An Empirical Analysis of Wholesale Cheese Pricing Practices on the Chicago Mercantile Exchange (CME) Spot Cheese Market

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Presentation Outline

- Chicago Mercantile Exchange *spot* cheese market
  - Role in the U.S. dairy industry pricing
  - Structure and participants
- Theoretical framework and hypotheses
  - Vertical price transmission
  - Cost pass-through
- Econometric model
- Data
- Estimation results
- Conclusion
CME Spot Cheese Market

- **Spot cheese market** is a private industry institution
- In the past it took place on the National Cheese Exchange and Wisconsin Cheese Exchange; it was moved to CME in 1997
- Originally it was used to trade surpluses of cheese (at the beginning of the last century)
- Over time, it became an institution performing a **primary price discovery function** in the U.S. dairy industry
  - CME spot cheese prices are used as reference prices in cheese contracts used to transact more than 90% of cheese produced in the country
  - **CME spot cheese prices influence milk prices** set within the Federal and State Milk Marketing Orders
    - Milk prices that first level handlers have to pay to dairy farmers are determined using a set of price formulas
    - A survey-based **wholesale cheese price** is the main determinant of milk price in these price formulas
CME Spot Cheese Market (cont.)

- CME spot cheese market is a thin (a low volume) market
  - < 1% of the total cheese volume produced in the country traded
- A relatively small number of traders participate on a regular basis
  - These are large ag cooperatives and food processing companies
  - They also operate in the cheese contract market
- Occasional concerns about market (price) manipulations are raised
  - They attract attention due to the role of CME spot cheese market in price discovery in the U.S. dairy industry

- Research on cheese pricing relevant to the CME spot cheese market is practically absent

- Our research objective is to analyze the nature of wholesale cheese pricing practices used by cheese wholesalers on CME spot cheese market
  - An analysis of vertical price transmission process, which reflects the nature of cost pass-through (CPT) for cheese wholesalers
  - Milk is the main input used to produce cheese
  - The CPT magnitude is used to conclude on the nature of cheese pricing: perfectly competitive or imperfectly competitive and a particular type of wholesale cheese pricing method
A linear vertical price transmission process: \( WP = a + b*FP \)
- \( WP \) is the CME wholesale cheddar cheese price ("output price")
- \( FP \) is FMMOs Class III milk price ("input price" or "farm price")
- \( a \) is a non-negative constant
- \( b \) is a farm price transmission coefficient (cost pass-through)
  - The magnitude of "\( b \)" and "\( a \)" is used to determine the pricing method used by wholesalers

**Hypotheses (are based on profit-maximizing FOC)**
- \( b=1 \) and \( a>0 \) -> perfect competition; a fixed absolute mark up pricing
- \( b<1 \) -> imperfect competition: seller market power/linear demand
  - \( b=0.5 \) monopoly and \( 0.5<b<1 \) oligopoly
  - Consistent with a fixed-percentage mark up pricing method (a margin stabilization pricing)
- \( b>1 \) -> imperfect competition: seller market power/non-linear demand
  - Impossible to distinguish monopoly and oligopoly
  - Consistent with an output price stabilization pricing method
Econometric Model

\[ WP = a + b*FP \]

- \( WP = a + b*FP \) is used to specify an econometric model
- **Asymmetry in farm price transmission process** is introduced in the econometric model
  - Assumption: *milk price increases are transmitted at a different rate than milk price decreases* (common in dairy industry)

\[ WP^*_t = \alpha_0 \times t + \sum_{i=0}^{N} \beta_i^+ \times FP\_INC^*_{t-i} + \sum_{i=0}^{M} \beta_i^- \times FP\_DEC^*_{t-i} + u_t \]

- \( WP^* \) is the sum of all period-to-period changes in wholesale cheese price from its initial value
- \( FP\_INC^* (>0) \) is the *sum* of all period-to-period *increases* and \( FP\_DEC^* (<0) \) is the *sum* of all period-to-period *decreases* in milk price from its initial value
- \( N \) and \( M \) are the number of lagged terms for increasing and decreasing phases of milk price
- *Betas are vertical price transmission coefficients (cost pass-through)* for the FP increasing phase and for the FP decreasing phase
Data

