Between a Cap and a Higher Price
The Dairy Quota Trilemma

Alex Chernoff

PhD Student - Queen's Economics Department
www.econ.queensu.ca/students/chernoff

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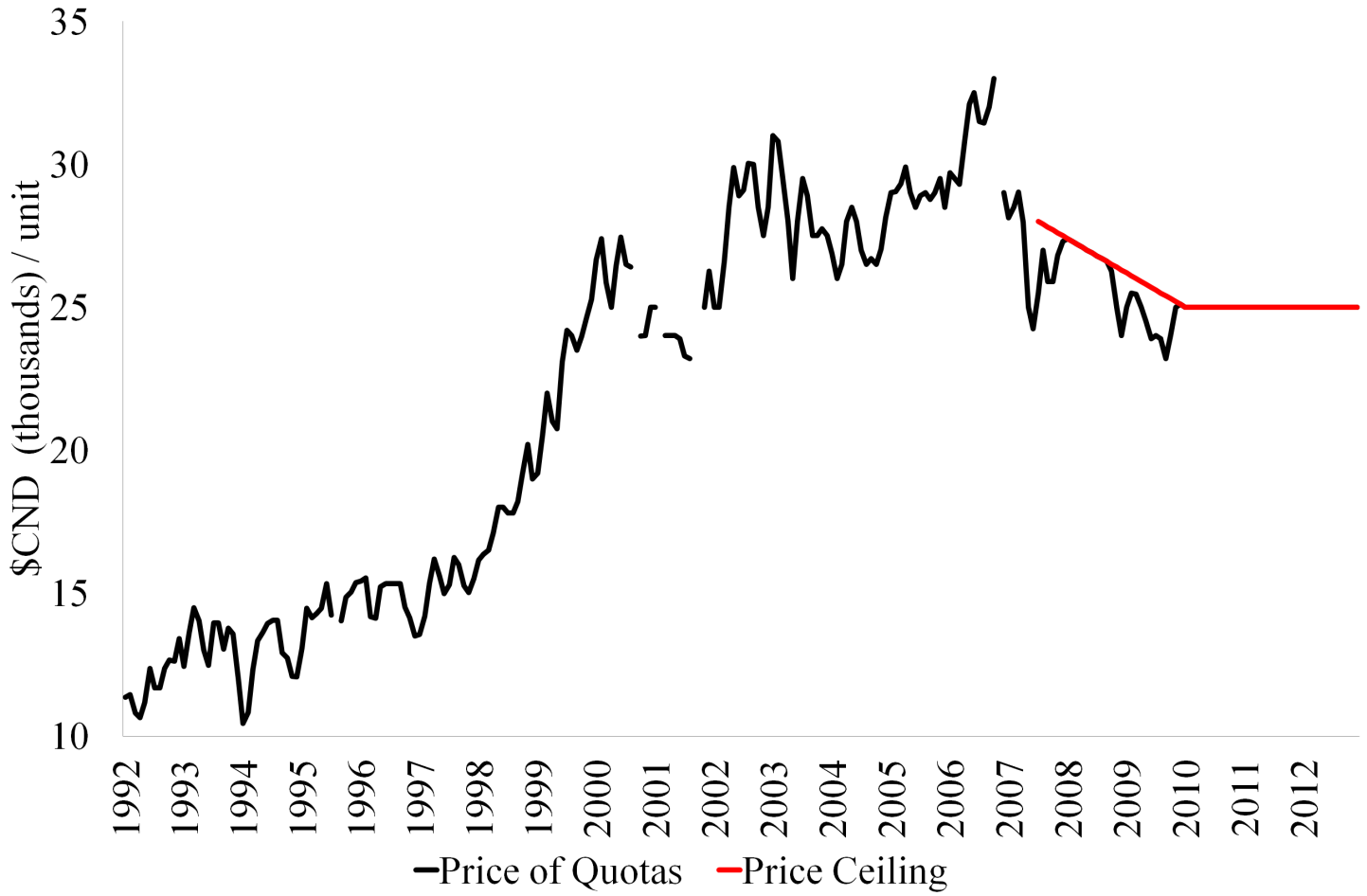
Outline

