. Each choice set had a total of 204 participants.

Table 2 contains consumer demographics for participants in the Control Treatment and the Information Treatment. As determined by t-tests, the demographics for participants in the Control and Information Treatments were not statistically different with the exception of race in the case of ground beef which was 89.7% Caucasian for the Control Treatment and 77.0% Caucasian for the Information Treatment. These were statistically different at the 5% significance level. On average, 81.7% of the participants in the steak choice experiment were Caucasian. In the steak choice experiment, 74.8% of participants were female while 77.0% were female in the ground beef choice experiment. This is quite a bit higher than the overall average percent of females in the state of Tennessee of 51.3%, which is to be expected as survey participants who did not purchase beef for their household were not permitted to continue with the survey, and women are the primary grocery shoppers for many households.

[Insert Table 2 here]

The average median age of participants in the steak and ground beef choice experiments was 41.8 and 40.5 years respectively. Average household size for the steak and ground beef participants was approximately three members. For the steak choice experiment, on average, 37.3% of participants resided in East Tennessee, 36.3% resided in Middle Tennessee, and 26.5% in West TN. In the ground beef choice experiment, on average, 40.2% of participants resided in

East Tennessee, 41.9% in Middle Tennessee, and 17.9% in West Tennessee. According to the U.S. Census (2015) the percent of the Tennessee population that resides in East Tennessee is 36.7%, Middle Tennessee is 38.7%, and West Tennessee is 24.6%.

Results

Results for USDA Choice Boneless Ribeye Beef Steaks

Random Parameters Logit model results for USDA Choice Boneless Ribeye Beef Steaks for both the Control Treatment and the Information Treatment are shown in Table 3. As anticipated, an increase in price caused a negative and significant impact on consumer utility in both the Control and Information Treatments. Consumers in both treatments exhibited positive and significant utility in response to steak products labeled with each of the individual attributes: Tennessee Certified Beef, Certified Angus Beef, grass fed beef, no hormones administered beef, and Master Quality Raised Beef. Significance in many of the standard deviations for both treatments is indicative of the heterogeneity in consumer preferences which is to be expected in this type of experiment.

[Insert Table 3 here]

Consumers in both the Control Treatment (uninformed consumers) and the Information Treatment (informed consumers) indicated positive and significant WTP for steak labeled with each of the individual attributes and the interactions between Tennessee Certified Beef and each of the attributes. As it concerns individual attributes, consumers indicated the highest WTP for Tennessee Certified Beef in both treatments with no hormones administered garnering the second highest premium. Uninformed consumers were willing to pay \$2.42 more per pound for steak labeled with Tennessee Certified Beef and \$2.35 more per pound when the steak exhibited the no hormones administered label. Informed consumers indicated an increased WTP of \$2.89

per pound for Tennessee Certified Beef and \$2.71 per pound for no hormones administered label. When looking at steak, both the uninformed and informed consumers had the lowest WTP for grass fed and CAB labels, however, they were still willing to pay a positive and significant premium for both. When looking at MQRB, consumers in the Control Treatment were willing to pay a positive premium of \$1.39 per pound when the label appeared on steak and consumers in the Information Treatment were willing to pay a positive premium of \$1.67 per pound. In the case of each individual attribute, the informed consumer was willing to pay higher premiums than the uninformed consumer with the highest increases being \$0.48 more per pound for grass fed and \$0.47 more per pound for Tennessee Certified Beef.

Interactions between Tennessee Certified Beef and each other attribute also garnered positive and significant premiums in both treatments in reference to steak. The uninformed consumer was willing to pay a positive premium of \$4.37 per pound for steak labeled as both Tennessee Certified Beef and no hormones administered whereas the informed consumer was only willing to pay \$3.28 per pound. This interaction was one of two that had a decreased WTP when the consumers were given the definition prior to the choice sets in the case of steak. The other instance of the premium decreasing when given the definitions was the interaction of Tennessee Certified Beef and grass fed which went from a premium of \$3.93 per pound to a premium of \$3.56 per pound. However, the interaction between Tennessee Certified Beef and grass fed did garner the second highest premium in both the Control Treatment and the Information Treatment. When consumers were given the definitions, the interaction between Tennessee Certified Beef and Master Quality Raised Beef garnered the highest premium in the Information Treatment at \$3.67 per pound which was \$1.05 higher than what the uninformed consumer indicated as their WTP. The lowest premium in the Control Treatment was for

Tennessee Certified Beef and Certified Angus Beef, however, consumers were still willing to pay \$2.51 more for this label over unlabeled beef steaks. In the Information Treatment, the lowest premium consumers were willing to pay was \$3.28 per pound when it came to Tennessee Certified Beef and no hormones administered.