- **CME cheddar cheese prices ($ per pound)**
  - USDA Agricultural Marketing Service (AMS) Dairy Market News Portal
  - Cheddar cheese prices for two styles of cheese currently traded
    - Cheddar sold in 500 pound barrels
    - Cheddar sold in 40 pound blocks
  - CME cheese prices are daily prices, also reported on a monthly basis

- **Class III milk price ($ per hundredweight)**
  - USDA AMS Milk Marketing Order Statistics Public Database
  - Is determined by USDA on a monthly basis and is publicly announced

- The econometric models are estimated using monthly data
  - Separate model for cheddar barrel and cheddar block
  - Class III milk price is converted into $ per pound

- Period of analysis: January 2000 – December 2014
• **FP decreasing phase:** only current month effect is statistically significant

• **FP increasing phase:** the current month and the first lag are statistically significant

• The immediate impact of FP change: asymmetry in FP transmission
  - Milk price increase is transmitted at a much higher rate than decrease

• The cumulative impact of FP change: symmetry in FP transmission

### OLS Estimation Results

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Dependent variable: CME cheddar block price</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Est. coef. (CPT)</td>
</tr>
<tr>
<td>$FP_{INC_t}^*$ ($\beta_0^+$)</td>
<td>1.23*</td>
</tr>
<tr>
<td>$FP_{INC_{t-1}}^*$ ($\beta_1^+$)</td>
<td>-0.58*</td>
</tr>
<tr>
<td>$FP_{DEC_t}^*$ ($\beta_0^-$)</td>
<td>0.64*</td>
</tr>
<tr>
<td>Constant</td>
<td>0.03</td>
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<tr>
<td>$\beta_0^+ + \beta_1^+$</td>
<td>0.64</td>
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</tbody>
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<tbody>
<tr>
<td>DW-statistic</td>
<td>1.28</td>
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<tr>
<td>R2</td>
<td>0.76</td>
</tr>
<tr>
<td>Sample size</td>
<td>178</td>
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</tbody>
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OLS Estimation Results: Empirical Evidence on Wholesale Cheese Pricing

A). The **cumulative effect** of milk price changes on cheese price

- **Symmetric** -> milk price increases are transmitted at the same rate as milk price decreases
- **Cost pass-through (CPT) is 0.64** -> imperfectly competitive pricing
- A null hypothesis of a perfectly competitive pricing is rejected
- Evidence of **oligopolistic pricing** in a **linear demand** market
- Wholesale cheese price stabilization pricing method

B). The **immediate (current month) effect** of milk price changes on cheese price

- **Asymmetric** -> milk price increases are transmitted at a much higher rate than milk price decreases (almost 2 times)
- A null hypothesis of a perfectly competitive pricing is rejected
- **CPT for milk price increase is 1.23** (more than a complete CPT)
- **Oligopoly or monopoly pricing** in a **non-linear demand** market
- Fixed-percentage mark up pricing (wholesale margin stabilization)
- **CPT for milk price decrease is 0.64** (incomplete CPT)
- **Oligopoly pricing** in a **linear demand** market
- Wholesale cheese price stabilization pricing method
The empirical evidence indicates that pricing practices used by cheese wholesalers at CME spot cheese market are consistent with the ones used by profit-maximizing oligopolists. This evidence reflects pricing methods that can be found in markets with similar to CME spot cheese market structural characteristics:

- A relatively small number of traders
- A homogeneous product
- An inelastic demand and a limited entry

CME spot cheese market is a low margin market:
- Wholesale cheese margin is 5% on average
- Seller market power is reflected in the asymmetric transmission of milk price increases and milk price decreases
- In the case of the current month effect:
  - The milk price increase transmission is more than a complete
    - Wholesale margin increases
  - The milk price decrease transmission is incomplete
    - Wholesale margin increases as well

Conclusion
Questions ???

Comments ...

Thank You

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