1. Motivation
2. Economic model of demand for dairy quotas
3. Empirical application
4. Counterfactual policy experiments
5. Conclusions

Concern over Rising Dairy Quota Prices

- The Canadian dairy sector is governed by supply management
- Dairy quotas are traded on provincial auctions
- The recent rise in quota prices has increased producers' cost of entry and expansion in the dairy sector
- Canada's two largest dairy producing provinces, Québec and Ontario, introduced ceilings on the price of quotas in 2007 and 2009 respectively

Québec Dairy Quota Prices - 1993-2012



Price Ceiling Legislation

- In Québec, dairy quotas have been traded at the price cap for over three years
- In 2012, the quantity of quotas demanded at the price cap was approximately 20 times the quantity supplied
- The introduction of a cap on the price of quotas has created a new source of inefficiency in the Canadian dairy sector
- An alternative policy option for reducing the price of quotas: lower the administered farm price of milk

The Dairy Quota Trilemma

Three policy options define the dairy quota trilemma

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2. Remove the price ceiling
3. Remove the price ceiling and lower the farm price of milk

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Preview of Results

1. What would be the price of dairy quotas in Québec if the price ceiling were removed?
   - In 2010, I estimate that dairy quotas would have traded at a price of $31,955 per unit in the absence of the price ceiling
2. What is the magnitude of the decrease in the farm price of milk required to reduce the valuation of Québec dairy quotas to the current ceiling level of $25,000 per unit?
   - In 2010, my results indicate that lowering the valuation of quotas to $25,000 per unit would have required an 11.83% reduction in farm price of milk

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A Model of Dairy Producer's Demand for Quotas

- Each farmer produces milk using a technology that features constant returns to scale in production quotas
- Farmers' allocate resources between consumption $c_{i,t}$ and quotas $q_{i,t}$
- The timing of the model is such that farmer i enters period t with a quota holding of $q_{i,t}$
- The government then announces the aggregate growth rate g_t of quotas, and farmer i is then entitled to produce $\tilde{q}_{i,t} \equiv (1 + g_t)q_{i,t}$ units in period t
- At the end of each period there is a risk of the government eliminating supply management, in which case the government awards all farmers with an adjustment package valued by farmers at $\bar{V}$

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Representative Dairy Producer's Problem

$$V(q_{i,t}, \pi_{i,t}, g_t, P_t) = \max_{c_{i,t}, q_{i,t+1}} \; ln\,(c_{i,t})$$

$$+\frac{1-\lambda}{1+r}\, E_t V(q_{i,t+1}, \pi_{i,t+1}, g_{t+1}, P_{t+1}) + \frac{\lambda}{1+r}\, \bar{V} \qquad (1)$$

$$subject\ to: \quad P_t q_{i,t}(1+g_t) + \pi_{i,t} q_{i,t}(1+g_t) = c_{i,t} + P_t q_{i,t+1}$$

Policy Functions

Under the specification of log utility from consumption, the policy functions $c^*_{i,t}$ and $q^*_{i,t+1}$ have the following closed form solutions:

$$c^*_{i,t} = (1 - \frac{1-\lambda}{1+r})(P_t q_{i,t}(1+g_t) + \pi_{i,t} q_{i,t}(1+g_t)) \tag{2}$$

$$P_t q^*_{i,t+1} = \frac{1-\lambda}{1+r}(P_t q_{i,t}(1+g_t) + \pi_{i,t} q_{i,t}(1+g_t)) \tag{3}$$

