POLITICAL MARKET POWER REFLECTED IN MILK PRICING UNDER SUPPLY MANAGEMENT

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Background

Political Market Power (PMP) (Ahn and Sumner, 2009, AJAE)

Market Power created by policies that are driven by the relative political power of interest groups (e.g., milk buyers and milk producers).

Supply Management
1. Setting prices,
2. Setting production levels (Quota),
3. Controlling imports (Tariff Rate Quotas (TRQ) and Minimum Access Commitments (MAC)).
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Briefs on Canadian Milk Markets

1. Canadian dairy producers supply two main markets: fluid milk, and industrial milk.
2. For industrial milk, the Canadian Dairy Commission (CDC) first sets a support price.
3. The responsibility for determining fluid milk prices remains with the provincial marketing boards.
4. Revenues from all milk sales are pooled and dairy producers receive a blended price.
Purpose

To develop a political economy model of supply management to investigate political market power reflected in price discrimination and quota levels in the dairy sector in Canada.

In our model, quota levels, as opposed to price differentials (Ahn and Sumner, 2009, AJAE), are the choice variable.
To develop a political economy model of supply management to investigate political market power reflected in price discrimination and quota levels in the dairy sector in Canada.
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- To develop a political economy model of supply management to investigate political market power reflected in *price discrimination* and *quota levels* in the dairy sector in Canada.

- In our model, *quota levels*, as opposed to price differentials (Ahn and Sumner, 2009, AJAE), are the choice variable.
Policy Preference Function (PPF): \[
\max_P PPF = (1 - w)\Gamma(P) + w\Pi(P) \quad (1)
\]

where \(\Gamma(P)\) is the consumers’ surplus, \(\Pi(P)\) is the producers’ surplus, and \(P\) is the level of a policy instrument.

\[
\max_P W = \Gamma(P) + \lambda\Pi(P) \quad (2)
\]

where \(\lambda = \frac{w}{1-w}\), is defined as the relative welfare weight.
Two methods of assessing the degree of political market power (Ahn and Sumner, 2009, AJAE):
Conceptual Framework

Two methods of assessing the degree of political market power (Ahn and Sumner, 2009, AJAE):

1. the Divergence Rate of Policy Level (DRPL):

\[ \frac{(\bar{P} - P_0)}{(P_m - P_0)} \cdot \]

In this study, \( P \) represents the price differential between fluid and industrial milk, i.e. \( P_d = \)
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3. \( P_m = P^F* - \bar{P}^I* \), maximum producers’ profit.
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2. the Divergence Rate of Welfare Weight (DRWW):

\[
\frac{(\bar{w} - 0.5)}{(1 - 0.5)}.
\]
Assumptions on Canadian Milk Markets

1. The price and the total quota of Industrial Milk are set by a national authority. Therefore the national industrial milk market is an oligopoly market with Cournot Competition.

2. The price and the quantity of Fluid Milk are regulated by provincial authorities. Therefore the provincial fluid milk markets are independent monopoly markets.

3. Price differential between fluid milk and industrial milk in province $i$: $P_{d,i} = P_{F,i} - P_{I}$

4. Producers in province $i$ receive a pooling revenue (blend price): $P_{b,i} = \left[ P_{F,i} \left( Q_{F,i} \right) + P_{I} \left( \sum Q_{I,i} \right) \right] / \left( Q_{F,i} + Q_{I,i} \right)$ \hspace{1cm} (3)
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3. Price differential between fluid milk and industrial milk in province \(i\): \(P_i^d = P_i^F - P_i^I\)

4. Producers in province \(i\) receive a pooling revenue (blend price):

\[
P_i^b = \left[ P_i^F (Q_i^F) Q_i^F + P_i^I (\sum Q_i^I) Q_i^I \right] / (Q_i^F + Q_i^I) \quad (3)
\]
The derivation of the Policy level that Maximize Producer Profits
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- For a monopolist or producer cartel, to chooses a price, is equivalent to choose a matched production $Q$. 

\[ \max Q_i \Pi_i = P_{F_i}(Q_{F_i}) + P_{I_i}(\sum Q_{I_i}) - \int Q_i 0 MC_i(Q) dQ \] 

Solving yields $Q_{F_i}^*$ and $Q_{I_i}^*$. Substituting them into demand functions we can get $P_{F_i}^*$, $P_{I_i}^*$ and the optimal price differentials $P_{d_i}^*$. 
The derivation of the Policy level that Maximize Producer Profits

