

# Consumer Preferences for Attributes of Farmstead Milk



by

Kimberly L. Jensen<sup>a</sup>, Dayton M. Lambert<sup>b</sup>, Alicia L. Rihn<sup>a</sup>, Elizabeth Eckelkamp<sup>c</sup>, Caitlin Zaring<sup>c</sup>, and Billie Ray<sup>a</sup>

<sup>a</sup>Department of Agricultural and Resource Economics, The University of Tennessee

<sup>b</sup>Department of Agricultural, Oklahoma State University

<sup>c</sup>Department of Animal Science, The University of Tennessee



# 1. Background and Objectives

- The dairy industry in Tennessee has experience many financial challenges, with many of its farms being smaller than the average US dairy farm size (41 dairy cows versus 175 cows, NASS 2017 ).
- Between 2002 and 2017, the number of farms with milk cows decreased by over 30%.
- Some farmers have begun looking at on-farm processing as a way to add value to the milk produced.
- One avenue to incorporate on-farm processing is by producing farmstead milk.

# 1. Background and Objectives

- **Tennessee Farmstead Milk** is where:

1. The farmer produces the raw commodity, milk, that is then
2. Processed and packaged on the farm in Tennessee

## **Tennessee Farmstead Milk is sold:**

- Direct-to-consumer
  - On-farm stores or farm stands, farmers markets, with home delivery services, or online
- By other sellers
  - Grocery stores,
  - Specialty stores, or
  - Restaurants

# 1. Background and Objectives

## Milk Attributes Related to Equipment Decisions

### Pasteurization Type

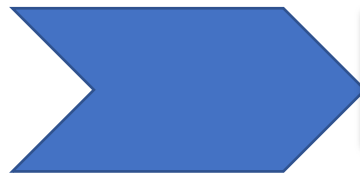
- VAT
- HTST
- Ultra



Pasteurizer  
Equipment

### Packaging Type

- Plastic
- Paper
- Glass



Packaging  
Equipment

### Homogenization and Standardization of Milkfat

- Lowfat (2% milkfat) homogenized
- Whole (3.25% milkfat) homogenized
- Full-fat homogenized
- Full-fat cream line (Non-homogenized)



Homogenizer

# 1. Background and Objectives

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### Pasteurization Type

- VAT
- HTST
- Ultra



**Pasteurizer  
Equipment**

Type	Temperature/Time	Shelf-Life Under Proper Refrigeration (less than 45°F)	Taste Effects
Vat Pasteurization (VAT)	145°F ≥30 minutes	12-21 days	None
High Temperature Short Time (HTST) Pasteurization	161°F ≥15 seconds	12-21 days	None
Ultra-Pasteurization (UP)	280°F ≥2 seconds	30-90 days	Ultra-pasteurized milks may have more of a "cooked" flavor when compared to conventionally pasteurized milks.

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\*Once opened, pasteurized milk should be used as soon as possible for best quality and taste.

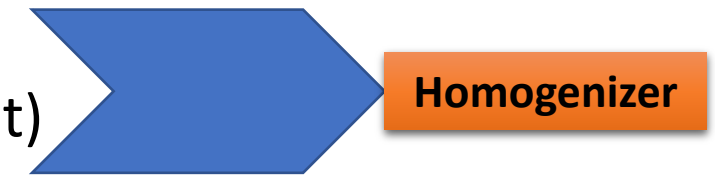
THE UNIVERSITY OF TENNESSEE

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- Full-fat **cream line** (Non-homogenized)



Milk that has not had its fat content standardized is called **Full-fat** milk. In other words, it is the milkfat in the milk as it is produced by the cow(s).

Milk that has not been homogenized is sometimes called **cream-line**. After non-homogenized (cream-line) milk is purchased, it is usually shaken by the consumer, before consumption.

# 1. Background and Objectives

- **Study Goal**: Provide information to dairy farmers considering on-farm processing of milk about consumers' preferences for milk attributes that may affect equipment purchase decisions.
- **Objective**: Provide measures of consumers' **WTP for Tennessee farmstead milk attributes**, including:
  - *Pasteurization type (VAT-base category, HTST, Ultra)*
  - *Packaging (Plastic-base category, Glass, and Paper), and*
  - *Homogenization/milkfat content (Lowfat homogenized milk-base category, Whole homogenized milk, Full fat homogenized milk, Cream-line non homogenized milk).*

## 2. Survey and Methods



Vat Pasteurized

3.25% Milkfat  
(Homogenized  
Whole)

Plastic Container

\$4.00



HTST Pasteurized

2% Milkfat  
(Homogenized  
Lowfat)

Glass Container

\$3.00



Neither



### Example Farmstead Milk Choice Set

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- Preferences for farmstead fluid milk attributes were obtained with **choice-based conjoint**.
- 2021 survey of **817 Tennessee consumers**.
- A D-efficient design was used.
  - 18 choice sets
  - Two blocks were offered, and participants were randomly assigned to one block.