Results for USDA Choice Ground Beef (85% Lean/15% Fat)

The Random Parameters Logit model results for USDA Choice Ground Beef (85% Lean/15% Fat) for both treatments are shown in Table 4. As with the steak, there was a decrease in consumer utility correlated with an increase in price in both treatments. Individual beef attributes all had a positive and significant influence on consumer utility in both the Control and Information Treatments. Again, as to be expected, heterogeneity in consumer preferences is indicated by significance in many of the standard deviations of the parameter estimates in both treatments.

[Insert Table 4 here]

In reference to ground beef, consumers indicated the highest WTP for no hormones administered followed closely by Tennessee Certified Beef in both treatments. The uninformed consumer was willing to pay a premium of \$1.27 per pound over the price of unlabeled ground beef and the informed consumer was willing to pay an additional \$1.59 per pound when the no hormones administered label was present. Consumers in the Control Treatment were willing to pay an additional \$1.15 per pound for the Tennessee Certified Beef label and consumers in the Information Treatment were willing to pay a premium of \$1.53 per pound. Ground beef consumers placed the least value on Certified Angus Beef in the Control Treatment. However, they still indicated they were willing to pay \$0.41 more per pound when this attribute was present. Uninformed consumers were willing to pay an \$0.81 and \$0.65 per pound premium for

grass fed and Master Quality Raised Beef respectively. Informed consumers indicated they would pay positive premiums for Certified Angus Beef, grass fed, and Master Quality Raised Beef as well with premiums of \$0.73, \$0.59, and \$0.91 per pound respectively. Grass fed was the only attribute in the ground beef choice experiment that showed a decrease in the WTP premium when consumers were given the definition prior to completing the choice sets.

Again, there was a significant positive WTP for all of the interactions between Tennessee Certified Beef and each attribute. In the Control Treatment, the highest premium garnered was for Tennessee Certified Beef and grass fed, \$1.76 per pound, and the second highest premium was for Tennessee Certified Beef and no hormones administered, \$1.63 per pound. Tennessee Certified Beef and Master Quality Raised Beef garnered a premium of \$1.45 in the control treatment and the lowest premium was \$1.29 per pound for Tennessee Certified Beef and Certified Angus Beef. In the Information Treatment, Tennessee Certified Beef and no hormones administered garnered the highest premium of \$2.41 per pound followed by \$1.98 per pound for Tennessee Certified Beef and grass fed, \$1.72 per pound for Tennessee Certified Beef and Master Quality Raised Beef, and \$1.61 per pound for Tennessee Certified Beef and Certified Angus Beef.

Conclusions

This study was conducted to measure premiums Tennessee beef consumers may place on selected beef attributes and to determine if additional value could be captured by the state and by Tennessee beef producers by creating an in-state branded beef program.

Results from this study indicate Tennessee beef consumers place value on an in-state branded beef product and will pay more for beef when this label is present on the beef product as opposed to unlabeled USDA Choice beef. While they were willing to pay premiums in both the

Control Treatment and the Information Treatment, they were willing to pay more for Tennessee Certified Beef when they were informed of the definition prior to completing the choice sets with the informed consumer willing to pay \$0.47 more per pound for ribeye steaks and \$0.38 more per pound for ground beef than the uninformed consumer. Thus, policy makers and producers may want to provide educational information to consumers on the definition of Tennessee Certified Beef if the program is adopted. A higher premium was shown in the case of almost every individual attribute as well as the interactions between Tennessee Certified Beef and each other attribute when consumers were informed of the definitions prior to the choice sets, which is indicative of the possible need to better educate beef consumers in order to garner the additional value added that could come with including these attributes on beef products in Tennessee.

