The Cow That Stole Christmas?
Exploring the Role of Media Coverage in Recent BSE Outbreaks

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Introduction

Estimating economic impacts of food safety scares, such as the concern surrounding beef supplies when bovine spongiform encephalopathy (BSE) is found in domestic cattle, is important to food industry analysts, policymakers and scientists. Accurate estimation is particularly important to stakeholders who weigh the relative benefits and costs of information systems designed for quality assurance, source verification and trace-back capability. Yet, determining potential implications on marketing channels often involves quantifying decreased demand for affected foods and the increased demand for substitutes directly related to the shock, an issue that requires careful methodological approaches and data interpretation.

Food safety demand shocks may be difficult to extract with primary data – after all, the event is unexpected making it costly and difficult to gauge consumers' responses in supermarket aisles. More often than not, *ex post* statistical analysis of secondary data identifies the impact that a food safety scare has had on consumer purchases. In this context, a challenge is how the event should be modeled. For example, should the demand shock be estimated with a single period dummy variable suggesting a sudden shift in consumer demand and eventual return to "normal?" Or alternatively, can word counts of print media be used to proxy initial consumer response, the increasing intensity of consumer awareness, and then a gradual return to initial/new demand conditions?

The purpose of this article is to consider alternative specification of consumer demand response to food safety shocks, or more generally, how the influence of media can be integrated into demand systems. Recent incidence of BSE in North American cattle is used as a specific event to illustrate opportunities and challenges in demand modeling. Several specifications are considered including simple dummy variables and word count indices. Findings are juxtaposed against similar empirical studies, and a final discussion reflects on lessons learned and opportunities for future work.

An Example: Canadian and U.S. BSE Events' Impact on Retail Meat Purchases

The announcement of Canada's single case of BSE (also known as mad cow disease) in May 2003 focused media attention on the safety of retail beef supplies. Although the BSE event in North America did not appreciably increase the risk of disease transmission, consumer beef demand may have been impacted given intensive media focus and public misconceptions surrounding that event. The Canadian event motivated the United States to close its border to Canadian beef products and live animal trade. Only seven months following the Canadian BSE event, the United States announced detection of BSE in a single cow in Washington. Subsequently, this event closed borders to trade between the United States and its export markets, perhaps reinforcing consumer concern over beef supplies.

Did a significant consumer response follow the BSE announcements? One way to answer this question is to cast consumer purchases within a meat demand system and attempt to capture the disease event

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with a suitable proxy. To this end, a linear almost ideal demand system (LAIDS) model was posited for meat demand with six specific meat share equations: ground beef (a meat cut identified as the most susceptible to BSE contamination), beef ribeye, beef top loin, pork center cut chops and boneless/skinless chicken breasts. Monthly point of purchase data (January 2001 to February 2005) comprises the price and share data used for the analysis.[2] In the LAIDS model, informational shift variables, such as a BSE event, can be incorporated into an individual share equation's shift parameter. But, the construction of the informational shift variable is worth further discussion.

Table 1 lists the alternative BSE event proxies considered in this study. Simple dummy variables are among those compared and include a variable equal to "1" in the month of the Canadian BSE event (May 2003) and a "0" otherwise, while another places a "1" beginning in May 2003 and extended to the remainder of the data set. In this case, parameter estimates and hypotheses tests will indicate whether the BSE event had a single month impact or if a longer structural effect is present. Likewise, the U.S. BSE event is given a single month proxy (a "1" in December 2003) and an extended dummy variable (a "1" in December 2003 and beyond).

Table 1. Description of BSE Event Variables.

Variable	Description
Simple Dummy	A "1" in the month of the event, a "0" otherwise.
Extended Dummy	A "1" in the event month continuing through subsequent months.
Negative Article	Word count of articles coded as "Negative."
Negative Article Squared	Word count of articles coded as "Negative" squared (quadratic impact).
Net Article	The word count of negative articles subtracted from a word count of positive articles.
Net Article Squared	A squared series of the "Net Article" data.
Brown and Schrader	The "Net Article" variable multiplied by the ratio of the "negative article" variable to the sum of negative and positive word counts.

