Did HAS Scores Impact Economic Incentives?

- A Study of Hygiene Scores in the U.K.

Wenjing Shang and Neal H. Hooker

Department of Agricultural, Environmental and Development Economics
The Ohio State University

Paper presented at AAEA Pre-conference workshop

New Food Safety Incentives and Regulatory, Technological, and Organizational Innovations
Long Beach, CA. July 22, 2006
Overview

• U.K. foodborne disease
  – ~60 million people, 900,000 cases per year
  – Several hundred deaths
  – Costs: about £1.5 billion (2004 prices)
    Food Standards Agency: www.food.gov.uk

• Presentation Structure
  – What is HAS?
  – Review scores
    • By plant type and pre- post-HACCP
  – What changed in 2006?
  – Next steps
What is HAS?

• HAS = Hygiene Assessment System
• Adopted in 1997
• Hygiene standards in all slaughterhouses and cutting plants monitored monthly by MHS (Meat Hygiene Service)
• Monthly HAS scores (0-100) published online
  – Moving average of previous three months
• Paper uses plant-level monthly data 1998 to 2005
## Industry Structure

<table>
<thead>
<tr>
<th>Category</th>
<th>Grouping</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Region</strong></td>
<td>England</td>
<td>1,150</td>
<td>78.5%</td>
</tr>
<tr>
<td></td>
<td>Scotland</td>
<td>135</td>
<td>9.2%</td>
</tr>
<tr>
<td></td>
<td>Wales</td>
<td>98</td>
<td>6.7%</td>
</tr>
<tr>
<td></td>
<td>Northern Island</td>
<td>82</td>
<td>5.6%</td>
</tr>
<tr>
<td><strong>Plant Size</strong></td>
<td>Large</td>
<td>859</td>
<td>58.6%</td>
</tr>
<tr>
<td></td>
<td>Small</td>
<td>606</td>
<td>41.4%</td>
</tr>
<tr>
<td><strong>Specie</strong></td>
<td>Red meat only</td>
<td>502</td>
<td>34.3%</td>
</tr>
<tr>
<td></td>
<td>Poultry meat only</td>
<td>195</td>
<td>13.3%</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>768</td>
<td>52.4%</td>
</tr>
<tr>
<td><strong>Operation Type</strong></td>
<td>Slaughterhouse</td>
<td>641</td>
<td>43.8%</td>
</tr>
<tr>
<td></td>
<td>Cutting plants</td>
<td>824</td>
<td>56.3%</td>
</tr>
</tbody>
</table>
HAS Scores by Region

Score


England
Northern Ireland
Scotland
Wales
Grand Total

---

HAS Scores by Region

Score


England
Northern Ireland
Scotland
Wales
Grand Total
HAS Scores by Specie

Score


- Red Meat Only
- Poultry Meat Only
- Other
Nonparametric Comparisons

1. Pre- and post-HACCP

2. Across four regions
   - England, Scotland, Wales, and Northern Ireland

3. Plant type
   - Large and small
   - Red meat and poultry
   - Slaughterhouses and cutting plants
What is HACCP?

• HACCP = Hazard Analysis Critical Control Point
• Internationally recognized and recommended system of food safety management
• Focuses on identifying the ‘critical points’ in a process where food safety problems (or ‘hazards’) can arise
• Puts controls in place to prevent things going wrong then monitors the process
• Record keeping is an important part of HACCP
Pre- and post-HACCP

- HACCP implementation by June 7, 2002 for large plants and June 7, 2003 for small plants
- Wilcoxon rank-sum test

- For **large plants**, no change in HAS scores pre- and post-HACCP (90% confidence level)

- For **small plants**, HAS scores went up after HACCP was implemented (99% confidence level)
Regional Differences in HAS Scores

• Friedman’s distribution-free test for unordered alternatives - HAS scores differ by geographic region (99% confidence level)

• Multiple 2-way comparisons (4 regions, 6 pairs)
  – Only Scotland > England (99% confidence level)
  – No other ordering conclusions can be drawn

• Possible explanations: Scotland has different history of food safety violations; distinct red meat combinations; stronger export orientation
Differences in HAS Scores

Plant size
- Reject the null hypothesis at the 99% confidence level
- Can conclude $\theta > 0$
- Full throughput (large) premises have **higher** HAS scores than smaller (low throughput) premises

Specie
- Reject the null hypothesis at the 90% confidence level
- Can conclude $\theta > 0$
- Red meat premises have **higher** HAS scores than poultry premises

Operation type
- Reject the null hypothesis at the 99% confidence level
- Can conclude $\theta < 0$
- Slaughterhouses have **lower** HAS scores than cutting plants
What Influences HAS Scores? Regression Results

• Larger-sized plants and plants in Scotland have **higher** scores
• Plants in Wales are more likely to have **lower** scores
• Operation type and specie don’t have significant impact on HAS score
• HAS scores improved over time and following HACCP implementation
All Change!

