Managing Invasive Species Risks: A Case Study of Mad Cow/ New Variant Creutzfeldt-Jakob Disease

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Case Study of BSE/nvCJD

- Why BSE/nvCJD?
- Risk Analysis Principles
- Chronology of Events and Policy Actions
- Risk Communication
- Consumer Responses
- Producer Responses
- Next Steps

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Why BSE/nvCJD?

- Ongoing research project to assess how best to allocate scarce resources to manage invasive species risks
  - Research on impacts, surveillance/monitoring, containment, extermination, and information provision
  - Identifying invasives to concentrate efforts on
- Focus on retrospective analysis of mad cow – Why?
  - Affected producers
  - Affected consumers
  - International trade issues
  - Issue in many countries, which allows a multi-country analysis

Background on BSE

- Leading causal theory
  - Abnormally configured protein, prion protein PrP (proteinaceous infectious particle)
- No immune response to agent yet detected
- Origins – scrapie agent (in sheep) and in rendered protein overcame the species barrier
- Transmittal through the food chain
- Timing – possibly due to change in rendering system in 1970's and introduction of meat and bone meal as protein supplement

BSE Consequences

- Disease indications
  - Long incubation period, 3-5 years for cattle
  - Slowly progressive
  - Uniformly fatal
  - Never degenerative
- Crossed the species barrier from cows to humans
- Human health nvCJD (new variant Creutzfeldt–Jakob disease)

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Commonalities of BSE and Other Invasive Species Management

- Novel and uncertain risks
- Policy actions before science fully resolved,
  e.g., 1997 Feed Ban
- Greater concern with indigenous cases vs. imported cases
- Domestic risks from imported cases
- Extent of industry compliance
- Nanotechnology, terrorism, and other dimly understood risks

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Risk Analysis Principles

General Guidelines

- Maximize expected benefits – expected costs
- Expectation based on mean value of probabilities, not "conservative values"
- Can implement conservatism through high values for damages
- Risk analysis is essential
- Critique of UK response – not guided by risk analysis but by political pressures

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Characterizing Mad Cow Risks

Risk Levels

- Small (poorly understood) risk to humans
- Quality of risks – high morbidity
- Larger risks to animals

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Risk Ambiguity

- Highly imprecise risk judgments
- Risk ambiguity aversion – a well documented form of irrationality
- Potential for alarmist consumer response causing real economic harms
- Public pressures to over-regulate imprecise risks
- Possible international repercussions, shield for protectionism

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Value of Information: Opportunities

Opportunities for Learning

- Can observe experience in other countries, increasing informational base
- Timing of risks also provides evidence on foreign experiments before making decisions regarding U.S. risks

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Value of Information: Limits

Limits on Learning

- Small probabilities limit informational content of any sample
- Latency periods
- Not a signature disease
- Doesn’t share all factors common to human TSEs
- Science is not well understood
  - Animals to humans link
  - Secondary exposure cases

