Competition in Food Retailing

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Market Structure of Food Retailing

Grocery retailing becoming more profitable

Presented by T.J. Richards
Arizona State University

Food Retailing

Source: U.S. Census Bureau
Market Structure of Food Retailing
National Concentration Relatively Low

Market Shares of Top Four Retailers: 2008
Source: Food Marketing Institute

Wal-Mart: 21%
Kroger: 13%
Safeway: 8%
Costco: 7%
Other: 51%
Market Structure of Food Retailing

Retail Markets are Local

<table>
<thead>
<tr>
<th>Measure</th>
<th>Atlanta</th>
<th>Chicago</th>
<th>Dallas</th>
<th>Los Angeles</th>
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</thead>
<tbody>
<tr>
<td>Supermarkets</td>
<td>698</td>
<td>1,160</td>
<td>881</td>
<td>2,376</td>
</tr>
<tr>
<td>Convenience Stores</td>
<td>3,528</td>
<td>3,624</td>
<td>4,963</td>
<td>6,168</td>
</tr>
<tr>
<td>Mass Merch.</td>
<td>635</td>
<td>721</td>
<td>932</td>
<td>810</td>
</tr>
<tr>
<td>Wholesale Clubs</td>
<td>31</td>
<td>37</td>
<td>33</td>
<td>101</td>
</tr>
<tr>
<td>Chain Share (%)</td>
<td>93.5</td>
<td>82.5</td>
<td>95.5</td>
<td>90.0</td>
</tr>
<tr>
<td>Supermarket %</td>
<td>83.5</td>
<td>87.2</td>
<td>87.1</td>
<td>87.1</td>
</tr>
<tr>
<td>Chain 1 (share %)</td>
<td>Kroger (30.2)</td>
<td>SuperValu (33.6)</td>
<td>Wal-Mart (31.3)</td>
<td>Ralphs (19.3)</td>
</tr>
<tr>
<td>Chain 2 (share %)</td>
<td>Publix (20.2)</td>
<td>Dominick’s (10.4)</td>
<td>Kroger (12.4)</td>
<td>Vons (16.8)</td>
</tr>
<tr>
<td>Chain 3 (share %)</td>
<td>Wal-Mart (27.4)</td>
<td>Cent. Coop (10.0)</td>
<td>Assc. Whls. (12.1)</td>
<td>Un. Western (13.0)</td>
</tr>
<tr>
<td>Chain 4 (share %)</td>
<td>Ingles (4.1)</td>
<td>Cert. Grocers (6.0)</td>
<td>Brookshires (7.9)</td>
<td>SuperValu (10.0)</td>
</tr>
<tr>
<td>CR4</td>
<td>81.9%</td>
<td>60.0%</td>
<td>63.7%</td>
<td>59.1%</td>
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</tbody>
</table>

Note: Data are from A. C. Nielsen Trade Dimensions Market Scope: 2008 Westport, CT. 2007.
Today’s Talk

Summary of Three NEIO Papers

- "Network Externalities in Food Retailing"
- "Commodity Prices and Food Inflation"
- "Retail and Wholesale Market Power in Organic Apples"

Format of Each Discussion

- Introduction - Problem and Objective
- Theoretical Framework and Hypotheses
- Description of Econometric Model
- Data and Estimation Method
- Results and Implications for Retail / Wholesale Competition

Synthesis of Findings from Papers
Paper #1: "Network Externalities in Food Retailing"
Observations

- SKU Count Rose by 52% from 1990 to 2004
- Big Box Retailers Now Dominate Many Categories
- Scale Economies in Food Retailing Small
- Change in Retailing Structure From Demand-Side
Objectives

- To Examine:
  - Network Externalities in Supermarket Pricing
  - Impact of Two-Sided Demand on Retail / Wholesale Pricing
  - Relationship Between Network Size and Margins

- To Estimate Degree of Competitiveness Among
  - Retailers
  - Wholesalers
THEORETICAL FRAMEWORK

- Retailers are Platforms with Two-Sided Demand
  - Consumers Demand Variety of Products (Larger Network)
  - Suppliers Demand Shelf-Space (Access to Consumers)
- Suppliers "Multi-Home," Consumers Do Not
- Retailers Internalize Network Externalities

Hypothesis
- Total Demand Rises with Network Size
- Retail Margins Rise
- Supplier Margins Fall
Econometric Model

- **Structural Model of Retail / Manufacturer Margins**
  - Consumer Demand
  - Retailers Choose Prices and Variety to Max Profit
  - Manufacturers Choose Wholesale Prices
  - Vertical Stackelberg / Horizontal Bertrand-Nash

