Tennessee Beef Producers' Willingness to Participate in a Tennessee Branded Beef Program

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Abstract

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Growing interest in producing locally produced beef to capture more value-added has been expressed by the Tennessee beef industry. This study measures Tennessee cattle producer willingness to supply beef to a Tennessee branded beef (TBB) program. Data from a 2016 survey of Tennessee beef cattle producers were used to estimate a probit for interest in TBB participation and a Tobit for cattle live weight that interested producers would supply. Over 70 percent were interested in participating, with age, income, production practices used, and risk attitudes influencing interest. Liveweight supply was influenced by producer age, animal units, production practices, and perceived barriers.

Keywords: **Branded Beef, Producer Willingness to Supply, Probit, Tobit**

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Introduction

In 2014, Tennessee had $825.1 million in cash receipts from cattle and calves accounting for 19.6 percent of all agricultural cash receipts that year (TDA 2016). Beef cattle are a top agricultural commodity in the state in terms of cash receipts. In 2016, Tennessee ranked 12th in terms of number of beef cattle nationally and 15th in terms of cattle and calves. As of January 1, 2016, there were a total of 896,000 head of beef cattle in Tennessee (USDA/NASS 2016).

Most Tennessee beef operations are cow-calf operations, but other methods of production and marketing take place in the state. Other methods include weaning, preconditioning, and backgrounding calves prior to marketing them as feeder cattle to feedlots, custom feeding them through a retained ownership agreement in out-of-state facilities such as those in the Midwest or Great Plains, or finishing on-farm and marketing them as local beef. Many cow-calf producers will market calves weighing less than 600 pounds to backgrounding operations in either Tennessee or to operations outside the state. Calves remaining in Tennessee to be backgrounded will then be marketed to a feedlot outside of the state or custom fed outside of the state through a retained ownership agreement. While finishing on farm is not popular within the state at this time, there are several producers in Tennessee who use this marketing method. Traditional marketing methods offer producers several options by which to market their cattle, but new alternative marketing methods are gaining popularity due to growing preferences for local beef as a part of the larger local foods movement. Cattle producers have a potential opportunity to capture more of the value-added process by supplying to these emerging markets by finishing their cattle in the state or on site. Finishing, however, adds to productions costs meaning a producer would need to receive a high enough premium to make the finishing process profitable.

Price premiums could potentially be increased on finished cattle if consumers were willing to pay an additional premium for beef branded as Tennessee produced. However, even if consumers are willing to pay a premium, producers would have to be willing to supply cattle to such a program. Participation might be influenced not only by premium levels, but the producer's ability to finish cattle and deliver them to slaughter facilities given their resources, desire to participate in a program, willingness to participate in a new market channel, and other factors.

Several state branding programs help ensure a better premium for producers who adhere to program standards and use the associated label. Iowa-80 Beef, Nebraska Cornfed beef, and South Dakota Certified are all programs designed to differentiate beef products based on geographic indications. Each program had the unexpected difficulty of a lack of federally inspected small to medium size packing facilities which would be best suited to handle the segregated cattle and beef products of such programs (Babcock and Clemens 2005). The Federal Trade Commission categorizes the beef packing industry as highly concentrated which presents two major difficulties for branded beef programs. The first difficulty is that packers are driven by maximizing throughput because money is made by moving large numbers of animals through packinghouses quickly and efficiently. The need to stop or slow production for a small batch of animals in order to segregate them for labeling purposes runs counter to this method of operation. Secondly, a traceable and auditable system requires close coordination between all participants in a value chain. This system can often break down because of just one participant. Economic realities of livestock processing favor the continued consolidation of packers (Babcock and Clemens 2005).

Currently there are a total of 13 federally inspected livestock slaughter facilities in Tennessee that are listed as possibilities for producers who want to have livestock slaughtered and processed under USDA inspection (Pepper, Leffew and Holland 2016). However, no study has been conducted that examines factors such as price premiums, producer demographics, farm characteristics, or perceptions about participating in a branded program that may influence Tennessee beef cattle producers' willingness to participate in a Tennessee branded beef program. In addition, no studies have been conducted that examine preferred marketing structures if cattle producers participated in a Tennessee branded beef program. Therefore, this research examines whether there is potential for a market channel of Tennessee branded beef.

Study Objectives

The primary objectives of this study are to a) measure Tennessee cattle producers' willingness to participate in a Tennessee branded beef (TBB) program, b) ascertain factors influencing interest in participation and c) also ascertain those factors influencing the amount of beef they would supply to such a program, including premiums, producer demographics, farm characteristics, and attitudes. The study also seeks to provide information about preferred marketing structures by producers for a TBB program, preferred methods of finishing, and program fees producers might be willing to pay for a TBB program.

Literature Review

Local Branding

Several studies have been conducted regarding consumer preferences for local meat and produce as well as their willingness to pay a premium for such products. A study conducted by Jensen, Bruch, et al.(2014) indicated that Tennessee consumers in metro areas were willing to

pay a premium for beef produced and harvested in-state. A survey of a random sampling of consumers from counties in and around Memphis, Nashville, Chattanooga, Knoxville, and Tri-Cities were asked about their preferences and willingness to pay for Tennessee beef. Respondents who indicated they would be willing to purchase Tennessee beef over a base product viewed the Tennessee beef to be fresher and safer than out of state beef. Humane treatment of animals was the most important characteristic to be identified on a product label, followed closely by naturally raised and locally produced. The research suggested future marketing programs, such as a Tennessee Beef label, should emphasize freshness, food safety, support of local farms, and support of local economies as these attributes were considered most important in choosing such a product by consumers. While Jensen et al. (2014) provided important information about consumer willingness to pay (WTP), it did not address premiums required, program provisions, or other factors influencing farmers' decision to participate. Research conducted by Maynard, Burndine and Meyer (2003) also suggested a large portion of consumers were willing to pay a premium for local meat products. Even with growing demand, very few beef producers participate in local retail markets. A study conducted by Velandia et al. (2014) found farmer participation in a state-sponsored marketing program could be associated with farm income, use of extension resources, and fresh produce sales. The research also found there to be a perception among producers surveyed that the state-sponsored marketing program was for larger operations and did not apply to smaller operations. Dalton, Holland and Hubbs (2015) conducted a study of USDA inspected livestock slaughter facilities in Tennessee. They found 90 percent of these facilities slaughter cattle and they all were operating well under capacity. All slaughter facilities in the study that were inspected for slaughtering were also inspected for processing.

