

Consumer Preferences for Tennessee Milk

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Abstract

To support dairy farmers in the state of Tennessee, in 2018 the TN Department of Agriculture instituted a “TN Milk” logo that indicates the milk is entirely sourced, processed, and bottled in Tennessee. To examine consumer preferences for this logo, TN-milk-drinking households were surveyed. The contingent valuation method was used to assess consumer willingness to pay for milk labeled as TN Milk. A probit regression with 352 observations was used to estimate the characteristics of consumers who were more likely to purchase TN Milk. Results suggest consumers would pay a 12% premium for TN Milk.

Keywords: contingent valuation, fluid milk, local, willingness to pay

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Introduction

Packaged Facts (2015) estimated that local foods generated \$12 billion in 2014 sales, accounting for 2% of total U.S. beverage and food retail sales. Recognizing this trend of increased consumer interest in purchasing local foods, the 110th Tennessee General Assembly passed legislation enacting the TN Milk logo (Tennessee Department of Agriculture, 2018). Enabled by this legislation, the Tennessee Department of Agriculture (TDA) instituted a TN Milk logo in September 2018 (TDA, 2018). This logo (Figure 1) was created with the goal of creating a marketing opportunity for TN dairy producers. The logo declares that the milk to be entirely sourced, processed, and bottled in Tennessee. As of 2019, the logo was in limited use and little was known about consumers' preferences for milk with the TN logo. In 2019, the logo was used by a regional chain of convenience stores that sell milk across East Tennessee, a University creamery in Middle Tennessee, and three other dairies that sell retail milk (TDA, 2018).



Figure 1. Tennessee Milk Logo

Part of the reason TDA introduced this label was to help the TN dairy industry; the number of TN dairy farms and milk cows has been declining over the past few decades. In 2011, there were 450 Grade A dairies in Tennessee (Moss et al., 2012). One-hundred percent of TN dairies are Grade A dairies, which means they sell fluid milk (USDA, 2019b); however, TN is considered a fluid milk “deficit” state, such that fluid milk sold in Tennessee is not solely from TN dairies (Moss et al., 2012). As of 2019, there were only 196 Grade A dairies in Tennessee, a decrease of 56% (TDA, 2019). The state’s production of milk has also decreased by 31%, to only 693 million pounds from 2007 to 2017 (LMIC, 2019).

From 2007 through 2017, the number of milk cows in Tennessee decreased by 37%, with only 40,000 milk cows as of 2017 (U.S. Department of Agriculture (USDA), 2019a; Livestock Marketing Information Center (LMIC), 2019). TN dairy herds are smaller than the national average and have lower-producing milk cows (17,129 lb of milk per cow) than the national average (23,149 lb of milk per cow) (USDA, 2019; LMIC, 2019). It is difficult for the relatively smaller TN dairies to compete with larger dairies that have economies of size. In an attempt to offset these issues and to help support the TN dairy industry, TDA created the TN Milk logo.

The goal of this research is to determine whether TN consumers prefer milk carrying the TN Milk logo and whether they would pay a premium for this milk. In addition, this research aims to identify target market segments for milk with the TN Milk logo. To accomplish this, a survey of TN consumers was conducted using the contingent valuation method to estimate their preferences for milk carrying the TN Milk logo.

Previous Research

Several research articles have examined consumer preferences for local foods (Merritt et al., 2018; Dobbs et al., 2016; Adalja et al., 2015; Gracia, de Magistris, and Nayga, 2012; Carpio and Isengildina-Massa, 2009; Brown, 2003; Park and Gómez, 2011). These studies have used choice experiments, experimental auctions, and the contingent valuation method to infer that consumers will pay premiums for local foods ranging from produce (Carpio and Isengildina-Massa) to beef (Merritt et al., 2018; Dobbs et al., 2016), lamb (Gracia, de Magistris, and Nayga, 2012), and 2% fluid milk (Park and Gómez, 2011).

Past research has examined consumer preferences for milk products carrying a variety of labels (Forbes-Brown, Micheels, and Hobbs, 2016; Schott and Bernard, 2015; Akaichi et al., 2012; Wolf, Tonsor, and Olynk, 2011; Brooks and Lusk, 2010; Wong et al., 2010; Best and Wolfe, 2009; Bernard and Bernard, 2009). Forbes-Brown, Micheels, and Hobbs used a discrete choice experiment to examine Canadian consumer preferences for a 100% Canadian Milk label on ice cream made from 100% Canadian milk. They found that Canadian consumers would pay a premium for this label. Schott and Bernard (2015) conducted an experimental auction to examine how dairy farm size moderated consumer willingness to pay (WTP) for conventional, noncertified organic, and organic milk. Akaichi et al. (2012) conducted a multiunit Vickrey auction and found that consumers were willing to pay a premium for organic milk. Using a choice experiment, Wolf, Tonsor, and Olynk (2011) examined consumer preferences for a variety of fluid milk attributes. Among other results, they found that consumers were willing to pay substantial premiums for milk produced without the use of the recombinant bovine somatotropin (rBST) growth hormone. To examine the profile of Southeastern local shoppers who might prefer local dairy products, Best and Wolfe (2009) used a telephone survey. Wong et al. (2010) examined which consumers in the Southeast would be willing to pay a premium for grass-fed and organic milk using survey data. Finally, Bernard and Bernard (2009) conducted an experimental auction to determine consumer WTP for organic, rBST-free, no antibiotics used, and conventional milk.

In addition to consumer surveys that elicit milk preferences, studies have used scanner data to explore U.S. household demand for fluid milk (Chen, Saghaian, and Zheng, 2018; Hovhannisyan and Gould, 2012; Schrock, 2012; Chang et al., 2011; Alviola and Capps, 2010; Brooks and Lusk, 2010; Jonas and Roosen, 2008). For example, Chen, Saghaian, and Zheng (2018) used data from the Nielsen Homescan Panel to examine demand relationships between different types of milk. Among other results, they found that as household incomes increased, consumers were more likely to buy organic milk instead of conventional milk. We contribute to the literature on fluid milk demand by determining consumer preferences for milk labeled with the TN Milk logo.