- **Consumer Demand is Hierarchical**
  - Discrete Choice of Supermarket
  - CES Model of Expenditures in Chosen Store

- **Wholesale Prices Not Observed**
  - Differentiate Retail First-Order Conditions
  - Impose Bertrand-Nash Competition
  - Recover Expression for Retail and Wholesale Margins
  - Retailing and Mfg Cost Estimated from Implied Margins
**Econometric Model**

- **Estimate Effect of Network Size on Margins**
- **Introduce Conduct Parameters**
  - $\phi = \text{Deviation of Retail Margins from Competition}$
  - $\theta = \text{Deviation of Supplier Margins from Competition}$
  - $\phi = \theta = 0$ Implies Perfect Competition
  - $\phi = \theta = 1$ Implies Bertrand-Nash Rivalry
- **Conduct Depends on Network Size**
  - $\phi = \phi_0 + \phi_1 N_j$
  - $\theta = \theta_0 + \theta_1 N_j$
  - $\phi_1 > 0$ Implies Retail Margins Rise in Network Size
  - $\theta_1 > 0$ Implies Supplier Margins Rise in Network Size
DATA DESCRIPTION

- **Store-level Scanner Data**
  - 104 Weeks from May 2003 - June 2005
  - All Stores in Visalia California (6, from 4 chains)
  - No Wal*Mart in Visalia
  - All Stores are HI-LO
  - Accounts for all of Visalia Supermarket Spending

- **Shopping Basket of Top 10 Categories**
  - Low Fat Milk, Regular Soft Drinks, Beer, Bread, etc.
  - CES Price Index for Each
  - Variation in SKUs over Time and Store
Estimation Method

- Two-Stage Estimation
  - Consumer Demand with GMM
  - Retail / Wholesale Margins with GMM

- Panel Data over Store / Category / Time

- Prices and Variety Endogenous
  - Identify Demand with Category-Specific Input Prices
  - Identify Supply with Category-Specific Demand Shifters
Results

- Specification Tests
  - Nested Logit / CES Model Preferred to Simple Logit
  - Supermarkets not Local Monopolists
  - Demand Rises in Network Size

- Retail Conduct
  \[ \phi = 0.785 \]
  \[ \phi_1 = 0.002 \]

- Supplier Conduct
  \[ \theta = 0.175 \]
  \[ \theta_1 = -0.002 \]

- All Parameter Estimates Statistically Significant
Results

- Retailer Margins Closer to Bertrand
- Supplier Margins Nearly Competitive
- Retail Margins Rise in Network Size
- Supplier Margins Fall in Network Size
- Results Consistent with Network Externalities
  - Retailers Internalize Network Effects, Raise Margins
  - Suppliers Unable to Internalize, Reduce Margins
- Opposite to Kaiser and Wright (2006, *IJIO*)
  - German Advertisers Value Readers more than Readers Value Ads
  - Subscription Prices Low, Ad Rates High
  - Value of Variety > Value of Distribution
  - Consumers Pay High Margins, Retailers Reduce Supplier Margins
Paper #2: "Commodity Prices and Food Inflation"
Observations and Objective

- Commodity Price Inflation in 2007 - 08
- Fears of Food Inflation by Policymakers
- Commodity Price Deflation in 2008 - 09
- Media Reports of Slow Retail Price Adjustment

Objective:
- Estimate Extent of Pass-Through for Two Commodities
- Explain Relationship Between Input Inflation and Market Power
- Explain Pass-Through at Retail and Wholesale Levels
Theoretical Framework

- Pass-Through Depends on Many Factors
  - Market Power Downstream (Bulow and Pfleiderer, 1983)
  - Market Power Upstream (Hamilton and Sunding, 1997)
  - Substitutability of Inputs (Gardner, 1975)
  - Rising or Falling Input Prices (Borenstein, et al., 1997)
  - Consumer Price Expectations (Benabou and Gertler, 1996)
  - Number of Products Sold (Hamilton, 2009)

- Contribution: Market Power Depends on Inflation
Hypotheses:

- $H_1$: Retail Market Power Rises with Inflation
- $H_2$: Retail Market Power Falls with Inflation
- $H_3$: Wholesale Market Power Rises with Inflation
- $H_4$: Wholesale Market Power Falls with Inflation

