# What's Going On With Milk?

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# What's Going On With Milk Study

**Principal Objective: Investigate demand interrelationships among milk segments and competing beverages using statistical and economic models.**

**Specific objectives:**

- (1) to estimate own-price elasticities for milk for the 11 Federal Milk Marketing Orders using data procured from the Agricultural Marketing Service (AMS, USDA);
- (2) to estimate own-price, cross-price, total expenditure, and income elasticities for milk and milk related products on a national or regional (eight IRI regions) basis using data procured from Information Resources Inc. (IRI); and
- (3) to provide a detailed literature review of the demand for fluid milk and milk related products.

# Committee Engaged Dr. Ariun Ishdorj & Dr. Oral Capps, Jr.

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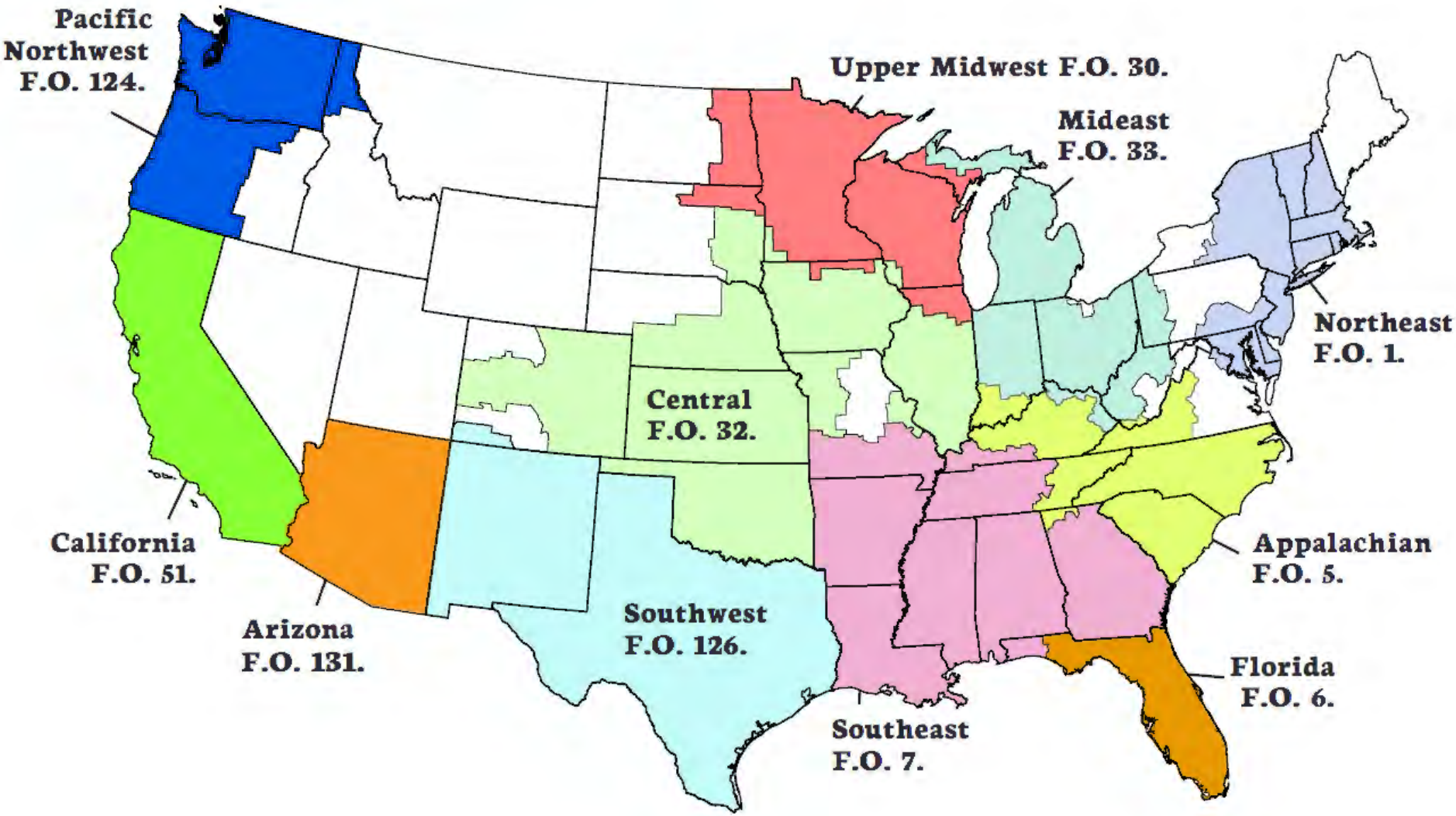
# Analysis of the USDA Data from the Agricultural Marketing Service (AMS)

