Measuring the Economic Impact of Food Safety Recalls on Food Processing Firms: An Event Study Analysis of the 2008 Listeriosis Recall in Canada

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Background

• 17 August 2008 CFIA issues health alert for *Listeriosis Monocytogenes*
• 22 August 2008 first Listeria related death announced
• 23 August 2008 Maple Leaf initiates public communications
  • 57 cases of Illnesses resulting in 22 deaths across Canada
Daily Closing Prices and Volume Trading for Maple Leaf Foods Inc. for the Period 5 August 2008 to 25 September 2008
Research Questions

• What was the impact of the 2008 Listeria recall on the return to Maple Leaf’s stocks?

• What was the impact of the 2008 Listeria recall on Premium Brands Holdings?(A spillover effect)

• Can we say anything about the effectiveness of Maple Leaf’s response?
Broader Literature Contributions

- Bovine Spongiform Encephalopathy (BSE) in the U.K. (Henson and Mazzocchi, 2002)
- *E. Coli* O157:H7 in the U.S. (McKenzie and Thomsen, 2001)
- Various food borne pathogens in the U.S. (Salin and Hooker, 2001)
  - Examine how firm’s stock price responds to negative food safety announcements over time
  - Use event study methods to assess the size of abnormal returns
Empirical Framework

• Event study approach
• Measure abnormal return after an unexpected shock (e.g. recall, lawsuit, etc)
• Abnormal return equals actual return minus expected return had the event not occurred:
  \[ AR_{it} = R_{it} - E[R_{it} | X_t] \]
  • \( R_{it} \) is the actual return
  • \( E[R_{it} | X_t] \) is the expected return had the event not occurred (conditioned on available information, \( X_t \))
• Need a way to measure \( E[R_{it} | X_t] \)
Empirical Framework, cont

- Measure expected return using the market model (replace $X_t$ with return to a market index ($R_{mt}$)):
  \[ AR_{it} = R_{it} - E[R_{it} | R_{mt}] \]
- Estimate market model using pre-event data (estimation window)
- Use estimated model and actual value of $R_{mt}$ to predict $E[R_{it} | R_{mt}]$ during the event window
- Calculate abnormal return
- Undertake calculations during event and post-event windows
Methods and Data

• Market model

\[ R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \]

• Daily stock prices from DataStream
  • MFI – Maple Leaf Foods Inc.
  • PBH – Premium Brands Holdings
  • S&P/TSX Smallcap Index
  • S&P/TSX Composite Index

• Internet news releases
  • Google, Google Finance, Yahoo! Canada Finance, TSX news feeds and the Canadian Securities Commission

<table>
<thead>
<tr>
<th></th>
<th>Est. Coeff</th>
<th>Est. Coeff</th>
<th>$R^2$</th>
<th>F-Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S&amp;P/TSX Smallcap Index</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MFI</td>
<td>0.538***</td>
<td>n/a</td>
<td>0.093</td>
<td>18.737***</td>
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<tr>
<td>MFI</td>
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<td>0.481***</td>
<td>0.079</td>
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<tr>
<td>PBH</td>
<td>0.273***</td>
<td>n/a</td>
<td>0.044</td>
<td>8.360***</td>
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<tr>
<td>PBH</td>
<td>n/a</td>
<td>0.182**</td>
<td>0.021</td>
<td>3.815*</td>
</tr>
</tbody>
</table>

***Statistically significant at one percent  
**Statistically significant at five percent  
*Statistically significant at ten percent
## Event Window Returns Analysis

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>AR’s to MFI</th>
<th>AR’s to PBH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Smallcap</td>
<td>Composite</td>
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<tr>
<td>Aug-15</td>
<td>+1</td>
<td>0.018</td>
<td>0.021</td>
</tr>
<tr>
<td>Aug-18</td>
<td>0</td>
<td>0.006</td>
<td>0.004</td>
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<tr>
<td>Aug-19</td>
<td>-1</td>
<td>-0.026</td>
<td>-0.025</td>
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<tr>
<td>Aug-20</td>
<td>-2</td>
<td>-0.018</td>
<td>-0.02</td>
</tr>
<tr>
<td>Aug-21</td>
<td>-3</td>
<td>-0.038</td>
<td>-0.036</td>
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<tr>
<td>Aug-22</td>
<td>-4</td>
<td>-0.04</td>
<td>-0.042</td>
</tr>
<tr>
<td>Aug-25</td>
<td>-5</td>
<td>-0.098</td>
<td>-0.096</td>
</tr>
<tr>
<td>Aug-26</td>
<td>-6</td>
<td>-0.094</td>
<td>-0.092</td>
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<tr>
<td>Aug-27</td>
<td>-7</td>
<td>0.032</td>
<td>0.03</td>
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<tr>
<td>Aug-28</td>
<td>-8</td>
<td>0.017</td>
<td>0.018</td>
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<tr>
<td>Aug-29</td>
<td>-9</td>
<td>0.024</td>
<td>0.029</td>
</tr>
<tr>
<td>CAR</td>
<td></td>
<td>-0.217</td>
<td>-0.208</td>
</tr>
<tr>
<td>SCAR</td>
<td></td>
<td>-10.886***</td>
<td>-10.385***</td>
</tr>
</tbody>
</table>