Retained Ownership and Marketing Arrangements

In addition to traditional marketing methods, several studies have been conducted on producer choice of alternative methods such as retained ownership and use of strategic alliances. In one case study of six selected beef strategic alliances, it was determined that alliances reduced transaction costs and increased information flow among industry segments although they did not specifically reduce risk or increase access to capital (Gillespie et al. 2006). Reasons mentioned in the case study as to why producers might not participate in an alliance included producers who simply farm as a hobby may not wish to devote more time and effort to change management practices, an unwillingness to give up autonomy, an unwillingness to abide by group marketing decisions, and a concern for only reducing risk and gaining access to capital. Gillespie et al. found that younger producers were more likely to use private treaties and retained ownership than their older counterparts suggesting new and younger producers may make greater use of alternative marketing methods (Gillespie, Basarir and Schupp 2004). Other factors in deciding how to market cattle include farm experience, diversification, farm size, production system, and production region (Gillespie et al. 2016).

Supply chain alliances are one way to ensure consumer demand for quality beef is met through branded beef products. Cow-calf producers are one of the most crucial elements in providing almost all of the desirable attributes in a branded beef product. Brocklebank and Hobbs (2004) asked Canadian producers at the 2003 Western Stock Growers Association Annual meeting to indicate how likely they would be willing to participate in a hypothetical supply chain alliance based on a set of four characteristics related to amounts of asset specific investment, price uncertainty in both quality variability and number of buyers, and premiums received. Using conjoint analysis it was found that cow-calf producers were willing to make specific asset

investments up to a certain point, but as the degree of investment required increases, willingness decreases. Cow-calf producers in this study appeared to be more concerned with the balance between premiums received and costs of required investments, but were less concerned about the number of buyers and the pricing method used.

Lacy, Hudson and Little (2003) conducted a study on Mississippi beef producers' willingness to participate in a marketing cooperative and how much capital they were willing to invest on a per head marketing basis using a contingent valuation framework. The research found the majority of the participants were willing to permanently identify all cows and calves, implement a specific pre-weaning health management program, and vaccinate and pre-condition calves 30-60 days past weaning (Lacy et al. 2003). This willingness to permanently identify all cows and calves could indicate a higher level of management and/or a desire to improve the cow herd. Many respondents also stated they would be willing to change the breed of the bull used. The authors also noted that producers who indicated they had attended educational events would be willing to pay more and more experienced producers were willing to pay less. On average, respondents stated they would be willing to pay $1.66 per head marketed.

Several studies have investigated profitability potential of retained ownership (Lewis et al. 2015; Pope et al. 2011; Franken et al. 2010), but many producers are hesitant to use it as a marketing strategy. Lewis et al. (2015), conducted a study that looked at how animal characteristics, carcass quality, and a supplemental prepartum feeding program for cows would impact net returns for retained ownership of calves through finishing. OLS regression indicated feed to gain ratio, average daily gain, dressing percentage, and quality grade significantly impact net returns. Standardized beta coefficients indicated feed to gain ratio and quality grade had the largest impact in explaining retained ownership profitability.

6

Pope et al. (2011), suggested a producers' risk aversion affected whether or not they would use retained ownership. Using an ordered probit model, the study asked participants to choose from five ordinal choices of *1) never, 2) seldom, 3) sometimes, 4) often and 5) always* to describe what they do with a calf after weaning which included the choices of 1) sell steers at weaning, 2) background steers, then sell them, or 3) retain steers through finishing. It was found that the probability a producer would sell a calf immediately after weaning decreased with greater risk tolerance. Producers who were the most risk averse had about a 60 percent probability they would *often* or *always* sell calves after weaning as opposed to the most risk-tolerant which only had a 15 percent probability they would sell calves at weaning. It was also shown that the share of gross farm income was significantly related to retaining ownership.

Franken et al. (2010), used structural equation modeling to trace the path effects of different producer characteristics on interest in and actual use of retained ownership. They found cattle quality, as measured by ownership of registered cattle, led to a significant increase in interest in retained ownership. Additionally, a producer's interest in performance-based management, as measured by interest in feedlot and carcass data, was significantly associated with interest in retained ownership.

In a study conducted by Babcock et al. (2007), the authors created a pilot program to market high quality beef using a certification mark and the USDA Process Verification Process Program to create a geographical indicator for Iowa-80 Beef. The authors hypothesized a program to differentiate and market very high quality beef produced in Iowa would allow producers to take greater advantage of price premiums. It was concluded stringent or unique production and/or processing criteria are needed to differentiate beef and other high value agricultural products. Bedoin, Kristensen and Noe (2009) also concluded an institutionally based

certification was a way to formalize the relationship between the values created in a food network.

Brand premiums can provide incentives needed for sourcing higher quality and more consistent cattle and can provide opportunities for increased revenues to be allocated across the supply chain (Martinez 2011). Martinez used Nielsen Homescan data to estimate the effect of observable beef product attributes on retail beef prices. It was concluded most random-weight beef brands contained in the data received premiums compared to unbranded products, but premiums varied widely across brands. The highest premiums were paid to brands with specific production quality requirements and rely on alternative market.

Technology Adoption and Tobit Model

Studies estimating the adoption of new technologies can be used as a proxy to estimate factors affecting willingness to participate in a new marketing program as well as the intensity of participation in such a program. Tobit models are often used in estimating the effects of variables upon crop and/or livestock technologies or management practices adoption (Adesina 1996; Baidu-Forson 1999; Foltz and Chang 2001; Jensen et al. 2007; Qualls et al. 2012; Rajasekharan and Verraputhran 2002; Ransom, Paudyal and Adhikari 2003). Foltz and Chang (2001) conducted a study of the adoption and profitability of using rbST on Connecticut dairy farms. The researchers used a Tobit model to estimate the rbST adoption intensity on milk production and farm profitability. They concluded younger, more educated farmers who own larger farms are significantly more likely to use rbST. Fernandez-Cornejo et al. (2001) contrasted the relationship between farm size and adoption for genetically engineered (GE) crops and precision farming. The analysis of the study was done using an extension of the McDonald and Moffit decomposition for the two-limit Tobit model. Adoption of precision farming technologies was

found to be more likely on larger farms, but not for GE crops. The researchers also concluded operators with more formal education were more likely to adopt both technologies. Cho et al. (2008) compared an ordered probit model and a Tobit model to estimate the willingness to pay (WTP) for conservation easements in North Carolina. They concluded both income and knowledge are positive and significant factors. In analyzing factors that would influence producer interest in producing switchgrass and determining the share of farmland interested producers would be willing to convert to switchgrass. Qualls et al. (2012) used a probit model to find the probability of interest in switchgrass and a Tobit model to estimate the land share interested producers would change to the crop. The researchers concluded interest in producing was tempered by concerns about potential conflicts with other crops, sufficient capacity to introduce a new crop, and introducing a new crop onto rented land. They also stated the results suggested larger farms would be willing to adopt a smaller share.