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Plastic Container

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Lowfat)

Glass Container

\$3.00



Neither



- Base categories:
  - Lowfat milk, plastic containers, VAT pasteurization.
- The prices were based on milk prices at major retailers at the time of the study for half gallons of regular and organic milk.
  - \$3, \$4, \$5, and \$6.
- Results were estimated with a random parameters multinomial logit in WTP-space using the STATA 17.0 wtpmixlogit module.

### Example Farmstead Milk Choice Set

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# 3. Results

## Demographic Characteristics of the Survey Sample and the Tennessee Population

	Sample	Current Population Survey <sup>a</sup>
Age (N=817)	49.01	39.0 <sup>b</sup>
Female (N=813)	61.99%	51.2% <sup>b</sup>
College Graduate (N=814)	40.17%	27.3% <sup>c</sup>
Household size (812)	3.48	2.52 <sup>d</sup>
Household Income (N=765)	\$59,229	53,320 <sup>e</sup>

<sup>a</sup> Census Bureau, 2020.

<sup>b</sup> Value for 2019

<sup>c</sup> Percent of persons aged 25 or older, 2015-2019.

<sup>d</sup> Persons per household 2015-2019.

<sup>e</sup> Median household income (in 2019 dollars), 2015-2019.

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- The sample age was somewhat **older** than the overall population.
- A higher percentage were **female**, which might be expected given the topic is shopping for milk.
- A higher percentage were **college graduates** than the overall population.
- **Household size** was somewhat **larger** and household income was somewhat higher.

# 3. Results

## Names and Definitions of Variables Used in the Mixed Logit Models for Farmstead Milk Choice

Variable Name	Description
Dependent Variable:	
Farmstead Milk	1 if chose half-gallon farmstead milk alternative, 0 otherwise
Product Attributes:	
Milk Price	Price of half-gallon of milk (\$3,\$4,\$5,\$6)
VAT	1 if VAT pasteurization used, 0 otherwise (omitted category)
HTST	1 if HTST pasteurization used, 0 otherwise
Ultra	1 if Ultra pasteurization used, 0 otherwise
Lowfat	1 if 2% milkfat, low-fat milk, 0 otherwise (omitted category)
Whole	1 if 3.25% milkfat, whole milk, 0 otherwise
Full Homog	1 if full-fat homogenized milk, 0 otherwise
Cream-line	1 if full-fat cream-line milk(non-homogenized), 0 otherwise
Plastic	1 if plastic container, 0 otherwise (omitted category)
Paper	1 if paper container, 0 otherwise
Glass	1 if glass container, 0 otherwise
Neither	1 if chose neither alternative offered, 0 otherwise

