Regional Impacts of BSE in Alberta

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Regional Impacts of BSE in Alberta

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The Global Rural; Rural Change, Connections, and Scale
THE SIXTH QUADRENNIAL CONFERENCE OF BRITISH, CANADIAN, AND AMERICAN RURAL GEOGRAPHERS.

July 17, 2007
Structure of Talk

• Global rural: Zoonosis!
• Beef Production is Important in Rural Alberta
• Alberta’s BSE Crisis in Context
• Half full or half empty?
  – We dodged a bullet!
  – Perfect Storm
• Regional Impact of BSE Crisis
Global Rural

- Globalization
- Climate change
- Emerging and re-emerging animal diseases and zoonoses
- Potential for unprecedented worldwide impact
The Countryside is Vulnerable...
Animal Disease: A Resurgent Threat

• Rural Canada has a vested interest in global aspects of animal health and trade in animals & products
  – High profile zoonotic trade barriers
  – Draconian control measures

• Confusing for consumers
  – FMD: Spring 2001(UK)
  – BSE: May 2003-2007: 10 cases
  – Avian Influenza: Fall 2003
Source: OIE: World Organisation for Animal Health
http://www.oie.int/eng/info/en_esbcarte.htm
Beef Cattle

Note: Each census farm is classified according to the NAICS commodity or commodity group that accounts for 50% or more of total receipts.
Source: Statistics Canada 2006 Census of Agriculture
Pasture: Canada’s dominant farm land use: 29.9% of area

<table>
<thead>
<tr>
<th>Province</th>
<th>Total farm area</th>
<th>Tame pasture</th>
<th>Natural pasture</th>
<th>Pasture as pct. of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newfoundland</td>
<td>100,271</td>
<td>6,251</td>
<td>17,524</td>
<td>23.7</td>
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<tr>
<td>Prince Edward I.</td>
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<td>29,192</td>
<td>31,786</td>
<td>9.4</td>
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<td>Nova Scotia</td>
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<td>56,520</td>
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<td>44,998</td>
<td>66,436</td>
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<td>451,810</td>
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<td>773,650</td>
<td>1,314,335</td>
<td>15.5</td>
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<td>Manitoba</td>
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<td>Saskatchewan</td>
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<td>3,473,646</td>
<td>12,668,456</td>
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<tr>
<td>Alberta</td>
<td>52,058,898</td>
<td>5,512,654</td>
<td>16,503,920</td>
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<tr>
<td>British Columbia</td>
<td>6,392,909</td>
<td>575,864</td>
<td>2,983,929</td>
<td>55.7</td>
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<tr>
<td>Canada</td>
<td>166,802,197</td>
<td>11,872,170</td>
<td>38,032,172</td>
<td>29.9</td>
</tr>
</tbody>
</table>

Source: Statistics Canada 2001 Census of Agriculture
Export Orientation

- Canada produces < 2% of world’s beef supply
- But Canada is 3rd largest beef exporter
  - (Brazil, Australia, Canada, Argentina, New Zealand, India, Uruguay, U.S., EU25, Mexico)
- >30% of cattle and 35% of beef production was exported in 2002
- U.S. dominates:
  - >80% of beef
  - 100% of live cattle
Trade Impact of BSE, May 20, 2003

World exports of canadian cattle and beef

millions of CAN$
Beef Consumption and the National Cattle Herd, 1960-2005

Source: Agriculture and Agri-Food Canada Livestock Market Review and Statistics Canada, Cansim II, Series label: D263233.
Alberta dodged a bullet!

- Drought
- Cattle on feed on May 1, 2003 was only 762,000
- Volume of COFD was only 45% of the peak 1.49 million on feed four years earlier on December 1, 1999.
- Cattle can stay outside on pasture
- It rained
- Deep pockets in Edmonton & Ottawa
Cattle on Feed

Source: Lessons Learned from the Canadian Drought Years 2001 and 2002
Synthesis Report for Agriculture and Agri-Food Canada by E. Wheaton (2005)
Finally, it rained
The Perfect Storm I

- Additive & compounding events that amplify impacts (droughts, floods, hoppers)
- If you remove one or more risk events...
- “major risk event” might collapse...
- “resulting in near normal impact”
- (Bruce Viney, Risk Management Specialist, Alberta Agriculture and Food, 2006)
The Perfect Storm II