Consequentiality

Several studies have examined the effects of consequentiality, or beliefs that survey responses might influence some outcome (Carson, Groves and List 2014; Interis et al. 2014; Interis and Petrolia 2014; Vossler and Evans 2009; Herriges, Kling and Tobias 2010; Lewis et al., 2016; Li et al. 2016; Vossler and Evans 2009; Interis et al. 2014; Interis and Petrolia 2014; Herriges, Kling, and Tobias 2010) and found evidence that consequentiality reduced hypothetical bias in stated preferences surveys. Hence, if a consumer considered their survey responses consequential to influencing policy, then hypothetical bias was reduced in their stated preference willingness to pay estimates. Given the potential for hypothetical bias in our study, we also examine the impact of consequentiality on producer willingness to supply a TBB program.

Methods and Data

Data Collection and Survey

Data for this study were obtained through an online survey of beef cattle producers who participated in the Tennessee Agricultural Enhancement Program (TAEP). The producers in this program are spread across the state, with a total of 5,500 beef cattle producers in the sample. An initial pretest was emailed to 25 producers in June 2016. A second pretest was emailed to 250 producers. Based on pretests, revisions were made to the survey before distributing the full field survey. The full field survey was sent out in August 2016. A follow up email was sent a week after the initial email, a second reminder email was sent 2 to 3 weeks after that. All surveys were collected by mid-September. The pretests and field surveys were distributed by email, the surveys were fielded, and responses collected through Qualtrics. A copy of the survey is available from the authors upon request.

The survey was divided into five sections. The first section titled "About Your Cattle Operation," asked if the participant had raised cattle in 2015 and if the participant was the primary decision maker of the cattle operation. If a participant answered no to either of these questions they were directed to the end of the survey or asked to forward the survey to the primary decision maker. These questions were used to separate out participants who either were not primary decision makers or who did not produce cattle recently.

The second section, "Finishing and Marketing Cattle," began by asking respondents to provide the number of head of cattle they managed and marketed in the following activities in 2015: producing calves for immediate sale at weaning, pre-conditioning (<90 days), backgrounding (>=90 days), retaining ownership in a custom feedlot, or finishing cattle. If a respondent did not have any cattle in retained ownership or finishing, then they were asked if they would be willing to finish cattle and then sell those cattle to an in-state federally inspected

slaughter facility if such a change was profitable. The respondents who already retained ownership and/or finished cattle were asked if they would be willing to sell to an in-state slaughter facility if it was profitable. Respondents who answered yes to either question were then given a premium level they would receive above a representative market price for supplying to the in-state federally inspected slaughter facility and asked if they would supply at this premium level. If a participant answered yes to this question, they were then asked how many head a year they could supply, the average live weight in pounds per head, and how the cattle would be finished (i.e. grass-fed on farm, grass and grain-fed on farm, feedlot in state, feedlot out of state, or other). Respondents answering no were asked to choose a minimum premium level at which they would be willing to sell to an in-state federally inspected slaughter facility.

The "Tennessee Branded Beef Program" section began by informing the respondent about a hypothetical Tennessee Branded Beef program and listed the possible benefits and requirements of the program. This section was designed to examine the potential for such a program and what premiums producers expected as well as what changes they would be willing to make to their current management practices. Participants were asked if they would be willing to participate in such a program given the first list of hypothetical requirements. Respondents who answered yes were then given a premium level above the standard maker price and asked if they would still be willing to sell their cattle through the program. If a participant answered yes to this question, they were then asked how many head a year they could supply, the average live weight in pounds per head, and how the cattle would be finished (i.e. grass-fed on farm, grass and grain-fed on farm, feedlot in state, feedlot out of state, or other). Respondents answering no were asked to choose a minimum premium level at which they would be willing to sell through the branded program. Participants were also asked how much they would be willing to pay to

cover costs of administering the program, their attitudes about various changes in management practices, and how they would want to sell the animals in the program (ex. a producer marketing cooperative of which they would be a member that markets the beef to a third party). The final part of this section gave a summary of the Advanced Master Beef Producer Program (AMBPP) and the Beef Quality Assurance (BQA) program. They were then asked if they are AMBPP and/or BQA certified.

The next section, "About Your Farm," asked respondents questions about the characteristics about the operation they managed such as the county in which the operation is located, number of head of cattle on operation, breeds of sires, marketing methods used, and acres farmed. The final section, "About You," was designed to gain information about the respondent such as age, education level, and income in order to understand and quantify the respondents' cattle operation as well as their own personal demographics. The survey also included questions about respondents' attitudes toward risk. In order the measure any effects of consequentiality, respondents were asked and whether or not they think their answers to the survey have an impact on the outcome of the TBB program.

There were five different versions of the survey. Each version was the same in every aspect except for the hypothetical premiums for selling through the Tennessee Branded Beef program. The hypothetical premium levels for participating in the branded program were $3, $5, $7, $9, and $11. These premiums were added on a base price of $130 per hundredweight assuming the animal graded choice. The price per hundredweight of $130 was based upon weekly weighted average price for finished cattle from May 2016 according to USDA-AMS report LM-CT150 (2016). The premium levels were based off of premiums received by

producers who participate in the Certified Angus Beef Program (Tatum 2016; Anderson 2016). The sample was randomly divided equally among the premium levels.