In the past several years, research has documented that consumers (Merritt et al., 2018; Dobbs et al., 2016; Adalja et al., 2015; Gracia, de Magistris, and Nayga, 2012; Carpio and Isengildina-Massa, 2009; Brown, 2003) and restaurants (McKay et al., 2019a) would pay a premium for local foods. Within the category of local foods, researchers have specifically examined whether consumers would pay a premium for food labeled as produced within their own state. For example, Carpio and Isengildina-Masa (2009) used the contingent valuation method and found that South Carolina consumers would pay more for fresh produce and animal products if they were grown in South Carolina. Merritt et al. (2018) used a choice experiment and found TN consumers would pay more for steak and ground beef labeled as TN Certified Beef. Similarly, Dobbs et al. (2016) used the contingent valuation method and found that TN consumers would pay more for TN steak. Using the contingent valuation method, McKay et al. (2019a) found that restaurants in Tennessee would also pay a premium for TN Certified Beef steak and ground beef. Given that previous research has found consumers will pay more for state-branded labels on food products, the goal of this research is to determine whether consumers will pay more for fluid milk labeled as TN Milk.

Data

Survey Design

In June 2019, an online Qualtrics survey was distributed to TN residents over the age of 18 who were primary food shoppers for the household and whose household included consumers of cow's milk. A copy of the survey instrument is available from the authors upon request. The goal of the survey was to obtain TN consumer preferences for milk carrying the new TN Milk logo. Qualtrics collected surveys until a total of 409 completed surveys were obtained. This number of observations was chosen since previous research using similar contingent valuation and probit regression methods used a similar number of observations (McKay et al. 2019a,b). The survey contained several sections, including a contingent valuation question that elicited consumer preferences for TN milk, attitudes toward fluid milk, consumer milk expenditures, attitudes toward local foods, and demographics.

Prior to eliciting consumer preferences for TN Milk, the TDA definition and logo (Figure 1) for TN Milk were provided to participants (TDA, 2018). TN Milk was defined as follows:

The Tennessee Milk logo is administered by the Tennessee Department of Agriculture and milk with this logo must be entirely sourced, processed, and bottled in Tennessee. This means milk with this logo is 100% from Tennessee dairy farms and is packaged and processed within the state.

Since the TN Milk logo was created almost a year prior to our survey, respondents were next asked how familiar they were with the TN Milk logo on a Likert scale (where 1 = not at all familiar and 5 = extremely familiar). Consumers were then provided a cheap talk script, which explained hypothetical bias and requested that participants make realistic choices regarding milk purchases (Cummings and Taylor, 1999). Consumers were next asked which type of milk they typically

consumed (i.e., whole, 2%, 1%, skim, and lactose-free). Depending on which milk they selected, they were asked to assume that the next few questions were about this type of milk.

To examine consumer preferences for a gallon of milk with the TN Milk logo, consumers were next presented with a contingent valuation question involving two gallons of fluid milk with varying prices. The first gallon was labeled with the TN Milk logo and the second gallon was identical in all other respects except that it had no logo and a varying price. The survey respondent could select either gallon of milk or neither product. The gallon of milk with no logo was always priced at \$2.69/gallon. The gallon of milk with the TN Milk logo was given one of five prices: \$2.69, \$3.19, \$3.69, \$4.19, or \$4.69 (each price was offered to 20% of respondents). Each survey participant was randomly assigned to see one of the varying prices for the TN Milk. The base price and the range of prices for the gallon of milk with the TN Milk logo were determined according to the average and range of market prices for a gallon of milk at major retailers that were collected prior to the survey through TN grocery store observation and from the USDA Agricultural Marketing Service *Retail Milk Price Report* (USDA, 2019c). Figure 2 illustrates an example choice set. The remaining survey questions asked consumers about their attitudes toward fluid milk, monthly milk expenditures, attitudes toward local foods, and demographics.

Assume you are in the grocery store and you wish to purchase a gallon of cow's milk. Which of the following gallons of milk shown below would you purchase? Please choose one of the two gallons of milk or choose the "neither of these" options.



Figure 2. Example Choice Set for Tennessee Milk

Economic Model and Conceptual Framework

Following McFadden's (1974) random utility model, a consumer will purchase one product over another if their utility for that product is greater than the utility derived from the other product. Thus, consumer c will choose milk labeled as TN Milk instead of an unlabeled gallon of milk if the expected utility from purchasing a gallon of TN Milk, represented by $E(U_{c,TN_Milk})$, is greater

than the expected utility from purchasing an unlabeled gallon of milk, represented by $E(U_{c,Milk})$ (i.e., $E(U_{c,TN_Milk}) > E(U_{c,Milk})$).

The probability (Pr) that a consumer will choose TN Milk is defined as

$$(1) \quad \Pr[y_{c,TN_Milk} = 1] = \Pr[E(U_{c,TN_Milk}) > E(U_{c,Milk})] = \Pr[\mathbf{x}_c' \boldsymbol{\beta} + \varepsilon_c > 0 | \mathbf{x}] = F(\mathbf{x}_c' \boldsymbol{\beta}),$$

where $\mathbf{x}_c' \boldsymbol{\beta}$ are observable elements of the difference between the expected utility of the two gallons of milk, ε is the difference between the random elements, and F is a cumulative distribution function (Greene, 2012). A vector of independent variables, \mathbf{x}_c , consists of consumer demographics, TN Milk prices, consumer milk expenditures per month, perceived quality and economic benefits of TN Milk, familiarity with the TN Milk logo, and consumer preferences toward local foods and organic milk. The latent model depicting this choice is

$$(2) \quad y_{c,TN_Milk}^* = \mathbf{x}_c' \boldsymbol{\beta} + \varepsilon_c,$$

where

$$(3) \quad y_{c,TN_Milk} = \begin{cases} 1 & \text{if } y_{c,TN_Milk}^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

because only the decision to purchase TN Milk is observed and not the actual utility.