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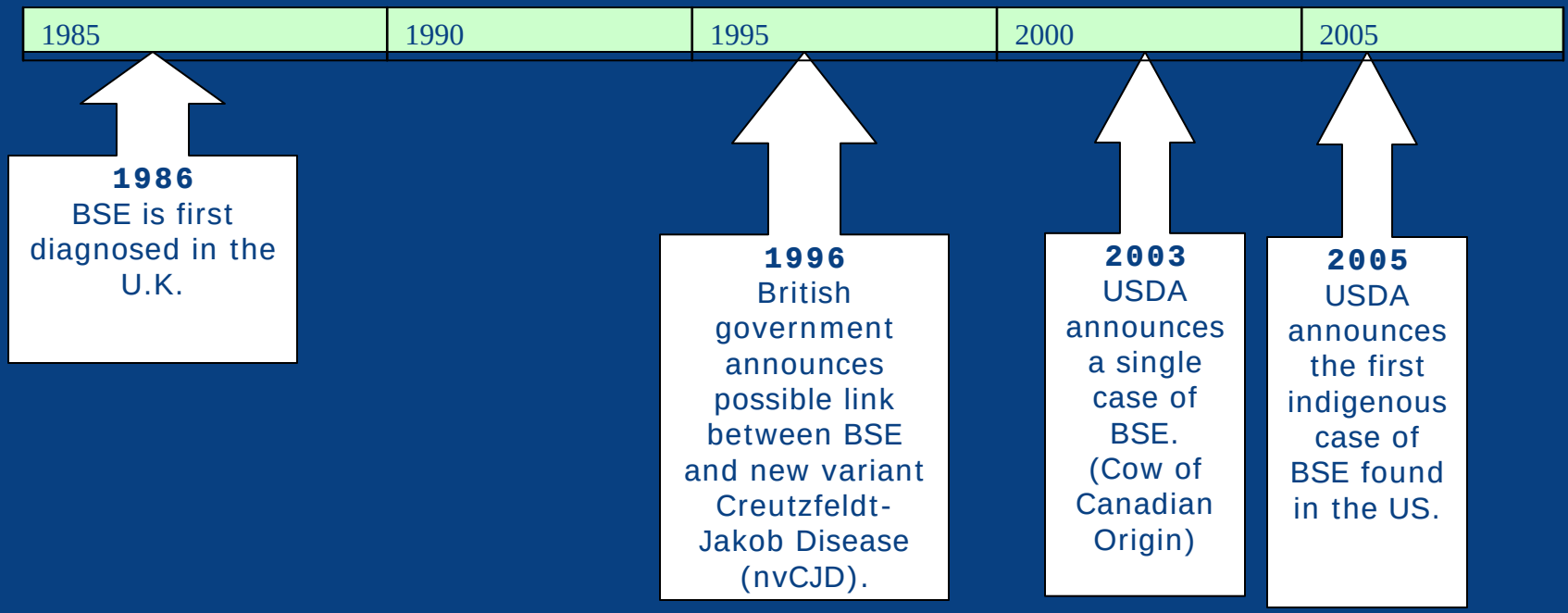
Chronology of Events and Policy Actions



