Costs of Meat and Poultry Recalls to Food Firms

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Recalls of meat, poultry and processed eggs occur under the supervision of the U.S. Department of Agriculture's Food Safety and Inspection Service (FSIS). Typically, meat and poultry products that have already been shipped and distributed into the market and are suspected of being potentially hazardous to public health, are voluntarily recalled by firms either by their own initiative or at the request of FSIS. A recall can occur for many different reasons including: foodborne illness outbreaks; products contaminated with foreign materials; mislabeling; undeclared allergens; underprocessed or undercooked products.

From 1994 to 2013 FSIS reported almost 1,300 meat and poultry recalls, representing approximately 638 million lb. of product. Nearly three-fourths of the recalls correspond to the most severe class of recalls (see box). Such recalls come at the expense of the firms directly involved and can generate substantial economic losses.

As a preventive measure, food firms invest substantial resources to reduce the probability of food safety hazards. However, determining optimal investment is elusive because food contamination incidents are difficult to predict and even more, their probable economic impact is unknown.

Assessing the economic impact that may result from a food recall entails a thorough understanding of the costs incurred by firms. However, direct measurement of a firm's total costs and losses of revenue requires firm-level data that are not generally

FSIS Recall Classification

The most severe class of recalls are Class I. Class I recalls involve a "situation where there is a reasonable probability that the use of the product will cause serious, adverse health consequences or death." For example, these recalls involve meat products contaminated with foodborne bacteria such as *Escherichia coli* O157:H7, *Listeria monocytogenes* or *Salmonella*.

Class II recalls involve a "situation where there is a remote probability of adverse health consequences from the use of the product." For example, a Class II recall is issued when products contain small amounts of undeclared allergens typically associated with milder human reactions.

The least severe class of recalls are Class III. These recalls involve a "situation where the use of the product will not cause adverse health consequences." For example, a Class III recall may involve products that contain excess water.

available. To overcome this limitation, we analyzed price reactions in financial markets during the period surrounding recall events. We expect the effects of a food recall would be rapidly reflected in stock market prices. As such, the magnitude of stock price reactions represents the expected costs incurred by the implicated firms. This magnitude of stock market reactions can be

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used to assess the benefits of implementing new technologies or food safety protocols, and also, adoption of industry food safety management systems (Salin and Hooker, 2001).

Meat and Poultry Recalls from Publicly Traded Firms

FSIS issued a total of 1,271 recalls from January 1994 to December 2013. Among these, we identified 163 recalls from 31 different publicly traded firms. The recalls involve beef, pork, chicken, turkey and other miscellaneous meat products, consisting of a large selection ranging from meat products such as ground beef or sausage, to products where meat is only one of many ingredients such as pizza or soup. Products recalled come in different package presentations and are sold raw, cooked or ready-to-eat.

Recalls from publicly traded firms account for almost 45% of the total amount of product recalled during the past two decades, about 278 million lb. For publicly traded companies, 115 recalls were Class I, 39 Class II, and 9 Class III. Table 1 summarizes the number of recalls by publicly traded firms. ConAgra, Sara Lee and Thorn Apple Valley realized almost 70% of the total product volume recalled by publicly traded firms, whereas ConAgra and Tyson Foods represented 36% of the recalls. Tyson Foods, with the largest number of recalls at 35, is not the company that recalled the largest amount of product having just under 5 million lb. recalled. Sara Lee had the largest product volume recalled with nearly 38 million lb. across 13 recall events.

Stock Price Reactions

We quantified the impact of meat and poultry recalls on the market value of firms by obtaining a measure of abnormal returns – the stock price movement associated with each specific recall. First, using daily stock price data for the 31 public firms in our sample, we calculated actual stock price returns. Then, abnormal returns were calculated as the difference between actual stock price returns, observed during the recall event, and

Table 1. Summary of Meat and Poultry Recalls from Publicly Traded Firms by Firm, 1994-2013.