The USDA data, available from the Agricultural Marketing Service (AMS), pertain to monthly estimated fluid milk products sales (volume in terms of millions of pounds). The primary motivation for the consideration of the USDA, AMS data is to draw comparisons to the IRI analysis, and to shed light on the **non-retail component** of fluid milk sales.

Unlike the IRI data, these sales data correspond to dispositions (deliveries) of fluid milk products in consumer type packages from milk processing (bottling) plants to outlets in Federal Order marketing areas. These outlets include food stores, convenience stores, warehouse stores/wholesale clubs, non-food stores, schools, food service industry, and home delivery. The USDA data are available nationally and regionally for **milk** in the 11 Federal Milk Orders

# The Eleven Federal Milk Marketing Order Areas



# Analysis of the USDA Data from the Agricultural Marketing Service (AMS)

To be consistent with the IRI national and regional analyses, the AMS data span the period from **January 2017 to August 2022.** To estimate own-price elasticities based on the estimated fluid milk sales reports, it was necessary to align price data to shadow the volume sales information.

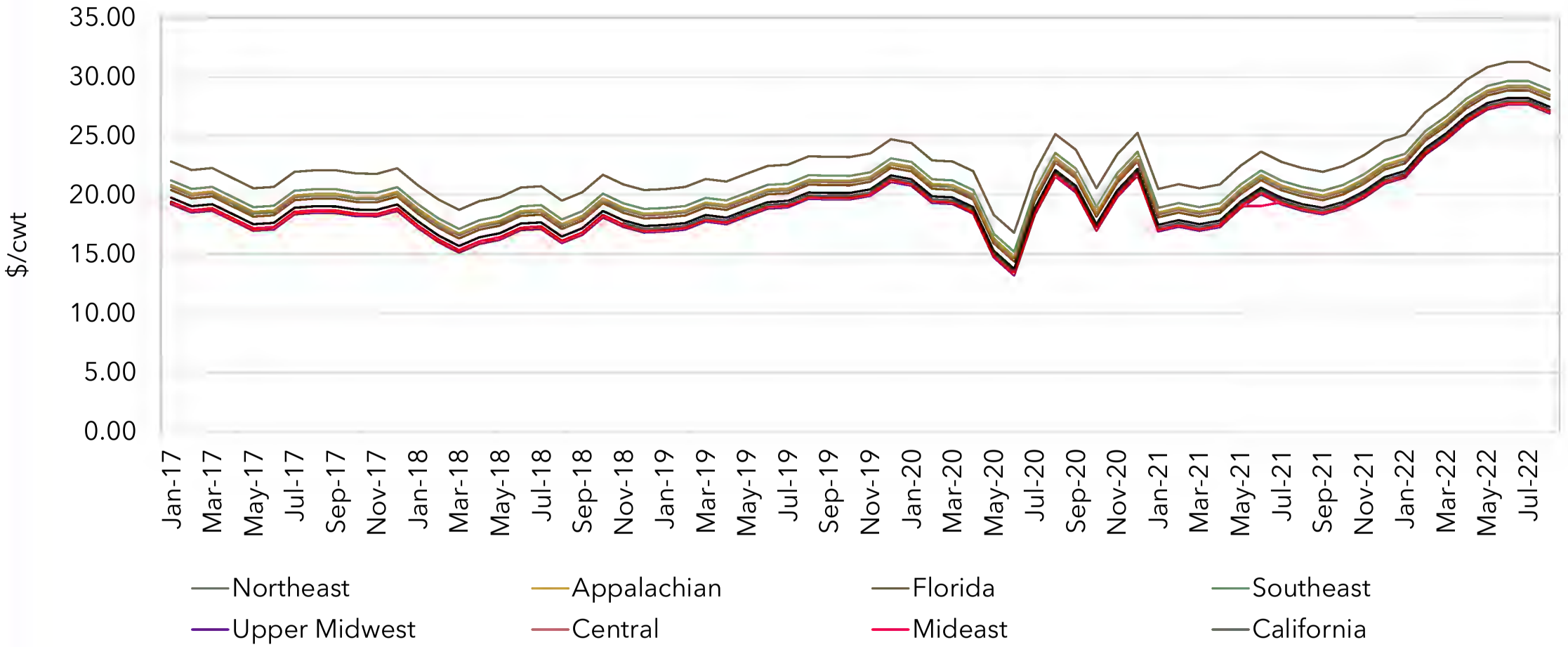
For the analysis of total milk by Federal Milk Marketing Order, we use the Class I prices associated with each order.