Equilibrium Price

- Dividing equation (3) by P_t and summing across all n producers yields the aggregate demand for quotas (Q^d_{t+1})
- The aggregate supply of quotas $Q^s_{t+1} = Q_t(1 + g_t)$ is the beginning of period aggregate supply adjusted by the aggregate growth rate g_t
- Equating aggregate supply and demand yields a parsimonious pricing formula for quotas:

$$P_t = \frac{\frac{1-\lambda}{1+r}}{(1 - \frac{1-\lambda}{1+r})} \frac{\sum_{i=1}^{n} \Pi_{i,t}}{Q_t(1 + g_t)} \tag{4}$$

Econometric Model

- I work directly from the policy function for quotas to develop an econometric model that is used to estimate the value of producers' effective discount factor
- Dividing both sides of (3) by $(P_t + \pi_{i,t})q_{i,t}(1 + g_t)$ and adding an error term results in the following empirical specification:

$$\frac{P_t q_{i,t+1}}{(P_t + \pi_{i,t})q_{i,t}(1 + g_t)} = \theta_1 + u_{i,t} \tag{5}$$

Econometric Model - Continued

Modifications to specification (5):

1. Structural break in the value of the effective discount factor at time t_{break}
2. End of period quota holdings $\tilde{q}_{i,t} \equiv (1 + g_t)q_{i,t}$

$$\frac{P_t \tilde{q}_{i,t+1}}{(P_t + \pi_{i,t})\tilde{q}_{i,t}(1 + g_{t+1})} = \theta_1 + \theta_2 d_t + u_{i,t} \qquad (6)$$

Where $d_t = 1$ *if* $t \leq t_{break}$; *and* $= 0$ *if* $t > t_{break}$

Data

- The farm-level variables are specified using the Agritel database, a farm-level panel data set that is collected annually in Québec
- Provincial-level variables are sourced from the Fédération des Producteurs de Lait du Québec (FPLQ) and the Canadian Dairy Information Centre (CDIC)
- Model (6) is estimated over the pre price ceiling era 1993-2005 with an unbalanced panel of 7097 observations

