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Danish Salmonella Control: Benefits, Costs, and  
Distributional Impacts

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Incentives and Regulatory, Technological, and  
Organizational Innovations  
July 22, 2006, Long Beach, CA

## Danish Salmonella Control: Benefits, Costs, and Distributional Impacts



by  
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## Overview over the presentation

- Salmonella control in Denmark
- Cost benefit analysis of direct economic effects
- General equilibrium analysis encompassing derived economic effects
- Comparison and conclusions



## Danish Salmonella Control

1995-2002:

- Control programmes regarding Salmonella in pork, poultry, and eggs
- Direct costs of 235 million USD
- The number of human Salmonella infections ↓ by 180,000 cases
  - 100,000 of which from fewer infections from eggs



## Industry level analysis - distribution of direct costs of salmonella control

Table 1. Relative direct costs for each sector 1995-2002

	$\frac{\text{direct costs}}{\text{total costs}}$
Pork	0.2 %
Poultry	0.9 %
Eggs	5.8 %

### Results

- The distribution of direct costs is not equal across sectors
  - The egg sector is hit hardest measured in terms of direct costs shares
- No behavioural adjustments
  - Direct cost equals profit loss



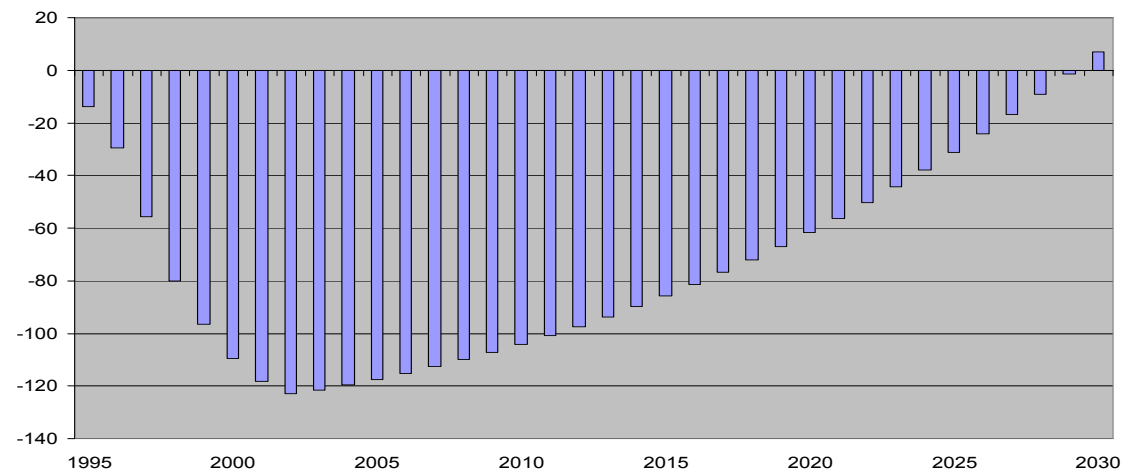
## Social welfare analysis - direct effects

- The cost benefit analysis includes
  - Direct costs: 235 million USD
  - Direct benefits (cost of illness)
    - Reduced public health expenditure
    - Increased productivity
    - Total of 116 million USD
- Result
  - In 1995–2002, there are direct net costs to society of 119 million USD



## Direct net benefits to society

Figure 1. Social direct net benefits, million USD



- Development of cost and benefits
  - Large initial costs, benefits with time lags
- **Result**
  - Not until 2030 do the net costs turn into net benefits





## Conclusions based on the analysis of direct effects

- Industry level analysis
  - Egg sector has the largest relative costs
- Social welfare analysis
  - Salmonella programme on eggs provides the largest benefits
  - Short run net costs
  - Long run net benefits from 2030



## General equilibrium analysis

- Same input data
- Incorporates the 3 direct effects
- Includes derived effects
- Allows producers and consumers to adjust their behaviour
- Takes account of interactions and feed-back mechanisms between agents
- Therefore, the general equilibrium analysis generates results that include both direct and derived effects



## What kind of results arise from a general equilibrium analysis?

- Industry level (changes in production, input demand, market prices)
  - Meat and egg producing sectors
  - Other sectors
- Consumers (changes in total consumption and demand structure)
- National level /social welfare (changes in gross domestic product, total unemployment, balance of payments)



## Industry level - long-run direct and derived effects

Table 2. Long-run direct and derived effects for each sector

Percentage changes	<i>Output price</i>	<i>Production quantity</i>	<i>Production value</i>
Pork	0.2	-0.4	-0.3
Poultry	0.7	-1.4	-1.2
Eggs	1.2	-0.2	1.0

