Milk Component Pricing and Milkfat in U.S. Diets

Food Product Composition and Public Health Conference

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Presentation Outline

- Role of Dairy Products as a Source of Dietary Fat
  - Overview of dairy product consumption patterns
  - Importance of specific dairy products
- The Pricing of Milk Under the Federal Order System
  - Pre-1995
  - Federal Order Reform of 2000
- Questions to Think About During Presentation
  - Would reduced demand for fat be reflected in farm gate prices?
  - How does the current pricing system provide appropriate market incentives for fat production?
Dietary fat intake increasing in the U.S.

Source: USDA, CNPP, Nutrient Content of U.S. Food Supply Database, 1909-2004 (Preliminary Version)
Dairy products are a significant source of total fat (≈15%) and saturated fat (≈ 29%).

Source: USDA, CNPP, Nutrient Content of U.S. Food Supply Database, 1909-2004 (Preliminary Version)
## Dairy Products as a Source of Dietary Fat

<table>
<thead>
<tr>
<th>Year</th>
<th>Group</th>
<th>Total Fat (%)</th>
<th>Saturated (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>Dairy</td>
<td>16.4</td>
<td>29.5</td>
</tr>
<tr>
<td></td>
<td>Total Meat</td>
<td>34.8</td>
<td>37.8</td>
</tr>
<tr>
<td></td>
<td>Fats/Oils</td>
<td>39.7</td>
<td>26.9</td>
</tr>
<tr>
<td>1987</td>
<td>Dairy</td>
<td>15.8</td>
<td>29.9</td>
</tr>
<tr>
<td></td>
<td>Total Meat</td>
<td>27.5</td>
<td>30.4</td>
</tr>
<tr>
<td></td>
<td>Fats/Oils</td>
<td>46.7</td>
<td>32.8</td>
</tr>
<tr>
<td>2004</td>
<td>Dairy</td>
<td>12.9</td>
<td>25.9</td>
</tr>
<tr>
<td></td>
<td>Total Meat</td>
<td>20.3</td>
<td>22.5</td>
</tr>
<tr>
<td></td>
<td>Fats/Oils</td>
<td>56.4</td>
<td>44.0</td>
</tr>
</tbody>
</table>

Source: USDA, CNPP, Nutrient Content of U.S. Food Supply Database, 1909-2004 (Preliminary Version)
Dairy Products as a Source of Dietary Fat

- Contribution of dairy products has changed

Source of Saturated Fat from Dairy Products

Source: USDA, CNPP, Nutrient Content of U.S. Food Supply Database, 1909-2004 (Preliminary Version)
The U.S. consumer is purchasing less fluid milk.

**Dairy Product Consumption Trends**

**Index of Fluid Milk Total and Milkfat Pounds**

- **Total Fluid Milk Index**
- **Fluid Milk Milkfat Index**

1970 Fluid Milk: 264 lbs.
1970 Fluid Milk Milkfat: 7.6 lbs

Source: USDA, ERS, Food Consumption Database
The U.S. consumer is purchasing less fluid milk

Dairy Product Consumption Trends

Source of Fluid Milk

% of Fluid


Source: USDA, ERS, Food Consumption Database
Dairy Product Consumption Trends

- The U.S. consumer is purchasing more cheese

**Per Capita Cheese Consumption: 1970-2005**

1970-2005 growth implies 2.5% CAGR

Source: USDA, ERS, Food Consumption Database
The U.S. consumer is purchasing more cheese

Dairy Product Consumption Trends

Source: USDA, ERS, Food Consumption Database
The above trends in dairy product consumption imply a change in the allocation of the U.S. supply of milkfat.
The Valuation of Milk Components

- We have reviewed in general terms
  - The consumption of dairy products in the U.S.
  - The significance of these products in meeting U.S. demand for dietary fat

- How can consumer valuation for milk and its components (fat, protein, other solids) be transmitted to farm level milk prices?

- For a majority of the milk produced in the U.S., the pricing of farm milk takes place under Federal and State marketing orders with administered milk prices.
In 2006, California and states comprising Federal Milk Marketing Order (FMMO) system accounted for approximately 85% of U.S. milk:
- California accounts for more than 20%

The following concerned solely with valuation of milk under FMMO system:
- Easily extended to the California situation

The FMMO system enabled by Agricultural Marketing Agreement Act of 1937:
- Not mandatory
- Dairy producers request and approve via referenda
The Valuation of Milk Components

- **Main objectives:**
  - Assure consumers adequate beverage (fluid) milk supply at reasonable price
  - Promote producer price stability
  - Provide sufficient producer prices to guarantee adequate Grade A milk supply

- **Objectives achieved via a number of mechanisms one of which is** *Classified pricing*
  - *Minimum* pay prices established for milk (and components)
  - Final farm price varies according to products manufactured from this milk
Prior to 1995 the value of manufacturing grade milk (grade B), obtained by surveying dairy processing plants in Minnesota and Wisconsin

- Minnesota-Wisconsin (M-W) milk price
- Competitive market price
- Thought to reflect supply/demand conditions for milk in the U.S.
The Valuation of Milk Components