Estimation Results

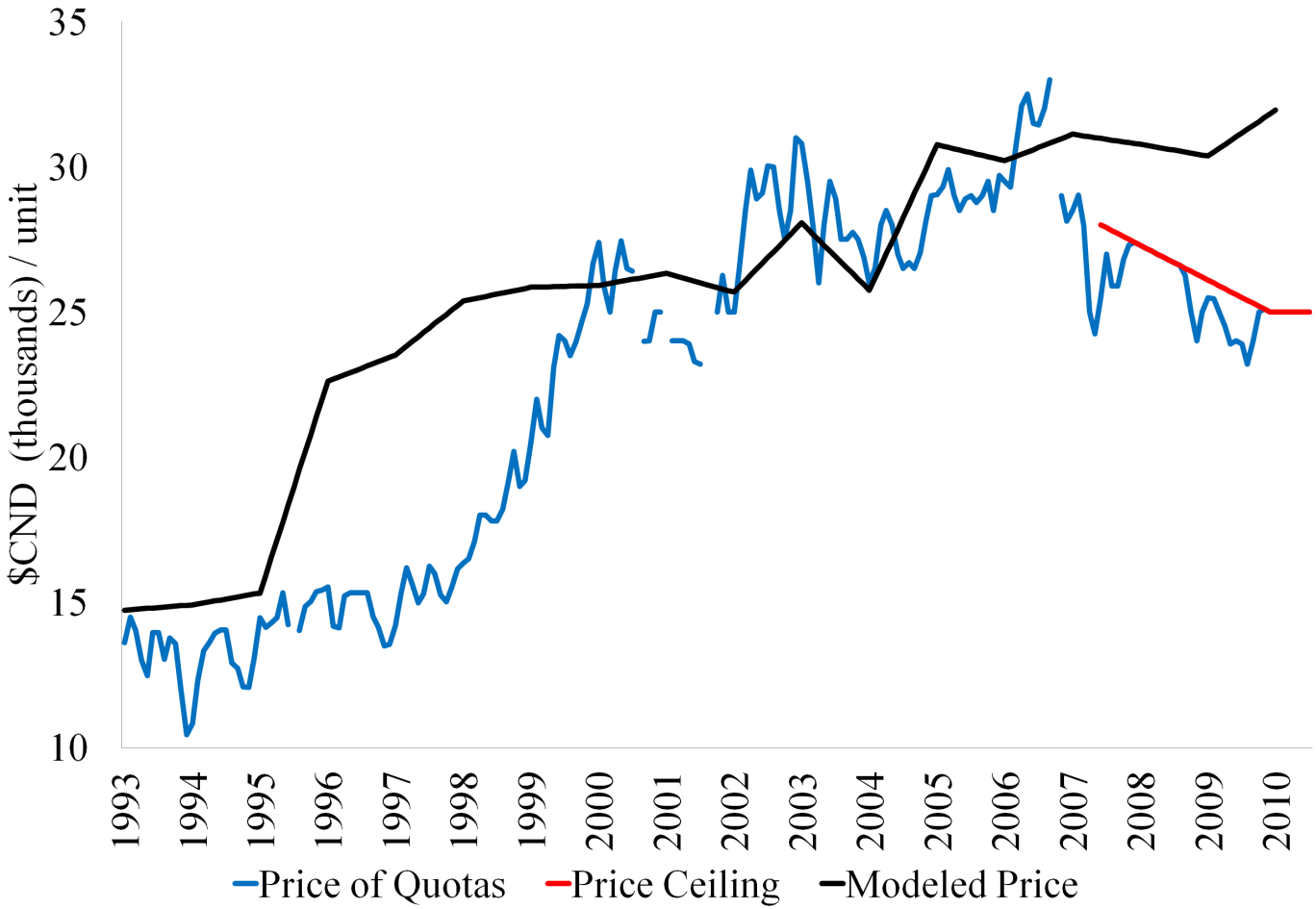
Coefficients	**Fixed Effects**	Random Effects
θ_1	**0.875*** **	0.878***
	(0.00104)	(0.00118)
θ_2	**-0.0604*** **	-0.0707***
	(0.00221)	(0.00185)
Break year	**1995**	1995
R-squared	**0.120**	
Observations	**7,097**	7,097
Number of farmers	**1,584**	1,584

$\theta_1 + \theta_2 \equiv$ Discount Factor 93-95; $\theta_1 \equiv$ Discount Factor 96-05

*** p<0.01, ** p<0.05, * p<0.1

Preferred specification in bold; Standard errors in parentheses

Québec Dairy Quota Prices



Methodology

Equilibrium price of quotas:

$$P_t = \frac{\frac{1-\lambda}{1+r}}{\left(1 - \frac{1-\lambda}{1+r}\right)} \left[\frac{\frac{\sum_{i=1}^{n} \Pi_{i,t}}{n}}{\frac{Q_t(1+g_t)}{n}} \right] \tag{7}$$

$$\textit{Where} \quad \Pi_{i,t} = P_t^m q_{i,t}(1+g_t) - w_{i,t} q_{i,t}(1+g_t)$$