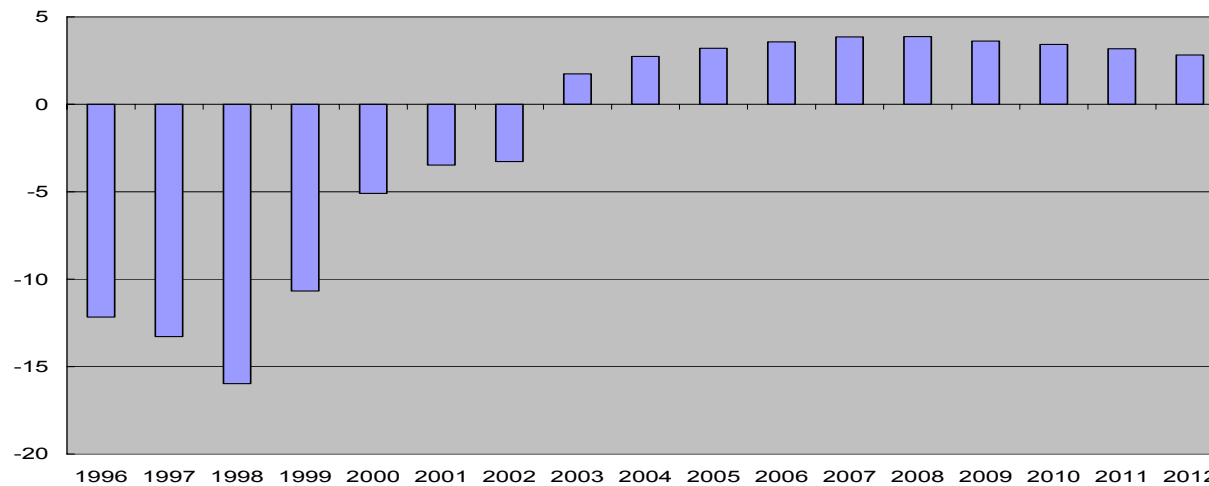
### Results

- General
  - Output prices  $\uparrow$  , production volume production  $\downarrow$  , production value  $\downarrow$
- Differences between setors
  - Egg: The value of production  $\uparrow$  (large direct costs, inelastic demand, no trade)
  - Meat: The value of production  $\downarrow$  (export oriented, elastic demand)



## Social welfare analysis - long-run direct and derived effects

Figure 2. Accumulated changes in GDP, million USD



- Same overall shape as the net direct effects
- **Results**
  - Net benefits from 2003 and onwards due to positive derived effects:
    - Unit production costs ↓
    - Increased demand for other goods and services



## Conclusions based on the general equilibrium analysis

- Incorporating market conditions, agents' behaviour, and interactions and feed back mechanisms between agents result in
  - the net effect on society is clearly positive (net benefits to society also in the short run)
  - the net effect on the industry is not so clear (a more equal distribution of effects at the industry level)



## Overall conclusions

- We obtain different results based on the same data
- Our case illustrates that when analysing food safety policies, a general equilibrium analysis can provide useful information
- It is important to
  - include market conditions (demand structures, trade, competition)
  - present not only results but also underlying assumptions and data uncertainties



**Lill Andersen:** assistant professor at the Institute of Food and Resource Economics at The Danish Veterinary and Agricultural University. I have a master degree in economics and econometrics from University of Southampton, England, and a master and phd degree in economics from University of Copenhagen, Denmark. My research is split into two parts. First, I conduct general equilibrium analyses of issues related to the Danish economy with the use of a dynamic computable general equilibrium model of the Danish economy. The analyses include the economic consequences of a production quota on pigs, salmonella control, and structural forecasts for the Danish economy. My other primary research interest is economic growth theory and development economics. Presently, I work on a project that examines (theoretically and empirically) the connections between international trade and economic growth, and derived effects on poverty and income structure. [lth@foi.dk](mailto:lth@foi.dk)

**Tove Christensen,** Senior researcher, Department of Consumption, Health and Ethics, Institute of Food and Resource Economics (FOI), the Royal Danish Veterinary and Agricultural University. I have a master's degree in mathematical economics, a Ph.D. in environmental economics, and entered recently the world of food safety economics. My research interests circle around the following topics 1) The role of the public sector in regulation of food production 2) The costs and benefits of food safety regulation 3) Understanding consumers' risk perception and valuation of non-market goods. I am involved in two large interdisciplinary research projects on enhancing food safety in Danish agricultural production. Our work includes identifying consumers' perceptions of food risks and risk reduction strategies, economic valuation studies, cost analyses, and cost benefit analyses. We focus on 1) determining optimal reduction strategies for *Campylobacter* in broilers using a chain perspective and 2) possibilities for reducing *Salmonella* in fresh pork using different decontamination strategies. [tove@foi.dk](mailto:tove@foi.dk)





***“New Food Safety Incentives & Regulatory, Technological & Organizational Innovations”*** - 7/22/2006, Long Beach, CA  
AAEA section cosponsors: FSN, AEM, FAMPS, INT

***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 Thornsby, Mollie Woods and Kellie Raper

Department of Agricultural Economics, Michigan State University



***“New Food Safety Incentives & Regulatory, Technological  
& Organizational Innovations”*** - 7/22/2006, Long Beach, CA (con't)

***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 policies 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