Expectation versus Market Share Effect
Econometric Model

- Structural Model of Retail / Wholesale Margins
  - Consumer Demand
  - Wholesaler Stackelberg Model
  - Wholesalers Set Prices and Retailers Follow
  - Solve by Backward Induction: Retailers then Wholesalers
  - Pricing at Each Level Bertrand-Nash

- Consumer Demand is Hierarchical
  - Choose to Buy from Supermarkets or Other Outlet
  - Choose Among Brands or Varieties

- Wholesale Prices not Observed
  - Derive Wholesale Prices by Differentiating Retail FOC
Econometric Model

- Deviation from Bertrand due to Input Inflation

- Define Regimes of Inflation and Deflation:

  \[ \phi_j = \phi_0 + \phi_1 \pi_j^+ + \phi_2 \pi_j^- \]
  \[ \theta_j = \theta_0 + \theta_1 \pi_j^+ + \theta_2 \pi_j^- \]

  \( \phi_1 > 0 \) Implies Retail Margins Rise in Inflationary Periods
  \( \phi_2 < 0 \) Implies Retail Margins Rise in Deflationary Periods
  \( \theta_1 > 0 \) Implies Wholesale Margins Rise in Inflationary Periods
  \( \theta_2 < 0 \) Implies Wholesale Margins Rise in Deflationary Periods

  Vice Versa for Narrowing Margins

- Simulate Pass-Through by Solving for Retail Price
DATA DESCRIPTION

- **Two Products: Unprocessed and Processed**
  - Fluid Milk
  - Fresh Potatoes

- **Potato Data:**
  - Aggregate (Chain-level) Scanner Data
  - 143 Weeks (Jan. 2006 - Sept. 2008)
  - Five Markets: Atlanta, Chicago, Dallas, Los Angeles, New York

- **Fluid Milk Data:**
  - Aggregate (Chain-level) Scanner Data
  - 104 Weeks (Mar. 2007 - Feb. 2009)
  - Ten Largest U.S. Markets
  - 18 Top Brands in Each Market by Share

- **Input Prices from USDA / BLS**
Estimation Method

- Demand Model Estimated by SML
- Pricing Model Estimated by GMM
- Instrument Endogenous Prices With:
  - Market-Specific Binary Variables Interacted with Input Prices
  - Product-Specific Binary Variables
- Estimate Model in Two Stages:
  - Consumer Demand Model in First Stage
  - Retail / Wholesale Pricing Model in Second Stage
RESULTS

POTATO MODEL MARGIN EQUATION

- **Specification Tests:**
  - Retail / Wholesale Model Preferred to Retail Only
  - Asymmetric Response of Conduct to Input Inflation
  - Partial Pass-Through of 89.6%

- **Conduct Parameters:**
  - Retail: $\phi = 0.828$
  - Wholesale: $\theta = 0.248$
  - Implies Retail Nearly Bertrand, Wholesale Nearly Competitive

- **Effect of Input Price Inflation:**
  - Retail: $\phi_1 = -0.037$ and $\phi_2 = -0.510$
  - Wholesale: $\theta_1 = -0.215$ and $\theta_2 = -0.170$
RESULTS

POTATO MODEL MARGIN EQUATION

- **Retail Interpretation:**
  - Retail Margins Narrow During Inflation
  - Implies Competitive Market Share Effect
  - Retail Margins Widen in Deflation
  - Implies Non-Competitive Expectation Effect

- **Wholesale Interpretation:**
  - Wholesale Margins Narrow During Inflation
  - Reflects Competitive, Market Share Effect
  - Wholesale Margins Widen in Deflation
  - Reflects Retailers’ Concerns in Media
Results

Fluid Milk Model Margin Equation

- Specification Tests:
  - Retail / Wholesale Model Preferred to Retail Only
  - Asymmetric Response of Conduct to Input Inflation
  - Partial Pass-Through of 3.4%

- Conduct Parameters:
  - Retail: $\phi = 0.289$
  - Wholesale: $\theta = 0.542$
  - Retail More Competitive than Wholesale
  - Both More Competitive than Bertrand

- Effect of Input Price Inflation:
  - Retail: $\phi_1 = -0.138$ and $\phi_2 = 0.091$
  - Wholesale: $\theta_1 = -1.181$ and $\theta_2 = 0.244$
Results

Fluid Milk Model Margin Equation

- **Retail Interpretation:**
  - Margins Narrow During Inflation
  - But, Margins Narrow in Deflation
  - Cost-Price Squeeze when Prices Rising
  - Consumers Expect Prices to Fall Faster