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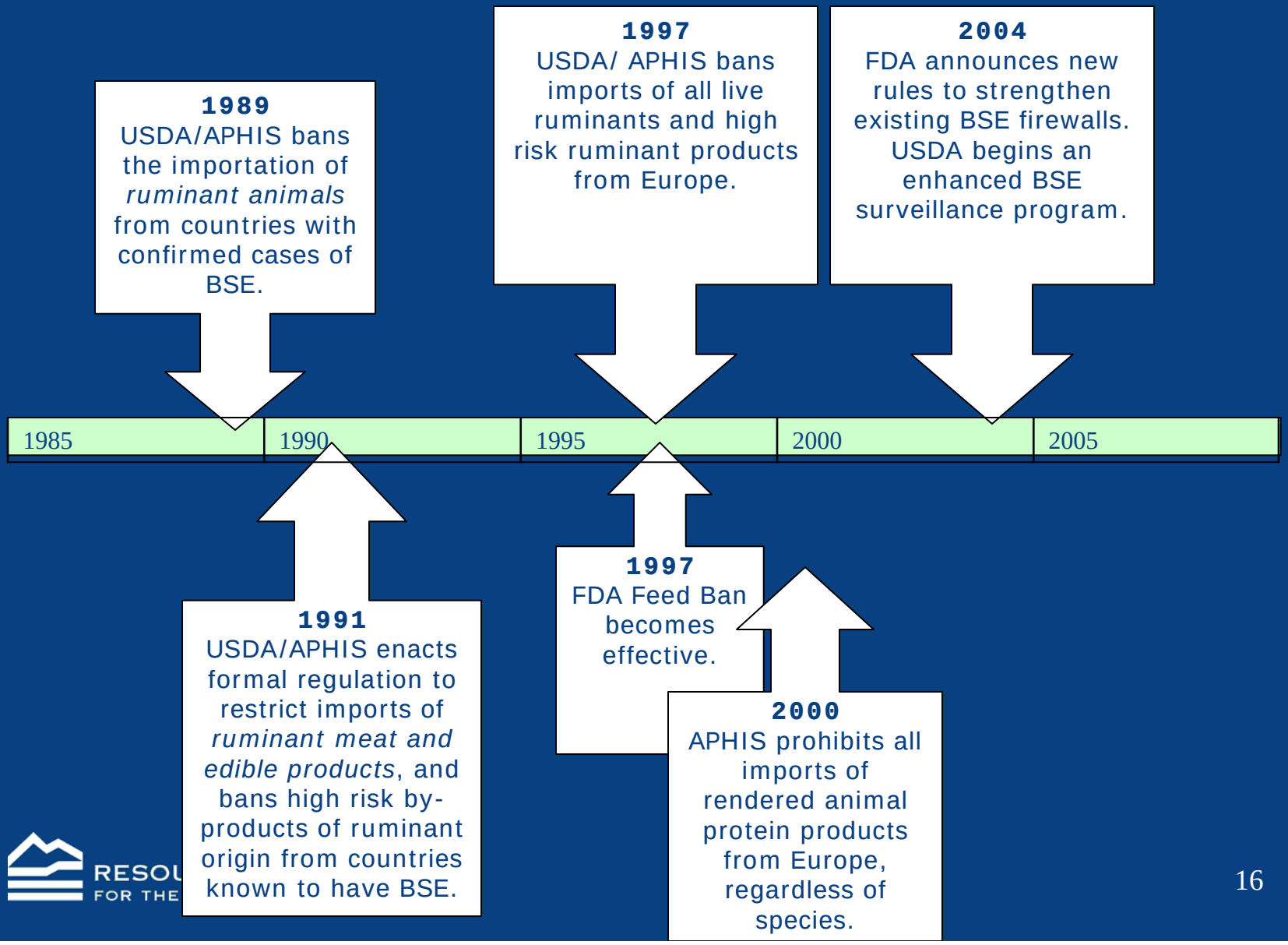