Economic Modeling

As noted earlier, Tobit models can be used in estimating the effects of variables upon crop and/or livestock technologies or management practices adoption (Adesina 1996; Baidu-Forson 1999; Foltz and Chang 2001; Jensen, Clark et al. 2007; Qualls et al. 2012; Rajasekharan and Verraputhran 2002; Ransom, Paudyal and Adhikari 2003). A producer's decision regarding program enrollment can be divided into stages. The first is interest in participating in a TBB program if profitable (*INTEREST*) given producer demographics, farm characteristics, and producer attitudes. Among those interested, the decision is then the amount of cattle live weight to supply per year to the program (*WEIGHT*) given premium levels, producer demographics, farm characteristics, and producer attitudes.

Therefore, this study assumes that if a producer indicates they would not supply cattle to a TBB program it is resultant from two decision points, either they are not interested in participating in a TBB program regardless of profitability or they are interested, but not at the premium level offered to them. This response pattern follows a Tobit specification with a binary sample selection rule (Cho et al. 2008; Qualls et al. 2012). The binary sample selection rule is used to model the interest/no interest in participating in the TBB program, while the Tobit model is used to estimate the live weight of cattle given interest in program participation. The outcomes for *INTEREST* take on a value of 1 if the producer is interested in participating in the TBB program, and 0 if not. If the producer indicates interest (*INTEREST*=1), then the value for cattle live weight they would supply into a TBB program is *WEIGHT*, which ranges from values from zero (if they do not accept the premium offered) to some positive value.

13

Interest in participating in a TBB program can be expressed as a binary decision. The underlying utility from being willing to participate in a TBB program given the program if profitable is expressed as:

(1) $INTEREST^* = \beta'x + \varepsilon,$

where x is a vector of explanatory variables including farm characteristics, producer demographics, and producer attitudes, β is a vector of parameters, and ε is a random error term (Table 1). The observed indicator of $INTEREST^*$ is whether or not the respondent stated they would be interested in participating in a TBB program if profitable, the binary variable *INTEREST*. Hence, the variable *INTEREST* takes on the value of 0,1 where:

2) $INTEREST = \begin{cases} 1, \beta'x + \varepsilon > 0 \\ 0, \beta'x + \varepsilon \leq 0 \end{cases}.$

Given interest in participation, then the producers were asked to indicate whether or not they would accept the premium offered to them and if so, how many head and average weight of cattle they would enroll in the program. Hence, the live weight of cattle they would enroll in the program if they were interested in participation can be modeled as a censored regression conditional upon interest. The live weight (*WEIGHT*) is then expressed as:

3) $WEIGHT = max\{\gamma'z + u, 0\} \quad if \ \beta'x + \varepsilon > 0$

$$unobserved \qquad if \ \beta'x + \varepsilon \leq 0,$$

where z is a vector of explanatory variables (premium, producer demographics, farm characteristics, and producer attitudes), γ is a vector of parameters, and u is a random error term. Variable names, sample means, and descriptions of the dependent and explanatory variables comprising z and x are provided in Table 2.

The error terms (ε, u) are assumed to be distributed as bivariate normal with zero means, variances of $(1, \sigma^2)$ and a correlation of ρ. If the error terms u and e are independent such that $\rho = 0$, then the two sets of parameters (β and γ, σ) are separable and the decisions can be modeled separately as a probit on *INTEREST* (using the whole sample) and a Tobit on *WEIGHT* (using the sample of only those interested in TBB). However, if there is correlation between the interest and live weight decisions ($\rho \neq 0$), then the two equations should be estimated jointly by maximizing the sample likelihood function (Cho et al. 2008). In this case, the likelihood function becomes:

$$(4)\ L = \prod_{INTEREST=0}[1 - \Phi_1 \beta'x)] \times \prod_{INTEREST=1,WEIGHT=0} \Phi_2\left(\beta'x, -\frac{\gamma'z}{\sigma}, -\rho\right) \times$$

$$\prod_{INTEREST=1,WEIGHT>0} \frac{1}{\sigma}\phi_1\left(\frac{WEIGHT-\gamma'z}{\sigma}\right)\Phi_1\left(\frac{\beta'x+\rho(WEIGHT-\gamma'z)/\sigma}{(1-\rho^2)^{1/2}}\right),$$

where ϕ_1 and Φ_1 are the univariate standard normal probability density function and cumulative distribution function (cdf), respectively, and Φ_2 is the bivariate standard normal cdf. Hence, the likelihood function encompasses three parts, the probability that a producer is not interested in the TBB program, the probability that a producer is interested, but not at the premium level offered, and the density function of the non-zero amount of cattle live weight the producer would enroll in the TBB program given interest in that program.

The probability of the ith producer being interested in the TBB program is then

(5) $\Pr(INTEREST = 1) = \Phi_1(\beta'x).$

The probability of accepting the premium offered, given interest in the TBB is:

(6) $\Pr(INTEREST = 1, WEIGHT > 0) = \Phi_2(\beta'x, \frac{\gamma'z}{\sigma}, \rho)/ \Phi_1(\beta'x).$

The expected value for *WEIGHT* given an interest in participating in the TBB and accepting the premium offered is:

(7) $E(WEIGHT|INTEREST_i = 1, WEIGHT > 0) = \gamma'z + \sigma\ \Phi_2(\beta'x, \frac{\gamma'z}{\sigma}, \rho)/ \Phi_1(\beta'x).$

The unconditional expected value of WEIGHT (live weight across all producers) is found by multiplying (5) and (7).

Factor Analysis

Several risk attitude questions were asked. In order to identify underlying risk attitude factors among the potentially correlated risk attitudes, principal factor analysis was used. Factor analysis finds a set of common underlying factors (q) that linearly construct the original set of *p* variables, where:

(8) $y_{ij} = a_{i1}f_{1j} + a_{i2}f_{2j}, + \cdots, + a_{iq}f_{qj} + \epsilon_{ij},$

where y_{ij} is the value of ith observation for the jth variable, a_{ik} is the ith observation on the kth common factor, f_{kj} is the set of factor loadings, and ϵ_{ij} is the jth variable's uniqueness.

An orthogonal rotation was used and factor loadings of 0.7 or greater were used to identify variables that loaded onto common factors.

