

EFFECTS OF FOOD RECALLS ON RETAILERS' STOCK PRICE

A Project Paper

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by

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ABSTRACT

With the frequent food recall events, the public has grown increasingly aware of food safety problems in the United States and elsewhere. My project focused on whether food recall events have a significant effect on retailers' stock price. To answer this question, I used the event study method, collected 9 retailers' stock price data from Yahoo Finance and chose 8 major food recall events before 2006 and 2011. Previous studies have shown that the impact of product recall announcements on retailers' financial value. My results indicate that food recall events do affect retailers' stock price. For instance, the stock price of Kroger was affected significantly by Nestlé Toll House cookie dough event and the stock price of Whole Foods Market was affected significantly by Peanut Corporation of America peanut product recall. The degree of the effect was sensitive to the length of event window.

BIOGRAPHICAL SKETCH

Before beginning her MPS degree at Cornell University, Shan Lang earned her two Bachelors of Agricultural Business from Colorado State University and Marketing from China Agricultural University in 2017.

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1. INTRODUCTION

1.1 The concern of food safety in the U.S.

Food safety is one of the biggest issues affecting the U.S. agricultural and food industries today. The U.S. Centers for Disease Control and Prevention estimates that one in six Americans die every year in consequence of food or drink infection. The United States Department of Agriculture (USDA) estimates that food-borne diseases cost more than \$15.6 billion a year. The most recent food recall event in the United States happened in April 2018, which is the romaine lettuce E. coli outbreak. So far, people from 26 states have been affected, especially in California and Pennsylvania (“North Dakota Confirms E. Coli Outbreak Case; 26 States Hit”, 2018). Under this situation, consumers have grown increasingly aware of food safety problem every time the Food and Drug Administration (FDA) or the U.S. Department of Agriculture (USDA) issues a recall (“About FoodSafety.gov”, 2009).

Food recall is proposed to remove food products from commerce when there is reason to believe the products may be adulterated or misbranded. It is as an important step to make sure food safe. Because of the food recall events, large-scale recalls may bankrupt a company and collateral damage often occurs to retailers which sell this product. There is no doubt that, food safety is a growing concern for many consumers since they can hear food recall announcements almost weekly in any newspaper. Although people have come to take our food supply for granted, there still have increasing worries about the food safety and its impact on their health (Senauer, 1989). Although with the development of technologies, food products are safer than ever before to some extent, because of some quality control programs, the safety perception of consumers decreased significantly. With facing the unforeseen health side-effects, the problem is uncertainty.

1.2 Other concerns among food consumers

Related to food safety and consumer health, many people are apprehensive of foods produced with biotechnology, which includes foods that contain genetically modified organisms (GMOs), organic foods, and natural food and so on. However, the discussion about GMO's safety issues never stops. Consumer's concern is a fear of the unknown. The consensus on the safety of GMOs remains to be broadly and uncritically aired. The safety of GMOs is always a controversial topic that has been much debated. The issued results are contradictory because of the range of different research methods, insufficiency of available procedures, and differences in the analysis and explanation of data. In this case, consumers, producers, processors, and politicians would like to support the position that the U.S. should have an adequate, reliable, wholesome, nutritious, high quality, reasonably priced and safe food supply (Senauer, 1989). Based on this trend, USDA regulates many related food labeling policies to ensure food safety and protect public health.

1.3 Policies behind food safety

The Centers for Disease Control (CDC), the U.S. Food and Drug Administration (FDA) and the U.S. Department of Agriculture Food Safety and Inspection Agency are working closely together at the federal level to promote food safety. State and local health departments, the food industry and consumers play a vital role as well ("About FoodSafety.gov", 2009).

The CDC provides an important connection between government agencies and food producers' food safety systems. Government agencies are accountable for making food safety standards, leading inspections, certifying that standards are met, and keeping a strong enforcement program to deal with those who do not obey with standards. On January 4, 2011, the Food Safety

Modernization Act (FSMA), signed into law by President Obama on allows the FDA to better care public health by consolidating the food safety system. It allows FDA pay more attention on preventing food safety problems, instead of responding to problems after they happen (“What Government Does”, 2009).