The dependent variable of the regression model was equal to one if a consumer selected the gallon of milk with the TN Milk logo and was 0 if the consumer selected the unlabeled milk. A total of 20 participants selected neither milk and were excluded from the regression because they were considered to be non-purchasers of milk. The errors in the linear model in equation (2) are assumed to be normally distributed and have an expected value of 0 with a variance of 1 (Greene, 2012). The normal cumulative density function is assumed to estimate the probability of a consumer's decision to purchase the gallon of milk labeled as TN Milk:

$$(4) \quad \Pr[y_{c,TN_Milk} = 1 | \mathbf{x}_c] = F(\mathbf{x}_c' \boldsymbol{\beta}) = \int_{-\infty}^{\mathbf{x}_c' \boldsymbol{\beta}} \phi(z) dz = \Phi(\mathbf{x}_c' \boldsymbol{\beta}),$$

where $\phi(z)$ is the probability density function of the standard normal distribution. The log-likelihood function is

$$(5) \quad \ln L = \sum_{c=1}^{352} [y_{c,TN_Milk} \ln \Phi(\mathbf{x}_c' \boldsymbol{\beta}) + (1 - y_{c,TN_Milk}) \ln \{1 - \Phi(\mathbf{x}_c' \boldsymbol{\beta})\}],$$

where the vector of β s maximizing equation (5) are the maximum likelihood estimates. Following Wooldridge (2002), the average marginal effects for the discrete and continuous variables were also calculated. Stata was used to estimate the probit regression using the probit command (StataCorp, 2017). The associated marginal effects were computed following the probit regression by using the Stata command margins. Of the 409 surveyed TN consumers who participated in the survey, 352 answered all of the questions included as variables in the probit regression.

Diagnostic Tests

Variance inflation factors (VIFs) and the conditional index test were used to examine the presence of multicollinearity in the model using the vif and coldiag2 Stata commands (Belsley, 1991; Gujarati and Porter, 2009; StataCorp, 2017). A VIF of under 10 indicates that multicollinearity is not a concern with the independent variables (Gujarati and Porter, 2009). A conditional index number of under 30 indicates multicollinearity is not a concern (Belsley, 1991).

Willingness to Pay Calculations

Results from the model were used to estimate average consumer WTP for milk labeled with the TN Milk logo with the formula

$$(6) \quad \widehat{WTP}_{c,TN_Milk} = -\frac{\hat{\beta}_0 + \mathbf{z}'\hat{\beta}_{-p}}{\hat{\beta}_p},$$

where $\hat{\beta}_0$ is the estimated intercept, $\hat{\beta}_{-p}$ is a vector of estimated parameters excluding the TN Milk price coefficient, \mathbf{z} is the vector of independent variables excluding TN Milk price, and $\hat{\beta}_p$ is the estimated parameter for the price of TN Milk (Dobbs et al., 2016). WTP was determined as the average WTP evaluated for each consumer.

Independent Variables and Hypothesized Results

The independent variables hypothesized to impact a consumer's decision to purchase TN Milk appear in Table 2. It is assumed that as the price of TN Milk (*Price*) increases, consumers will be less likely to purchase TN Milk. This is consistent with previous contingent valuation studies that also found as price increases, consumer willingness to adopt a product decreases (McKay et al., 2019a,b). It is unknown if consumers who spend more on milk per month (*Milk Spending*), will be more or less likely to adopt TN Milk. This variable was created by multiplying participant responses to how often they purchased milk in a month by the price they stated they paid for the container of milk they purchased at each visit. Bernard and Bernard (2009) found that as consumers purchased milk more frequently, their bids in an experimental auction for different types of milk had a higher variance. Even though the predicted sign of this variable is unknown, it is important to control for whether frequent milk shoppers would prefer TN Milk, since this would have large implications on the success of the label if frequent milk shoppers were more likely to purchase TN Milk.

A *Quality_Benefits* index was created to estimate consumer perceived quality of TN Milk. This variable was created by averaging consumer responses (based on a five-point Likert scale, where 1 = strongly disagree and 5 = strongly agree) to the following four statements:

- i. Compared with other milk, TN Milk will likely be fresher,.
- ii. Compared with other milk, TN Milk will likely be safer.
- iii. Compared with other milk, TN Milk will likely be better for the environment.
- iv. Compared with other milk, TN Milk will likely taste better.

It is hypothesized that consumers who consider TN Milk to be of higher quality would be more likely to purchase TN Milk. Sharma, Moon, and Strohbehn (2014) found that restaurants considered local foods to be of higher quality and were thus willing to promote local foods. However, McKay et al. (2019a) did not find the perceived quality of TN Certified Beef (TCB) to have an impact on a restaurant's decision to offer TCB ground beef or sirloin steak.

An *Economics_Benefits* index was created to estimate consumer perceived benefits of TN Milk to the TN and farmer economy. This variable was created by averaging consumer responses (based on a five-point Likert scale, where 1 = strongly disagree and 5 = strongly agree) to the following two statements:

- i. Compared with other milk, TN Milk will likely help support TN dairy farmers' incomes.
- ii. Compared with other milk, TN Milk will likely help support the state's economy.

It is hypothesized that consumers who consider TN Milk to have more economic benefits for TN dairy farmers and the state's economy (*Economics_Benefits*) will be more likely to purchase TN Milk.

Consumers were asked whether they were willing to pay a price premium for locally produced food (*Local_Premium*) (based on a five-point Likert scale, where 1 = strongly disagree and 5 = strongly agree). As consumers are more likely to pay premiums for locally produced foods, we hypothesize that they will be more likely to purchase TN Milk since it is a state-specific product. A dummy variable was created that was equal to 1 if consumers regularly purchase organic cow's milk (*Purchase_Organic*) and 0 otherwise. We hypothesize that consumers who value organic dairy production will also value local production and be more likely to purchase TN Milk. Previous research has found that some consumers associate attributes of organic products, such as no synthetic pesticides and nongenetically modified ingredients, with local foods (Campbell et al., 2014).