Results

A map of the survey respondents is provided in Figure 1, along with a listing of the top 5 counties in inventory for the state. A total of 516 responded to all questions needed for the analysis of interest in the TBB program and a total 364 to the questions needed for the analysis of liveweight of cattle they would indicate they would be willing to supply to a TBB program given interest. Summary statistics are provided for each of the variables. Table 1 contains means of the variables used in the probit model of *INTEREST*, and Table 2 contains means of the variables used in the Tobit analysis of *WEIGHT*. Notably, 70.5 percent expressed interest in participating in a TBB program if it was profitable. On average, the live weight per farm that the producers indicated they would supply was 58,598 pounds per year. Assuming an average liveweight of 1,300 pounds per head, this works out to about an average of 45 head per farm per year or about 16,380 head in total per year. Taking a cumulative total weight across respondents, this sums to 21,295,795 pounds. By comparison, according to USDA statistics, the state currently slaughters about 50,985 head in Federally Inspected facilities in a year (USDA/NASS 2016)

The results of the factor analysis to find underlying risk attitude factors are shown in Table 3. As can be seen from the analysis, overall financial matters and financial matters related to the beef cattle business loaded onto a factor (*RISKATTTFIN*). Adopting new herd management practices and technologies and finding new market outlets loaded onto a factor (*RISKATTTMGT*).The question regarding risk perceptions of retaining cattle did not load onto either of the factors, so it was entered separately into the probit model of *INTEREST* as the variable *RISKATTITRETAIN*.

The models for INTEREST and WEIGHT were initially estimated jointly as a Tobit with sample selection. However, the estimated correlation coefficient on the error terms between the two equations was not significantly different from zero, so the models were estimated separately as Probit and Tobit models. The estimated coefficients, standard errors, as well as the marginal effects, and their associated standard errors are presented in Table 4, for the probit model of *INTEREST* and in Table 5, for the Tobit model of *WEIGHT*.

Probit Model of Interest

Shown in Table 4, the Likelihood Ratio test against an intercept only model indicated that the probit model was significant overall. The model correctly classified 71.71 percent of the observations for *INTEREST*. While being over 65 (*AGEGT65*) had a negative influence on probability of program interest (6.9 percent), being under 35 (*AGELT35*) had a positive influence (17.2 percent). Unexpectedly, being a college graduate had a negative influence, with college graduates being 6.7 percent less likely to express interest. Household income had a significant and positive influence on probability of being interested (for each $10,000 in income, probability increased by 0.4 percent). Backgrounding cattle had a positive influence (7.5 percent increase) on probability of interest as did finishing cattle (17.7 percent increase). Producers who viewed themselves as more risk takers in production and marketing (*RISKATTMGT*) matters as well as retaining animals (*RISKATTRETAIN*) were more likely to be interested in TBB program participation. Those producers who were Master Beef and Beef Quality Assurance Certified (*MASTERBQA*) were 9.7 percent more likely to be interested. Variables that did not have significant influences on *INTEREST* included being located in Middle Tennessee (where most beef cattle are located, *MIDDLE*), being located in a county near Federally Inspected Slaughter (*NRFISLTR*), sole proprietorship (*SOLE*), being a full time producer (*FULLTIME*), the share of

18

farm income from beef (*FIBEEF*), retaining animals in custom feedlots (*RETAIN*), number of types of marketing outlets used (*MKTOUTLETS*), risk attitudes toward overall financial matters (*RISKATTFIN*), and belief in influence of the survey responses on a TBB program (*SURVOUTCOME*).

Tobit Model of Liveweight

As can be seen in Table 5, with regards to the overall fit of the Tobit model, the Likelihood Ratio test of the Tobit model revealed the model to be significant overall. The percent of non-zero observations for *WEIGHT* correctly classified was 60.99 percent. The correlation between the predicted value for *WEIGHT* and actual value for *WEIGHT* was 0.6538.

The estimated coefficient and marginal effects on the premium (PREMIUMTBB) were not significantly different from zero. However, variables with positive influences on *WEIGHT* were *SOLE, ANIMALUNITS, BACKGROUND, RETAIN*, and unexpectedly *BARRIERCOMINGLE*. The marginal effects suggest for each additional animal unit on the farm, the added weight the farm indicated they would supply through a branded program was 472 pounds. Among the dummy variables for production practices, a farmer already retaining animals (RETAIN) had the largest marginal effect at 43,677 pounds. Variables with significant negative effects on *WEIGHT* included A*GEGLT35* (23,250 pound decrease)*, PASTAC* (108 pounds less per pasture acre), *FINISH* (11,666 pounds less if finish)*, BARRIERCHGBULLS* (decrease of 6,180 pounds with each additional increase in level of concern as a barrier), and *BARRIERFWDCON* (decrease of 7,326 pounds with each increase in level of concern as a barrier). Variables with no significant influence included *AGEEGT65, COLLGRAD, MIDDLE, NRIFISLTR, SHRPAST, FULLTIME, FIBEEF, MKTOUTLETS, MASTERBQA,* and *SURVOUTCOME.*

Analysis of preferred finishing method, fees, and marketing methods

Among producers interested in the program, it appears over 80 percent would prefer to finish the cattle on a mix of grass/grain on their farms (Figure 2). With respect to program administration fees, cumulatively, over 82 percent would pay $50 per year for program administration, while nearly 42 percent would pay $100 per year (Figure 3). Above $100 per year, the percentage who would pay drops markedly to around 11 percent. As shown in Figure 4, those interested in participating in a TBB Program expressed a strong preference for selling through a producer owned cooperative, either farmer-owned cooperative processing facility (42.33 percent) or a farmer-owned marketing cooperative (36.07 percent).

Conclusions

No significant effect of premium on liveweight was found. While younger producers were more likely to be interested in participating in a TBB program, they were willing to supply fewer pounds on average. College graduates appeared to be less interested in the program. Location factors, such as area of the state or proximity to Federally Inspected slaughter did not appear to significantly influence interest or live weight. Sole proprietorship did not influence interest, but did positively influence the live weight to be supplied among those interested. Wealth and farm size, in terms of household income and animal units positively influence interest and live weight to be supplied. Neither full-time farming status nor share of farm income from beef influenced either measure, as it might be expected that full-time, more specialized producers might hold a greater interest in participating in a TBB program. Types of beef cattle activities, including backgrounding, retaining, and finishing did influence interest and live weight. Those backgrounding tended to be more interested and willing to supply live weight. Retaining cattle already only influenced live weight. The negative sign on finishing on-farm

already is interesting and may reflect some slaughter through federally inspected facilities, but also custom slaughter and selling of shares of live animals. While it was hypothesized that using more types of market outlets might signal openness to a new market channel, no significant effect was found. If a TBB program required changing breed of bulls and forward contracting, this would diminish the live weight supplied among those interested. Belief that the survey could influence a TBB program outcome did not influence either interest or live weight. Hence, no "consequentiality" effects were found.