- For a monopolist or producer cartel, to choose a price, is equivalent to choose a matched production $Q$.
- The profit maximization problem of the producer cartel in province $i$ is:

$$\max_{Q_i} \Pi_i = P_i^F(Q_i^F)Q_i^F + P^I(\Sigma Q_i^I)Q_i^I - \int_0^{Q_i} MC_i(Q)dQ \quad (4)$$
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- The profit-maximizing decision satisfies:

$$MR^F_i = MR^I_i = MC_i$$
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$$\max \Pi_i = P_i^F(Q_i^F)Q_i^F + P_i^l(\sum Q_i^l)Q_i^l - \int_0^{Q_i} MC_i(Q) dQ \quad (4)$$

- The profit-maximizing decision satisfies:

$$MR_i^F = MR_i^l = MC_i$$

- Solving yields $Q_i^{F*}$ and $Q_i^{l*}$. Substituting them into demand functions we can get $P_i^{F*}$, $P_i^{l*}$ and the optimal price differentials $P_i^{d*}$. 
Market Equilibrium in Milk Markets under Supply Management
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Note: Competitive Equilibrium: $P_0 = P_C - P_C = 0$. 

![Diagram](image-url)
Market Equilibrium in Milk Markets under Supply Management
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Note: Full political market power: $P_m = P_{d^*} = P_{i^*} - P^{I^*}$. 

$\frac{(\bar{P} - P_0)}{(P_m - P_0)}$?
Derivation of the Welfare Weights Implied by Observed Price Differentials
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- The maximization problem of the regulator in province $i$:

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The first order condition is:

$$\frac{dW_i}{dQ_i} = -Q_i^F \frac{\partial P_i^F}{\partial Q_i^F} - Q_i^I \frac{\partial P_i^I}{\partial \sum Q_i^I}$$

$$+ \lambda_i [P_i^F + Q_i^F \frac{\partial P_i^F}{\partial Q_i^F} + P_i^I (\sum Q_i^I) + Q_i^I \frac{\partial P_i^I}{\partial \sum Q_i^I} - MC_i]$$

$$= 0 \quad (5)$$
Derivation of the Welfare Weights Implied by Observed Price Differentials

- The maximization problem of the regulator in province $i$:
  \[
  \max_{Q_i} W_i = \Gamma_i + \lambda \Pi_i
  \]

- The first order condition is:
  \[
  \frac{dW_i}{dQ_i} = -Q_i^F \frac{\partial P_i^F}{\partial Q_i^F} - Q_i^I \frac{\partial P_i^I}{\partial \sum Q_i^I} + \lambda_i [P_i^F + Q_i^F \frac{\partial P_i^F}{\partial Q_i^F} + P_i^I (\sum Q_i^I) + Q_i^I \frac{\partial P_i^I}{\partial \sum Q_i^I} - MC_i] = 0
  \]
  \[
  (5)
  \]

- Solving for $\lambda_i^*$, and substitute to $\lambda = \frac{w}{1-w}$, we can get $\bar{w}$ and
  \[
  DRWW = \frac{(\bar{w} - 0.5)}{(1 - 0.5)}.
  \]
Table 1: Price and Quantity in the Base Dairy Year (2004/2005)

<table>
<thead>
<tr>
<th>Regions</th>
<th>Class 1(a) Price (C$/hl std)</th>
<th>Class 4(a) Price (C$/hl std)</th>
<th>Blend Price</th>
<th>Class 1(a) Milk Volumes (hl std)</th>
<th>Class 4(a) Milk Volumes (hl std)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC</td>
<td>68.45</td>
<td>65.77</td>
<td>68.40</td>
<td>3215909</td>
<td>64755</td>
</tr>
<tr>
<td>MB</td>
<td>73.42</td>
<td>66.91</td>
<td>71.83</td>
<td>1035855</td>
<td>335206</td>
</tr>
<tr>
<td>ON</td>
<td>74.65</td>
<td>65.99</td>
<td>73.64</td>
<td>9722811</td>
<td>1273708</td>
</tr>
<tr>
<td>QC</td>
<td>75.03</td>
<td>68.87</td>
<td>74.30</td>
<td>6136907</td>
<td>823254</td>
</tr>
<tr>
<td>NB</td>
<td>75.51</td>
<td>61.46</td>
<td>75.01</td>
<td>586788</td>
<td>22001</td>
</tr>
<tr>
<td>NS</td>
<td>75.43</td>
<td>65.89</td>
<td>74.47</td>
<td>904502</td>
<td>101194</td>
</tr>
</tbody>
</table>