1.4 U.S. major food recall events

In my project, I selected eight of the biggest food recall events in recent U.S. history. Based on the timeline, the following are the background of these events. In September 2006, five people died and 205 people were sickened by E. Coli after eating contaminated spinach that was grown on a central California farm. At this time, the leafy green industry lost sales of over \$350 million and it greatly affected the sales of packaged spinach for a long time. On March 16 2007, Menu Foods announced the recall of more than 60 million cans and pouches of pet food sold. Moreover, they recalled more than 20 dog biscuit brands sold by Walmart because of contamination. The recall resulted in thousands of consumer complaints that their pets were ill. On February 17 2008, Hallmark recalled of 143 million pounds of beef. It was the largest beef recall event in U.S. history. The Class II recall was released because of a slaughterhouse mistreating cows and unhealthy cattle to be slaughtered without an inspection. On January 13 2009, the Peanut Corporation of America issued one of the largest food recalls for products that included salmonella from the company's contaminated factory in Blakely, Ga., which resulted in total of eight deaths and over 500 illness reported in 43 states. In June 29 2009, Nestlé USA issued a recall of 300,000 cases of refrigerated cookie-dough products for an E. coli risk. The public was notified to throw away packages of Nestlé Toll House refrigerated cookie dough since 65 E. Coli-related illnesses were reported in 29 states. On May 6 2010, Freshway Foods of Sidney, Ohio, published a recall of romaine lettuce

products that were connected to an outbreak of a foodborne illness from E. Coli 0145 bacteria. This lettuce was transported to 23 states. The egg-production companies, Wright County Egg and Hillandale Farms, issued a recall of 550 million eggs on August 13 2010. For 1,500 cases of salmonella poisoning were reported. FDA said that the contaminated shell eggs might link to dirty farm conditions and the size of the farms' chicken cages. On August 3 2011, food producer and marketer Cargill issued a recall of 36 million pounds of ground turkey because it may have been contaminated with a drug-resistant strain of salmonella. The reason was the inadequate cleanup and infected turkeys (“10 Biggest Food Recalls in U.S. History”).

1.5. Overview of the paper

The remainder of my research project is organized as follows. Chapter 2 provides a summary of findings from the literature that study similar research questions. Chapter 3 presents the methodology for an event study and Chapter 4 shows the results from my regression analysis. In the end, Chapter 5 gives my conclusion and some implications of the research question.

2. LITERATURE REVIEW

2.1 Consumers' behaviors and choices

There have been many studies that research in consumers' behaviors and choices. In the consumer survey published in January 1989 by Food Marketing Institute (FMI), people were asked how confident they were about the safety of the food in supermarkets. The result showed that only 23% people responded completely confident (Food Marketing Institute, 1989). The Food Marketing Institute's survey in 2001 indicated that 37% of shoppers said they purchased organically grown food to maintain their health; and 44% of these shoppers had purchased organic food in the last 6 months (Food Marketing Institute, 1989).

Based on the study by Goldman and Clancy, a survey was done among shoppers at a food cooperative in New York State to measure the relationship between organic produce purchases and attitudes related to pesticide use in agriculture, food costs, and other reasons affecting produce buying (Goldman and Clancy, 1991). There are two-fifths of the co-op shoppers surveyed always bought organically grown products, and one-third co-op shoppers are likely to pay 100% over conventional produce for residue-free products. The results showed that co-op shoppers who usually purchased organic produce were less concerned than other shoppers about price. When they were shopping, they were more concerned about food safety. What's more, there was no connection between income and frequency of organic purchases. Major consumers were concerned about pesticide residues in products. They concluded that educators should highlight food safety benefits of organic farming to consumers (Goldman and Clancy, 1991).