For the national level analysis, we use prices from IRI channels for the U.S. market for traditional flavored milk, traditional white milk, organic milk, and total milk due to the unavailability of corresponding price information from AMS.

- Because the prices based on the IRI data indigenous to the U.S. market were available weekly, the weekly prices were aggregated to form monthly prices for the purposes of this analysis.
- To support this proxy for the use of the monthly IRI prices for the four products in question, the correlation of monthly Class I prices for total milk and the monthly prices of total milk based on the IRI data for the United States was nearly 0.70.

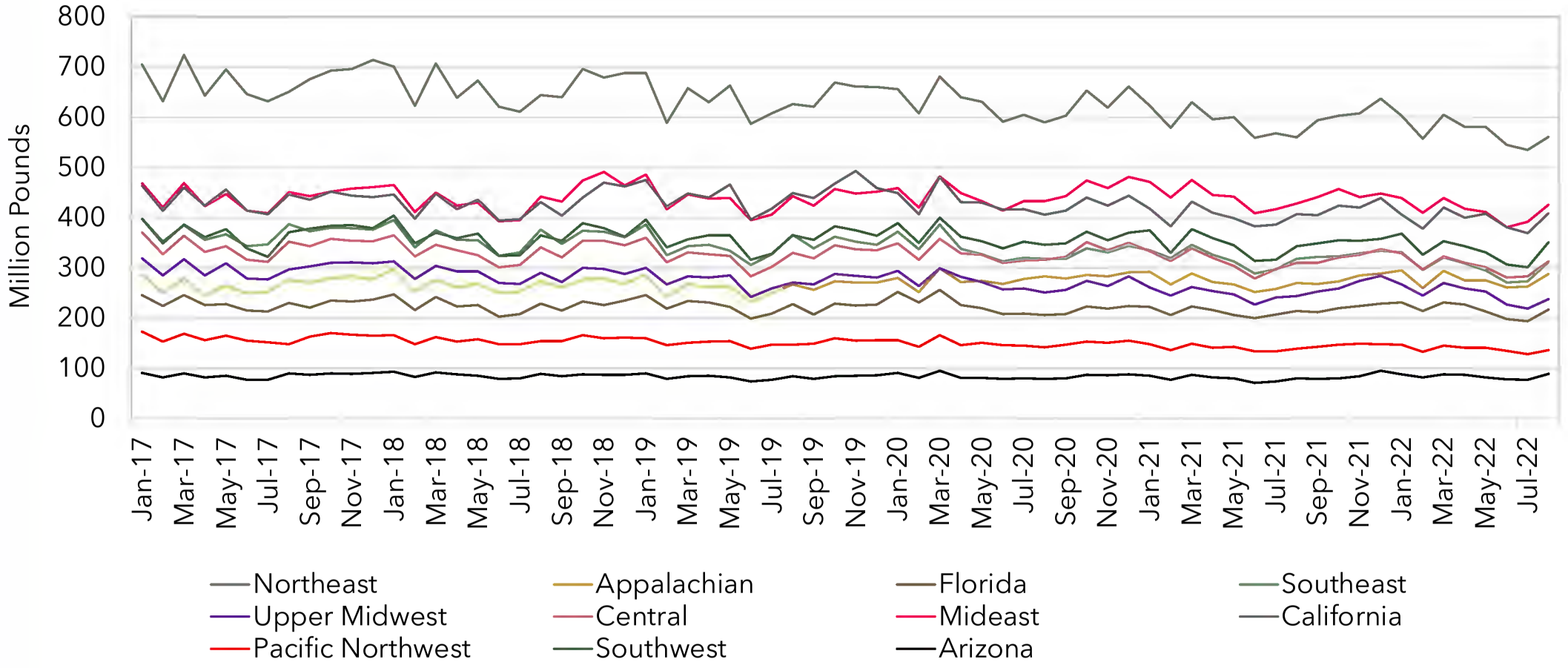
*Analysis of the USDA Data from the Agricultural Marketing Service*