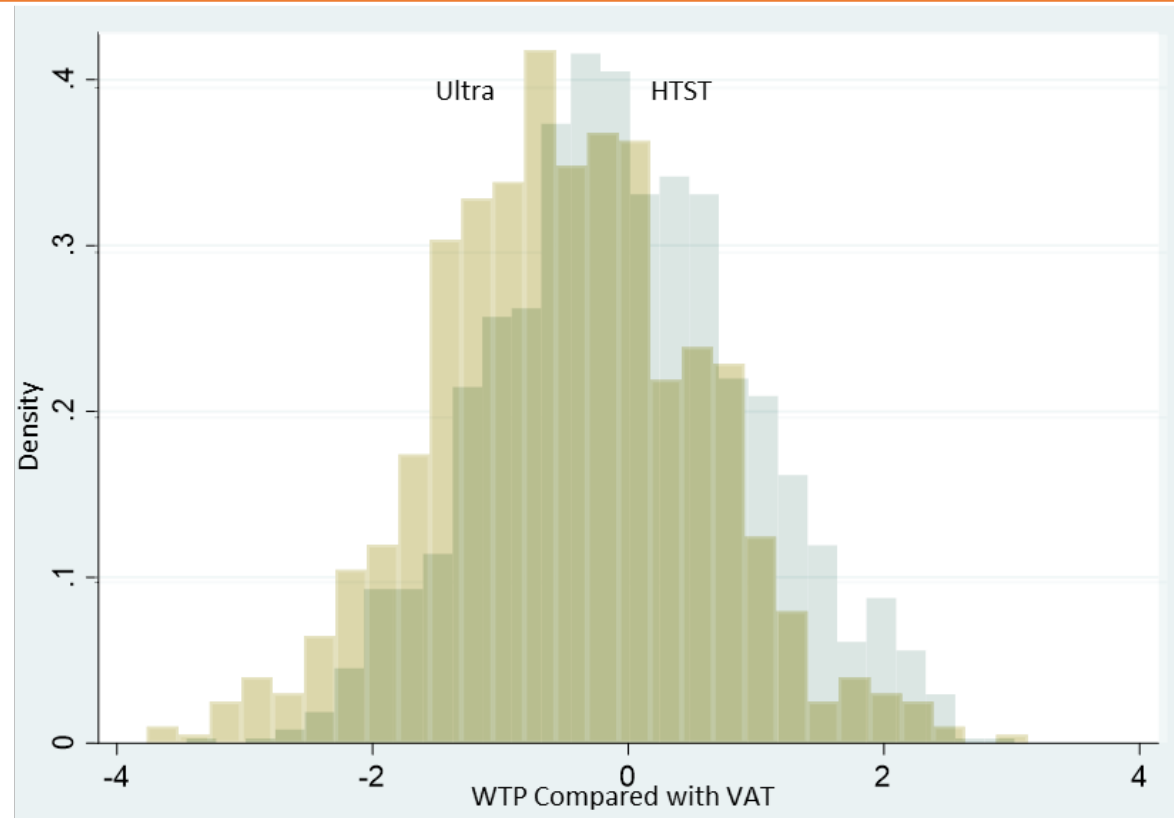
# 3. Results

## Estimated Mixed Logit Model in WTP-Space for Farmstead Milk Attributes

Variable	Estimated Coefficient		Variable	Estimated Coefficient
Mean			SD	
HTST	-0.0521		HTST	1.3944***
Ultra	-0.4734***		Ultra	1.5754***
Whole	-1.1201***		Whole	3.016***
Cream-line	-2.9261***		Cream-line	4.2514***
Full Homog	-1.7415***		Full Homog	2.918***
Paper	-0.8508***		Paper	2.3915***
Glass	-0.6934***		Glass	2.952***
Neither	-5.5942***			
LNPrice	-0.5032***		LNPrice	0.3497***
Mean Price	-0.6427***			
SD Price	1.0033***			
LLR Test Against Intercept $\sim\chi^2(9 \text{ df})$	5370.07***			
LLR	-12632.463			
N	817			

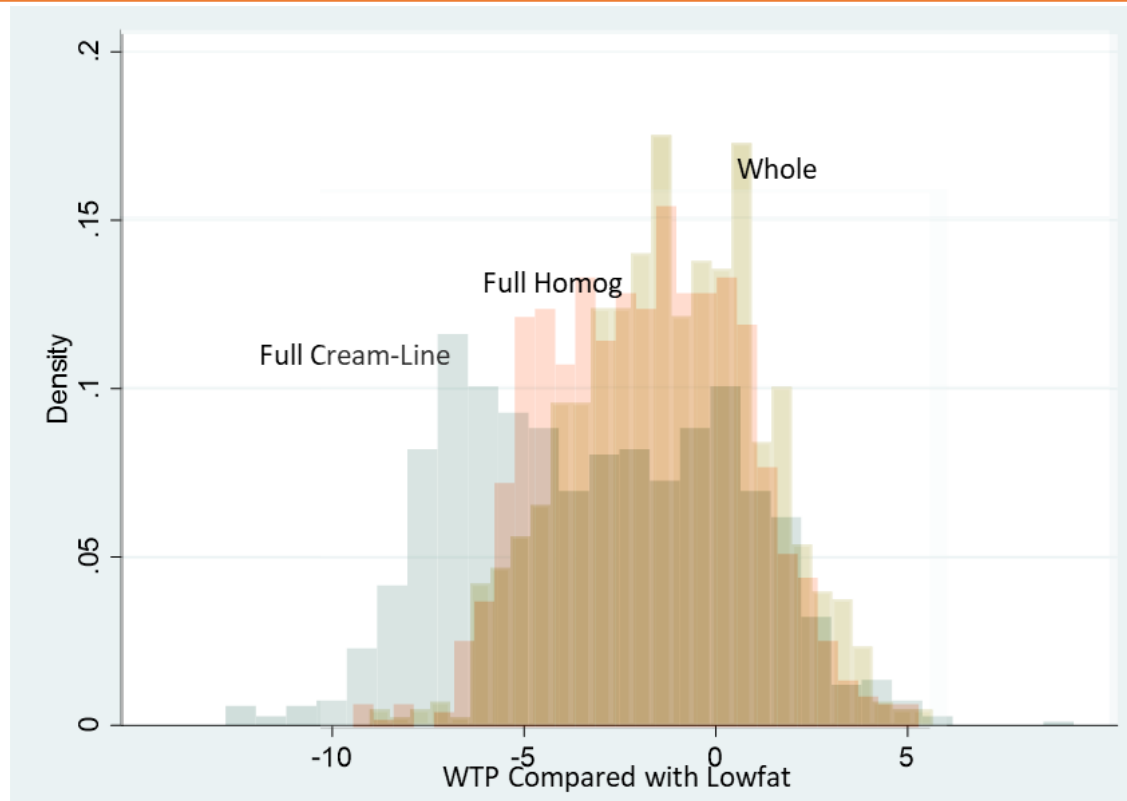
\*\*\* indicates significance at the 1% level.