• HAS concluded in December 2005
  – EU-wide risk-based Audit system replaced HAS

• Audit categories impacted by Food Business Operator-level (FBO) risk factors
  – Related to the establishment activities and nature of the food business
    • Fixed scores - higher score may be consequence of establishment's higher risk activities not necessarily reflecting performance of FBO
  – Related to the FBOs’ actions
    • Based on the FBOs’ actions and compliance history
Audits

<table>
<thead>
<tr>
<th>Audit Category</th>
<th>Minimum Audit Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>At least once every 12 months</td>
</tr>
<tr>
<td>II</td>
<td>At least once every 8 months</td>
</tr>
<tr>
<td>III</td>
<td>At least once every 5 months</td>
</tr>
<tr>
<td>IV</td>
<td>At least once every 3 months</td>
</tr>
<tr>
<td>V</td>
<td>At least once every 2 months</td>
</tr>
</tbody>
</table>

- Slaughterhouse and cutting plant audits at least once every eight months (Category II)
First Audit Report: 271 Plants

<table>
<thead>
<tr>
<th>Operating under Art. 4.5</th>
<th>Trading Name</th>
<th>Town</th>
<th>Audit Category</th>
<th>Audit Date</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>of Reg. EC 853/2004/</td>
<td>A TRAVES &amp; SON Ltd</td>
<td>Escrick</td>
<td>III</td>
<td>Jan-06</td>
<td></td>
</tr>
<tr>
<td>Conditional approval/</td>
<td>AGRICULTURAL &amp; FOOD RESEARCH</td>
<td>Newbury</td>
<td>IV</td>
<td>Mar-06</td>
<td></td>
</tr>
<tr>
<td>Approval no.</td>
<td>COUNCIL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENGLAND</td>
<td>ALI AKBAR SHAN</td>
<td>Ossett</td>
<td>V</td>
<td>Feb-06</td>
<td></td>
</tr>
<tr>
<td>Red Meat Slaughterhouses</td>
<td>B RILEY AND SONS</td>
<td>Burnley</td>
<td>IV</td>
<td>Mar-06</td>
<td></td>
</tr>
</tbody>
</table>

- Transition from continuous numerical to categorical **risk communication**
- Comparing audit categories within plant groups
Future Research

• Case studies
  – Why certain plants and regions perform better
    • One Scottish plant scored 100 (1998 to 2004)

• Tracking the audit risk-based scheme
  – Correlations between audit category and previous HAS scores for each plant
Future Research

• Link performance measures to plant characteristics in more comprehensive models

• Absolute vs. relative performance

• Who uses this risk communication?
  – Point of purchase connection?
Thanks!

- Hooker.27@osu.edu; http://aede.osu.edu
- Neal Hooker received a Ph.D. in Resource Economics from the University of Massachusetts then concurrently held postdoc positions at U. Mass and the Center for Food Safety at Texas A&M University. He next held an Assistant Professor position in the Department of Agricultural and Resource Economics at Colorado State University before moving to the Department of Agricultural, Environmental and Development Economics at The Ohio State University where he is an Assistant Professor. He holds a research, teaching, and extension position in the general areas of agribusiness marketing, management, policy, and international trade. Dr. Hooker is particularly interested in how agricultural and food quality characteristics, most especially safety and nutrition attributes, are communicated, controlled, and (where appropriate) certified. Dr. Hooker has published 26 journal articles and 7 book chapters on the economics of food safety and quality considering aspects such as the role of HACCP as an international trade standard, the impact of product recalls, international marketing of food safety attributes, E-Business, and comparisons of voluntary and mandatory quality management systems. He co-edited a book Interdisciplinary Food Safety Research and a special issue of a journal on Private Sector Management of Food Safety. Dr. Hooker served on a joint Institute of Medicine / National Research Council - National Academy of Sciences Committee and Sub-Committee which prepared a report Scientific Criteria to Ensure Safe Food. He has been a (co-) principal investigator on 18 grant and contract awards totaling more than $2.8 million.
Industry perspectives on incentives for food safety innovation
Continuous food safety innovation as a management strategy
   Dave Theno, Jack in the Box, US
Economic incentives for food safety in their supply chain
   Susan Ajeska, Fresh Express, US
Innovative food safety training systems
   Gary Fread, Guelph Food Technology Centre, Canada