For steak and ground beef, consumers indicated a significant interest in the attribute no hormones administered. This attribute garnered the second highest premium in steak and the highest premium in ground beef regardless of treatment. This indicates consumers desire this attribute and therefore producers may want to evaluate the feasibility of including this in their production practices in order to capture additional value. When including this attribute in conjunction with Tennessee Certified Beef, uninformed consumers were willing to pay \$4.37 more per pound for ribeye steaks and \$1.63 more per pound for ground beef. Informed consumers indicated a positive WTP of \$3.28 per pound for steak and \$2.41 more per pound for ground beef when no hormones administered was included along with the Tennessee Certified Beef label.

In both treatments and in both the case of ribeye steaks and ground beef, consumers also placed high value on beef that had both the Tennessee Certified Beef and the grass fed labels. This is interesting because when looking at the attributes individually, grass fed garnered some

of the lowest premiums. One explanation for this could be that consumers who prefer locally raised beef from Tennessee also prefer grass fed beef. When looking at the interaction between Tennessee Certified Beef and Master Quality Raised Beef consumers showed a WTP of \$1.05 more per pound when they were informed versus when they were not. This suggests increasing the information available to consumers about the Beef Quality Assurance program and the Advanced Master Beef Producers Program could increase premiums consumers would pay for beef with these attributes.

This research provides important information in evaluating the feasibility of finishing beef-in state for additional value added to beef producers; consumers are willing to pay a positive premium for Tennessee Certified Beef, Certified Angus Beef, grass fed beef, Master Quality Raised Beef, and beef that has had no hormones administered. Given these premiums, additional research is merited to examine the overall feasibility of providing these attributes given changes to beef cattle production costs for Tennessee beef producers. The research also suggests that promotion and advertising that provide definitions of these attributes can help consumers make informed decisions to pay additional premiums for these attributes.

References

- Adalja, A., J. Hanson, C. Towe, and E. Tselepidakis. "An Examination of Consumer Willingness to Pay for Local Products." Paper presented at AAEA and CAES joint annual meeting, Washington DC, August 4-6, 2013.
- Adamowicz, W., J. Louviere, and J. Swait. "Introduction to attribute-based stated choice methods." Prepared by Avanis Inc. for the National Oceanic Atmospheric Administration, U.S. Department of Commerce. January 1998.
- Adamowicz, W., P. Boxall, M. Williams, and J. Louviere. "Stated Preference Approaches for Measuring Passive Use Values: Choice Experiments and Contingent Valuation." *American Journal of Agricultural Economics* 80/1(February 1998):64–75.
- Advanced Master Beef Producer Program. 2016. Internet site: <http://utbfc.utk.edu/AMBP.html> (Accessed July 13, 2016)
- Beef Quality Assurance. 2016. Internet site: <http://www.bqa.org/about/intro-to-bqa> (Accessed July 13, 2016)
- Brooker, J.R., D.B. Eastwood, C.L. Stout, and R.H. Orr. "Branding Locally Grown Produce in Supermarkets." *Journal of Food Distribution Research* 19, 1(February 1988):51-60.
- Carlberg, J.G., E. Froehlich, and C.E. Ward. "Willingness-to-Pay for Branded Fresh Beef Products in Canada." Report to Canfax Research Services Administrator of the Improving Alignment of the Supply Chain Component of the National Beef Industry Development Fund, March 2007.
- Carpio, C.E. and O. Isengilidina-Massa. "Consumer Willingness to Pay for Locally Grown Products: The Case of South Carolina." Paper presented at the Southern Agricultural Economics Association Annual Meeting, Dallas, TX, February 2-6, 2008.

Certified Angus Beef Brand. 2016. Internet site:

<https://www.certifiedangusbeef.com/brand/specs.php> (Accessed June 20, 2016)

Chang, K., P. Xu, K. Underwood, C. Maen, and G. Langelett. “Consumers' Willingness to Pay for Locally Produced Ground Beef: A Case Study of the Rural Northern Great Plains,” *Journal of International Food and Agribusiness Marketing* 25(2013):42–67.