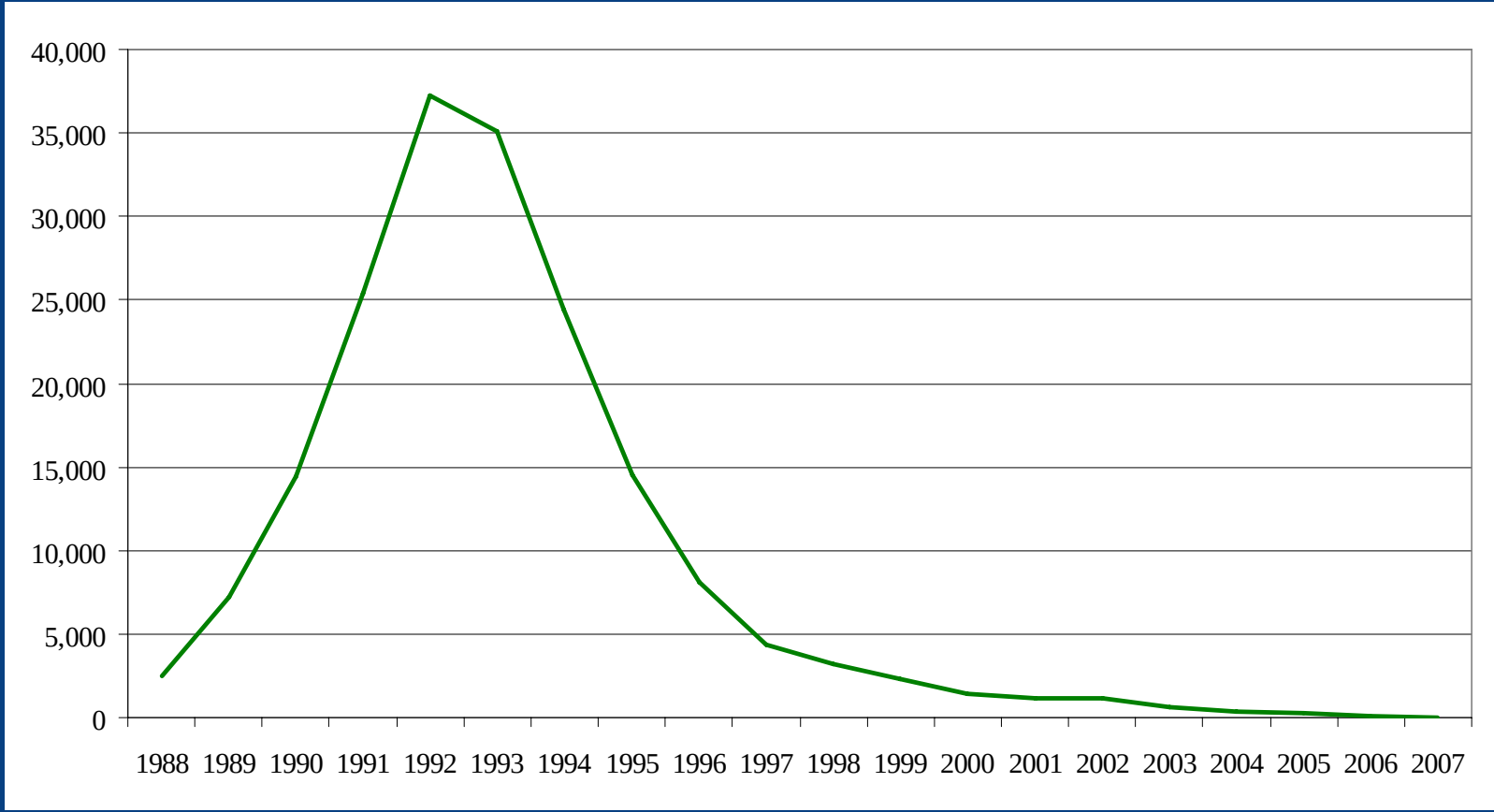
U.S. Policy Actions



