What Drives Media Reporting of Food Safety Events? Evidence from U.S. Meat Recalls

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Selected Paper prepared for presentation at the Agricultural and Applied Economics Association's 2016 AAEA Annual Meeting, Boston, July 31 – August 2

[Please do not cite. This is a very early draft of the paper. Please email the authors if you would like to see an updated draft.]

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Abstract

This paper examines how the characteristics of a recall affect the volume of media coverage about that recall. We link data on media reports to a comprehensive list of virtually all recalls of meat products over the period 2001–2012. We find considerable evidence that, up to a point, the characteristics of a food recall significantly affect reporting about that recall. Specifically a one percent increase in the volume of meat recalled results in a 0.1 percent increase in media coverage. In addition, we find that media coverage is significantly larger for incidents related to bacterial contamination as compared to other types of recalls.

Keywords: Food Safety, Media Bias, Meat Recall

1. The First Section

Between 2000 and 2012, the USDA Food Safety Inspection Service (USDA-FSIS) issued 864 recalls, or roughly one every five to six days. Recalls varied in size and scope ranging from 1 lb to 14 million lbs. While, some products are recalled for minor violations, others are recalled due to potentially life threatening contamination. However, the USDA-FSIS (and the FDA) do not communicate directly with consumers. As a result, they rely on the news media to transmit important food safety information to consumers in a timely and accurate manner. Given the number of recalls, and competition with other events for coverage, not all recalls can or should be given media attention. This paper asks how the characteristics of an FSIS recall drives reporting about the recall itself. Put differently, are certain types of recall more likely to garner media attention?

In this paper, we investigate how the characteristics of a recall – e.g. it's size and scope, the cause of the recall, the risk posed to human health – affect the extent to which an event is covered in the media. In other words, is there systematic bias in the way in which recalls are covered in the media? Is there a threshold below which recalls will not be covered? We then ask, given recall characteristics, how does media coverage translate into consumer awareness of recalls. To this end, we use an index of Google searches related food recalls in the weeks following a recall as a proxy for consumer interest.

The way in which media coverage affects consumer purchasing behavior has been extensively studied (Smith, van Ravenswaay, & Thomspon 1988; Burton & Young 1996; Verkeke & Ward 2001; Dahlgran and Fairchild 2002; ; Piggott & Marsh 2004; Marsh, Schroeder & Mintert 2004; Mazzochi 2006; Chang & Just 2007; Taylor, Phaneuf & Piggott 2009; Taylor, Klaiber & Kuchler 2013). Counts of newspaper articles are widely used by agricultural economists as a proxy for consumer awareness of food safety events. These measures, which are often formalized as media indices, are subsequently incorporated into structural models of demand. In sum, this literature finds that recalls have a significant short run impact, but with the notable exception of the U.K. BSE crisis, their long run impact may be small. Our research question differs from previous work in that it investigates the drivers behind media indices rather than the effect of media indices on purchasing behavior. To the extent that media coverage differs significantly as a function of recall characteristics, this paper will shed light on previous findings.

This paper also contributes to a broader literature at the intersection of economics and political science on media reporting bias. Previous work in this vein has looked at how newspapers cover statements by political actors (Groseclose & Mylow 2005; Baron 2006; Gentzkow & Shapiro 2010). Perhaps most closely related to this paper is work by Swinnen, McCluskey, & Francken (2005), which looks at detailed counts of media reporting for two food safety crisis in three newspapers in Belgium. Our question is fundamentally different and we add to the literature by considering *all* meat recalls across all major newspapers over a 12 year period in the United States. Moreover, our analysis extends beyond crisis and explicitly examines the differences in reporting between crisis and non-crisis events.

This paper makes two main contributions. To the best of our knowledge, this paper is the first to explicitly study how recalls are covered in the U.S.

media. Understanding this relationship is important to economists who use media indices as explanatory variables in structural demand models, as well as to policy makers who rely on the media to convey important health information to individuals. Second we investigate the extent to which media reporting affects consumer awareness of recalls by studying data from Google searches.

Background

In the United States, the Department of Agriculture's Food Safety Inspection Service (USDA-FSIS) oversees the recalls of meat and poultry products produced by federally inspected establishments. Once FSIS has determined that the recalled product is potentially available for purchase by consumers, the agency issues a recall release to "media wire services, media outlets in areas that received recalled products, the FSIS e-mail subscription service, and the @USDAfoodsafety Twitter feed" (USDA-FSIS 2012). The recall release is also posted on the USDA-FSIS website.

