

POLITICAL MARKET POWER REFLECTED IN MILK PRICING UNDER SUPPLY MANAGEMENT

Na Li
Alan Ker

July 1, 2011



Food, Agricultural and
Resource Economics

UNIVERSITY
of **GUELPH**

- 1 BACKGROUND
- 2 THEORETICAL MODEL
- 3 DATA AND SIMULATIONS
- 4 SUMMARY AND CONCLUSIONS

Background

Background

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

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).

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

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,

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),

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)).

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

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.

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.

Conceptual Framework

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**.

Conceptual Framework

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):

$$\frac{(\bar{P} - P_0)}{(P_m - P_0)}$$

In this study, P represents the price differential between fluid and industrial milk, i.e. $P_d =$

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):

$$\frac{(\bar{P} - P_0)}{(P_m - P_0)}.$$

In this study, P represents the price differential between fluid and industrial milk, i.e. $P_d =$

- 1 $0 = P_0$, competitive solution;

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):

$$\frac{(\bar{P} - P_0)}{(P_m - P_0)}$$

In this study, P represents the price differential between fluid and industrial milk, i.e. $P_d =$

- 1 $0 = P_0$, competitive solution;
- 2 \bar{P} , observed price differential

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):

$$\frac{(\bar{P} - P_0)}{(P_m - P_0)}.$$

In this study, P represents the price differential between fluid and industrial milk, i.e. $P_d =$

- 1 $0 = P_0$, competitive solution;
- 2 \bar{P} , observed price differential
- 3 $P_m = P^{F*} - \bar{P}^{I*}$, maximum producers' profit.

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):

$$\frac{(\bar{P} - P_0)}{(P_m - P_0)}.$$

In this study, P represents the price differential between fluid and industrial milk, i.e. $P_d =$

- 1 $0 = P_0$, competitive solution;
 - 2 \bar{P} , observed price differential
 - 3 $P_m = P^{F*} - \bar{P}^{I*}$, maximum producers' profit.
- 2 the Divergence Rate of Welfare Weight (DRWW):

$$\frac{(\bar{w} - 0.5)}{(1 - 0.5)},$$

Assumptions on Canadian Milk Markets

Assumptions on Canadian Milk Markets

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

Assumptions on Canadian Milk Markets

- 1 The price and the total quota of **Industrial Milk** are set by **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.

Assumptions on Canadian Milk Markets

- 1 The price and the total quota of **Industrial Milk** are set by **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 : $P_i^d = P_i^F - P^I$

Assumptions on Canadian Milk Markets

- 1 The price and the total quota of **Industrial Milk** are set by **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 : $P_i^d = P_i^F - P^I$
- 4 Producers in province i receive a **pooling revenue** (blend price) :

$$P_i^b = \left[P_i^F(Q_i^F)Q_i^F + P^I(\sum Q_i^I)Q_i^I \right] / (Q_i^F + Q_i^I) \quad (3)$$

The derivation of the Policy level that Maximize Producer Profits

The derivation of the Policy level that Maximize Producer Profits

- For a monopolist or producer cartel, to chooses a price, is equivalent to choose a matched production Q .

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:

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

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:

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

- The profit-maximizing decision satisfies :

$$MR_i^F = MR_i^I = MC_i$$

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:

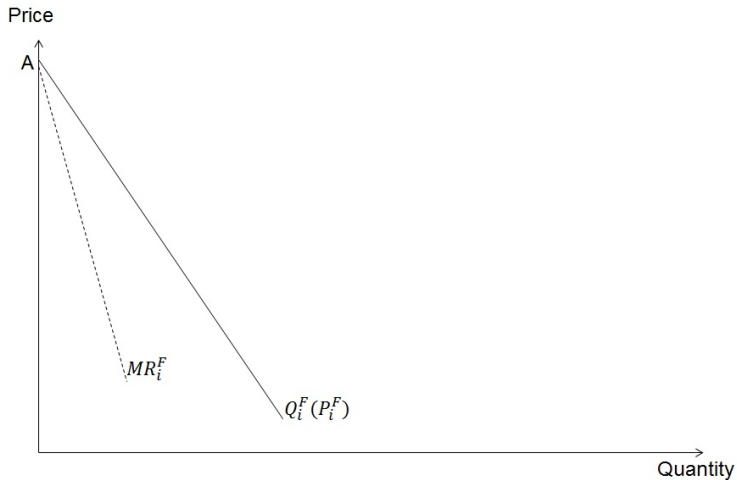
$$\max_{Q_i} \Pi_i = P_i^F(Q_i^F)Q_i^F + P^I(\sum Q_i^I)Q_i^I - \int_0^{Q_i} MC_i(Q)dQ \quad (4)$$