Consumers were asked how familiar they were with the TN Milk logo on a scale from 1 (not at all familiar) to 5 (extremely familiar) (*Logo_Familiar*). As consumers were more familiar with the TN Milk logo, it was expected that they would be more likely to choose the TN Milk. Similarly, Collart, Palma, and Carpio (2011) found that familiarity with two Texas state-sponsored plant logo programs had a positive influence on consumer willingness to pay for plants bearing the state-sponsored logo.

Previous research regarding consumer food preferences have controlled for demographics in their analysis (e.g., Brown 2003; Chen, Saghaian, and Zheng, 2018; Bernard and Bernard 2009; Dobbs et al., 2016; Hawkins, Vassalos, and Motallebi, 2019). Similarly, we controlled for farming background, income, gender, age, household size, and age in our probit regression. If someone in

the household was raised on a farm or worked on a farm at some point (*Farmer*), it was hypothesized the family would be more likely to purchase TN Milk to support the dairy industry and fellow farmers. Brown (2003) found that households in which someone was raised on a farm (or had parents who were raised on a farm) had stronger preferences for locally grown food and were willing to pay a premium for locally grown food.

Chen, Saghaian, and Zheng (2018) found that as household incomes increased, consumers were more likely to buy organic milk instead of conventional milk. Bernard and Bernard (2009) found that individuals with higher incomes would pay more for recombinant bovine somatotropin-free (rBST-free) milk. Similarly, we hypothesized that as consumer incomes increased, consumers would be more likely to purchase TN Milk. Bernard and Bernard found that males and older individuals were less likely to pay more for organic milk. Dobbs et al. (2016) found that older consumers were less likely to choose TN steak. Similarly, we predict females and younger individuals will be more likely to purchase TN Milk.

Bernard and Bernard (2009) found that those with college degrees or higher were willing to pay more for recombinant bovine somatotropin-free (rBST-free) milk and milk with no antibiotics. Thus, we expect individuals with college degrees or higher to be more willing to purchase TN Milk.

We are uncertain, *a priori*, on how household size would impact a consumer's decision to purchase TN Milk. Dobbs et al. (2016) found that education and household size did not influence a consumer's decision to purchase TN beef. A study by Hawkins, Vassalos, and Motallebi (2019) of South Carolina branded programs found no significant difference in familiarity with the labels across household size. However, in a study of consumer purchases of "New Jersey Fresh"-labeled products, Govindasamy et al. (1998) found that households with a size of four or more were more likely to have bought Jersey Fresh products than households of smaller size. We are also uncertain, *a priori*, how race would impact a consumer's decision to purchase TN Milk. Best and Wolfe (2009) did not find race to be significant in determining southeastern consumer preferences for local dairy products.

Results

Survey Descriptive Statistics

Table 1 presents demographic averages for all participants, participants in each of the five TN Milk price levels, and the TN general population (U.S. Census Bureau, 2020). About 82% of respondents were female, higher than the state average of 51%, but this is expected since the sample was limited to primary food shoppers (U.S. Census Bureau, 2020). The average age of the respondents was just under 44 years, compared to the state median age of 39 (U.S. Census Bureau, 2020). Our sample had a slightly higher percentage of white participants than the TN average and a slightly larger average household size than the TN average. The percentage of individuals with a bachelor's degree or higher and household income were both slightly lower than the TN average. Demographics were consistent across all TN milk price levels.

Table 1. Participant Demographics Overall and by TN Milk Price Level (per gallon)

Demographic	Description	Means						
		All Prices (N = 352)	\$2.69 (N = 67)	\$3.19 (N = 72)	\$3.69 (N = 71)	\$4.19 (N = 70)	\$4.69 (N = 72)	TN population ¹
Female	Percentage female	82.39%	80.60%	81.94%	78.87%	87.14%	83.33%	51%
Age	Age in years	43.61	44.54	40.53 ^a	43.08	42.84	47.08 ^a	39
Race	= 1 if white, 0 otherwise	86.36%	83.589% ^a	94.44% ^{a,b,c}	83.10% ^b	84.29% ^c	86.11%	77%
Household size	Number of household members	3.07	3.28	2.97	3.25	2.81	3.06	2.60
College grad	= 1 if bachelor's degree or higher, 0 otherwise	24.72%	26.87%	26.39%	23.94%	21.43%	25.00%	27.5%
Income	Household income level (\$ 100 thousands)	0.46	0.50	0.51	0.43	0.41	0.46	0.52

Notes: If two means in a row have the same letter superscript, this indicates that two demographics means for given TN Milk price level are significantly different at the 5% level as judged by *t*-tests.

Source: U.S. Census Bureau (2020).

However, among respondents who were presented with the \$3.19/gallon price level, a significantly higher percentage were white individuals than at most of the other price levels, as judged by a *t*-test at the 5% significance level. Since this percentage was only 8%–11% higher than the other categories, this is not likely to have an impact on results. The only other demographic that was significantly different across two TN milk price levels (\$3.19/gallon and \$4.69/gallon) was age (Table 1). However, the difference in age among these price categories was less than 7 years; thus, it is not likely to have any impact on the results.

Figure 3 shows the percentage of consumers who chose TN Milk instead of unlabeled milk at each price level. When TN Milk was the same price as the unlabeled milk, 85% of consumers chose the TN Milk. However, the percentage of consumers choosing TN Milk declined to 6% when it was \$4.19/gallon. Using a *t*-test at the 5% level of significance, the percentage of respondents who chose TN Milk versus unlabeled milk was not significantly different among the following price ranges: \$3.19, \$3.39, and \$4.69; \$4.19 and \$4.69. When considering all price levels, 30% of consumers chose the gallon of milk labeled as TN Milk (Table 2).