Data Construction

The data used in the paper comes from three distinct sources. First, the meat and poultry recall data are from the USDA Food Safety and Inspection Service (FSIS) meat recall archive that is publicly available online. Data on media reports of food recall news are from LexisNexis® Academic. Finally, an index of the volume of Google queries related to meat recalls were obtained from an online utility provided by Google, named Google Trends. We now describe our data construction process in detail.

FSIS Meat Recall Data

We obtain information on recalls from the FSIS recall archive. Each recall consists of press releases, reports and notification issued by the FSIS for the recalled meat and poultry products. From the recall archive we collect characteristics of the recall such as the quantity of product recalled, the severity of the recall, and the reasons for the recall.

There were 864 meat and poultry food product recalls in the last 12 years. Table 1 summarizes the characteristics of FSIS product recalls over the period 2001 to 2012. Note that information on the quantity recalled for 31 products was missing and as a result are dropped from the analysis. We divide the remaining 833 recalled products into four broad categories, namely: beef, pork, poultry, processed meat and others. Note that the processed meat category includes products such as hot dogs, luncheon meats, sausages and the others category includes those products which are either a combination of meats or not identified as containing any specific meat, such as soup, burritos,pizza etc. Over the period in question, food products containing beef are the most frequently recalled, followed by food products containing poultry and processed meat products. Infection due to Listeria is the most frequent cause of a recall followed by infection due to E. Coli.

FSIS classifies food product recalls according to the severity of the health threat they present to the consumers. Class 1 level of severity refers to the situation where use of the product will cause severe health consequences or death. Class 2 refers to the situation where there is low probability of adverse health effects and class 3 refers to the situation where the use of the product will cause no adverse health effects (USDA FSIS). Almost 71 percent of all the food products recalled were of severity class 1 and 19 percent were of severity class 2, the remaining 10 percent were class 3. The FSIS recall information provides the region and states where the food products were recalled. Regions were constructed following the US Census Region and Divisions of the United States. Most of the recalls happened in the southern states followed by the midwest and the northeast.

News Data and Classification

Our key outcome variable is a count of newspaper articles and transcripts of broadcast media related to a given recall. Counts of articles and transcripts from all media sources were collected using the LexisNexis® Academic search engine. Note that LexisNexis® is a well-known online archive of legal and media documents. Indeed, much of the previous work in the area has also used LexisNexis® data (Taylor and Phaneuf, 2009; Piggott and Marsh, 2004; Burton and Young, 1996).

We began by querying the LexisNexis® database for media reports containing keywords related to food product recalls, over the period 2001–2012. This generated an exhaustive list of 52,168 articles plausibly related to food recalls. One problem with this approach is that it generates a relatively large number of false positives, articles that contain relevant keywords but are unrelated to a given recall. To address this, we use the natural language

Table 1: Meat and Poultry FSIS recalls, 2001-2012

	Beef	Pork	Poultry	Processed Meat	Others	Total
Number of Recalls	295	104	179	140	115	833
Reason for Recalll						
Listeria	32	41	59	56	21	209
E. Coli	165	1	0	5	3	174
Salmonella	8	5	11	3	5	32
Undeclared Allergen	16	22	59	33	36	166
Contamination	18	16	28	16	19	97
UnderProcessing/Undercooking	6	5	10	8	5	34
Mislabeling and others	50	14	17	22	26	129
Severity of Recalll						
Class 1	227	70	129	104	68	598
Class 2	39	20	42	21	37	159
Class 3	29	14	8	15	10	76
Region for Recalll						
West	79	28	54	31	33	225
NorthEast	77	27	62	41	31	238
South	107	37	53	50	37	284
MidWest	88	31	60	33	30	242
Nationwide	55	17	43	21	28	164

processing capabilities in Python[1] to construct a probability that an entry in the media database refers to a given recall [2]. We exclude articles where the matching probability falls below 0.5. The result of this exercise was a list of articles related to each recall published from 2001 to 2012. For each article, we construct a number of variables from its text, including the article headline, number of times a key-word appeared in the article, date published and, source of news.

We then merge the information on media reports to the FSIS recall

[1]See *http : //nltk.org/* for further details.

