An Analysis of the Effect of Milk Compositional Standard On the Profitability of Ontario Dairy Farms

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What is the focus?

- Fluid milk at farm level, joint products of Solid non-fat (SNF) and butterfat (BF)
- Initially payments on all milk solids - increased production of SNF
- Structural Surplus of Skimmed Milk Powder
- Solid Non Fat (SNF) : Butterfat (BF) ratio standard & component price change
Structural Surplus of Skimmed Milk Powder produced in Canada from dairy years 1990/91 to 2007/08

- Pricing of milk based on BF content
- First application of Multiple Component Pricing
- Price shift
- Second stage of MCP
- Export limits by WTO
- 1.5% allowance of MSQ

Source: Coyle (2005)
Research Question

Do the SNF:BF ratio regulation and the price shift influence the profitability of Ontario dairy farms?
Key Literature

• Output quality-oriented standards and profitability

  Helfand (1988)
  - Different forms of standards. Standard on pollution per unit of output results decrease profits.

  Hatcher (2007)
  - Ratio standards make a difference to the optimal decision rules derived for a profit-maximizing firm.

  More (2009)
  - Milk quality standard has a range of economic consequences which may affect farm profitability.
Conceptual Framework of Farm Profit Maximization

\[ \max \pi = (p_1 - m)y_1 + (p_2 + m)y_2 - w_1x_1 - w_2x_2 \]

\[ \text{s.t. } f_2(y_1, x_{12}, x_{22}, z) \leq \bar{y}_2 \]

\[ f_1(y_2, x_{11}, x_{21}, z) \leq \theta_R \ \bar{y}_2 \]

where,
\[ x_1, x_2 = \text{inputs} \quad w_1, w_2 = \text{input prices} \quad z = \text{farm characteristics} \]
\[ p_1, p_2 = \text{protein price, BF price} \quad m = \text{price shift from protein to BF} \]
\[ f_2(y_1, x_{12}, x_{22}, z) = \text{BF prod. function} \quad f_1(y_2, x_{11}, x_{12}, z) = \text{protein prod. function} \]
\[ \bar{y}_2 = \text{BF production under quota} \quad \theta_R = \text{SNF:BF ratio standard} \]
Effect of SNF:BF ratio standard on profit

\[ \frac{\partial \pi^*}{\partial \theta_R} = \begin{cases} \lambda_2 \bar{y}_2 & \text{if } \lambda_2 > 0 \\ 0 & \text{if } \lambda_2 = 0 \end{cases} \]  

\[ \text{.....(1)} \]

Effect of component price change on profit

\[ \frac{\partial \pi^*}{\partial m} = \begin{cases} \bar{y}_2 - y_1 > 0 & \text{if } \bar{y}_2 - y_1 > 0 \\ \bar{y}_2 - y_1 < 0 & \text{if } \bar{y}_2 - y_1 < 0 \end{cases} \]  

\[ \text{.....(2)} \]
Empirical Framework

Estimation of a regression model to test the effect of SNF: BF ratio standard and the component price change on dairy farm profitability

\[ \pi_{it} = \beta_0 + \beta_1 \text{STANDARD}_{it} + \beta_2 \text{PS}_{it} \\
+ \beta_{fc} \text{Farm Characteristics} + \beta_{fo} \text{Farm Operator Characteristics} \\
+ \beta_{tsc} \text{Technology} + \beta_{tr} \text{Trend}_{it} + u_{it} \]

\[ \pi = TR - TC \]
Data

- Data sources:
  - Ontario Dairy Farm Accounting Project (ODFAP)
    - Physical, financial and technical data
    - Rotating Panel data: 1996-2008, 60-80 farms per year
  - Dairy Farmers of Ontario, Statistics Canada
<table>
<thead>
<tr>
<th>Description of Variables</th>
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</thead>
<tbody>
<tr>
<td>Dairy returns to management ($)</td>
<td>Direct revenue dairy-direct expenses dairy-allocation of indirect and overhead expenses-labour allocation expenditure</td>
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</tbody>
</table>
| SNF:BF ratio standard                           | 1= After imposition of the standard (i.e. ≥ 2005)  
0= Before imposition of the standard (i.e. <2005) |
| Component price change                          | 1= After the component price change (i.e. ≥2004)  
0= Before the component price change (i.e. <2004) |
## Results

Dairy returns to management regression model

### Policies

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
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<tbody>
<tr>
<td>SNF:BF ratio standard</td>
<td>-248 NS</td>
<td>7663 NS</td>
<td>-</td>
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<tr>
<td>Component price change</td>
<td>21175***</td>
<td>-</td>
<td>21093***</td>
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*** Statistically Significant at 1% significance level, NS – Not Significant
SNF:BF ratios of the sample of Ontario dairy farms over the period from 1996 to 2008

Source: ODFAP data, Calculations using SPSS
Actual SNF:BF ratios of the sample of Ontario dairy farms over the period from 2004 to 2008

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<td>1</td>
<td>0</td>
<td>0</td>
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Source: ODFAP data 2004-2008
SNF:BF ratios of the sample of Ontario dairy farms over the period from 1996 to 2008

Source: ODFAP data 1996-2008
Mann-Whitney-Wilcoxon test statistics

P-value = 0.702

Kolmogorov-Smirnov (K-S) test statistics

P-value = 0.014
Conclusions

- SNF: BF ratio standard may not have a significant impact on farm profits.
  - Restrictive vs preventive policy

- Component price shift from protein to butterfat (approx. $3.00), increases profits

- The effectiveness of SNF to BF ratio standard in overcoming the problem of structural surplus of SMP

  “One of the challenges for the future”
  (CDC, 2009)
Acknowledgements
Thank you