2.2 Perspectives from retailers on recall events

Research has shown that the entire supply chain responds to the safety of the products that it processes (Zsidisin et al., 2004), however, many firms have found it is a big challenge to make sure the product safety, especially for those who have large sectors of their supply chains overseas (Marucheck et al., 2011b). Since the numerous geographically supply chain members involved in planning, sourcing, producing and delivering goods to consumers, it is an important step to develop a specific understanding of how the food recall event affects every supply chain member, especially for the retailers.

In most cases, we expect the direct cost for a food recall announcement will be greater for manufacturers than retailers, since retailers do not participate the production of the food that they sell. The manufacturer need to repay retailers expenses associated with the recall. Besides, fines and lawsuits are typically directed at the manufacturer. Thus, the costs of a food recall announcement primarily affect the manufacturer. However, the indirect costs of administering a product recall can be notable for a retailer (Hora et al., 2011). A retailer will be reluctant to spend time on recall-related returns since the retailer will have large costs related with the procedure of receiving recalled products back from consumers, issuing credit or exchange, shipping products back to the manufacturer and so on (Hora et al., 2011). Therefore, although the manufacturers bear the major direct costs related with refunds, exchanges and repair, the retailers are often responsible for receiving recalled products and administering the refunds, which means retailers suffer from the large indirect costs as well; and possible calls due to a damaged reputation. In their study they made one of their hypothesis as the higher the hazard level of a product recalled by a retailer, the more negative the stock market's reaction to a product recall announcement will be. By applying

event study method, they collected the stock price data and recall announcement data (Ni et al., 2011).

Their results indicated that the stock market reaction is more negative with the level of product hazard growths. This important factor has been overlooked by most previous studies on product recall announcements. As a result of the reduction in risk aversion, investors have reacted more strongly to the announcement of the recall of more potentially insecure products, which has led to a greater falling-off in market value. Besides, changes in media attention caused by the media's announcements regarding the recall of product hazards at different levels are important (Ni et al., 2011).

Another study about the financial impact of product recall announcements in China also used an event study methodology to further study this issue (Zhao et al., 2013). As a whole, their findings are consistent with prior research that product recalls cause negative abnormal returns. The objectives they studied includes automobile industry, food industry, electronics industry and pharmaceuticals industry. They proposed that a product recall announcement is associated with a negative abnormal return on stock price and a product recall announcement in the food industry will be associated with a more negative standardized abnormal return than one in the automotive industry. They chose product recall announcements for companies whose common stock was listed on the Shenzhen A Share Stock Exchange and the Shanghai A Share Stock Exchange. They used the event study methodology as well, based on daily stock prices, to estimate the impact of a product recall announcement on shareholder wealth. Their results showed that companies in the food industry countered more severely to product recall announcements. Firms in the food industry

are more likely to adopt inactive recall strategies. On the other hand, firms in the automotive industry reacted less to the announcement, which means that even if there are no accidents, cars will also be recalled more frequently because companies in the auto industry are more likely to adopt active recall strategies (Zhao et al., 2013).

After learning from the previous studies, I decided to further research the effects of recall events. Instead of the broad research of product recall, I will focus on the significant food recall events. From my perspective, food recall is not only a public health issue, but also critical finance issues. The average cost of a recall to a food company is \$10M in direct costs, in addition to brand damage and lost sales. Moreover, the costs for larger brands may be significantly higher based on the preliminary recall costs reported by firms of some recent recalls.