Organizational and technological food safety innovations
Is co-regulation more efficient and effective in supplying safer food?
   Marian Garcia, Dept. of Agricultural Sciences, Imperial College London
   Andrew Fearne, Centre for Supply Chain Research, University of Kent, UK
Chain level dairy innovation and changes in expected recall costs
   Annet Velthuis, Cyriel van Erve, Miranda Meuwissen, & Ruud Huirne
   Business Economics & Institute for Risk Management in Agriculture, Wageningen University, the Netherlands
“New Food Safety Incentives & Regulatory, Technological & Organizational Innovations” - 7/22/2006, Long Beach, CA (con’t)

**Regulatory food safety innovations**
Prioritization of foodborne pathogens
   Marie-Josée Mangen, J. Kemmeren, Y. van Duynhoven, A.H. and Havelaar, National Institute for Public Health & Environment (RIVM), the Netherlands
Risk-based inspection: US Hazard Coefficients for meat and poultry
   Don Anderson, Food Safety and Inspection Service, USDA
UK HAS scores and impact on economic incentives
   Wenjing Shang and Neal H. Hooker, Department of Agricultural, Environmental & Development Economics, Ohio State University

**Private market mechanisms and food safety insurance**
Sweden’s decade of success with private insurance for *Salmonella* in broilers
   Tanya Roberts, ERS, USDA and Hans Andersson, SLU, Sweden
Are product recalls insurable in the Netherlands dairy supply chain?
   Miranda Meuwissen, Natasha Valeeva, Annet Velthuis & Ruud Huirne, Institute for Risk Management in Agriculture; Business Economics & Animal Sciences Group, Wageningen University, the Netherlands
Recapturing value from food safety certification: incentives and firm strategy
   Suzanne Thornsbury, Mollie Woods and Kellie Raper
   Department of Agricultural Economics, Michigan State University
Applications evaluating innovation and incentives for food safety
Impact of new US food safety standards on produce exporters in northern Mexico
Belem Avendaño, Department of Economics, Universidad Autónoma de Baja California, Mexico and Linda Calvin, ERS, USDA
EU food safety standards and impact on Kenyan exports of green beans and fish
Julius Okello, University of Nairobi, Kenya
Danish Salmonella control: benefits, costs, and distributional impacts
Lill Andersen, Food and Resource Economics Institute, and Tove Christensen, Royal Danish Veterinary and Agricultural University, Denmark

Wrap up panel discussion of conference
FSN section rep. – Tanya Roberts, ERS, USDA
AEM section rep. – Randy Westgren, University of Illinois
INT section rep. – Julie Caswell, University of Massachusetts
FAMPS section rep. – Jean Kinsey, University of Minnesota
Discussion of everyone attending conference
Note: speaker is either the 1st person named or the person underlined.

Thanks to RTI International for co-sponsoring the workshop.
“New Food Safety Incentives & Regulatory, Technological & Organizational Innovations” - 7/22/2006, Long Beach, CA (con’t)

Workshop objectives
- Analyze how new public policies and private strategies are changing economic incentives for food safety,
- Showcase frontier research and the array of new analytical tools and methods that economists are applying to food safety research questions,
- Evaluate the economic impact of new food safety public policies and private strategies on the national and international marketplace,
- Demonstrate how new public polices and private strategies in one country can force technological change and influence markets and regulations in other countries, and
- Encourage cross-fertilization of ideas between the four sponsoring sections.

Workshop organizing committee
Tanya Roberts, ERS/USDA, Washington, DC - Chair
Julie Caswell, University of Massachusetts, MA
Helen Jensen, Iowa State University, IA
Drew Starbird, Santa Clara University, CA
Ruud Huirne, Wageningen University, the Netherlands
Andrew Fearne, University of Kent, UK
Mogens Lund, FOI, Denmark
Mary Muth, Research Triangle Institute Foundation, NC
Jayson Lusk, Oklahoma State University, OK
Randy Westgren, University of Illinois, IL
Darren Hudson, Mississippi State University, MI