# Class I Milk Prices by Federal Milk Marketing Order, January 2017 to August 2022, $/cwt



*Analysis of the USDA Data from the Agricultural Marketing Service*

# Total Milk Product Sales by Federal Milk Marketing Order, January 2017 to August 2022, millions of pounds



# Analysis of the USDA Data from the Agricultural Marketing Service

## SUR Model for Traditional Flavored Milk, Traditional White Milk, Organic Milk, and Total Milk

## SUR Model for Total Milk Products by Federal Milk Marketing Order

These models account for not only prices but also seasonality and the pandemic.

- The vetting of seasonality is done using monthly indicator of dummy variables.
- To shed light on the impact of COVID-19, indicator or dummy variables are constructed as follows: (1) March 2020 alone; (2) April 2020 alone; (3) May 2020 alone; and (4) for the remaining months June 2020 to August 2022.
- The base or reference category is the period January 2017 to February 2020.
- To explore dynamics, we also entertain volume sales twelve months ago.

# Analysis of the USDA Data from the Agricultural Marketing Service (AMS)

**SUR Model for Traditional Flavored Milk, Traditional White Milk, Organic Milk, and Total Milk**

## OWN-PRICE ELASTICITIES

Total Milk: -0.24
Organic Milk: -0.74
Traditional White Milk: -0.37
Traditional Flavored Milk: Not Meaningful

# Analysis of the USDA Data from the Agricultural Marketing Service (AMS)

## SUR Model for Total Milk by Federal Milk Marketing Order

## OWN-PRICE ELASTICITY FOR TOTAL MILK

Appalachian: -0.002
Arizona: -0.046
California: -0.082
Central: -0.111
Florida: -0.031
Mideast: -0.118
Northeast: -0.089
Pacific Northwest: -0.069
Southeast: -0.156
Southwest: -0.099
Upper Midwest: -0.094

# Analysis Based on IRI Data

Milk was divided into five segments; five competing beverages and yogurt were also included for a total of eleven products.

**Product Categories**

| | |
|---|---|
| Traditional White Milk<br>Organic Milk<br>Traditional Flavored Milk<br>Health Enhance Milk<br>Lactose-free Milk | **Total Milk** |
| Juices<br>Bottled Water<br>Sports Drinks<br>Protein Beverages<br>Plant-Beverages<br>Yogurt | **Competitive Beverages** |

In addition to total U.S. coverage, analyses by eight IRI regions were done.

# Own-Price Elasticity

The IRI weekly data used covered 5+ years (January 8, 2017 – May 15, 2022).

- Provided information on product segment/category sales in dollars, volume and units along with merchandising levels, and total points of distribution.
- Two periods: **Pre-COVID period (January 8, 2017 to March 15, 2020)**
  **COVID-affected period (June 28, 2020 to May 15, 2022)**

Used Barten's Synthetic Model, a demand systems model, to derive own-price, cross-price, and total expenditure elasticities of demand for total milk, milk sub-categories, competitive beverages and yogurt.