- **Wholesale Interpretation:**
  - Wholesale Margins Narrow During Inflation
  - Margins Narrow in Deflation
  - Wholesalers Absorb More of Price Rise
  - Retailers Expect Production Costs to Fall Faster
CONCLUSIONS

- Retail / Whls Market Power Product-Specific
- Retail More Competitive for Processed Product
- Retail / Whls More Competitive than Bertrand
- Pass-Through Higher for Minimally Processed
Paper #3: "Market Power in Organic Apples"
Organic Foods Growing Rapidly
- $13.8 B - $21.1 B from 2005 - 2008
- Fruits and Veg 43% in 2003

Reports of Shortages of Organic Product

Organics Sell for Premium at Retail

Question Whether Premium Due to:
- High Production Costs
- Grower Market Power due to Shortages

Objective:
- Test for Grower / Retailer Market Power in Organics
- Test for Trends in Grower / Retailer Margins
Theoretical Framework

- Suppliers Possess Market Power When:
  - Retailers Promote Product (Richards and Patterson, 2005)
  - Short Harvest (Sexton and Zhang, 1996)
  - Scale, Assortment, Experienced (Draganska and Klapper, 2007)

- Retailer Has Market Power When:
  - Concentrated Market (Inderst and Shaffer, 2007)
  - It is Wal*Mart (Volpe and Lavoie, 2007)
  - Supplier Market in Surplus
**Theoretical Framework**

- **Hypotheses:**
  - $H_1$ : Retail Market Power Lower for Organics
  - $H_2$ : Retail Market Power Rising over Time
  - $H_3$ : Wholesale Market Power Higher for Organics
  - $H_4$ : Wholesale Market Power Falling over Time
Econometric Model

- Deviation from Maintained Game
  - Organic / Not Organic
  - Organic Attribute Interacted with Time Trend

- Conduct Parameters for Retail / Wholesale:

\[
\phi_j = \phi_0 + \phi_1 O_j + \phi_2 O_j t
\]
\[
\theta_j = \theta_0 + \theta_1 O_j + \theta_2 O_j t
\]

- \( \phi_1 > 0 \) Means Higher Margins for Organic at Retail
- \( \phi_2 < 0 \) Means Organic Margin Declines with Time
- \( \theta_1 > 0 \) Means Higher Margins for Organic Suppliers
- \( \theta_2 < 0 \) Means Organic Margin Declines with Time

- If Growers Profit, Margin Should Fall
Data Description

- Retail Scanner Data for Apples
  - Five Markets: Atlanta, Chicago, Dallas, Los Angeles, New York
  - Six Varieties / Organic and Non-Organic for Each

- Grower Price Data:
  - Washington Growers Clearing House
  - Organic and Non-Organic Prices for Each Variety
  - Not Matched with Retail Markets, so Not Wholesale Price

- Input Prices from USDA / BLS
**Estimation Method**

- Demand Model Estimated by SML
- Pricing Model Estimated by GMM
- Instrument Endogenous Prices With:
  - Product-Specific Binary Variables Interacted with Input Prices
  - Market-Specific Binary Variables
- Estimate Model in Two Stages:
  - Consumer Demand Model in First Stage
  - Retail and Wholesale Pricing Models in Second Stage
Results

• Conduct Parameters:
  - Retail: $\phi_R = 0.395$ and $\phi_O = 0.056$
  - Wholesale: $\theta_R = 0.078$ and $\theta_O = 1.216$
  - Where $R$ Subscript is Regular, $O$ is Organic

• Effect of Organic and Trend:
  - Retail: $\phi_1 = -0.451$ and $\phi_2 = -0.001$
  - Wholesale: $\theta_1 = 1.137$ and $\theta_2 = -0.012$
Results

- Retail Conduct:
  - Non-Organic Retail Prices Less Competitive than Organic
  - Retail Margins Lower for Organics
  - Retail Organic Margins Declining Over Time

- Wholesale Interpretation:
  - Organic Margins Much Wider than Non-Organic
  - Wholesale Margins Wider for Organics
  - Wholesale Organic Margins Narrow Over Time
Conclusions

- Organic Retailing Highly Competitive
- Non-Organic Retail Prices Less than Bertrand
- Organic Whls Less Competitive than Bertrand
- Non-Organic Wholesalers Very Competitive
- Organic Effect on Market Power Declining
**Synthesis**

- **Product / Market Heterogeneity in Retail Power**
- **Retailers Less Competitive than Suppliers**
- **Retailers More Competitive in Processed Goods**
- **Retailers More Competitive for High Demand Items**
- **Retailers Take Advantage of Declining Prices**