Ticker	Company	No.	Pounds
AHP	American Home Products	1	150,000
BOBE	Bob Evans Farms Inc.	1	8,500
CAG	ConAgra Inc.	24	114,669,426
COST	Costco Wholesale Corp.	4	222,123
CPB	Campbell Soup Co.	9	16,322,137
DEG	The Delhaize Group	1	Undetermined
DLM	Del Monte Foods Co.	1	31,650
GIS	General Mills Inc.	1	3,300,000
HAIN	The Hain Celestial Group	1	983,700
HFI	Hudson Foods Inc.	5	28,313,959
HNZ	Heinz H. J. Co.	3	94,886
HRL	Hormel Foods Corp.	6	234,946
IBP	IBP Inc.	5	1,160,355
K	Kellogg Co.	1	2,790
KFT	Kraft Foods Inc.	5	28,508
KR	Kroger Co.	3	490,131
NSRGY	Nestle SA	13	1,689,393
PPC	Pilgrim's Pride Corp.	4	28,806,600
SAFM	Sanderson Farms Inc.	1	Undetermined
SFD	Smithfield Foods Inc.	13	1,007,821
SJM	Smucker J. M. Co.	1	3,000
SLE	Sara Lee Corp.	13	37,723,229
SVU	Supervalu Inc.	2	962
SYY	Sysco Corp.	1	16,800
TAVI	Thorn Apple Valley Inc.	2	35,009,936
THS	TreeHouse Foods Inc.	3	214,957
TSN	Tyson Foods Inc.	35	4,854,233
UVV	Universal Corp.	1	578,000
WFM	Whole Foods Market Inc.	1	1,275
WIN	Winn Dixie Stores Inc.	1	1,734,002
WMK	Weis Markets Inc.	1	2,852
Total		**163**	**277,656,171**

predicted stock price returns, expected when there had not been a recall event. Next, abnormal returns were aggregated across time and recall events to estimate the overall impact of meat and poultry recalls on stock price returns. This measure is known as cumulative average abnormal returns (*CAAR*). Table 2 reports the typical cumulative stock price reactions following a recall, as a measure of *CAAR*, for all recall and just for Class I recalls. Results are presented for the day of the recall announcement (day 0) and up to 20 trading days after the recall event.

The "All Recalls column of Table 2 illustrates the typical food recall impact on day zero (recall announcement day) and after.
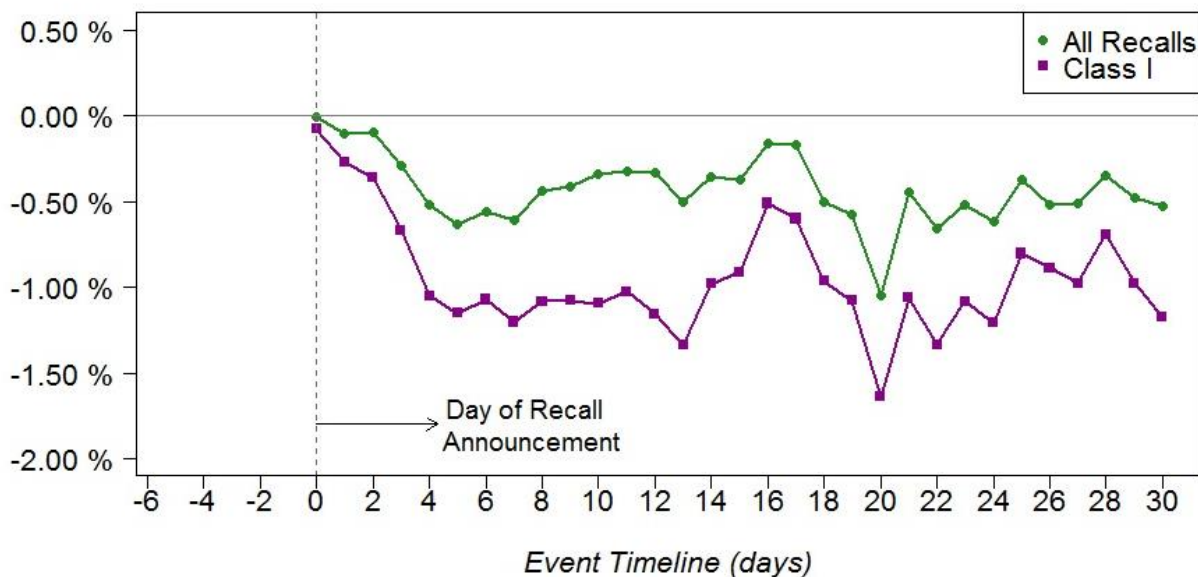
Table 2. Cumulative Stock Price Reactions following a Meat and Poultry Recall (% change in stock price associated with the recall).