*** indicates 1 percent left-tail level of significance
** indicates 5 percent left-tail level of significance
* indicates 10 percent left-tail level of significance
### Post-Event Window Returns Analysis  
**2 September 2008 – 30 September 2008**

<table>
<thead>
<tr>
<th></th>
<th>AR’s to MFI</th>
<th></th>
<th>AR’s to PBH</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Smallcap Composite</td>
<td></td>
<td>Smallcap Composite</td>
<td></td>
</tr>
<tr>
<td><strong>CAR</strong></td>
<td>0.112</td>
<td>0.073</td>
<td>-0.078</td>
<td>-0.107</td>
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<tr>
<td><strong>SCAR</strong></td>
<td>5.636***</td>
<td>3.650***</td>
<td>-5.150***</td>
<td>-6.976***</td>
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</tbody>
</table>

*** indicates 1 percent one-tail level of significance
Conclusions

• The 2008 Listeria announcement had a significant effect on returns over the event window
  • MFI stat. significant negative abnormal returns
  • PBH stat. significant negative abnormal returns

• Post-event window
  • MFI stat. significant positive abnormal returns
  • PBH stat. significant negative abnormal returns
Conclusions Con’t

• Public communications may have caused positive abnormal returns to MFI shares during the post-event window.

• Mean closing prices of MFI shares do not regain pre-event mean closing price level during the post-event window.

• Premium Brands Holdings does not announce changes to food processing procedures.
THANK YOU

Happy to answer any questions
Estimation, Event and Post-event Windows; Daily Closing Maple Leaf Foods Inc. Share Price for the period
3 December 2007 through 30 September 2008
Event and Estimation Windows

(Campbell et al., 1997)

<table>
<thead>
<tr>
<th></th>
<th>MFI on S&amp;P/TSX Smallcap</th>
<th>MFI on S&amp;P/TSX Composite</th>
<th>PBH on S&amp;P/TSX Smallcap</th>
<th>PBH on S&amp;P/TSX Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skewness</td>
<td>-0.295</td>
<td>-0.258</td>
<td>0.503</td>
<td>0.371</td>
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<tr>
<td>Kurtosis</td>
<td>0.734</td>
<td>0.689</td>
<td>2.305</td>
<td>2.318</td>
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<tr>
<td>Jarque-Bera</td>
<td>6.193</td>
<td>5.125</td>
<td>45.089</td>
<td>42.039</td>
</tr>
<tr>
<td>D-W d-Stat</td>
<td>1.94</td>
<td>2.2</td>
<td>1.98</td>
<td>1.94</td>
</tr>
<tr>
<td>White’s Test</td>
<td>1.089</td>
<td>0.830</td>
<td>2.180</td>
<td>0.398</td>
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</table>
Abnormal Returns

\[ \varepsilon_{it}^* = R_{it} - E[R_{it} | X_t] \]
Investor Maximization Problem

\[ \max \xi u(c_t) + E[\beta u(c_{t+1})] \text{s.t.} \]

\[ c_t = W_t - p_t \xi \]

\[ c_{t+1} = W_{t+1} + x_{t+1} \xi \]
Basic Asset Pricing Equation

\[ U(c_t, c_{t+1}) = u(W_t - p_t \xi) + E_t[\beta u(W_{t+1} + x_{t+1} \xi)] \]

\[ - p_t u'(c_t) + E_t[\beta u'(c_{t+1}) x_{t+1}] = 0 \]

\[ p_t u'(c_t) = E_t[\beta u'(c_{t+1}) x_{t+1}] \]

\[ p_t = E_t \left[ \beta \frac{u'(c_{t+1})}{u'(c_t)} x_{t+1} \right] \]
Market Model Proof

\[
\varepsilon_{it} = R_{it} - E\left[R_{it} \mid X_t\right]
\]

\[
E\left[R_{it} \mid X_t\right] \cong (\alpha_i + \beta R_{mt})
\]

\[
R_{it} = \alpha_i + \beta R_{mt} + \varepsilon_t
\]
Economic Problem

To date, the impact of a food safety recall, as deadly and widespread as the 2008 Listeriosis recall, on a publicly traded firm’s asset return has not been subjected to economic analysis.

- change in returns indicative of economic cost to firms due to catastrophic events.
Conceptual Framework

\[ \frac{u'(c_{t+1})}{u'(c_t)} = \frac{W_{t+1}}{W_t} \]

\[ p_t^* = E_t \left[ \beta \frac{u'(c_{t+1})}{u'(c_t)} x_{t+1} \right] \]
Hypotheses Tested

- The Listeria recall event has no impact on the mean or variance of Maple Leaf returns.

- The Listeria recall event has no impact on the mean or variance of returns to the index of publicly traded Canadian meat processing firms.

\[
\hat{S}_i(\tau_1, \tau_2) = \frac{\hat{C}_i(\tau_1, \tau_2)}{\hat{\sigma}_i(\tau_1, \tau_2)}
\]