Sources: Canadian Dairy Information Centre (CDIC)
Blend prices are calculated using equation (3)
Table 2: Simulated $P^d$ that Maximize Profits and Degree of PMP of Milk Producers (2004/2005)

<table>
<thead>
<tr>
<th>Provinces Observed</th>
<th>Simulated $P^d$</th>
<th>Calculated Degree of PMP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$P^d$</td>
<td>Mean</td>
</tr>
<tr>
<td>BC</td>
<td>2.69</td>
<td>45.59</td>
</tr>
<tr>
<td>MB</td>
<td>6.50</td>
<td>53.76</td>
</tr>
<tr>
<td>ON</td>
<td>8.66</td>
<td>52.56</td>
</tr>
<tr>
<td>QC</td>
<td>6.16</td>
<td>53.50</td>
</tr>
<tr>
<td>NS</td>
<td>9.54</td>
<td>59.90</td>
</tr>
<tr>
<td>Average</td>
<td>7.93</td>
<td>54.58</td>
</tr>
</tbody>
</table>

Results are simulated with an estimated $\eta^F = -0.57(0.13)$, an estimated $\eta^l = -0.52(0.10)$ and an assumed milk supply elasticity of 1.
Table 3: Imputed Welfare Weights and Degree of PMP of Milk Producers (2004/2005)

<table>
<thead>
<tr>
<th>Provinces</th>
<th>Imputed Welfare Weight $\lambda$</th>
<th>Welfare Mean Confidence intervals</th>
<th>Calculated Degree of Political Market Power Mean Confidence intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC</td>
<td>1.769 (1.248, 2.750)</td>
<td>0.278 (0.110, 0.467)</td>
<td></td>
</tr>
<tr>
<td>MB</td>
<td>1.320 (1.119, 1.563)</td>
<td>0.138 (0.056, 0.220)</td>
<td></td>
</tr>
<tr>
<td>ON</td>
<td>1.439 (1.167, 1.808)</td>
<td>0.180 (0.077, 0.288)</td>
<td></td>
</tr>
<tr>
<td>QC</td>
<td>1.365 (1.143, 1.620)</td>
<td>0.154 (0.067, 0.237)</td>
<td></td>
</tr>
<tr>
<td>NB</td>
<td>1.831 (1.275, 3.076)</td>
<td>0.293 (0.121, 0.509)</td>
<td></td>
</tr>
<tr>
<td>NS</td>
<td>1.657 (1.228, 2.430)</td>
<td>0.247 (0.102, 0.417)</td>
<td></td>
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<tr>
<td>Average</td>
<td>1.564 (1.196, 2.208)</td>
<td>0.215 (0.089, 0.356)</td>
<td></td>
</tr>
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</table>

Results are simulated with an estimated $\eta^F = -0.57(0.13)$, an estimated $\eta^I = -0.52(0.10)$ and an assumed milk supply elasticity of 1.
Calculated Degree of Political Market Power with \( \eta^F = -0.57 \) and \( \eta^I = -0.52 \)

Note: Results are obtained with estimated mean of \( \eta^F = -0.57 \) and \( \eta^I = -0.52 \).
Calculated Degree of Political Market Power $\eta^F = -0.315$ and $\eta^I = -0.324$

Note: Results are obtained with estimated upper bound $\eta^F = -0.57 + 1.96 \times 0.13 = -0.315$ and estimated upper bound $\eta^I = -0.52 + 1.96 \times 0.10 = -0.324$. 
Conclusion Remarks

Observed $P_d$ imply some degree of PMP of milk producers to milk buyers, but are below those that would maximize producer profits.

1. The national average of $P_d$ is about 14% of profit-maximizing $P_d$.

2. The national average of $\lambda$ implies that the PMP of milk producers is about 22% of the PMP by producers.
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These results suggest that milk producers have more political power than milk buyers, but small relative to full monopoly power. This is consistent with:

1. The role of highly concentrated dairy processors,
2. The fact that there are some imports and non-dairy alternatives.
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Thank You for your attention!

Welcome to Comment and/or Ask Questions!