The media is a primary source of food information for consumers, but the impact that the media has on consumer purchases is empirically difficult to disentangle. One approach is to construct media proxies from word counts. A LexisNexis™ search of articles using the terms "mad cow disease" "BSE" and "bovine spongiform encephalopathy" was performed, and words in each article counted to form a monthly data series ranging from January 2001 to February 2005. Media coverage is coded into two types: "Negative" for articles that suggest that beef food safety is questionable; and "Positive," indicating that beef food safety has been described in favorable terms. Examples of positive articles could include but are not limited to, new or more efficient testing methods to detect the presence of BSE (assuring efficiency with regard to food safety), a suspected case having a negative test result, assurances of the safety of the meat system and how no diseased animal made it into food marketing channels, or detailed descriptions of the safeguards developed and implemented to prevent BSE incidences. Examples of negative articles are reports of faulty systems or testing methods, negative test results, or descriptions of how the disease could easily occur in the United States. The word counts of negative and positive articles are summed in a given month to create the respective data series. A third data series, "Net," is created by subtracting the word count of monthly negative articles from the monthly positive articles.

Five BSE event variables are created from the previously mentioned word count series and these are summarized in the lower portion of Table 1. The first variable is the word count sum of "Negative" monthly articles. Next, the negative word count sums are squared, indicating a stronger overall impact on consumer's preferences. A third BSE proxy is the "Net" variable that subtracts positive word counts

[2] A more detailed description of the empirical procedure and the data can be found in Johnson et al. (2005).

from negative word counts giving a quantitative measure of overall media coverage. The fourth media index variable squares the monthly net article word count sums. The final index follows Brown and Schrader (1990), in that the index is created when the net word count is multiplied by the ratio of negative word counts to the total word count in each respective month. With this index, the net effect of coverage is given more emphasis as negative articles take a larger share of overall media coverage.

An iterated seemingly unrelated regression procedure was used to derive parameter estimates, and the parameter estimates for the event proxies are shown in Table 2 (other parameter estimates are suppressed as they are beyond the scope of this paper, but demand estimates were robust across all specifications). The various BSE event parameter estimates are found in columns ranging from the "Negative Article Squared" to "Brown and Schrader" following the approaches described in Table 1.

Table 2. Comparing BSE Event Proxies in a LAIDS Meat Demand System.

Share Equation	*Negative Article Squared*	*Negative Article*	*Net Article Squared*	*Net Article*	*Extended Dummy Variable*	*One Month Dummy*	*Brown and Schrader*
Ribeye Share	-5.98E-23	-2.66E-13	-3.14E-13	8.84E-09	-1.46E-03	-1.40E-03	1.62E-08
(t-stat)	-0.71	-0.65	-0.68	0.29	-1.03	-0.73	0.50
Chuck Share	-7.79E-23	-3.69E-13	-4.26E-13	2.19E-08	-1.61E-03	-1.80E-03	2.73E-08
(t-stat)	-1.77	-1.70	-1.74	1.30	-2.02	-1.78	1.53
Ground Share	-2.51E-22	-1.20E-12	-1.36E-12	6.54E-08	-4.90E-03	-5.81E-03	8.42E-08
(t-stat)	-1.96	-1.89	-1.91	1.33	-2.06	-1.98	1.62
Pork Share	6.91E-22	3.35E-12	3.81E-12	-2.18E-07	7.64E-03	1.59E-02	-2.62E-07
(t-stat)	1.85	1.82	1.83	-1.54	1.09	1.86	-1.74
Chicken Share	-1.34E-22	-7.27E-13	-7.95E-13	7.00E-08	3.61E-03	-3.05E-03	7.38E-08
(t-stat)	-1.00	-1.11	-1.08	1.42	1.28	-1.00	1.40

At first glance, neither the ribeye share nor the chicken breast share indicates a statistically significant impact from any BSE event formulation. In the three remaining share equations, the beef products (ground and chuck roast) experience a negative impact, indicating that consumers purchased less of these two beef products. The greater negative impact occurred with ground beef, which in the print media was portrayed as the beef product with the greatest risk of contamination from BSE infected tissue. Conversely, the BSE event dummies have a positive impact on the pork share equation indicating that pork may have been a substitute choice among those consumers concerned about the beef market events.

The event dummy variables (Extended Dummy Variable, One Month Dummy) have a greater impact on meat shares when compared to the media index variables. Moreover, the simple dummy variables tend to be statistically significant across more share equations than the media index variables, perhaps because the dummy variables capture more complex information shifters including electronic media, whereas word count variables are specific to the print media. Alternatively, media attention on the BSE event provides no additional information on consumer demand response. This may partially be due to the fact that we are examining monthly changes, and in today's 24-hour media age, events pass out of public attention quickly.