ChoiceMetrics. *Ngene 1.1.2 User Manual & Reference Guide*. 2014. Internet site:

<http://www.choice-metrics.com/features.html> (Accessed June 28, 2016)

Crawford, T.L., J.M. Hawkes, A. Rupasingha, and R.D. McConnaughey. “Adding Value to the New Mexico Beef Industry.” New Mexico State University, 2008.

Daly, A., S., Hess and G. de Jong. “Calculating Errors for Measures Derived from Choice Modelling Estimates.” *Transportation Research Part B: Methodological* (2012):333-341.

Dobbs, L.M., K.L. Jensen, M.B. Leffew, B.C. English, D.M. Lambert, and C.D. Clark. “Consumer Willingness to Pay for Tennessee Beef.” *Journal of Food Distribution Research* 47, 2(July 2016):38-61.

Eastwood, D.B., J.R. Brooker, and R.H. Orr. “Consumer Preferences for Local Versus Out-of-State Grown Selected Fresh Produce: The Case of Knoxville, Tennessee.” *Southern Journal of Agricultural Economics* 19(December, 1987):193-194.

Grannis, J.L., N.H. Hooker, and D.D. Thilmany. “Consumer Preference for Specific Attributes in Natural Beef Products.” Paper presented at Western Agricultural Economics Association Annual Meeting, Vancouver, BC, June 29-July 1, 2000.

Franken, J.R., J.L. Parcell, and G.T. Tonsor. 2011. “Consumers’ Willingness-to-Pay for Retail Branded Beef Products with Bundled Attributes.” Paper presented at the Agricultural &

- Applied Economics Association's 2011 AAEA & NAREA Joint Annual Meeting, Pittsburgh, PA, July 24-26, 2011.
- Hanagriff, R.D., R.D. Rhoades, and D. Wilmeth. "Consumer Preferences in Purchasing Beef and the Values They Attribute to Branded Products." Paper presented at Southern Agricultural Economics Association annual meeting, Atlanta GA, 31 January–3 February, 2008.
- Johnson, J.T., W.L. Upchurch, and L.R. Arrington. "Governor's Rural Challenge: A 10-Year Strategic Plan." A report to Governor Bill Haslam, Tennessee. December, 2013. Online: <http://www.tn.gov/agriculture/publications/ruralchallenge/AgReport.pdf> (Accessed July 30, 2016)
- Lewis, K.E., A.P. Griffith, C.N. Boyer, and J. Rhinehart. "Does Pre-partum Supplemental Feed Impact Beef Cattle Profitability through Finishing?" *Journal of Agricultural and Applied Economics*, 48/2(2016), 173-191.
- Loureiro, M.L. and W. J. Umberger. "A choice experiment model for beef: What US consumer response tell us about relative preferences for food safety, country of origin labelling, and traceability." *Food Policy* 32(August 2007):496–514.
- Maynard, L. J., K.H. Burdine, and A.L. Meyer. "Market Potential for Locally Produced Meat Products." *Journal of Food Distribution Research* 34/2(July 2003):26–37.
- Menard, J., K. Jensen, and B. English. "An Examination of Consumers' Preferences for Differentiated Beef Products." Prepared by Agri-Industry Modeling & Analysis Group (AIMAG)* for The Center for Profitable Agriculture, Department of Agriculture and Resource Economics, The University of Tennessee. June 2012.

Mennecke, B.E., A.M. Townsend, D.J. Hayes, and S.M. Lonergan. "A Study of the Factors that Influence Consumer Attitudes Toward Beef Products Using the Conjoint Market Analysis Tool." *Journal of Animal Science* 85(October 2007):2639-2659.

Revelt, D. and K. Train. "Customer-specific Taste Parameters and Mixed Logit: Households' Choice of Electricity Supplier." Working Paper No. E00-274 Department of Economics., University of California Berkley, 2000. Retrieved July 10, 2016, from <https://escholarship.org/uc/item/1900p96t>

Revelt, D. and K. Train. "Mixed Logit with Repeated Choices: Households' Choices of Appliance Efficiency Level." *Review of Economics and Statistics* 80(July 1997):647-657.