- The profit-maximizing decision satisfies :

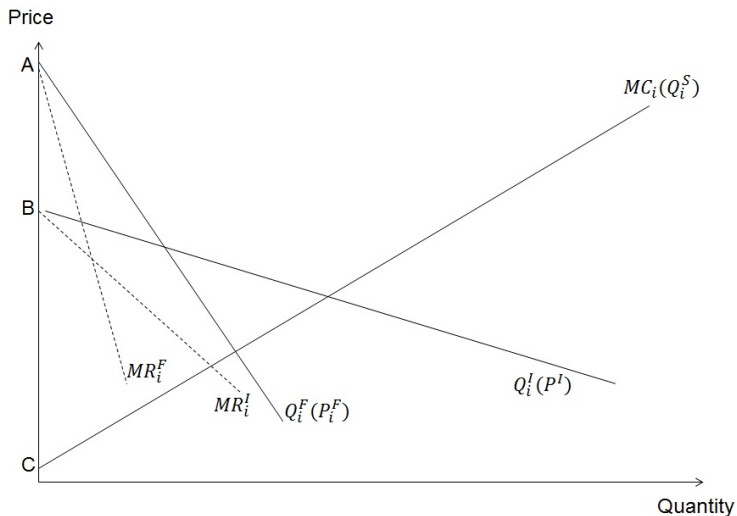
$$MR_i^F = MR_i^I = MC_i$$

- Solving yields Q_i^{F*} and Q_i^{I*} . Substituting them into demand functions we can get P_i^{F*} , P^{I*} and the optimal price differentials P_i^{d*} .