Related Empirical Demand Shock Studies

A limitation of our study is its monthly data series – after all, a food safety scare may come and go within a month's time muting the demand shift. A more geographically focused, weekly study of the same BSE event is found in Peng, McAnn-Hiltz and Goddard (2004). The authors estimate a BSE media index variable using weekly point of purchase scanner data for fresh and refrigerated beef, pork and chicken (acquired from AC Nielsen) from Alberta retail stores. The beef products were split into ground beef and "other" beef. Results confirmed the assumption that the newspaper articles addressing BSE had a negative (small in magnitude) and statistically significant impact on the Alberta consumers' demand for beef (cuts other than ground).

More generally, Kalaitzandonakes, Marks and Vickner (2004) argue that acute media focus on food safety is temporary and small in its impact when examining a short-term media event (e.g., unapproved corn mixed in the human corn food supply chain) and the more sustained media coverage of biotechnology in foods. In the latter case, consumers did not change purchasing patterns during the analysis period. In the former case, acute media coverage affected purchases, but the overall response was limited. Interestingly, specific brands mentioned in media coverage absorbed the brunt of losses. Attempts to uncover lagged effects from media coverage proved fruitless.

Media index variables used in this study focus on print articles and word counts within the articles. This data construct is a limitation to the study. As noted by a reviewer, the media reports newsworthy events in "pulses" or "cycles" among many different media types including television, Internet, radio and print. An example of media pulse modeling is Dahlgren and Fairchild (2002) who perform a case study of chicken contaminated with salmonella. In the case study, a negative poultry report is first broadcast on the television news program *60 Minutes*, and then media coverage expands quickly from other sources. The authors' media proxy considers a count of weekly keyword appearance in television and print news coverage, but weights the appearance by the audience size to gain insight into overall consumer exposure to the event. The formulation is negative and statistically significant in some, but not all of the models considered. It should be noted too, that simple weekly word count and simple dummy variables were used in preliminary modeling efforts. Exposure, or the reach of BSE news, is not considered in our event study.

In addition to news exposure, the current generation of consumers may pay more attention to headlines (of all media types) rather than the full content of reports. If this is true, constructing a media index from headlines may provide a more accurate portrayal of how consumers' perceptions and buying behavior are impacted by food safety events. As an example, Verbeke and Ward (2001) proxied consumer awareness with a media index based on the number of positive and negative television reports, rather than full-fledged word counts, in Belgium. Using a linear AIDS model and a monthly panel data set of consumer purchases, the authors find that the TV coverage had a significant and negative impact on beef/veal consumption and a positive, significant effect on pork consumption.

If ERS-USDA data were available in a weekly time series, we might better be able to match the media exposure of the BSE event to the cycle of consumer purchases. Repeating the analysis with closer attention to these dynamics may provide more statistically significant results vis a vis simple dummy variables. Such is the experience of Kalaitzandonakes, Marks and Vickner (2004) who first create a daily media coverage series based on print media, radio transcripts and television transcripts, count the number of times that "Starlink" or similar phrases appear in the coverage, and then aggregate the daily series to exactly match the weekly scanner data set that they have for purchases. Dahlgren and Fairchild (2002) also make use of weekly media information, but must adapt their consumer purchase data from a monthly to a weekly data series with proxies.

Concluding Remarks

Conventional wisdom argues that the public response to the U.S. discovery of BSE in December 2003 would have been more substantial had it not occurred in the holiday season – a season when beef consumption is low, and consumers' attention is diverted from the media. This lends support to the proposition that, as rational as the proposition is, using media indices as indicators of consumer awareness/concern is not always an appropriate or effective methodology. Additionally, construction of media indices is quite costly relative to the inclusion of simple dummy variables.

This is not to say that construction of media indices and their use in economic studies is without value. In fact, media study may be particularly appropriate when public institutions are perceived to perform inadequately. For instance, when consumers have less assurance that government institutions can respond to food safety issues, the role of media may be enhanced. After the mishandling of BSE in the United Kingdom, European consumers look to third party validation including the media, rather than government, to assure them of a safe food supply whereas a large majority of U.S. consumers still trust the USDA's oversight of the food system. Another instance when media may be an important influencer is when branded products are addressed, an increasing issue with more source assurance claims being made by private marketers. Media indices may be useful in examining both the lost flow of demand for these goods, and may also be particularly useful in describing the erosion of brand equity (a stock effect).

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