Day	All Recalls	Class I
0	-0.01	-0.08
1	-0.10	-0.27 *
2	-0.10	-0.36 *
3	-0.29	-0.67 *
4	-0.52 *	-1.05 *
5	-0.63 *	-1.15 *
10	-0.34 *	-1.09 *
15	-0.37	-0.91 *
20	-1.05 *	-1.64 *

* Indicates that the magnitude is statistically lower than zero at the 0.10 level.

This impact is negative, however, it takes 4 days after the recall event for stock prices to react in a statistically significant way, suggesting that the stock market does not systematically react immediately to all recalls. Regardless of the recall class, stock returns decreased, on average, 0.63% within 5 days after the recall event. Stock price reactions after Class I recalls are larger, in absolute value, as expected since these recalls pose the most human health threat. For example, by day 5 (5 days after the recall announcement) stock returns decreased on average 1.15% after a Class I recall. This means that the average firm in our sample, with 472 million shares of stock outstanding and a $20 per share value on the day of a recall announcement, realized a reduced value of approximately $109 million in market equity 5 days after a recall event. Recognize, some firms realized larger losses and some realized smaller losses, the results in Table 2 are averages across firms and recall events. Class II and Class III recalls did not have statistically significant stock price impacts, suggesting that stock markets tend to only react adversely to Class I recalls likely because of the health risk involved. These findings are consistent with Thomsen and Mckenzie (2001). Figure 1 shows the overall impact of all recalls and Class I recalls in the stock market. Price reactions seem to be persistent over time.

Figure 1. Average Impact of Meat and Poultry Recall in the Stock Market.

Explaining Stock Price Reactions

Critical to prudent investment decisions targeted at reducing product recall probabilities and designing mitigation strategies during such events is understanding what factors drive the magnitude of impact of meat and poultry recalls. Several factors have the potential to influence this magnitude of impact. For instance, the seriousness of the human health risk associated with the event may impact shareholder losses. Moreover, firms recalling a large volume of product would be expected to be impacted more than those experiencing a small-volume recall. The extent of media information accompanying a recall event can decrease consumer demand for the implicated product (Piggott and Marsh, 2004; Schlenker and Villas-Boas, 2009). Therefore, media information can also help explain stock price reactions.

Firm size, scale of operations and levels of diversification may also influence how firm valuation changes in the midst of a food safety breach. Larger, more diversified firms are expected to be more able to weather a food safety recall than small companies. Additionally, a firm's past experience managing recalls can influence the outcome from contamination incidents on the market value of firms (Salin and Hooker, 2001; Wang et al., 2002). That is, firms undertaking an effective food safety crisis management strategy may help minimize stock market reactions.

A description of factors used to explain stock price reactions is presented in table 3. Factors are divided into two groups: those directly related to the recall event or the firm issuing the recall and control factors used to predict stock returns behavior.

Using statistical models we estimated the relationship between each one of these factors and the magnitude of impact of meat and poultry recalls, expressed as *CAAR*. Table 4 presents the marginal effect of each factor on stock price reactions 5, 10 and 15 days after the recall announcement. Focusing on factors that are statistically significant at standard levels, *Recall Size* has a negative impact on stock returns, holding everything else constant. The importance of this factor increases over time following a recall announcement. On average, when the size of a recall increases by 170%, compared with the average recall in our sample of 42,000 lb., stock returns become more negative ranging from -0.27% to -0.42%.

Firm Size indicates that on average, larger firms experience lesser impacts after a recall, holding everything else constant. For example, firms with $11 billion equity (170% larger than the average firm in our sample of

Table 3. Factors Explaining Stock Price Reactions.