In general, the results suggest a relatively high degree of interest among beef cattle producers in participating in a TBB Program for beef. Producers with higher incomes and greater herd sizes are more likely to be interested and willing to supply more live weight to a program. While it might be anticipated that middle region of the state or proximity to a Federally Inspected facility would positively influence interest, these location factors did not. Hence, interest appears to be fairly constant across location.

The responding cattle producers appear to desire to grass/grain feed on-farm to finish cattle for a TBB program. Most are willing to pay a $50 a year program management fee. Most also desire to sell their beef through a cooperatively owned mechanism, either a producer-owned processing facility or using a producer-owned marketing cooperative.

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Table 1. Variables in Probit Model for Interest in Participating in the Program (*INTEREST*)

Variable Name	Description	Mean (n=516)
Dependent Variable:		
INTEREST	1 if interested in participating in the TBB program, 0 otherwise	0.705
Explanatory Variables:		
AGEGT65	1 if age of the producer in years>65, 0 otherwise	0.172
AGELT35	1 if age of the producer in years<35, 0 otherwise	0.089
COLLGRAD	1 if college graduate, 0 otherwise	0.574
MIDDLE	1 if middle Tennessee, 0 otherwise	0.510
SOLE	1 if sole proprietor, 0 otherwise	0.814
NRFISLTR	1 if in county or surrounding county of federally inspected slaughter facility, 0 otherwise	0.422
HHINC	2015 Household income (farm and non-farm, thous. dollars)	122.985
FULLTIME	1 if percent of total taxable household income coming from farming>50 percent, 0 otherwise	0.461
FIBEEF	Percent of farm income from beef	51.667
BACKGROUND	1 if background cattle, 0 otherwise	0.275
RETAIN	1 if retain ownership of cattle in feedlots, 0 otherwise	0.035
FINISH	1 if finish cattle on-farm, 0 otherwise	0.343
MKTOUTLETS	Number of types of market outlets cattle producers use to sell cattle	1.824
RISKATTFIN	Factor representing attitudes toward financial risk taking	0.010
RISKATTMGT	Factor representing attitudes toward management and marketing practices risk taking	0.019
RISKATTRETAIN	Willingness to rake risks regarding retaining ownership (1=not willing at all, …10=very willing to take risks)	5.866
MASTERBQA	1 if Advanced Master Beef Producer and Beef Quality Assurance certified, 0 otherwise	0.899
SURVOUTCOME	Agreement that responses to survey will influence outcome of a TBB Program (1=strongly disagree,…5=strongly agree)	3.936

27

Table 2. Variables for Tobit Model of Live weight of Cattle would Supply to a TBB Program Given Interest (*WEIGHT*)

Variable Name	Description	Mean (n=364)
Dependent Variable:		
WEIGHT	Liveweight pounds of cattle would supply to TBB program	58597.800
Explanatory Variables:		
PREMIUMTBB	Premium for TBB Program ($3, $5, $7, $9, $11/cwt)	6.923
AGEGT65	1 if age of the producer in years>65, 0 otherwise	0.140
AGELT35	1 if age of the producer in years<35, 0 otherwise	0.107
COLLGRAD	1 if college graduate, 0 otherwise	0.571
SOLE	1 if sole proprietor, 0 otherwise	0.810
MIDDLE	1 if middle Tennessee, 0 otherwise	0.511
NRFISLTR	1 if in county or surrounding county of federally inspected slaughter facility, 0 otherwise	0.434
*ANIMALUNITS**	Number of animal units	97.280
PASTAC	Pasture acres	171.764
SHRPAST	Share of acres in pasture	0.552
FULLTIME	1 if percent of total taxable household income coming from farming>50 percent, 0 otherwise	0.462
FIBEEF	Percent of farm income from beef	50.907
BACKGROUND	1 if background cattle, 0 otherwise	0.321
RETAIN	1 if retain ownership of cattle in feedlots, 0 otherwise	0.038
FINISH	1 if finish cattle on-farm, 0 otherwise	0.412
MKTOUTLETS	Number of types of market outlets cattle producers use to sell cattle	1.885
BARRIERCHGBULLS	Potential barrier of program if must change breed of bull (1=not a barrier, …5=complete barrier)	2.404
BARRIERCOMINGLE	Potential barrier of program if comingle animals (1=not a barrier, …5=complete barrier) g	2.209
BARRIERFWDCON	Potential barrier of program if must use forward contracts (1=not a barrier, …5=complete barrier)	2.135
MASTERBQA	1 if Advanced Master Beef Producer and Beef Quality Assurance certified, 0 otherwise	0.920
SURVOUTCOME	Agreement that responses to survey will influence outcome of a TBB Program (1=strongly disagree,…5=strongly agree)	4.011

*Animal units are calculated as .92*cows+ .08* calves+ 1.35* bulls+.6*backgrounder calves+ .6*stocker calves+ .92*dairy cows+ .8*replacement heifers +.8*miscellaneous cattle (Source: http://extension.usu.edu/files/publications/publication/NR_RM_04.pdf)

Table 3. Factor Analysis of Risk Attitude Variables

| | | Factor Loadings | | |
Description	Mean	Factor 1	Factor 2	Unique ness
Overall financial matters	5.475	0.810	0.304	0.251
Financial matters related to beef cattle business	5.878	0.808	0.355	0.221
Adopting new herd management practices and technologies	7.039	0.422	0.711	0.316
Finding new market outlets	7.333	0.351	0.741	0.328
Retaining ownership	5.866	0.386	0.460	0.640