• Northern Plains Drought 2000-2001
  – Forage exported south, reducing Alberta’s stocks
  – Price of hay increased
  – U.S. feed freight subsidy encourages Canadian feed exports

• 9/11 attacks
  – Reduced consumer demand in U.S.
  – Alberta calf prices drop 25%

• Drought 2002
  – Hay and feed are scarce and dear in Alberta
  – Producers in weakened financial position
  – (Yet Alberta’s cattle inventory declined from 2001-2003)

• BSE border closures
  – Cattle prices tank
  – Compensation to producers: $2.5 billion
Long-run Effects of BSE on the structure & distribution of the provincial cattle herd

- Census of Agriculture 2001, 2006
- May 16th
- Exploratory: $H_1, H_0$
- “an unusually obstinate attempt to think clearly” (Bertrand Russell)
• Suppression problem

• Nation
   – Province
     • Census Agricultural Region
       – Census Division
         » Consolidated Census Subdivision
         » ~ county + embedded municipalities
Alberta’s Cattle Herd Structure, 2006

<table>
<thead>
<tr>
<th>Bovine type (i=1-8)</th>
<th>Head count</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B_1$ Beef cows</td>
<td>2,035,841</td>
<td>32.0</td>
</tr>
<tr>
<td>$B_2$ Dairy cows</td>
<td>78,875</td>
<td>1.2</td>
</tr>
<tr>
<td>$B_3$ Calves</td>
<td>2,050,773</td>
<td>32.2</td>
</tr>
<tr>
<td>$B_4$ Dairy heifers</td>
<td>37,803</td>
<td>0.6</td>
</tr>
<tr>
<td>$B_5$ Beef rep heifers</td>
<td>275,683</td>
<td>4.3</td>
</tr>
<tr>
<td>$B_6$ Slaughter heifers</td>
<td>805,829</td>
<td>12.7</td>
</tr>
<tr>
<td>$B_7$ Steers</td>
<td>974,559</td>
<td>15.3</td>
</tr>
<tr>
<td>$B_8$ Bulls</td>
<td>109,753</td>
<td>1.7</td>
</tr>
<tr>
<td>$B_T$ Total cattle &amp; calves</td>
<td>6,369,116</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Notation: Bovines and time

\[ B_i, b_i, B_T, b_T \]

\[ t, \quad t' \]

\[ t = 2001, \quad t' = 2006 \]
Notation: Incremental change

\[ \Delta B_{i}^{t,t'} = B_{i}^{t} - B_{i}^{t'} \]

\[ \Delta b_{i}^{t,t'} = b_{i}^{t} - b_{i}^{t'} \]
More Notation: Herd size change

\[ R_{i}^{t,t'} = \frac{B_{i}^{t} - B_{i}^{t'}}{B_{i}^{t}} = \frac{\Delta B_{i}^{t,t'}}{B_{i}^{t}} \]

\[ r_{i}^{t,t'} = \frac{b_{i}^{t} - b_{i}^{t'}}{b_{i}^{t}} = \frac{\Delta b_{i}^{t,t'}}{b_{i}^{t}} \]
Shift and Share Analysis of Alberta’s Cattle Herd

• What is total shift?

\[ tsb_i = \Delta b_i^{t,t'} - \left( R_{T,t'}^t \ast b_i^t \right) \]

• \( tsb_i \) measures total number of bovines that have shifted into or out of a region
• in a sense: observed-expected
• We should “expect” (naively), that \( b_i \) should grow as \( B_i \)
Shift and Share Analysis of Alberta’s Cattle Herd

- We can partition shift into components

\[ tsb_i = ssb_i + rsb_i \]

- Total shift = structural shift + regional shift
Shift and Share Analysis of Alberta’s Cattle Herd

• Structural shift

\[ s_{sb_i} = \left( R_{i,t}^{t,t'} - R_{T}^{t,t'} \right) \ast b_i^t \]

• The province is our arbitrary reference rate, \( R \)
• We scale the \( i-T \) difference in R by regional \( b_i \)
Shift and Share Analysis of Alberta’s Cattle Herd

• Regional shift

\[ rsb_i = (r_{i,tt'} - R_{i,tt'}) \times b_i \]

• The \( r_i \) and \( R_i \) terms measure the difference between regional and national growth by bovine type.
• We scale the difference by \( b_i \)
Shift and Share Analysis of Alberta’s Cattle Herd

Fleshing out the model

\[ \Delta b_{i,t}^{t',t'} = (R_T^{t,t'} \cdot b_i^t) + [(R_i^{t,t'} - R_T^{t,t'}) \cdot b_i^t] + [(r_i^{t,t'} - R_i^{t,t'}) \cdot b_i^t] \]

- By rearranging terms we arrive at the shift and share model expressed as three components:

\[ \Delta b_i = pe_i + sse_i + rse_i \]

Bovine = provincial + structural + regional
Change effect shift effect shift effect
Shift and Share Analysis of Alberta’s Cattle Herd

What are the implications of herd structure for places?