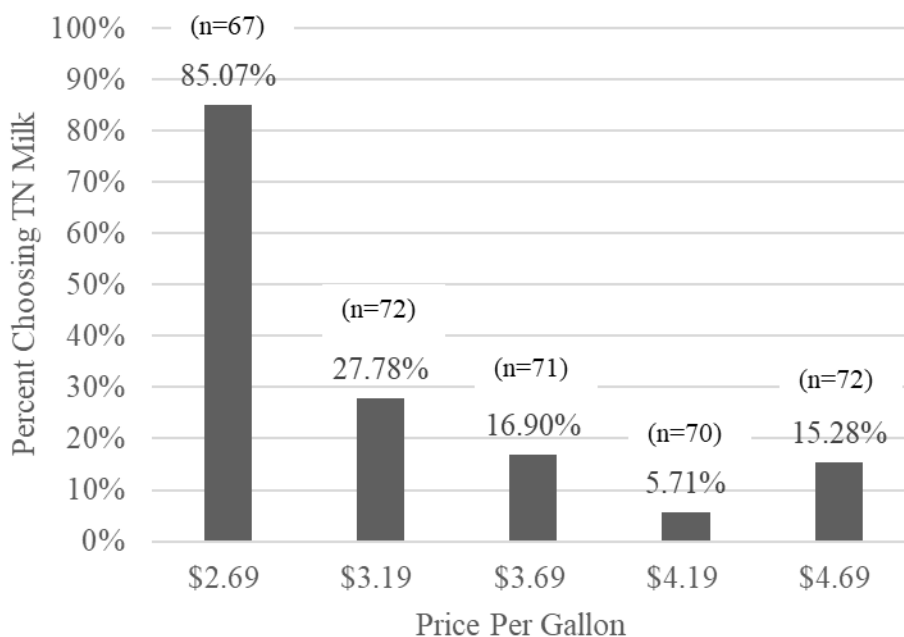


Figure 3. Percentage of Consumers Choosing TN Milk instead of \$2.69 Per Gallon Unlabeled Milk

Note: Using a *t*-test, the percentage of respondents who chose TN Milk versus the unlabeled milk was not significantly different at the 5% level of significance among the following price ranges: \$3.19, \$3.39, and \$4.69; \$4.19 and \$4.69.

Table 2 presents the probit regression dependent and independent variable means and standard deviations. On average, consumers spent \$14.49 per month on milk (*Milk Spending*). On average, consumers somewhat agreed that TN Milk would be of better quality (*Quality_Benefits*; average Likert score of 3.60). On average, consumers somewhat agreed that TN milk would help support TN dairy farmers' incomes and help support the state's economy (*Economics_Benefits*; average Likert score of 4.36).

On average, consumers neither agreed nor disagreed that they would pay a price premium for locally produced foods (*Local_Premium*; average Likert score of 2.91). About 15% of the sample regularly purchased organic cow's milk (*Purchase_Organic*). In terms of familiarity with the TN Milk logo (*Logo_Familiar*), participants were on average not very familiar with the logo (average Likert score of 1.60, where 1 = not at all familiar and 2 = slightly familiar). This suggests that the TN Milk logo could benefit from some type of educational or promotional campaign that allows TN consumers to learn about the logo and its definition.

In terms of demographics, approximately 44% of the sample said someone in their household had been raised on a farm or worked on a farm at some point (*Farmer*). Approximately 82% of the sample was female, 86% was white, 25% had earned at least a college degree, and the average household income was \$46,321. The average participant was 44 years old and had a household size of 3.07 individuals.

Probit Regression Results

Table 3 reports the results of the probit regression and associated marginal effects. The VIFs were all less than 10 and the mean VIF was 1.25. The conditional index number was equal to 21.54. Thus, multicollinearity was not a concern in our estimated regression (Belsley, 1991; Gujarati and Porter, 2009).

As expected, the price of TN Milk negatively impacted a consumer's decision to purchase TN Milk rather than unlabeled milk. With a dollar increase in TN Milk price, a consumer, on average, was 29% less likely to purchase TN Milk ($p < 0.01$). As consumers spent more money on milk per month (*Milk_Spending*), they were more likely to purchase TN Milk instead of unlabeled milk. If they spent \$10 more per month on milk, they were 7% more likely to purchase TN Milk instead of unlabeled milk ($p < 0.05$).

As consumers increased their agreement that TN Milk would be of higher quality (*Quality_Benefits*) by one point on the five-point Likert scale, they were 17% more likely to purchase TN Milk ($p < 0.01$). This suggests that consumers place a premium on TN Milk because they believe it will likely be of higher quality. Meanwhile, consumer level of agreement that TN Milk would provide economic benefits to TN (*Economic_Benefits*) was not associated with a consumer's decision to purchase TN Milk. These results imply that while consumers agreed TN Milk would provide benefits to the TN economy and to farmers, this belief did not influence their decision to purchase TN Milk; however, their level of agreement with the perceived quality of TN Milk did influence their decision to purchase TN Milk. Thus, quality was a more important consideration to them than their potential positive impact on the local economy when deciding whether to purchase TN Milk.

As consumers were more willing to pay a premium for local foods (*Local_Premium*), they were 4% more likely to purchase TN Milk ($p < 0.01$). If consumers purchased organic milk (*Purchase_Organic*), they were 12% more likely to purchase TN Milk ($p < 0.05$). Thus, consumers who purchase local foods and organic milk were also more likely to purchase TN Milk. The level

Table 3. Probit Regression Results and Marginal Effects for Tennessee Milk Preferences