Savage, S.J. and D. M. Waldman. "Learning and fatigue during choice experiments: A comparison of online and mail survey codes." *Journal of Applied Econometrics* 23(February 2008):351-371.

Syrenelas, K.G., K.E. Lewis, C. Grebitus, R.M. Nayga, Jr. "Consumer Willingness to Pay for "Natural" Beef." Working Paper.

Tennessee Department of Agriculture-Animals. Internet Site:
<http://www.tennessee.gov/agriculture/topic/ag-businesses-animals> (Accessed June 27, 2016)

Tennessee Department of Agriculture-Tennessee State Government. Internet Site:
<https://www.tn.gov/main/section/local> (Accessed November 19, 2016)

Tennessee Department of Economic and Community Development-Tennessee Quick Facts.

Internet Site: <http://www.tnecd.com/research-and-data/tn-quick-facts/> (Accessed November 19, 2016)

Tennessee Department of Agriculture- Tennessee Agriculture 2015 Department Report & Statistical Summary. Internet Site:

<https://www.tn.gov/assets/entities/agriculture/attachments/annualreport15.pdf> (Accessed January 1, 2017)

Tonsor, G. T. and R. S. Shupp. “Cheap talk scripts and online choice experiments: looking beyond the mean.” *American Journal of Agricultural Economics* 93/4(July 2011):1015-1031.

Train, K. E. *Discrete Choice Methods with Simulation*. Cambridge, MA: Cambridge University Press, 2002.

United States Census Bureau. 2016. Internet Site: <http://www.census.gov/quickfacts> (Accessed November 19, 2016).

United States Department of Agriculture. National Retail Report-Beef. Retrieved from:

<https://www.ams.usda.gov/mnreports/lswbfrtl.pdf> [Accessed August 2016]

United States Department of Agriculture-National Agricultural Statistical Service. Internet Site:

https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/Tennessee/ (Accessed June 27, 2016)

Table 1: Attribute descriptions and attribute levels included in the choice experiment

	USDA Choice Boneless Ribeye Beef Steak	USDA Choice Ground Beef (85% Lean/ 15% Fat)
Attribute	Attribute Levels	Attribute Levels
Price	\$5.99/lb \$7.99/lb \$9.99/lb \$11.99/lb	\$1.99/lb \$2.99/lb \$3.99/lb \$4.99/lb
Tennessee Certified Beef	Tennessee Certified Beef label None	Tennessee Certified Beef label None
Grass fed	Grass fed label None	Grass fed label None
Certified Angus Beef	Certified Angus Beef label None	Certified Angus Beef label None
No hormones administered	No hormones administered None	No hormones administered None
Master Quality Raised Beef	Master Quality Raised Beef label None	Master Quality Raised Beef label None

Table 2: Control and Information Treatment Sample Demographics arranged by USDA Choice Boneless Ribeye Beef Steaks and USDA Choice Ground Beef (85% Lean/15% Fat) as well as the Population Demographics for Tennessee

Variable	Control Treatment		Information Treatment		Tennessee Population
	Ribeye Steak n=204	Ground Beef n=204	Ribeye Steak n=204	Ground Beef n=204	
Gender (% female)	78.9%	78.9%	70.6%	75.0%	51.3% ²
Median Age (years)	42.0	39.0	41.5	42.0	38.7 ¹
Race (% white)	81.9%	89.7% ^a	81.4%	77.0% ^a	78.8% ²
Education (Bachelor's Degree or Higher)	27.0%	22.5%	29.4%	33.3%	24.9% ²
Average Household Income	\$51,078.43	\$46,840.80	\$51,403.94	\$50,049.02	\$45,219 ²
Household Size	2.97	2.96	3.01	2.68	2.53 ²
Area of Residence					
East Tennessee	33.3%	42.2%	41.2%	38.2%	36.7% ²
Middle Tennessee	36.8%	42.6%	35.8%	41.2%	38.7% ²
West Tennessee	29.9%	15.2%	23.0%	20.6%	24.6% ²

Notes: ¹ Tennessee Department of Economic and Community Development, 2016. ²U.S. Census Bureau, 2015; As evidenced by a t-test, there were no significantly different values for demographics between the full sample in the Control Treatment versus the full sample in the Information Treatment at the 5% level. ^aDenotes statistically different means between the Control Treatment and the Information Treatment sample at the 5% level using a t-test.