- June, 1995 a new Basic Formula Price (BFP) replaced the M-W
  - Wholesale dairy product prices determined gross milk value via formula
  - Based on value of manufactured products and assumed product yields from milk
    - 40 lb. Block Cheddar
    - NFDM
    - Buttermilk powder
    - Grade AA/A butter

- Starting in April, 2000 a major change in method used to value milk under the FMMO system
The Valuation of Milk Components

- Under the current system (post-2000), four milk classes
  - Class I: beverage products
  - Class II: soft manufactured products (e.g., ice cream, cottage cheese and creams)
  - Class III: hard cheese and cream cheeses
  - Class IV: butter and dry milk products (e.g., non-fat dry milk)

- Under Federal pricing system, formulas used to set monthly minimum pay prices for each class of milk
  - Proprietary plants are required to pay
  - Coops are exempt but pay at least the minimum
Class specific minimum prices

- Based on product formulas relating milk component values (e.g., fat, protein, solids-not-fat and other solids) to:
  - Wholesale dairy product prices
  - Assumed Product yield
  - Assumed manufacturing (non-milk) costs (i.e., make allowances)

Minimum price for a specific milk class: multiply component volumes/cwt of milk at standard composition by derived component values
The Valuation of Milk Components

- Farm milk assumptions used in pricing formulas:
  - *Farm Milk*:
    - 3.5% fat
    - 3.1% of skim is *true protein* (3.3% total protein)
      → 2.9915% of farm milk (3.1*.965)
    - 82.2% of true protein is casein
    - 5.9% other solids (8.685% total non-fat solids)

- There is significant variability in farm milk composition across breeds, farming practices and farm size
  - Not a problem as milk value determined by the value of components (e.g., $/lb milkfat, $/lb protein)
The Valuation of Milk Components

- **Product assumptions used in pricing formulas:**
  - *Cheddar Cheese*
    - 90.0% fat retention, 95.9% casein retention
    - 38% moisture
    - Van Slyke cheese yield formula
  - “Gross” cheese yield of 9.685 lb/cwt (9.662 lb/cwt net after farm-plant losses)
  - *Dry Whey*: 1.03 lbs. of dry whey/lb of other solids
  - *Butter*
    - 80% BF
    - 1.20 lbs of butter/lb of BF (after losses)
  - *NFDM*: 0.99 lbs. NFDM/lb. non-fat solids
As noted above, there are 4 classes of milk

- I would like to walk you through the determination of the valuation of one class, Class III
- In 2005, Class III products accounted for 39.6% of total supply of U.S. milkfat
- Can use this a pattern for other classes
  - Different commodities used
  - Different product yields
  - Different make allowances
Class III: Cream Cheese and Hard Cheeses

Based on Cheese, Butter and Dry Whey product prices

1. Class III Butterfat Price/lb =
   \[(\text{NASS Monthly AA butter price} - 0.1202) \times 1.20\]

2. Other Solids Price/Lb. =
   \[(\text{NASS Monthly Dry Whey Price} - 0.1956) \times 1.03\]

The above cheese price refers to 40 lb Cheddar blocks and 500 lb barrels.
The Valuation of Milk Components

(3) Protein Price/Lb. =

(NASS Monthly Cheese Price – 0.1682) x 1.383 +

{[(NASS Monthly Cheese Price – 0.1682) x 1.572] – 0.9 x Butterfat Price} x 1.17

(4) Class III Skim Milk Price = 3.1 x Protein Price +

5.9 x Other Solids Price

(5) Class III Price = 3.5 x Class III Butterfat Price +

0.965 x Class III Skim Milk Price
The Valuation of Milk Components

NASS Grade A Butter Price

Butterfat Price ($/lb)

x 3.5

NASS Cheese Price ($/lb)

Protein Price ($/lb)

x 3.1

NASS Dry Whey Price ($/lb)

Other Solids Price ($/lb)

x 5.9

Class III Skim Price ($/cwt)

Class III Price ($/cwt)

x 0.965

Note: The numbers in parentheses identify product price formula
The Valuation of Milk Components

- After Substituting (1), (2), (3), and (4) into (5) results in (6) Class III Price =
  9.64 x NASS Cheese Price
  + 0.42 x NASS Butter Price
  + 5.86 x NASS Dry Whey Price
  - 2.82

- Similarly for Class IV we have:
  4.20 x NASS Butter Price
  + 8.60 NASS NFDM Price – 1.85

Combined Make Allowance
Combined Make Allowance
The Valuation of Milk Components

Impact of a 10¢ Increase in Product Prices On Class III Milk Price (¢/cwt)

<table>
<thead>
<tr>
<th>Milk Type</th>
<th>Cheese</th>
<th>Butter</th>
<th>Whey</th>
<th>NFDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class III</td>
<td>96.4</td>
<td>4.2</td>
<td>58.6</td>
<td>-----</td>
</tr>
<tr>
<td>Class IV</td>
<td>------</td>
<td>42.0</td>
<td>-----</td>
<td>86.0</td>
</tr>
</tbody>
</table>