Independent Variables	Model in Paper	
	Coefficient	Marginal Effect
<i>Price</i>	-1.579*** (0.198)	-0.288*** (0.022)
<i>Milk_Spending</i>	0.036** (0.015)	0.007** (0.003)
<i>Quality_Benefits</i>	0.942*** (0.198)	0.172*** (0.031)
<i>Economic_Benefits</i>	-0.020 (0.132)	-0.004 (0.024)
<i>Local_Premium</i>	0.228*** (0.920)	0.042** (0.017)
<i>Purchase_Organic</i>	0.659** (0.324)	0.120** (0.059)
<i>Logo_Familiar</i>	-0.114 (0.095)	-0.021 (0.017)
<i>Farmer</i>	0.186 (0.203)	0.034 (0.037)
<i>Female</i>	-0.024 (0.251)	-0.004 (0.046)
<i>Age</i>	0.003 (0.008)	0.001 (0.001)
<i>Income</i>	0.400 (6.000)	0.070 (0.005)
<i>College_Degree</i>	-0.127 (0.229)	-0.023 (0.042)
<i>Household_Size</i>	-0.084 (0.064)	-0.015 (0.012)
<i>%White</i>	0.338 (0.285)	0.062 (0.052)
Constant	-0.011 (0.874)	
No. of obs.	352	
Pseudo- R^2	0.465	
Wald χ^2 (10)	103.00***	
Log pseudo-likelihood	-114.30	

Notes: Standard errors in parentheses. Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level.

of familiarity that a consumer had with the TN Milk logo (*Logo_Familiar*) did not have an impact on their decision to purchase TN Milk. Other variables not associated with consumers' decisions to purchase TN Milk were age, gender, income, education, household size, race, and whether someone in their household had grown up on a farm or worked on a farm at some point in their life.

WTP Estimates and Estimated TN Milk Consumption

On average, surveyed consumers in TN were willing to pay \$3.02/gallon for TN Milk, with a lower bound (95% confidence level) of \$2.86/gallon and an upper bound (95% confidence level) of \$3.15/gallon. Considering this research assumed an average price of milk of \$2.69/gallon, this represents an average WTP premium of \$0.33/gallon for TN Milk, or a 12% price premium.

Consumers were also asked, "If you were to purchase TN Milk, about how much would you likely purchase per month (in gallons)?" On average, consumers stated they would be willing to purchase 3.8 gallons of TN Milk per month ($N = 176$). If we assumed that consumers would purchase TN Milk at the average premium we found of \$0.33/gallon and they would purchase, on average, 3.8 gallons of milk a month, this equates to a total monthly household premium average of \$1.25 per month. There are approximately 2.5 million households in TN (U.S. Census Bureau, 2020). Thus, if we assume 30% of them would be willing to consume TN Milk, which is the percentage of our sample who stated they would purchase TN Milk (Table 2), that would mean about 750,000 households would choose TN Milk. Multiplying this by the average monthly premium of \$1.25 for TN Milk, this would equal an average monthly premium of \$937,500 per month gained by selling TN Milk. However, if we consider only consumers who stated they would purchase TN Milk at a premium (Figure 3, price levels of \$3.19/gallon and greater), then only 16% of the sample stated they would choose TN milk. This would equate to only 400,000 TN households; multiplying this by the average monthly premium of \$1.25 for TN Milk would equate to an average monthly premium of \$500,000. Thus, it is possible that a premium of approximately \$500,000/month–\$937,500/month could be gained by selling TN Milk depending on the estimated percentage of TN residents who would be willing to purchase TN Milk at a given premium of 12%. However, this is likely an overestimate since not all households consume milk and this calculation assumes all TN households are potential milk consumers. This calculation also assumes TN Milk is available readily across the state, which is also not necessarily true (as of now). For example, consumers were also asked, "What is the farthest distance out of your way you would travel by auto to purchase TN Milk?" On average, consumers were only willing to drive 3.2 miles out of their way to purchase TN Milk ($N = 203$). To attract 750,000 households to purchase TN Milk, it would have to be available in almost all retail outlets. Consumers also stated that for fluid cow's milk to be considered locally produced, the milk could travel, on average, 85 miles ($N = 352$). However, it is worth noting that the responses to this question ranged from 0 to 1,000 miles.

As the TN Milk logo is marketed over a longer period, additional research should compare the WTP estimates from this study with market pricing. However, while retail prices statewide for TN Milk that is being sold on the market were not collected in this study, anecdotally local market observations by the authors did not suggest that local retailers of TN Milk were charging consumers a premium price for this milk.

Table 2. Probit Regression Variable Definitions, Means, and Standard Deviations ($N = 352$)

Variable	Description	Hyp. Sign	Mean	Std. Dev.
Dependent variable				
<i>TN_Milk</i>	Percentage of respondents choosing TN Milk over generic milk		29.55	0.46
Independent variables				
<i>Price</i>	TN Milk price levels (dollars per gallon) of \$2.69, \$3.19, \$3.69, \$4.19, or \$4.69	–	3.70	0.70
<i>Milk_Spending</i>	Monthly spending on milk (in dollars) (number of times purchased milk in month multiplied by price paid for container of milk)	?	14.49	6.85
<i>Quality_Benefits</i>	Index created by averaging the Likert scores for the following statements: “Compared with other milk, TN Milk will likely (1) be fresher, (2) be safer, (3) be better for the environment, and (4) taste better.” ^a	+	3.60	0.86
<i>Economic_Benefits</i>	Index created by averaging the Likert scores for the following statements: “Compared with other milk, TN Milk will likely (1) help support Tennessee dairy farmers’ incomes and (2) help support the state’s economy.” ^a	+	4.36	0.92
<i>Local_Premium</i>	Likert response to “I am willing to pay price premiums for locally produced food.” ^a	+	2.91	1.26
<i>Purchase_Organic</i>	1 if regularly purchase organic cow’s milk, 0 otherwise	+	0.15	0.36
<i>Logo_Familiar</i>	Likert response to “How familiar were you with the TN Milk logo before taking this survey?” ^b	+	1.60	1.12
<i>Farmer</i>	1 if anybody in your household was raised on a farm, or ever worked on a farm, 0 otherwise	+	0.44	0.50
<i>Female</i>	Percentage of respondents who are female	+	82.39	0.38
<i>Age</i>	Age in years	–	43.61	13.86
<i>Income</i>	Household income level (\$ 100 thousands)	+	0.46	0.33
<i>College_Degree</i>	Percentage with a bachelor’s degree or higher	+	24.72	0.43
<i>Household_Size</i>	Number of household members	?	3.07	1.63
<i>%White</i>	Percentage of sample who selected white as their race	?	86.36	0.34

Notes: Hyp = hypothesized.