Table 4. Estimated Probit Model for *INTEREST*

| Variable Name	Estimated Coeff.	Std. Err.		Estimated Marginal Effect	Std. Err.	
Intercept	**-1.314**	**0.469**	***			
AGEGT65	**-0.246**	**0.166**	*	**-0.069**	**0.047**	*
AGELT35	**0.611**	**0.266**	**	**0.172**	**0.074**	**
COLLGRAD	**-0.237**	**0.139**	*	**-0.067**	**0.039**	*
MIDDLE	0.170	0.137		0.048	0.038	
NRFISLTR	0.029	0.138		0.008	0.039	
SOLE	0.011	0.166		0.003	0.047	
HHINC	**0.002**	**0.001**	*	**0.0004**	**0.000**	*
FULLTIME	0.047	0.137		0.013	0.039	
FIBEEF	-0.002	0.002		-0.001	0.001	
BACKGROUND	**0.266**	**0.159**	*	**0.075**	**0.044**	*
RETAIN	-0.075	0.381		-0.021	0.107	
FINISH	**0.629**	**0.149**	***	**0.177**	**0.040**	***
MKTOUTLETS	0.084	0.086		0.024	0.024	
RISKATTFIN	-0.018	0.083		-0.005	0.023	
RISKATTMGT	**0.200**	**0.097**	**	**0.056**	**0.027**	**
RISKATTRETAIN	**0.122**	**0.029**	***	**0.034**	**0.008**	***
MASTERBQA	**0.344**	**0.207**	*	**0.097**	**0.058**	*
SURVOUTCOME	0.108	0.077		0.030	0.021	
N=516						
LR CHISQ(18)	108.35	***				
Pseudo R2	0.1732					
Pct Correctly Classified	71.71%					

***=significant at α=.01, **=significant at α=.05, *=significant at α=.15.

Table 5. Estimated Tobit Model for *WEIGHT*

| Variable Name	Estimated Coeff.	Std. Err.		Estimated Marginal Effect	Std Err.	
Intercept	**-110216.800**	**71593.340**	*			
PREMIUMTBB	-286.041	3011.975		-121.0418	1274.558	
AGEGT65	-25507.280	25293.470		-10793.74	10709.68	
AGELT35	**-54943.480**	**28984.910**	**	**-23250.05**	**12286.28**	**
COLLGRAD	-5141.047	17529.780		-2175.501	7420.349	
MIDDLE	-1711.796	18147.410		-724.3688	7679.668	
NRFISLTR	-1323.260	18032.830		-559.9547	7631.137	
SOLE	**37745.780**	**22148.280**	*	**15972.62**	**9383.219**	
ANIMALUNITS	**1116.514**	**129.219**	***	**472.4674**	**55.57117**	***
PASTAC	**-254.756**	**69.379**	***	**-107.8034**	**29.41563**	***
SHRPAST	46564.580	38548.440		19704.41	16328.7	
FULLTIME	1449.427	18350.850		613.344	7765.272	
FIBEEF	-19.349	270.016		-8.18767	114.2633	
BACKGROUND	**46972.300**	**19616.120**	**	**19876.94**	**8343.433**	**
RETAIN	**103215.500**	**45648.100**	**	**43676.98**	**19331.14**	**
FINISH	**-27568.530**	**18198.190**	*	**-11665.98**	**7714.628**	*
MKTOUTLETS	14491.310	10498.680		6132.187	4451.395	
BARRIERCHGBULLS	**-14603.250**	**7135.659**	**	**-6179.555**	**3026.928**	**
BARRIERCOMINGLE	**17089.190**	**8250.383**	**	**7231.515**	**3504.822**	**
BARRIERFWDCON	**-17311.570**	**8822.826**	*	**-7325.618**	**3743.808**	**
MASTERBQA	36236.870	32061.450		15334.11	13574.84	
SURVOUTCOME	1804.776	9852.590		763.7145	4169.642	
σ	153306.600	6322.166				
N=364						
LR CHISQ(21)	149.75	***				
Corr	0.6538					
$\widehat{WEIGHT} * WEIGHT$						
Pct Correctly Classified Non-Zero	60.99%					

***=significant at α=.01, **=significant at α=.05, *=significant at α=.15.
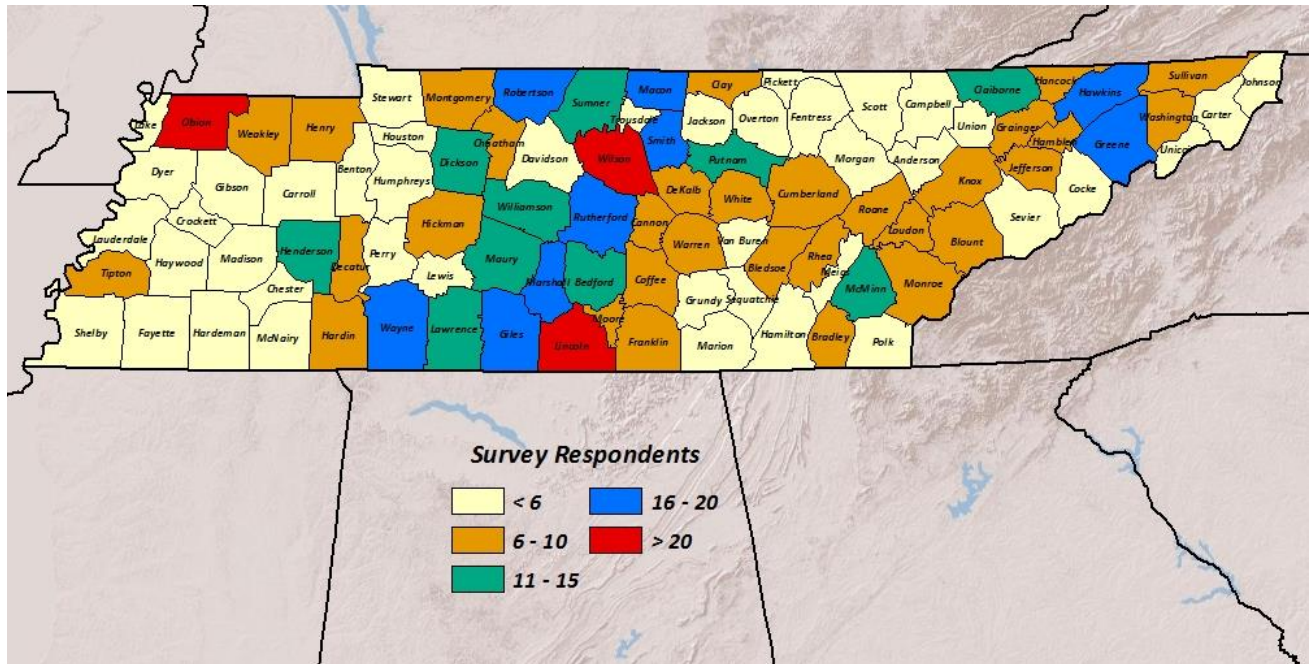
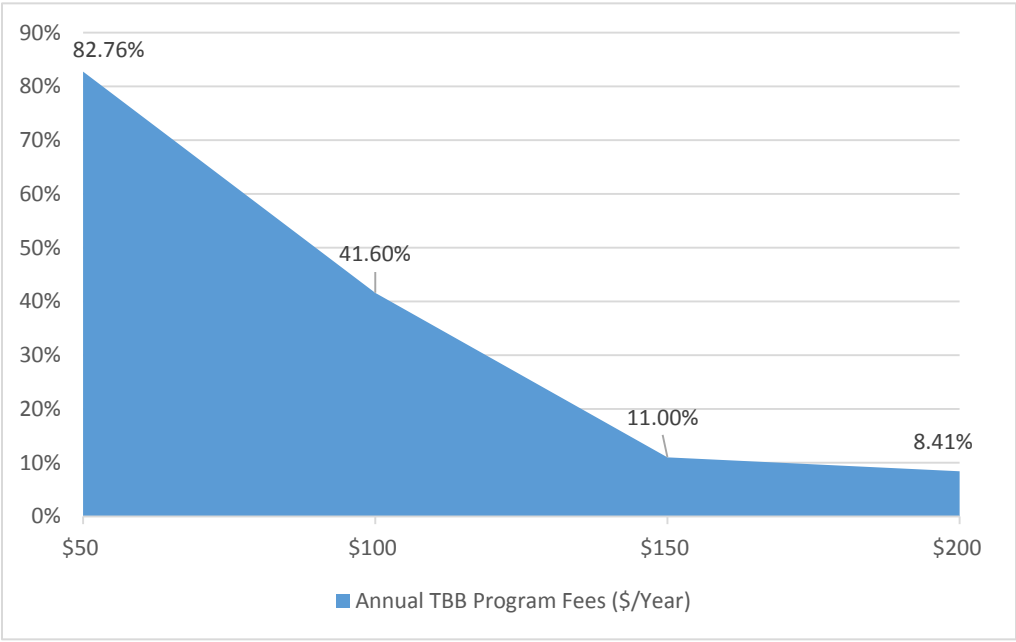| Tennessee's Top Five Counties for Beef Cattle Inventory		
County	Head Cattle & Calves	Rank
Greene	70,000	1
Lincoln	60,000	2
Giles	58,000	3
Bedford	52,000	4
Maury	51,000	5
Statewide	1,720,000	