• Let’s consider all cattle in the region
• Total *structural shift effect* \[ \sum_{i}^{n} ssb_i > 0 \]
• A region with ‘favourable’ structure:
  – Has large numbers of bovine type that grew fast provincially 2001-2006
  – Has small numbers of bovine type that declined provincially 2001-2006
    • Growth could imply expectations of rising prices (replacement heifers)
    • Growth could simply imply lack of slaughter capacity (cows)
Shift and Share Analysis of Alberta’s Cattle Herd
What’s it all mean for regions?

• Total *regional shift effect*:

\[ \sum_{i=1}^{n} rse_i > 0 \]

• A region with a favourable regional shift effect competes effectively with other regions:
  – *Weather conditions/irrigation water*
  – *Fixed capital investment/infrastructure*
    • *(production, processing, marketing)*
  – *Proximity to U.S. markets (north-south)*
## Cattle Population in Alberta, 2001-2006

<table>
<thead>
<tr>
<th>Bovine type</th>
<th>Cattle population</th>
<th>Absolute Change</th>
<th>Percent Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2006</td>
<td>2001</td>
<td></td>
</tr>
<tr>
<td>Beef cows</td>
<td>2,035,841</td>
<td>2,099,288</td>
<td>-63,447</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>78,875</td>
<td>84,044</td>
<td>-5,169</td>
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<tr>
<td>Calves</td>
<td>2,050,773</td>
<td>2,169,607</td>
<td>-118,834</td>
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<tr>
<td>Dairy heifers</td>
<td>37,803</td>
<td>38,485</td>
<td>-682</td>
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<tr>
<td>Beef rep heifers</td>
<td>275,683</td>
<td>359,291</td>
<td>-83,608</td>
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<td>Slaughter heifers</td>
<td>805,829</td>
<td>761,553</td>
<td>44,276</td>
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<td>Steers</td>
<td>974,559</td>
<td>991,554</td>
<td>-16,995</td>
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<tr>
<td>Bulls</td>
<td>109,753</td>
<td>111,379</td>
<td>-1,626</td>
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<tr>
<td>Total cattle &amp; calves</td>
<td>6,369,116</td>
<td>6,615,201</td>
<td>-246,085</td>
</tr>
</tbody>
</table>

Source: Statistics Canada, 2006 Census of Agriculture, *Farm Data and Farm Operator Data*, catalogue no. 95-629-XWE.
• Viewed change against a backdrop of provincial decline

• Big gainers:
  – Vulcan
  – Kneehill
  – Peace

• Big losers:
  – Calgary/southwest
  – Ponoka
  – Lethbridge
• Highway 2 corridor
• (Canamex highway)
  – Edmonton
  – Red Deer
  – Calgary
  – Lethbridge
• Steers, distributed in proportion to feedlots
## Cattle Population in Vulcan County, 2001-2006

<table>
<thead>
<tr>
<th>Bovine Type</th>
<th>Cattle Population</th>
<th>Absolute Change</th>
<th>Percent Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef cows</td>
<td>28,154</td>
<td>29,660</td>
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<tr>
<td>Dairy cows</td>
<td>1,129</td>
<td>691</td>
<td>438</td>
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<tr>
<td>Calves</td>
<td>63,627</td>
<td>27,712</td>
<td>35,915</td>
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<tr>
<td>Dairy heifers</td>
<td>399</td>
<td>342</td>
<td>57</td>
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<tr>
<td>Beef replacement heifers</td>
<td>3,402</td>
<td>2,655</td>
<td>747</td>
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<tr>
<td>Slaughter heifers</td>
<td>30,430</td>
<td>9,600</td>
<td>20,830</td>
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<tr>
<td>Steers</td>
<td>43,332</td>
<td>6,610</td>
<td>36,722</td>
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<tr>
<td>Bulls</td>
<td>1,496</td>
<td>1,481</td>
<td>15</td>
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<tr>
<td>Total cattle &amp; calves</td>
<td>171,969</td>
<td>78,751</td>
<td>93,218</td>
</tr>
</tbody>
</table>