# Prices, Quantities, and Budget Shares for the United States

**Price:**

- The average prices for organic milk, health enhanced milk and lactose free milk were more than double the average price for traditional white milk in both periods.
- An increase in average price per volume for total milk and for each of the milk sub-categories was observed from pre-COVID to COVID-affected. The highest price increase was observed for traditional white milk (14%), followed by traditional flavored milk (11%) and health enhanced milk (5%), while the least price increase was observed for lactose-free milk (1%).

**Quantity:**

- The average quantity sold decreased for traditional white milk and traditional flavored milk from the pre-COVID period to the COVID-affected period, whereas the average quantities sold increased for all other milk-subcategories.

**Budget Share:**

- Out of eleven product categories (five milk categories, five competitive beverages and yogurt) total milk represented slightly over 25% of the market share pre-COVID and slightly over 23% during the COVID-affected period.
- The majority of total milk budget share was attributed to traditional white milk (67%), followed by organic milk (13%).

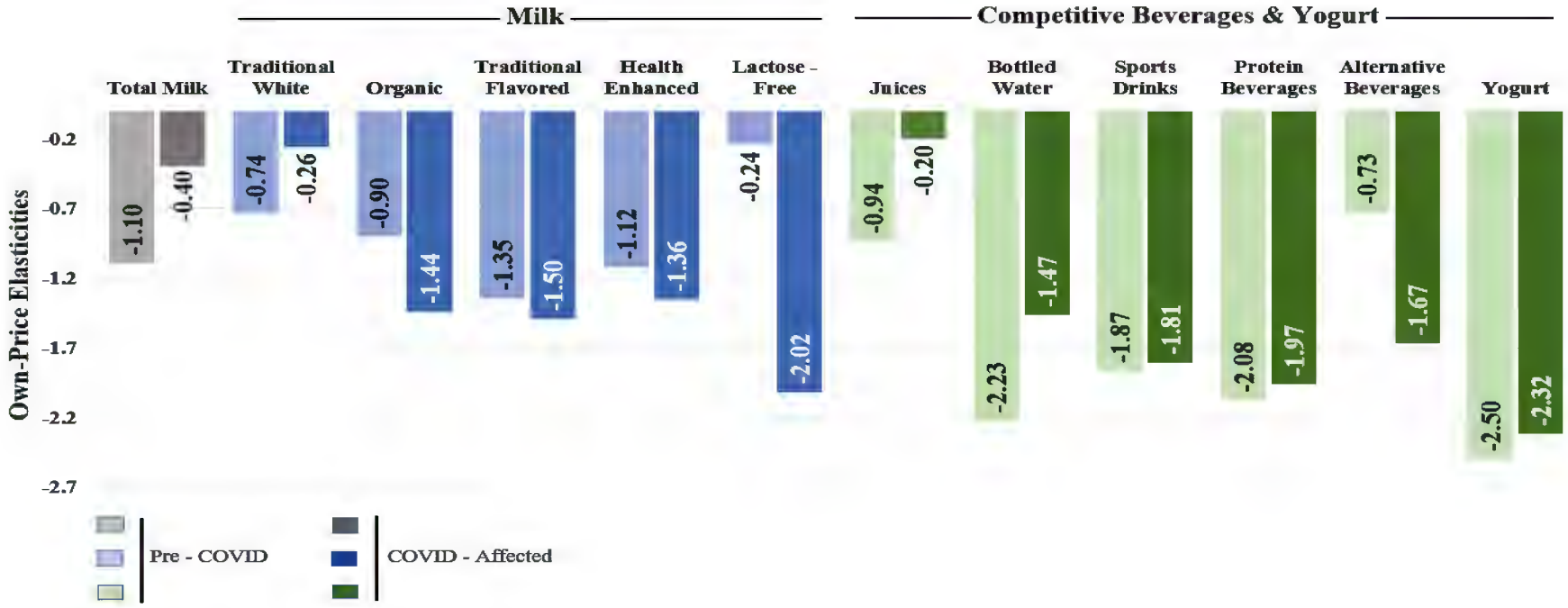
| | Price ($/volume) | | Quantity (millions) | | Budget Share (%) | |
|---|---|---|---|---|---|---|
| | Pre-COVID | COVID-Affected | Pre-COVID | COVID-Affected | Pre-COVID | COVID-Affected |
| **Total Milk** | **3.69** ↑ | **4.24** | **65.43** ↓ | **60.79** | **25.47** ↓ | **23.25** |
| Traditional White | 3.07 ↑ | 3.48 | 54.39 ↓ | 48.56 | 17.11 ↓ | 14.82 |
| Organic | 8.01 ↑ | 8.29 | 3.90 ↑ | 3.99 | 3.20 ↓ | 2.91 |
| Traditional Flavored | 5.05 ↑ | 5.60 | 2.82 ↓ | 2.69 | 1.46 ↓ | 1.32 |
| Health Enhanced | 9.21 ↑ | 9.64 | 2.05 ↑ | 2.72 | 1.93 ↑ | 2.30 |
| Lactose-Free | 7.61 ↑ | 7.66 | 2.26 ↑ | 2.83 | 1.76 ↑ | 1.90 |