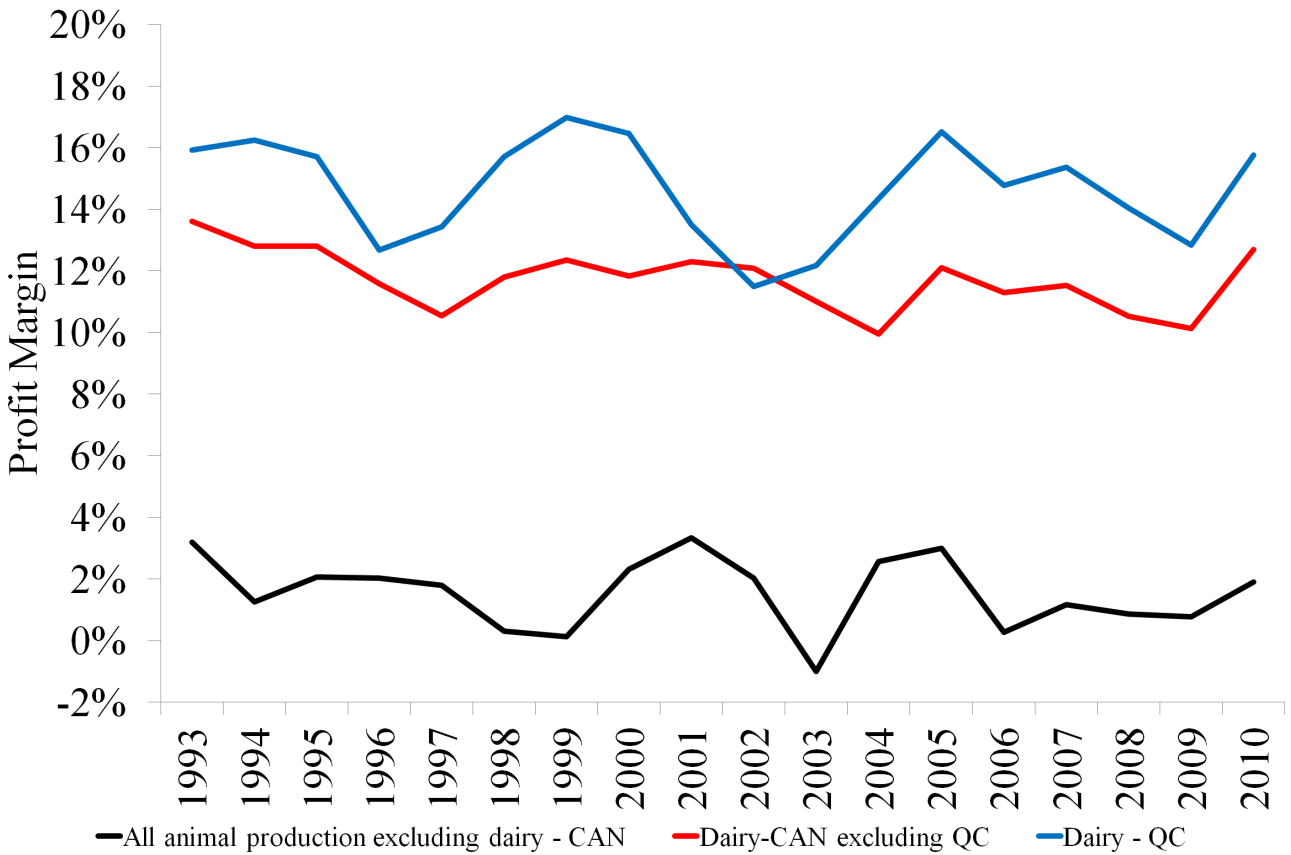
Re-arranging (7) allows me to determine the percentage reduction in average producer revenues that is necessary to reduce the price of quotas to $25,000 per unit

Results

- Lowering the valuation of dairy quotas in Québec to $25,000 per unit in 2010 would require an 11.83% reduction in farm price of milk
- In 2010, an 11.83% reduction in the operating revenue would have reduced Québec dairy farmers' profit margin to 4.46%
- While this is still 2.56 percentage points higher than the 2010 profit margin of other Canadian animal product producers, it falls 8.24 percentage points short of the 2010 average profit margin of dairy farmers in the rest of Canada

All profit margin calculations are based on Statistics Canada CANSIM Table 20048

Profit Margins in Canadian Animal Production



Source: Statistics Canada CANSIM table 20048

Conclusions

- In 2010, I estimate that dairy quotas in Québec would have traded at a price of $31,955 per unit in the absence of the price ceiling
- In 2010, lowering the valuation of Québec dairy quotas to $25,000 per unit would have required an 11.83% reduction in the farm price of milk
- Québec dairy farmers' profit margin would be reduced to the lowest level in recent history, however the margin would remain higher than the profit margin in other Canadian animal product industries