Market Equilibrium in Milk Markets under Supply Management

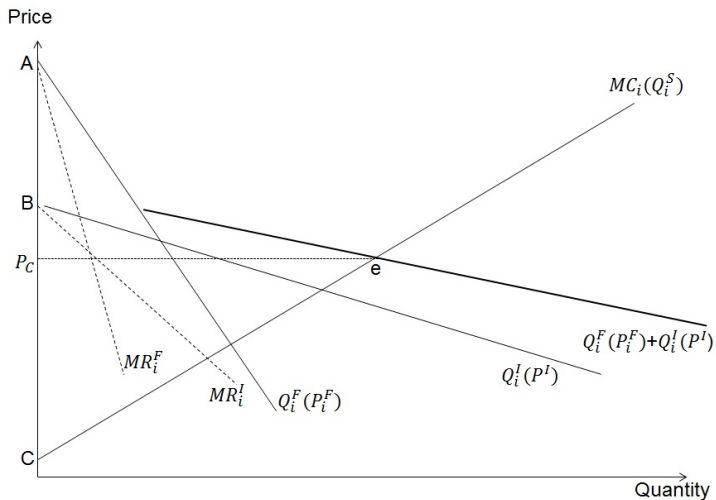


Market Equilibrium in Milk Markets under Supply Management

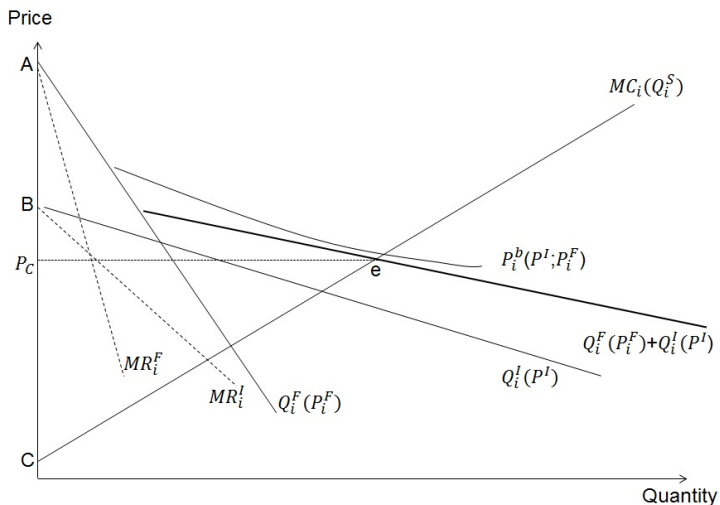


Market Equilibrium in Milk Markets under Supply Management

Note: Competitive Equilibrium: $P_0 = P_C - P_C = 0$.

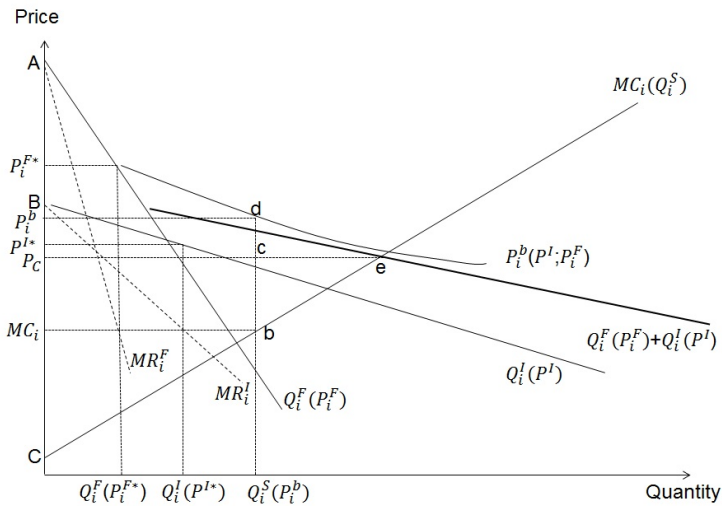


Market Equilibrium in Milk Markets under Supply Management



Market Equilibrium in Milk Markets under Supply Management

Note: Full political market power: $P_m = P_i^{d*} = P_i^{F*} - P^I$. $\frac{(\bar{P} - P_0)}{(P_m - P_0)}$?



Derivation of the Welfare Weights Implied by Observed Price Differentials

Derivation of the Welfare Weights Implied by Observed Price Differentials

- The maximization problem of the regulator in province i :

$$\max_{Q_i} W_i = \Gamma_i + \lambda \Pi_i$$

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:

$$\begin{aligned} \frac{dW_i}{dQ_i} &= -Q_i^F \frac{\partial P_i^F}{\partial Q_i^F} - Q_i^I \frac{\partial P^I}{\partial \sum Q_i^I} \\ &\quad + \lambda_i [P_i^F + Q_i^F \frac{\partial P_i^F}{\partial Q_i^F} + P^I (\sum Q_i^I) + Q_i^I \frac{\partial P^I}{\partial \sum Q_i^I} - MC_i] \\ &= 0 \end{aligned} \tag{5}$$

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:

$$\begin{aligned} \frac{dW_i}{dQ_i} &= -Q_i^F \frac{\partial P_i^F}{\partial Q_i^F} - Q_i^I \frac{\partial P^I}{\partial \sum Q_i^I} \\ &\quad + \lambda_i [P_i^F + Q_i^F \frac{\partial P_i^F}{\partial Q_i^F} + P^I (\sum Q_i^I) + Q_i^I \frac{\partial P^I}{\partial \sum Q_i^I} - MC_i] \\ &= 0 \end{aligned} \tag{5}$$

- Solving for λ_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)

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

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)