# Own-Price Elasticities for the United States

Pre-COVID:

- Traditional white milk, organic milk and lactose-free milk were less sensitive to price changes.
  - A 1% increase in price of traditional white milk led to a 0.74% decrease in quantity demanded for traditional white milk.
- Traditional flavored milk and health enhance milk were more price sensitive to price changes.
  - A 1% increase in price of traditional flavored milk led to a 1.35% decrease in quantity demanded for traditional flavored milk.

Notable differences were observed in elasticities between pre-COVID and COVID-affected periods.



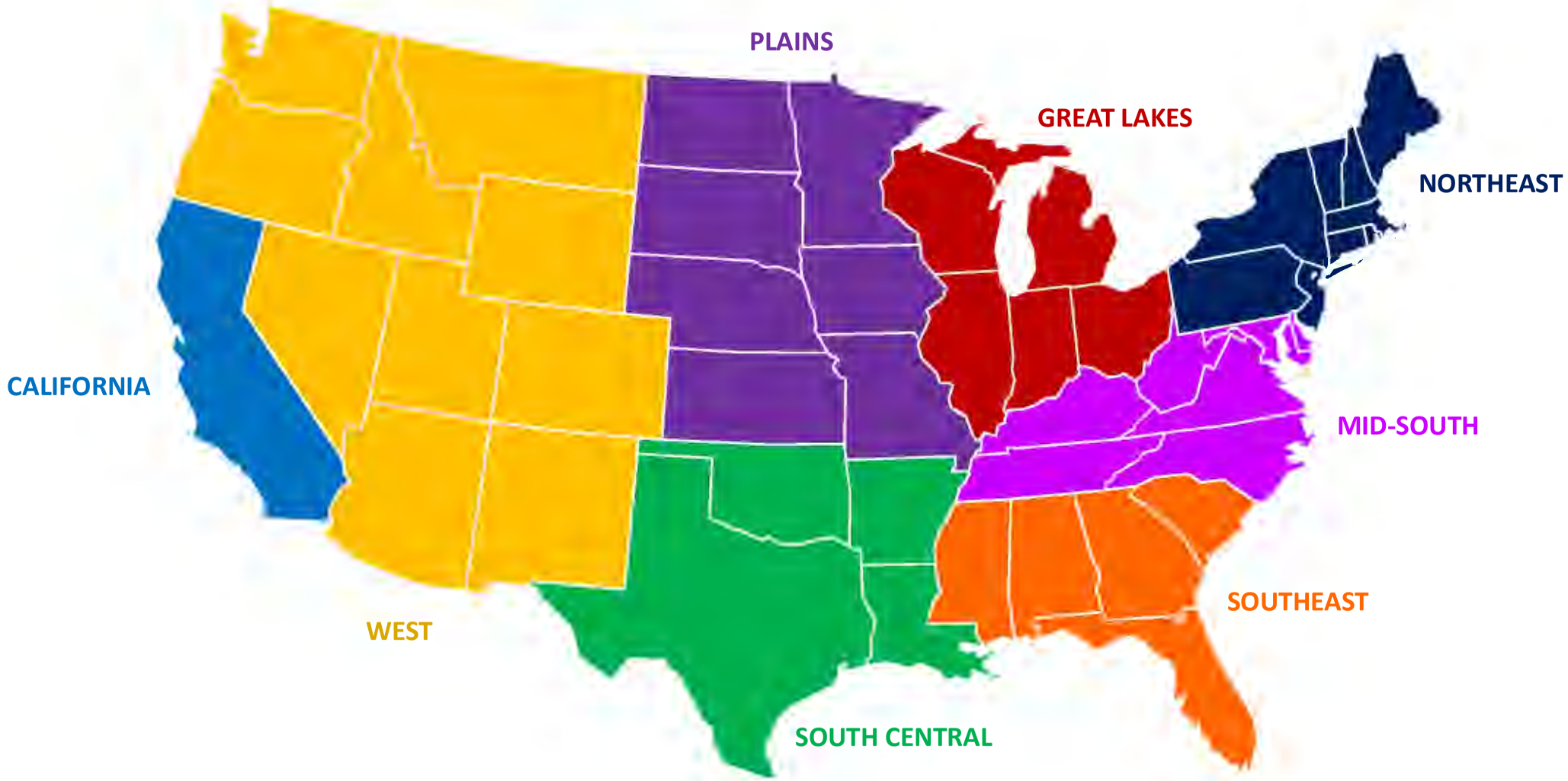
# Cross-Price Elasticity

Compensated own-price and cross-price elasticities of demand capture the substitutability and complementary among the eleven products considered.

- Most cross-price elasticities were positive pre-COVID, indicating the presence of substitution relationships over complementary relationships among eleven products.
  - *Traditional flavored milk was a substitute for health enhanced and lactose-free milk;*
  - *Traditional white milk and organic milk were substitutes for alternative (plant-based) beverages;*
  - *Bottled water was a substitute for all milk products, competitive beverages and yogurt.*