^a On a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).^b On a five-point Likert scale from 1 (not at all familiar) 5 (extremely familiar).

It should also be noted that all survey participants were given the definition of TN Milk prior to indicating their preferences for TN Milk. It is possible that consumers in the supermarket may not be aware of the exact definition of TN Milk; this may mean that our estimated premiums for TN milk are higher than if we had not provided consumers with the definition of TN Milk.

Discussion and Conclusions

To support TN dairy farmers, the TDA instituted the TN Milk logo in September 2018. Milk labeled as TN Milk indicates the milk is entirely sourced, processed, and bottled in TN.

Results from this study show that TN Milk consumers would pay an average premium of \$0.33/gallon for milk bearing the TN Milk logo, a 12% price premium. If TN Milk were priced the same as unlabeled milk, 85% of consumers indicated they would purchase TN Milk; however, across all price levels considered, 30% of consumers chose TN Milk over unlabeled milk.

Results from the probit regression indicated, as expected, that as the price of TN Milk increased, consumers were less likely to purchase TN Milk. Results also show that consumers who spend more on milk per month, consider TN milk to be of higher quality, would be willing to pay premiums for local products, and purchase organic milk were more likely to purchase TN Milk than unlabeled milk. These are characteristics of consumers that should be targeted in the marketing of TN milk. It is interesting to note that no specific demographics of consumers were found to be significant throughout our modeling, indicating TN Milk preferences are uniform across race, gender, income, age, education, and household size.

Given that the TN logo is fairly new and, on average, consumers disagreed that they were familiar with the TN Milk logo, increased promotion and marketing of the benefits of TN Milk will be needed to increase awareness and label recognition among consumers. This study provides valuable information on consumer's preferences for TN Milk and the characteristics of consumers who are more likely to purchase TN Milk. The results can be used by the dairy industry, retailers, and policy makers to help market TN Milk. Future research could use a choice experiment to determine which additional attributes could be complementary to the TN Milk logo.

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References

- Adalja, A., J. Hanson, C. Towe, and E. Tselepidakis. 2015. "An Examination of Consumer Willingness to Pay for Local Products." *Agricultural and Resource Economics Review* 44: 253–274.
- Akaichi, F., R.M. Nayga, Jr., and J.M. Gil. 2012. "Assessing Consumers' Willingness to Pay for Different Units of Organic Milk: Evidence from Multiunit Auctions." *Canadian Journal of Agricultural Economics* 60(4): 469–494.
- Alviola, P.A., and O. Capps. 2010. "Household Demand Analysis of Organic and Conventional Fluid Milk in the United States Based on the 2004 Nielsen Homescan Panel." *Agribusiness: An International Journal* 26: 369–388.
- Belsley, D.A. 1991. "A Guide to Using the Collinearity Diagnostics." *Computer Science in Economics and Management* 4(1): 33–50.
- Bernard, J.C., and D.J. Bernard. 2009. "What Is it about Organic Milk? An Experimental Analysis." *American Journal of Agricultural Economics* 91(3): 826–836.
- Best, M.J., and C.L. Wolfe. 2009. "A Profile of Local Dairy Consumers in the Southeast and the Potential for Dairies to Market Value-Added Products Locally." *Journal of Food Distribution Research* 40(1): 22–31.
- Brooks, K., and J.L. Lusk. 2010. "Stated and Revealed Preferences for Organic and Cloned Milk: Combining Choice Experiment and Scanner Data." *American Journal of Agricultural Economics* 92(4): 1229–1241.
- Brown, C. 2003. "Consumers' Preferences for Locally Produced Food: A Study in Southeast Missouri." *American Journal of Alternative Agriculture* 18(4): 213.
- Campbell, B., H. Khachatryan, B. Behe, J. Dennis, and C. Hall. 2014. "U.S. and Canadian Consumer Perception of Local and Organic Terminology." *International Food and Agribusiness Management Review* 17(2): 21–40.
- Carpio, C.E., and O. Isengildina-Massa. 2009. "Consumer Willingness to Pay for Locally Grown Products: The Case of South Carolina." *Agribusiness: An International Journal* 25(3): 412–426.
- Chang, C.H., N.H. Hooker, E. Jones, and A. Sam. 2011. "Organic and Conventional Milk Purchase Behaviors in Central Ohio." *Agribusiness: An International Journal* 27: 311–326.
- Chen, B., S. Saghaian, and Y. Zheng. 2018. "Organic Labelling, Private Label, and US Household Demand for Fluid Milk." *Applied Economics* 50(28): 3039–3050.