Table 3: Parameter estimates, willingness to pay, and standard deviations of the estimates for the different beef attributes for USDA Choice Boneless Ribeye Beef Steak

Attributes	Control Treatment		Information Treatment		WTP Difference
	Parameter Estimate	Willingness to pay (per pound)	Parameter Estimate	Willingness to pay (per pound)	
<i>Mean Estimates</i>					
Price	-0.5083***		-0.5272***		
Tennessee Certified Beef	1.2294***	\$2.42***	1.5218***	\$2.89***	\$0.47
Certified Angus Beef	0.6042***	\$1.19***	0.7526***	\$1.43***	\$0.24
Grass fed	0.4829**	\$0.95**	0.7554***	\$1.43***	\$0.48
Master Quality Raised Beef	0.7068***	\$1.39***	0.8782***	\$1.67***	\$0.28
No hormones administered	1.1928***	\$2.35***	1.4299***	\$2.71***	\$0.36
Tennessee Certified Beef & Certified Angus Beef	-0.5560**	\$2.51***	-0.5031*	\$3.36***	\$0.85
Tennessee Certified Beef & Grass fed	0.2859	\$3.93***	-0.3979	\$3.56***	(\$0.37)
Tennessee Certified Beef & Master Quality Raised Beef	-0.6034***	\$2.62***	-0.4655**	\$3.67***	\$1.05
Tennessee Certified Beef & No hormones administered	-0.1990	\$4.37***	-1.2248***	\$3.28***	(\$1.09)
<i>Standard Deviations of Estimates</i>					
Tennessee Certified Beef	.9509***		.8674***		
Certified Angus Beef	.4979**		.6374***		
Grass fed	.7874***		0.3779		
Master Quality Raised Beef	0.1812		0.0674		
No hormones administered	1.9300***		1.7749***		
Tennessee Certified Beef & Certified Angus Beef	.7081**		.7633***		
Tennessee Certified Beef & Grass fed	0.1278		0.064		
Tennessee Certified Beef & Master Quality Raised Beef	0.1557		1.0002***		
Tennessee Certified Beef & No hormones administered	0.6495		0.2901		
Observations	2,448		2,448		
Log-likelihood	-1715.3510		-1787.5798		
McFadden's Pseudo R-squared	0.3622		0.3353		

***, **, * indicate significance at the 1%, 5%, and 10% level.

Table 4: Parameter estimates, willingness to pay, and standard deviations of the estimates for the different beef attributes for USDA Choice Ground Beef (85% Lean/15% Fat)

Attributes	Control Treatment		Information Treatment		WTP Difference
	Parameter Estimate	Willingness to pay (per pound)	Parameter Estimate	Willingness to pay (per pound)	
Mean Estimates					
Price	-1.2725***		-1.0854***		
Tennessee Certified Beef	1.4642***	\$1.15***	1.6571***	\$1.53***	\$0.38
Certified Angus Beef	0.5169***	\$0.41**	0.7970***	\$0.73***	\$0.32
Grass fed	1.0305***	\$0.81***	0.6352***	\$0.59***	(\$0.22)
Master Quality Raised Beef	0.8272***	\$0.65***	0.9870***	\$0.91***	\$0.26
No hormones administered	1.6130***	\$1.27***	1.7301***	\$1.59***	\$0.32
Tennessee Certified Beef & Certified Angus Beef	-0.3356	\$1.29***	-0.7093**	\$1.61***	\$0.32
Tennessee Certified Beef & Grass fed	-0.2566	\$1.76***	-0.1461	\$1.98***	\$0.22
Tennessee Certified Beef & Master Quality Raised Beef	-0.4485**	\$1.45***	-0.7793***	\$1.72***	\$0.27
Tennessee Certified Beef & No hormones administered	-1.0070**	\$1.63***	-0.7747**	\$2.41***	\$0.78
Standard Deviation of Estimates					
Tennessee Certified Beef	0.8539***		0.9041***		
Certified Angus Beef	0.7508***		0.4809**		
Grass fed	0.9216***		0.5188**		
Master Quality Raised Beef	0.1989		0.4651**		
No hormones administered	1.8196***		1.9615***		
Tennessee Certified Beef & Certified Angus Beef	0.4853		0.9006***		
Tennessee Certified Beef & Grass fed	0.3338		0.3977*		
Tennessee Certified Beef & Master Quality Raised Beef	0.4994		0.6624**		
Tennessee Certified Beef & No hormones administered	2.0984***		0.7070		
Observations	2,448		2,448		
Log-likelihood	-1632.0250		-1699.1063		
McFadden's Pseudo R-squared	0.3932		0.3682		