[2]Details of the Naive Bayes matching algorithm are beyond the scope of this short paper but will be provided in the final draft. See Tumarkin & Whitelaw (2001) and Antweiler & Frank (2004) for applications to finance.

database. This was done by matching the date and keywords specific to a given recall to the date and keywords in a news item. The result was a potentially one to many (or zero) match of recalls to media reports. Thus our primary dataset consists of the product recall information along with the count of published articles that relate to each product recall. This type of aggregated media index has been used as a measure of consumers' awareness of product recalls in previous research (Burton and Young, 1996; Marsh et. al., 2004; Taylor and Phaneuf, 2009).

Table 2 summarizes the news items and the product recall information. Over the period 2001 to 2012 we linked 9551 distinct articles to USDA-FSIS recalls. Almost 44 percent were related to beef products recall followed by processed meat products recall. Recalls due to E. Coli infection had a 29 percent news coverage and 77 percent of the articles were related to the recalls belonging to the class 1 severity.

Google Trend Data

As a measure of consumer awareness of meat recalls, we use information on internet searches provided by Google in the form of Google Trends data. Specifically, Google Trends gives an index of the volume of queries entered into Google in a given geographic region, here the United States. The query index is calculated as:

$$\text{Query Share} = \frac{\text{Number of queries for a search term in a region for that time period}}{\text{Total number of queries in that region for that time period}}$$

The maximum query share in the time period specified is normalized to be 100 and the query share at the initial date being examined is normalized to be zero. As a result, the index depends on period considered[3].

The index is scaled to run from 1 to 100 and if search levels fall below a certain point, Google reports a zero. According to Google's history archive, Google Trends was introduced in the United States in 2006. This may explain why the trends peak start from 2006 onwards. The index reaches a maximum of 100 during the 2008 Westland meat recall, which was the largest recall in United States history.

In our subsequent analysis we analyze the data on internet search in weekly form. For each recall, we link the Google Index in a given week and

[3]For futher details on the construction of the Google Index, see Choi and Varian (2009, 2012).

Table 2: Media Information variables, 2001-2012

	Mean	Standard Deviation	Percentage	Maximum
Beef	14.27	17.29	0.44	193
Pork	9.70	11.61	0.09	67
Poultry	12.12	12.58	0.21	105
Processed Meat	9.68	14.58	0.16	111
Others	10.74	13.77	0.13	105
Reason for Recall				
Listeria	9.47	11.01	0.17	105
E. Coli	16.28	16.11	0.29	85
Salmonella	19.62	21.94	0.06	105
Undeclared Allergen	10.83	13.44	0.16	111
Contamination	10.90	10.39	0.09	77
UnderProcessing/Undercooking	14.20	17.52	0.04	85
Mislabeling and others	9.66	18.03	0.14	193
Severity of Recalll				
Class 1	12.67	14.65	0.77	111
Class 2	11.59	17.97	0.18	193
Class 3	7.39	6.42	0.05	27
Region for Recalll				
West	11.64	13.08	0.29	105
NorthEast	11.48	13.87	0.25	111
South	12.31	14.86	0.32	111
MidWest	11.67	12.67	0.31	88
Nationwide	18.26	23.07	0.22	193

the following week to the week in which a product was recalled. In this way we capture a direct measure of consumer interest in food recalls. Note that when multiple recalls occur in a two week period (as occurs not infrequently), we confound popular interest in one recall with popular interest in another recall. This is a limitation of the Google Trends data and is an issue in the empirical work that follows.

2. Empirical Methods

We regress the natural logarithm of our measure of media attention described above on the characteristics of a given recall.

$$ln(Count)_i = \alpha ln(Quantity)_i + \sum_{j=1}^{J-1} \beta_j Product_{ij} + \sum_{k=1}^{K-1} \gamma_k Class_{ik} + \sum_{l=1}^{L-1} \theta_i Cause_{il} + \mathbf{\Phi}_i + \mathbf{\Psi}_i + u_i \tag{1}$$

where, *Quantity* corresponds to the number of pounds of product recalled, *Product* refers to the type of meat recalled (beef, pork, poultry, processed meats), *Class* corresponds to the USDA-FSIS definition of class of recall, and *Cause* refers to the underlying reason for the recall (bacterial contamination – salmonella, listeria, ecoli –, undeclared allergen, mislabeling, contamination). Finally, we include year ($\mathbf{\Phi}_i$) fixed effects to control for national trends and region ($\mathbf{\Psi}_i$) fixed effects to capture time invariant regional unobservables[4]. Note that in all cases we report heteroskedasticity consistent standard errors (White 1980).