Source: USDA/NASS (2016).

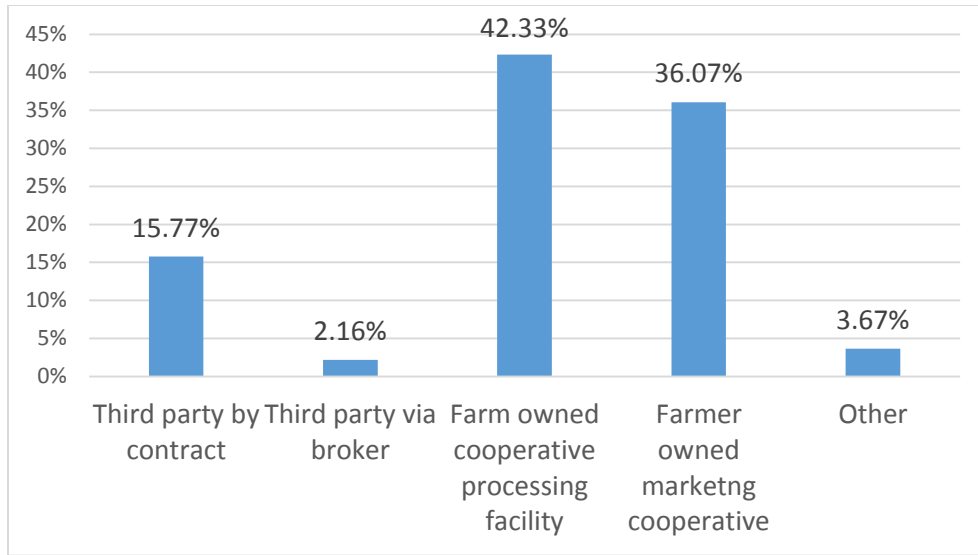Figure 1. Map of Survey Respondents, by County
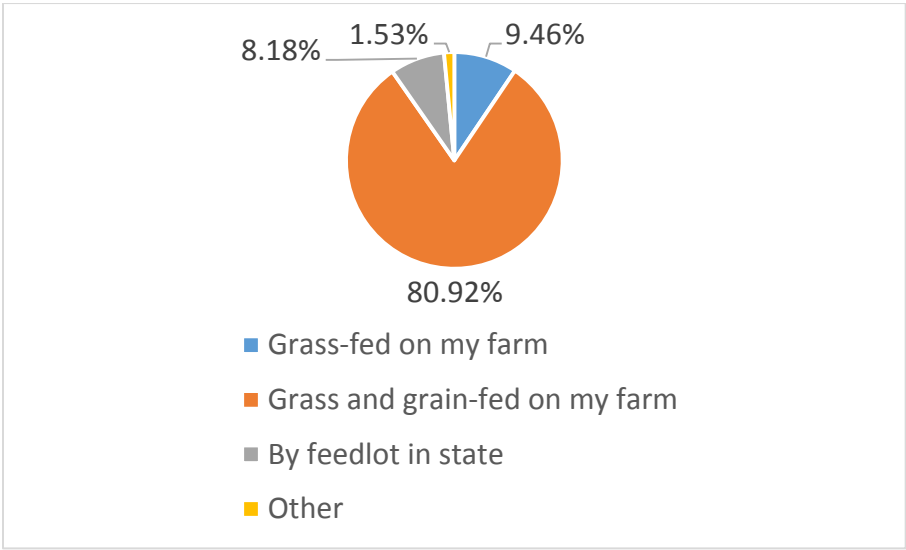
(N=391)

Figure 2. Preferred Finishing Method by Beef Producers for TBB Program Beef

(N=464)

Figure 3. Annual Fee Tennessee Beef Producers Would Pay for TBB Program Administration

(N=463)

Figure 4. Preferred Marketing Arrangements by Beef Cattle Producers for TBB Program Beef