# 3. Results



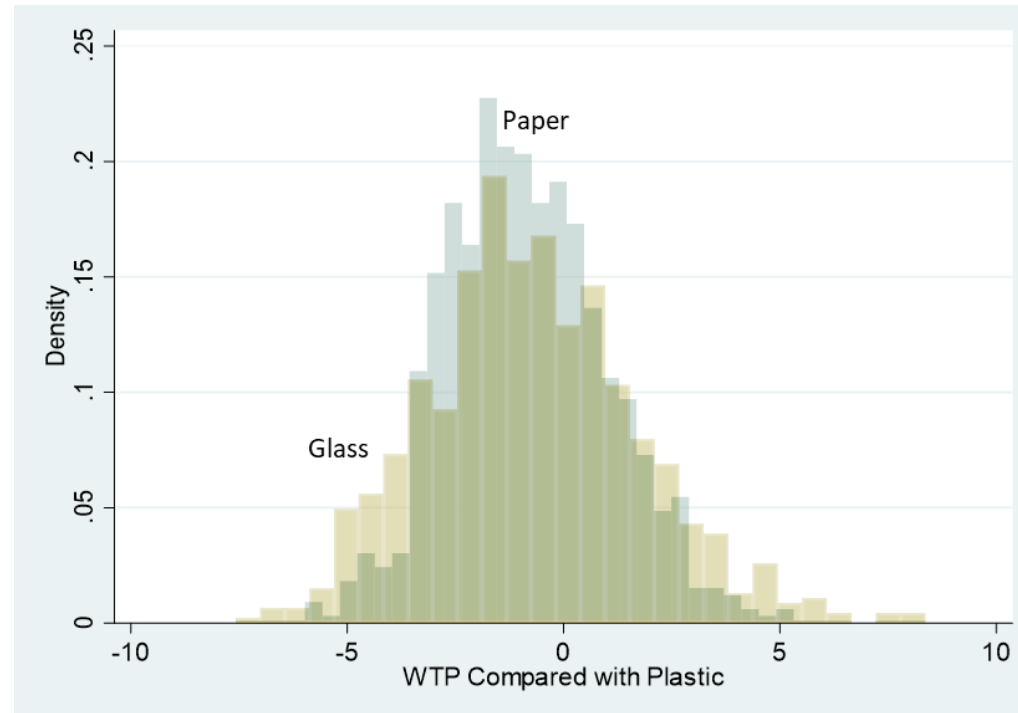
Histogram of WTP Estimates Compared with VAT for Ultra and HTST

# 3. Results



Histogram of WTP Estimates for Whole, Full Homogenized, and Full-Cream-Line compared with Lowfat

# 3. Results



Histogram of WTP Estimates for Glass and Paper compared with Plastic

# 4. Conclusions

- Overall, consumers prefer a farmstead milk that is:
  - Lowfat
  - In a plastic container, and
  - VAT pasteurized.



# 4. Conclusions

- HTST and Ultra equipment cost more than VAT equipment. The results suggest that consumers **may not be willing to pay more** for these types of pasteurization methods and hence the investment in these may not be the optimal choice.
- The results do, however, suggest that consumers prefer a lowfat milk over a cream-line or full-fat milk. Hence, the **additional price premiums for lowfat milk** should be weighed against the **cost of a homogenizer** to make this equipment investment decision.

# 4. Conclusions

- Surprisingly, consumers **preferred plastic jugs** over glass containers. While glass was thought to perhaps bring a premium due to its nostalgic effects and being able to see the milk, it appears that consumers prefer the **convenience** of plastic packaging.
- Also consumers **preferred plastic over paperboard**. This may be the result of some consumers perceiving a **taste difference** from paperboard milk cartons. Plastic is generally regarded as least expensive among the packaging types, hence these study results point toward **investment in packaging for plastic** containers for farmstead milk.