Number of BSE Cases reported in U.K.



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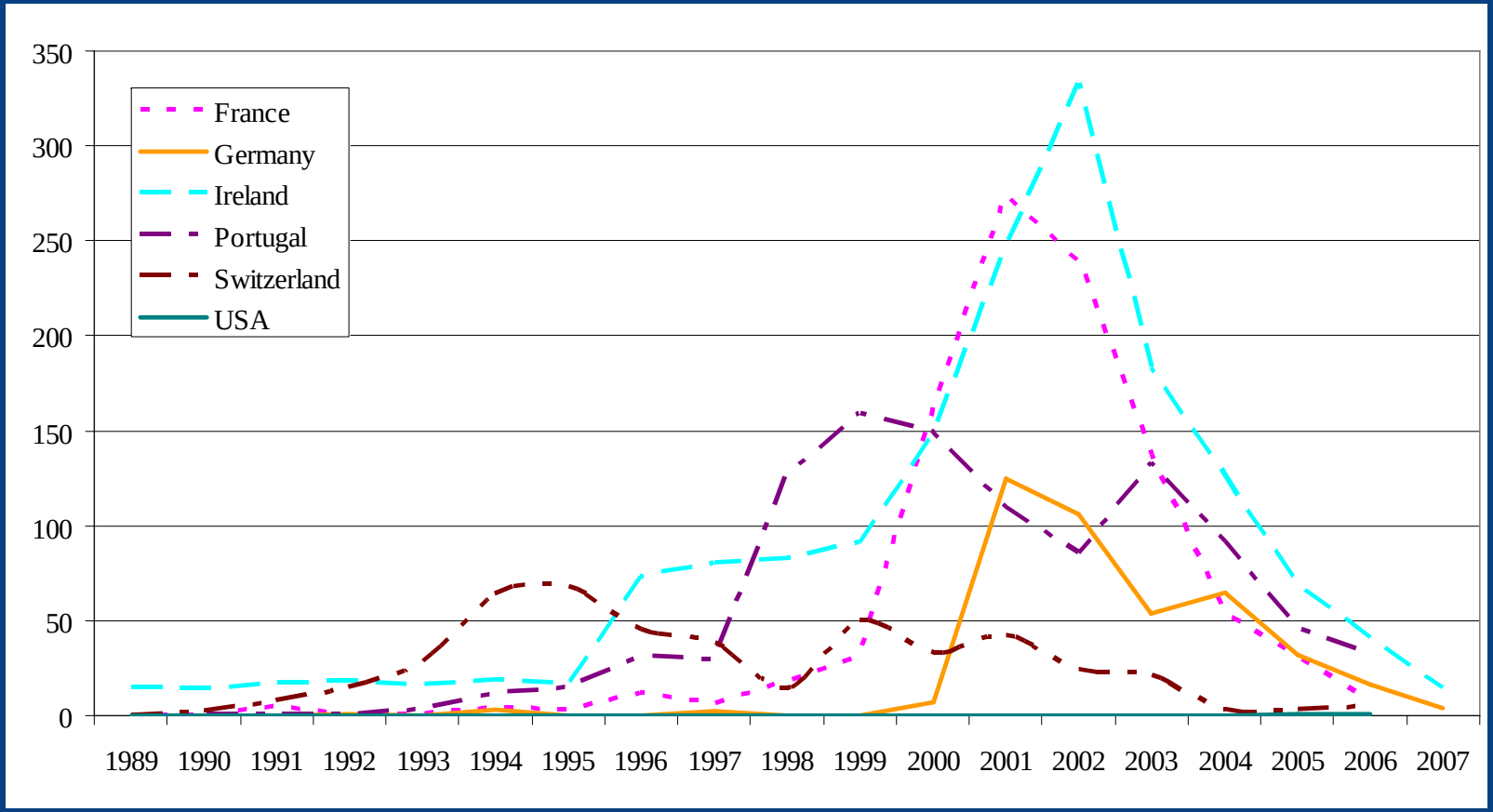
Number of reported BSE cases in farmed cattle worldwide



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Risk Communication

- 1996 scientists predicted tens of thousands of nvCJD deaths
- 1996 estimate of 500-500,000 British deaths
- 2000 estimate of 500,000 deaths in U.K.
- Revised 2000 estimate of maximum of 136,000 deaths

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BSE Human Link

- 1st confirmed nvCJD death – 1996
- 161 deaths observed through September 2007 in U.K.
- Just over 200 documented cases worldwide through July 2007
- Is there a long-term latency period?

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Number of Cases of nvCJD through July 2007

Country	Total Number of Primary Cases (Number Alive)	Total Number of Secondary Cases: Blood Transfusion (Number Alive))	Cumulative Residence in UK > 6 Months During 1980-1996 Period
UK	163 (5)	3 (0)	166
France	22 (2)	-	1
Republic of Ireland	4 (1)	-	2
Italy	1 (0)	-	0
USA	3† (0)	-	2
Canada	1 (0)	-	1
Saudi Arabia	1 (1)	-	0
Japan	1* (0)	-	0
Netherlands	2 (0)	-	0
Portugal	2 (1)	-	0
Spain	1 (0)	-	0

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Media Study

- Full text articles obtained from LexisNexis' *Major US Newspapers Database*
  - The top 50 U.S. newspapers by circulation in *Editor & Publisher Year Book*
  - **Search Terms:** ALLCAPS(BSE) OR (BOVINE SPONGIFORM ENCEPHALOPATHY!) OR (MAD COW!)
  - **Search Criteria:** January 1, 1986-December 31, 2005

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Media Study Continued: 1986-1995 What are they saying?