***, **, * significant for $\alpha = 0.01, 0.05, 0.10$ respectively

Assume you are in the grocery store and you wish to purchase a boneless ribeye beef steak that is USDA Choice. Which of the following products presented below do you prefer? Please choose one of the two alternatives or choose the neither option.

- ☐ • \$9.99 per pound
- Tennessee Certified Beef
 - Certified Angus Beef



- ☐ • \$5.99 per pound
- Certified Angus Beef



- ☐ Neither

Figure 1: Example of steak choice set that a consumer would have seen while participating in the survey

Assume you are in the grocery store and you wish to purchase a package of ground beef (85% lean/15% fat) that is USDA Choice. Which of the following products presented below do you prefer? Please choose one of the two alternatives or choose the neither option.

- ☐ • \$3.99 per pound
- Master Quality Raised Beef
 - Certified Angus Beef



-
- ☐ • \$2.99 per pound
- Tennessee Certified Beef



-
- ☐ Neither

Figure 2: Example of ground beef choice set that a consumer would have seen while participating in the survey

Appendix A: Cheap Talk Script & Definitions provided to survey participants

Cheap Talk Script: *“The experience from previous similar surveys is that people often state a higher willingness to pay than what one is actually willing to pay for the good. For instance, a recent study asked people whether they would purchase a new food product similar to the one you are about to be asked about. This purchase was hypothetical (as it will be for you) in that no one actually had to pay money when they indicated a willingness to purchase. In the study, 80% of people said they would buy the new product, but when a grocery store actually stocked the product, only 43% of people actually bought the new product when they had to pay for it. This difference (43% vs. 80%) is what we refer to as hypothetical bias. Accordingly, it is important that you make each of your upcoming selections like you would if you were actually facing these exact choices in a store, i.e., noting that buying a product means that you would have less money available for other purchases”.*

Label Definitions:

Tennessee Certified Beef: Tennessee Certified Beef declares that the animal was born, raised and harvested in Tennessee and graded USDA Choice or Prime

Grass fed: This label indicates that the animal was fed only grass and forage

Certified Angus Beef: USDA graders inspect black-hided cattle (typical of the Angus breed) and give it a grade. All beef considered for the brand must grade in the top two thirds of Choice or Prime

No hormones administered: The term "no hormones administered" **may** be approved for use on the label of beef products if sufficient documentation is provided to the United States Department of Agriculture by the beef producer showing no hormones have been used in raising the animals

Master Quality Raised Beef: Master Quality Raised Beef ensures that the beef purchased originated from cattle that were raised throughout their entire lifespan by farmers who are certified in the following two programs:

(1) Advanced Master Beef Producer Program

The Advanced Master Beef Producer Program (AMBPP) is an educational program provided by the University of Tennessee designed to help cattle farmers improve cattle health management and cattle farm profitability. This program is open to any cattle farmers in the United States. The AMBPP certification is given to producers who complete the program.

(2) Beef Quality Assurance Program

Beef Quality Assurance (BQA) is a nationally coordinated, state implemented program that provides systematic information to U.S. beef producers and beef consumers of how common sense husbandry techniques can be coupled with accepted scientific knowledge to raise cattle under optimum management and environmental conditions. BQA guidelines are designed to make certain all beef consumers can take pride in what they purchase – and can trust and have confidence in the entire beef industry