- Collart, A., M. Palma, and C. Carpio. 2011. "Promoting a Local Brand: Assessing the Economic Benefits of the Texas Superstar® and Earth-Kind® Promotion on Place (POP) Program." Paper presented at the annual meeting of the Southern Agricultural Economics Association, February 5–8, Corpus Christi, Texas.
- Cummings, R.G., and L.O. Taylor. 1999. "Unbiased Value Estimates for Environmental Goods: A Cheap Talk Design for the Contingent Valuation Method." *American Economic Review* 89(3): 649–665.
- Dobbs, L.M., K.L. Jensen, M.B. Leffew, B.C. English, D.M. Lambert, and C.D. Clark. 2016. "Consumer Willingness to Pay for Tennessee Beef." *Journal of Food Distribution Research* 47(2): 38–61.
- Forbes-Brown, S., E.T. Micheels, and J.E. Hobbs. 2016. "Consumer Willingness to Pay for Dairy Products with the 100% Canadian Milk Label: A Discrete Choice Experiment." *Journal of International Food and Agribusiness Marketing* 28(3): 203–224.
- Govindasamy, R., A. Pingali, J. Italia, and D. Thatch. 1998. "Consumer Response to State-Sponsored Marketing Programs: The Case of Jersey Fresh." New Brunswick, NJ: Rutgers University, New Jersey Agricultural Experiment Station Report P-02137-2-98, February.
- Gracia, A., T. de Magistris, and R.M. Nayga. 2012. "Importance of Social Influence in Consumers' Willingness to Pay for Local Food: Are there Gender Differences?: WTP and Gender Differences." *Agribusiness: An International Journal* 28(3): 361–371.
- Greene, W.H. 2012. *Econometric Analysis*, 7th ed. Boston, MA: Prentice Hall.
- Gujarati, D.N., and D. Porter. 2009. *Basic Econometrics*, 5th ed. Boston, MA: McGraw-Hill Irwin.
- Hawkins, B., M. Vassalos, and M. Motallebi. 2019. "Factors Influencing Consumers Familiarity with State Branded Programs: A Case Study for South Carolina." *Journal of Food Distribution Research* 50(2): 69–86.
- Hovhannisyan, V., and B.W. Gould. 2012. "A Structural Model of the Analysis of Retail Market Power: The Case of Fluid Milk." *American Journal of Agricultural Economics* 94: 67–79.
- Jonas, A., and J. Roosen. 2008. "Demand for Milk Labels in Germany: Organic Milk, Conventional Brands, and Retail Labels." *Agribusiness: An International Journal* 24: 192–206.
- Livestock Marketing Information Center. 2019. *Milk Production, Inventory-Annual*. Available online: <http://www.lmic.info/membersonly/Spreadsheets/Dairy/InventoryProduction>.

- McFadden, D. 1974. "Conditional Logit Analysis of Qualitative Choice Behavior." In P. Zarembka, ed. *Frontiers in Economics*. New York, NY: Academic Press. pp. 105–142.
- McKay, L., K.L. DeLong, K.L. Jensen, A.P. Griffith, C.N. Boyer, and D.M. Lambert. 2019a. "Restaurant Willingness to Pay for Local Beef." *Agribusiness: An International Journal* 35(4): 610–624.
- McKay, L., K.L. DeLong, S. Schexnayder, A.P. Griffith, D.B. Taylor, P. Olfason, and R.T. Trout Fryxell. 2019b. "Cow-Calf Producers' Willingness to Pay for Bulls Resistant to Horn Flies (Diptera: Muscidae)." *Journal of Economic Entomology* 112(3): 1476–1484.
- Merritt, M. G., K.L. DeLong, A.P. Griffith, , and K.L. Jensen. 2018. "Consumer Willingness to Pay for Tennessee Certified Beef." *Journal of Agricultural and Applied Economics* 50(2): 233–254.
- Moss, J., K. Jensen, B. English, and R. Holland. 2012. "The Tennessee Dairy Industry and Its Value-Added Opportunities." Knoxville, TN: UT Extension. Available online: <https://extension.tennessee.edu/publications/Documents/W284.pdf>.
- Packaged Facts. 2015. "Sales of Local Foods Reaches \$12 Billion." Rockville, MD: Packaged Facts. Available online: <https://www.packagedfacts.com/about/release.asp?id=3717>.
- Park, K., and M.I. Gómez. 2010. "Do Price Premiums Exist for Local Products?" *Journal of Food Distribution Research* 42(1): 145–152.
- Schott, L., and J. Bernard. 2015. "Comparing Consumer's Willingness to Pay for Conventional, Non-Certified Organic and Organic Milk from Small and Large Farms." *Journal of Food Distribution Research* 46(8): 186–205.
- Schrock, R. 2012. "The Organic Milk Market in Germany Is Maturing: A Demand System Analysis of Organic and Conventional Fresh Milk Segmented by Consumer Groups." *Agribusiness: An International Journal* 28: 274–292.
- Sharma, A., J. Moon, and C. Strohbehn. 2014. "Restaurant's Decision to Purchase Local Foods: Influence of Value Chain Activities." *International Journal of Hospitality Management* 39: 130–143.
- StataCorp. 2017. *Stata Statistical Software*, v. 15. College Station, TX: StataCorp.
- Tennessee Department of Agriculture. 2018. *Support Local Dairies, Look for New Tennessee Milk Logo*. Nashville, TN: Tennessee Department of Agriculture. Available online: <https://www.tn.gov/agriculture/news/2018/9/5/tennessee-milk-logo.html>.
- Tennessee Department of Agriculture. 2019. *Grade A Cow Dairies County Data*. Nashville, TN: Tennessee Department of Agriculture. Personal communication.

- U.S. Census Bureau. 2020. *Tennessee Demographics*. Available online: <https://data.census.gov/cedsci/profile?g=0400000US47&q=Tennessee>.
- U.S. Department of Agriculture. 2019a. *Milk Production Quarterly Publications*. Washington, DC: U.S. Department of Agriculture, National Agricultural Statistics Service. Available online: <https://usda.library.cornell.edu/concern/publications/h989r321c?locale=en>.
- U.S. Department of Agriculture. 2019b. *Milk Production, Disposition, and Income, 2018 Summary*. Washington, DC: U.S. Department of Agriculture, National Agricultural Statistics Service. Available online: <https://usda.library.cornell.edu/concern/publications/h989r321c?locale=en>.
- U.S. Department of Agriculture. 2019c. *Retail Milk Price Report*. Washington, DC: U.S. Department of Agriculture, Agricultural Marketing Service. Available online: <https://www.ams.usda.gov/resources/marketing-order-statistics/retail-milk-prices>.
- Wolf, C.A., G.T. Tonsor, and N.J. Olynk. 2011. “Understanding US Consumer Demand for Milk Production Attributes.” *Journal of Agricultural and Resource Economics* 36(2): 326–342.
- Wong, J., U. Raghunathan, C.L. Escalante, and K. Wolfe. 2010. “Consumer Premiums for Environmentally Friendly Grass-Fed and Organic Milk in the Southeast.” *Journal of Agribusiness* 28(1): 75–88.
- Wooldridge, J.M. 2002. *Introduction to Econometrics*. New York, NY: Southwest Press.