- No coverage 1986-88
- Increase to 25 hits in 1990
  - ➢ Related to UK Events
- Consistent 10-25 hits per year 1990-1995
- Article Topics:
  - Trade disputes in the EU
  - 10,000+ cattle killed by disease in UK
  - UK government continues to see only a remote risk to humans
  - New research on spread of disease through cattle feed

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Media Study Continued: 1996-2005

- March 21-22, 1996: 53 media hits in 2 days following the UK government's announcement of the link between BSE and humans
- 1996-2005: Close to daily coverage of disease
- 2003 and 2005: Heavy coverage after USDA announces the first and second case of BSE

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Media Study Analysis/Conclusions

- 1996: Upturn in media hits
  - 10 years after the disease was discovered in Britain
  - How did this influence US FDA's 1997 Feed Ban?
  - Does this coincide with an upturn in U.S. public consciousness of/about the disease?
  - How does this compare to the polling (public opinion poll data)?
- "Oprah Effect"
  - 100+ media hits reference Oprah Winfrey's 4/16/96 show
- Harvard/Tuskegee Risk Assessment 2001
  - 15 major newspapers cover release of this risk assessment, finds that "If BSE has been introduced into the U.S., the course of the disease has been arrested and it is destined for eradication by the measures currently in place" (p. iv).

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U.K. Opinion Polls on BSE

- U.K. 1995
  - Very worried or somewhat worried about possible spread of disease to humans – 45%, 52% (2 polls)
- U.K. 1996
  - Suspicious of what Ministers have to say – 86%
- U.K. 1996
  - Government has handled pretty badly or very badly – 79%, 82% (2 polls)

U.S. Opinion Polls on Mad Cow Disease

- U.S. 2001
  - Very concerned or somewhat concerned about mad cow disease becoming a problem in the U.S. – 65%
- U.S. 2004
  - Very worried or somewhat worried that someone in family will become victim of mad cow disease – 16%
- U.S. 2004
  - Confidence in the government –

    a great deal - 45%, somewhat - 43%

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Japan CV Study on BSE Testing of Beef

- First BSE-infected cow found in Japan in Sept 2001
  - After third infected cow in three months, beef consumption had fallen nearly 70%
- In December 2001, contingent valuation study undertaken in Nagano (McCluskey et al 2005)
  - Convenience sample at food cooperative, N = 381
  - 50% response rate
  - Referendum elicitation of WTP for BSE tested beef
  - Payment vehicle: price premium
- Japanese consumers state that they would be willing to pay 50% price premium for beef labeled as BSE tested

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Changes in Beef Consumption

- U.S. after 2003 event
  - Kuchler & Tegene 2006: short-lived, modest reduction
  - Schlenker & Villas-Boas 2006: 25-30% transitory reduction
- Change in UK consumption before 1996 UK announcement
  - Burton and Young 1996, 1997: beef share of meat market declines 4-5% as pork and lamb shares increase
- French consumption after 1996 UK announcement
  - Adda 2007: beef consumption fell ~30%

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Producer Responses

- Evidence from cattle futures markets
  - Schlenker & Villas-Boas 2006: futures prices fell ~20%, recovered within 3 months for 2003 case
- Some producers have called for testing their animals so they can market them as BSE-free

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Next Steps

- Consumer analysis
  - Use Nielsen scanner data to investigate effects of media, multiple events and policy actions on U.S. consumption
  - Investigate the effects of multiple events and policy actions in U.S. and elsewhere
  - Assess how response varies with household demographics
  - How do revealed consumption decisions compare to stated preferences in surveys?

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Next Steps

- Producer analysis
  - Use 20-year series of cattle futures data to assess how producers expected prices change (and duration of price changes) in response to new information about BSE/nvCJD
  - Investigate effect of new information on BSE in UK, other countries' bans of imports from U.S.

Next Steps

- Synthesize for lessons learned
  - Risks clearly overestimated – initially by experts, and subsequently by public
  - How do these perceived risks affect market outcomes?
  - What can the government do to maintain credibility and take “appropriate” measures to mitigate invasive species risks?
  - How can government communicate information about poorly understood risks?
  - How do these lessons apply to other risks?

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