To study the consumer awareness of meat recalls – to the extent that this can be measured by the volume of internet search activity – we regress the Google search index on the set of explanatory variables described above, and the aforementioned measure of media activity, *ln(Count)*. As noted above, Google reports zero when the level of search activity falls below an undisclosed threshold. To account for the truncation, we use a tobit model and set the truncation point just below the lowest observed value of the index over the period[5].

Results

Table 3 contains our main results. The first column contains the results for our main specification presented in Eq 1. In short, we find, perhaps not surprisingly, that the characteristics of a recall explain an important share –

[4]Note that results are robust to including state instead of region fixed effects

[5]The choice of truncation point is admittedly adhoc, though results are robust to choices slightly above and below this minimum.

roughly 30% – of the variation in media coverage of a given recall, though a substantial portion of the variation remains unexplained.

Relative to the omitted category (Others), a beef recall receives 26.9% [6] more coverage and a poultry recall receives roughly 23.4% more coverage. Both of these are significantly different from zero at all conventional levels. The severity of a recall also has a statistically significant and economically important effect on the volume of reporting. Recalls that USDA-FSIS classifies as level one receives 52% more coverage and recalls classified as level two receive roughly 38.8% more coverage. These are relative to recalls classified as level 3, i.e. recalls that do not represent a threat to human health. Recalls caused by bacterial contamination, specifically Salmonella and E.coli, received a greater volume of coverage, 54.4% and 40.6% respectively. Finally, we see that the total quantity of product recalled has an important effect on coverage. A one percent increase in quantity recalled yields a 0.1 percent increase in coverage.

The second column of table 3 contains the estimation results for Google index as the dependent variable. Results show that a beef recall generates a significant amount of Google searches by the consumers as compared to recall of products in the other category. The total quantity of product recalled has significant effect on the Google searches. The media index (count of articles related to the recall) shows an increase in the consumer Google searches for the recall. This implies that the media coverage of the recalls is responsible for generating awareness among the consumers, atleast to some extent.

Discussion and Conclusion

While it is impossible to say what the optimal level of media coverage of a recall should be, our results suggest that the media may under report recalls that pose a higher risk to consumer health (Class 1 recalls) than those which have lower or no health risks. According to our estimates, recalls focused on products that may severely impact human health attract only 52% more articles than recalls of products that do not present any serious health threat. The volume effect also seems small. The

Suggests that there may be some nonlinear relationship. All recalls get some small coverage. Coverage scales with severity and quantity recalled.

[6]Marginal effects are computed as $\exp(0.239) - 1 = 0.269$

Table 3: Results for Measure of Media Attention

	(1) Log(Article Count)	(2) Log(Keyword Count)	(3) Google Index
Beef	0.239**	0.759***	9.959**
	(2.09)	(3.19)	(2.18)
Pork	0.110	0.594**	-0.0546
	(0.90)	(2.57)	(-0.02)
Poultry	0.212**	0.631***	2.751
	(2.04)	(2.85)	(1.02)
Processed Meat	-0.0383	0.175	2.193
	(-0.34)	(0.78)	(0.70)
Severity 1	0.420***	0.592**	2.244
	(3.22)	(2.36)	(0.52)
Severity 2	0.329**	0.295	3.508
	(2.51)	(1.11)	(0.82)
Log(Quantity)	0.106***	0.135***	1.453***
	(8.02)	(5.29)	(2.65)
Number of Regions	0.00949	0.00284	-0.279
	(1.02)	(0.18)	(-1.15)
Listeria	0.0387	0.251	4.835
	(0.32)	(1.09)	(1.44)
Ecoli	0.341**	0.964***	-4.467
	(2.52)	(4.13)	(-0.87)
salmonella	0.435**	0.503	-6.755
	(2.44)	(1.23)	(-1.17)
Allergen	0.143	0.378	1.505
	(1.27)	(1.64)	(0.53)

Table 3: Continued: Results for Measure of Media Attention

	(1) Log(Article Count)	(2) Log(Keyword Count)	(3) Google Index
Contamination	0.148	0.458**	-3.902
	(1.34)	(2.08)	(-0.90)
Underprocessing	0.127	0.462*	-4.291
	(0.67)	(1.75)	(-0.69)
Log(Article Count)			3.261**
			(2.14)
Observations	833	833	458

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Above a certain point, it looks like there is a limit on the amount of media coverage.

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