Provinces	Observed P^d	Simulated P^d		Calculated Degree of PMP	
		Mean	Confidence intervals	Mean	Confidence intervals
BC	2.69	45.59	(14.23, 100.69)	0.059	(0.027, 0.189)
MB	6.50	53.76	(21.58, 112.45)	0.121	(0.058, 0.301)
ON	8.66	52.56	(20.39, 111.10)	0.165	(0.078, 0.350)
QC	6.16	53.50	(20.79, 112.63)	0.115	(0.055, 0.425)
NS	9.54	59.90	(27.94, 119.54)	0.159	(0.080, 0.453)
Average	7.93	54.58	(22.66, 112.95)	0.141	(0.070, 0.341)

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.

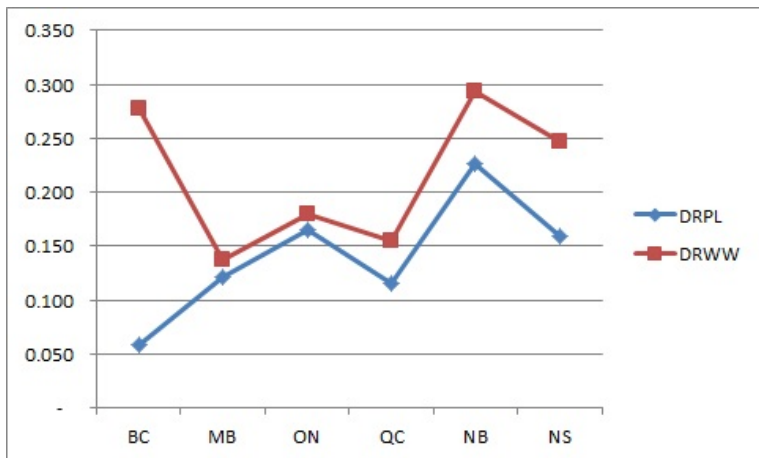
Table 3: Imputed Welfare Weights and Degree of PMP of Milk Producers (2004/2005)

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

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.

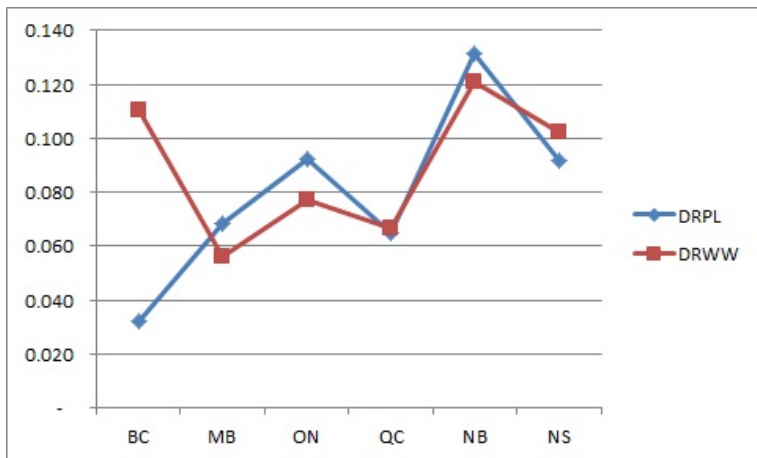
Calculated Degree of Political Market Power with

$$\eta^F = -0.57 \text{ and } \eta^I = -0.52$$



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

Conclusion Remarks

- Observed P^d s imply some degree of PMP of milk producers to milk buyers, but are below those that would maximize producer profits.

Conclusion Remarks

- Observed P^d s 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 .

Conclusion Remarks

- Observed P^d s 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 λ implies that the PMP of milk producers is about 22% of the PMP by producers.

Conclusion Remarks

Conclusion Remarks

- These results suggest that milk producers have more political power than milk buyers, but small relative to full monopoly power. This is consistent with:

Conclusion Remarks

- 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, and

Conclusion Remarks

- 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, and
 - ② The fact that there are some imports and non-dairy alternatives.

- **Thank You** for your attention!
- Welcome to **Comment and/or Ask Questions!**