Source: Statistics Canada, 2006 Census of Agriculture, *Farm Data and Farm Operator Data*, catalogue no. 95-629-XWE.
## Shift-share Parameters for Vulcan County, 2001-2006

<table>
<thead>
<tr>
<th>Bovine type</th>
<th>2006-2001 Change</th>
<th>Provincial growth effect</th>
<th>Structural effect</th>
<th>Regional effect</th>
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<tbody>
<tr>
<td>Beef cows</td>
<td>-1,506</td>
<td>-1,103</td>
<td>207</td>
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<tr>
<td>Dairy cows</td>
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<td>-26</td>
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<td>Calves</td>
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<td>-487</td>
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<td>7</td>
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<td>Beef rep heifers</td>
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<td>-519</td>
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<td>Slaughter heifers</td>
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<td>915</td>
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<td>Steers</td>
<td>36,722</td>
<td>-246</td>
<td>133</td>
<td>36,835.3</td>
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<tr>
<td>Bulls</td>
<td>15</td>
<td>-55</td>
<td>33</td>
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<td>Totals</td>
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<td>-2,930</td>
<td>272</td>
<td>95,875.4</td>
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<td>Region</td>
<td>Observed bovine change 2006-2001</td>
<td>Expected bovine change 2006-2001</td>
<td>Structural shift effect</td>
<td>Regional shift effect</td>
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<td>Agricultural Region 1</td>
<td>10,785</td>
<td>-21,140</td>
<td>-3,811</td>
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<td>Warner County</td>
<td>8,829</td>
<td>-3,736</td>
<td>430</td>
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<td>Lethbridge County</td>
<td>-56,853</td>
<td>-21,707</td>
<td>25,532</td>
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<td>Taber MD</td>
<td>-6,880</td>
<td>-5,875</td>
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<td>Newell County</td>
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<td>-9,942</td>
<td>2,433</td>
<td>166</td>
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<tr>
<td>Vulcan County</td>
<td>93,218</td>
<td>-2,930</td>
<td>272</td>
<td>95,875</td>
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<tr>
<td>Wheatland County</td>
<td>-2,651</td>
<td>-7,771</td>
<td>2,123</td>
<td>2,997</td>
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<td>Starland County</td>
<td>2,514</td>
<td>-1,184</td>
<td>-372</td>
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<td>Kneehill County</td>
<td>33,877</td>
<td>-3,428</td>
<td>-630</td>
<td>37,935</td>
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<td>Agricultural Region 3</td>
<td>-140,826</td>
<td>-38,549</td>
<td>187</td>
<td>-102,465</td>
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<td>Agricultural Region 4A</td>
<td>-25,104</td>
<td>-19,122</td>
<td>-3,258</td>
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<td>Agricultural Region 4B</td>
<td>9,575</td>
<td>-19,917</td>
<td>-4,050</td>
<td>33,542</td>
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<td>Red Deer County</td>
<td>-26,054</td>
<td>-8,874</td>
<td>-324</td>
<td>-16,855</td>
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<td>Lacombe County</td>
<td>-6,717</td>
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<td>Ponoka County</td>
<td>-74,638</td>
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<td>Clearwater County</td>
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<td>Census Division No. 11</td>
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<td>Agricultural Region 6</td>
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<td>-32,432</td>
<td>-8,234</td>
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<td>Agricultural Region 7</td>
<td>27,983</td>
<td>-14,594</td>
<td>-6,777</td>
<td>49,353</td>
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<td>Alberta Total</td>
<td>-246,085</td>
<td>-246,085</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
• Herd structure favours the traditional ecumene, notably Lethbridge County
• Where there is negative structure effect it is absolutely small, northern and affects both gainers and losers.
• Regional effect is strong determinant of gainers
  – Peace
  – Vulcan
  – Kneehill

• And strong determinant of losers
  – Calgary/SW
  – Ponoka
  – Lethbridge
Conclusions

• Global threats to the countryside are manifest through epidemiological processes
• Impact of disease detection & regulation of food safety is uneven
• Multiple stressors (e.g. drought)
• Regional impacts vary widely
  – Herd structure seems to play minor role
  – Regional shift effect is large
  – Geography matters!