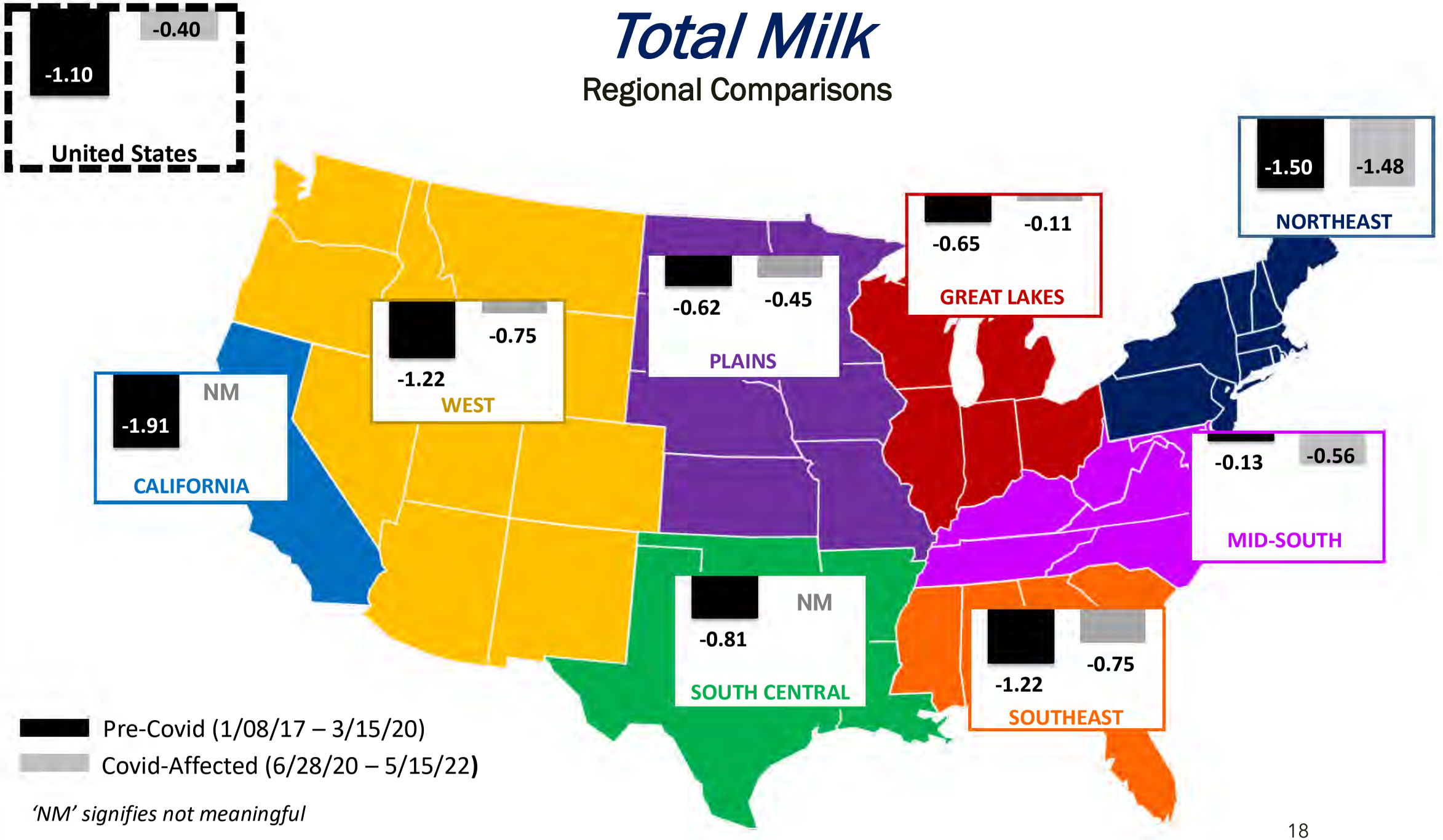
- Similar patterns were observed for the COVID-affected period but with greater number of substitutes compared to the pre-COVID periods.
  - *Lactose-free milk was a substitute for traditional white milk and organic milk;*
  - *Traditional white milk and organic milk were substitutes;*
  - *All competitive beverages, except juices, were substitutes for milk.*

# Analysis Based on the Eight IRI Regions



# Total Milk

## Regional Comparisons




*'NM' signifies not meaningful*

# Summary of Regional Analysis

- At the national level, total milk was fairly price responsive pre-COVID and that also was true for California, West, Northeast and Southeast. Elasticity was less price responsive in Plains, Great Lakes and South Central.
- Milk and Juice elasticities followed a similar pattern, and both became less price elastic for most of the regions in the Covid-affected period.
  - *These categories declined in nearly all 8 regions.*
- All the competitive beverages were responsive to price changes across all regions pre-COVID, except juices.
- Sports drinks and protein beverages were relatively less affected by COVID. Highly responsive to changes in prices pre-COVID and during COVID-affected.
- Plant-based alternative beverages were responsive to price changes across most regions pre-COVID and became lest price responsive during COVID-affected.
- California and Northeast had similar patterns, perhaps driven by extended Covid restrictions during the "Affected" period.

# SYSTEMATIC REVIEW & META ANALYSIS

Thirty-seven existing studies reported own-price elasticities for milk, ranging [-2.41, 0] with median value of -0.236 among 66 elasticities reported.

The overall white milk elasticity from meta-analysis of the data from 18 existing studies was estimated to be: **-0.37 (95% CI: [-0.59, -0.15]).**

Flavored milk elasticities range: [-3.82, -1.39].

Organic milk elasticities range: [-4.22,-0.63].

These elasticities were all reported pre-COVID.

# THANK YOU

## QUESTIONS?

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