To place this in perspective:

- 2006 average FMMO Class III price: $11.89/cwt
- 2006 average FMMO Class IV price: $11.06/cwt
- 2006 NASS commodity prices:
  - Cheese: $1.25/lb
  - Butter: $1.22/lb
  - Dry Whey: $0.33/lb
  - NFDM: $0.88/lb
The Valuation of Milk Components

- Now lets get back to the valuation of milkfat (and other milk components) with administered prices
  - It should be recognized that under the FMMO system values are minimum values
    - Over-order premiums are allowed
  - Dairy products operate within a national (and international market for dry products)
    - Regions are at a disadvantage if over-premiums offered only locally
Now let’s get back to the valuation of milkfat (and other milk components) when one has administered prices

- Current system is very limited in terms of how consumer preferences for milk components translated to milk valuation
  - Only a few commodities used in formulas
  - Administratively difficult to change to meet changing consumer demands

- Changes in Milkfat valuation
  - Direct impact via butter price
  - Indirect impact via cheddar cheese production
Implications for Market Incentives

- Cheddar less important as source of cheese consumption
  - Relatively high in fat compared to Mozzarella

![Chart showing Cheddar's diminishing cheese share](chart.png)

- Mozzarella: 12.7% Sat. Fat
- Cheddar: 21.1% Sat. Fat
- 2005: 32.2% of cheese is Cheddar
- 32.5% of cheese is Mozzarella

Source: USDA, ERS, Food Consumption Database
## Implications for Market Incentives

<table>
<thead>
<tr>
<th>Type of Cheese Product</th>
<th>Year of Introduction</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cheese</td>
<td></td>
<td>257</td>
<td>343</td>
<td>286</td>
<td>350</td>
<td>369</td>
<td>454</td>
</tr>
<tr>
<td>Low/No/Reduced Fat</td>
<td></td>
<td>25</td>
<td>7</td>
<td>11</td>
<td>37</td>
<td>50</td>
<td>27</td>
</tr>
<tr>
<td>Low/No/Reduced Transfat</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

Source: Mintel Group, Global New Products Database.
### Implications for Market Incentives

<table>
<thead>
<tr>
<th>Cheese Type</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cheese</td>
<td>2,119</td>
<td>2,131</td>
<td>2,217</td>
<td>2,249</td>
<td>2,227</td>
<td>2,248</td>
</tr>
<tr>
<td>Non-Imitation Cheese</td>
<td>2,073</td>
<td>2,088</td>
<td>2,173</td>
<td>2,204</td>
<td>2,186</td>
<td>2,214</td>
</tr>
<tr>
<td>Reduced Fat Varieties</td>
<td>2.5%</td>
<td>2.3%</td>
<td>2.1%</td>
<td>2.1%</td>
<td>1.9%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Fat Free</td>
<td>4.7%</td>
<td>4.7%</td>
<td>4.5%</td>
<td>4.8%</td>
<td>5.2%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Light/Reduced Fat</td>
<td>1.6%</td>
<td>1.6%</td>
<td>1.5%</td>
<td>1.5%</td>
<td>1.6%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Low Fat</td>
<td>91.2%</td>
<td>91.4%</td>
<td>91.9%</td>
<td>91.6%</td>
<td>91.3%</td>
<td>91.0%</td>
</tr>
<tr>
<td>Regular Fat</td>
<td>8.8%</td>
<td>8.6%</td>
<td>8.1%</td>
<td>8.4%</td>
<td>8.7%</td>
<td>9.0%</td>
</tr>
</tbody>
</table>

Data for reduced fat versions of full fat varieties. Sales are in Million lbs. %’s are percent of non-imitation.
Source: Information Resources, Inc. 2007
Implications for Market Incentives

- New dairy products beings developed both for direct consumption and as an ingredient
  - Example: ↑ use of whey and its derivatives
    - Until recently, whey a by-product with a negative value from cheese production
    - ↑ demand for use in sports nutrition and dietary supplements, infant formula and functional foods
  - Whey protein concentrates (WPC) and isolates (WPI) and other whey protein products >20% annual growth rates
  - Only method for these to enter formulas is via dried whey valuation
Implications for Market Incentives

- Increasingly important markets not directly accounted for within pricing formulas

Source: USDA, Dairy Products Report, Various Issues
Implications for Market Incentives

- Increasingly important markets not directly accounted for within pricing formulas

Dried Whey as Percent of WPC-34 Price

\[ \rho = 0.756 \]

Source: Derived from data contained in USDA, AMS, Dairy Market News
Implications for Market Incentives

- Would reduced demand for fat be reflected in farm gate prices
  - Direct effect: equilibrium price for butter
  - Indirect effect: equilibrium price for full-fat cheddar
- How does the current pricing system provide appropriate market incentives for fat production
  - Does classified pricing based on limited commodities damper innovation?
  - Current example of increased value of whey
  - Would increasing commodities associated with formulation solve problem or is it a moving target?
  - Should we eliminate formulas altogether?
Thanks for Your Time

Any Questions?