Factor	Description	Source
Recall and Firm Related Factors		
Severity (Class)	Class I, Class II and Class III	FSIS
Recall Size	Number of pounds recalled	FSIS
Foodborne Pathogen	Recalls caused by a foodborne pathogen	FSIS
Firm Size	Measured as market equity	Annual Reports
Firm's Experience	Firms involved in a food recall within the last year	FSIS
HACCP	Hazard Analysis Critical Control Points (HACCP) implementation	USDA
Media Index	Number of articles published per recall per day	LexisNexis
Diversification	Production/sales segment of meat and poultry products	Annual Reports
Subsidiary	Recall issued by a subsidiary	Company Website
Cluster	Other recalls within past 10 days	FSIS
Control Factors		
Momentum	Return over previous 12 months	Bloomberg
Initial Shock	Return on event day	Bloomberg
Trading Volume	Percentage of shares outstanding that is traded daily	Bloomberg

Table 4. Effects of Recall and Firm Related factors on Stock Price Returns (%).

Factor	5-Days after Recall	10-Days after Recall	15-Days after Recall
Class I	-0.42	-0.81	-1.06
Class III	0.86	1.55	1.49
Recall Size	-0.27 *	-0.33 *	-0.42 *
Firm Size	0.48 *	0.51	0.40
Pathogen	-0.14	-0.02	0.11
Experience	1.29 *	1.65 *	1.72 *
HACCP	-0.12	-1.12	-1.43
Cluster	0.44	0.43	0.24
Media Index	-0.10 *	-0.11 *	-0.08 *
Diversification	0.51	0.17	0.01
Subsidiary	-0.39	-0.01	-0.21

* Indicates that effect is statistically significant at the 0.10 level.

$4 billion) realize a 0.48% less severe stock return impact 5 days after a recall event.

Experience has a relatively large influence on stock price reactions to recalls. Contrary to logic that firms incurring more than one recall within the past year might reflect more negative impact in stock prices as it could reflect sustained damage to reputation, the effect of this factor is actually positive. Recurrent firms have on average about a 1.29% stronger stock price 5 days after a recall relative to a firm facing its first recall in the past year, holding everything else constant. This result is consistent with Salin and Hooker (2001). Apparently, investors take into consideration the past performance of a company when dealing with product recalls as they adjust firm valuations. When a firm efficiently follows the protocols for managing a recall event and establishes clear communication channels with stakeholders, it sends a good signal to the stock market, and investors appear to be more comfortable that another recall is not as major of a threat as is the first recall in recent history. This does not imply that the second recall is a net positive event for the company, but that the impact of the recall on stock price is likely to be less severe. A firm that survived a recent recall event may provide confidence to investors that the firm can deal effectively with a new recall.

Media Index has a negative impact in stock returns, holding everything else constant. For example, one additional recall-related article published within 5 days after the recall announcement, decreases stock returns by 0.10%, on average.

Implications

Several implications for food companies, particularly regarding recall management arise from our analysis. One implication is related to recall size. Firms should try to rapidly identify contaminated products, perhaps by testing products in smaller lots, so that recalls of massive amounts of product are less likely. Large recalls are immensely costly to the firm and result in sizeable stock price impacts which can potentially result in firm bankruptcies. Regarding firm size, small firms should consider investing more of the total firms' value in food safety technologies and protocols as they have greater risk of bankruptcy in the event of a recall.

Another implication is related to the firm's experience, which is more precisely measuring the experience that recurrent firms have on managing food recalls. Recurrent firms appear to have less stock devaluation for the same recall compared to firms experiencing a recall for the first time. Firms with limited experience handling a food recall, can learn from recurrent firms that have successfully managed food recalls.

The implication of media information is that once news reaches the public, it will have a negative impact on the firm's market value. Therefore, having a plan in place to deal with this situation is important. Recommendations concerning appropriate strategies for managing the influence of media fall outside of the scope of our analysis. Nevertheless, companies need to be ready to implement plans to try to reduce adverse impacts of media while dealing with a food recall.

Finally, since factors such as firm size, recall size and media information can potentially cause substantial shareholder losses, investors may want to know more about the firm's food safety experience and strategy before investing.

For More Information:

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