Thus, in my project, I studied the effect of significant food recall events to major retailers in U.S. I chose nine typical food retailers in the U.S. as the objects of study. They are Walmart (WMT), Target (TGT), Costco(COST), Kroger Co. (KR), Whole Foods Market (WFM), Village Super Market (VLGEA), Ingles Markets (IMKTA), Weis Markets(WMK) and SpartanNash (SPTN). Based on the capital size, I separated them as two groups. Group one is the large capital supermarkets which includes Walmart (WMT), Target (TGT), Costco(COST), Kroger Co. (KR), Whole Foods Market (WFM). Group two is the small or medium supermarkets which is composed of Village Super Market (VLGEA), Ingles Markets (IMKTA), Weis Markets(WMK) and SpartanNash (SPTN). By comparing the difference between the two groups, I also can know if the capital size will affect the results. Prior study found that investors adjust their firm valuation based on their anticipation of the future financial consequences of a recall event announcement (Folkes,

1984). Consumers' reaction about a recall event may result in engaging in disapproving behaviors, like negative words or public boycotts (Folkes, 1984). The increasing negative publicity will lead to more lost sales and reduction in a retailer's financial value. Besides, a food recall announcement will also appeal much media attention, resulting in greater disutility by shareholders. Thus, in my project, I will use stock returns as the indicator of retailer's financial value. Like the most prior studies, I also used event study as an empirical tool to measure the response of stock returns to changes in the food retailer industry resulting from food recall events from the beginning of 2006 to the end of 2011.

Figure 1. Number of recalls by retailer and year.

Retailers	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Walmart	2	6	4	8	2	8	10	4	9	13
Target	1	2	4	3	5	8	5	9	4	6
Kroger							1			1
Walgreen	1	1		1						1
Costco									2	
Home Depot	3		2		3	4	3	3	2	4
CVS Caremark						1	1	1		
Lowe's			1	1	2	1	1	1	2	2
Best Buy						1		1	1	1
Safety										1

Source: Ni et al., 2011

3. METHODOLOGY

An event study is a statistical method to assess the impact of an event on the value of a firm. As the event study can be used to elicit the effects of any type of event on the direction and magnitude of stock price changes, it is very versatile. Event studies are thus common to various research areas, such as accounting and finance, management, economics, marketing, information technology, law, and political science.

Event studies have a long history. In 1933, James Dolley first published the concept of event study. In Dolley's work, he observed the price effects of stock splits, learning nominal price changes at the time of the split. Event study is a potentially important way to assess the dynamic effects. It can track the stock price for a period of time around a specific event, which includes the performance before, during and after the event (King, et al., 2002).

Event study has many practical applications. In finance study, event study often be applied to a large number of firm specific event, such as mergers and acquisitions, announcements, issues of debt or equity. Moreover, event studies also applied in the field of law and economics to measure the impact on the value of a firm of a change in the regulatory environment (Schwert, 1981) and in legal liability cases event studies are used to assess damages (Mitchell and Netter, 1994). Specially, event studies imply the following: Based on an estimation window prior to the analyzed event, the method estimates what the normal stock returns of the affected firm(s) should be at the day of the event and several days prior and after the event (i.e., during the event window). Thereafter, the method deducts this 'normal returns' from the 'actual returns' to receive 'abnormal returns' attributed to the event.

To examine the influence of the food recall on food retailer stock performance in U.S., I used the event-study methodology (ESM), which is always used to measure the effect of an economic event on the stock returns of a firm.

The ESM allows me to separate the component of stock price movement due to the firm-specific events from that due to market-wide movements. The component attributed to firm-specific events like the food recall event is called abnormal return (AR). AR is the difference between actual return and expected return at the time of the event.

$$(1) \quad \text{abnormal return(AR)} = \text{actual return} - \text{expected return}$$

Normally, AR will be positive if an announcement of an event is good news, which means that the market believes that the event will increase the firm's value. On the other hand, a negative AR indicates bad news. At this time, the market believes that the event would decrease the firm's value.

I also need to calculate the cumulative mean abnormal return (CAR) on an event date so as to follow up the valuation impact of that event. In this case, by testing the statistical significance of the CAR, if it is statistically different from zero, I can say that this food recall significantly effects stock prices. For getting the AR of stocks, I chose the market model (MM), which is used most often.

Firstly, the S&P 500 index and nine retailers' stock prices over 2006-2011 are shown in Figure 2 to see the general effects at the points of food recalls.

Figure 2. Market Index Change across Time.

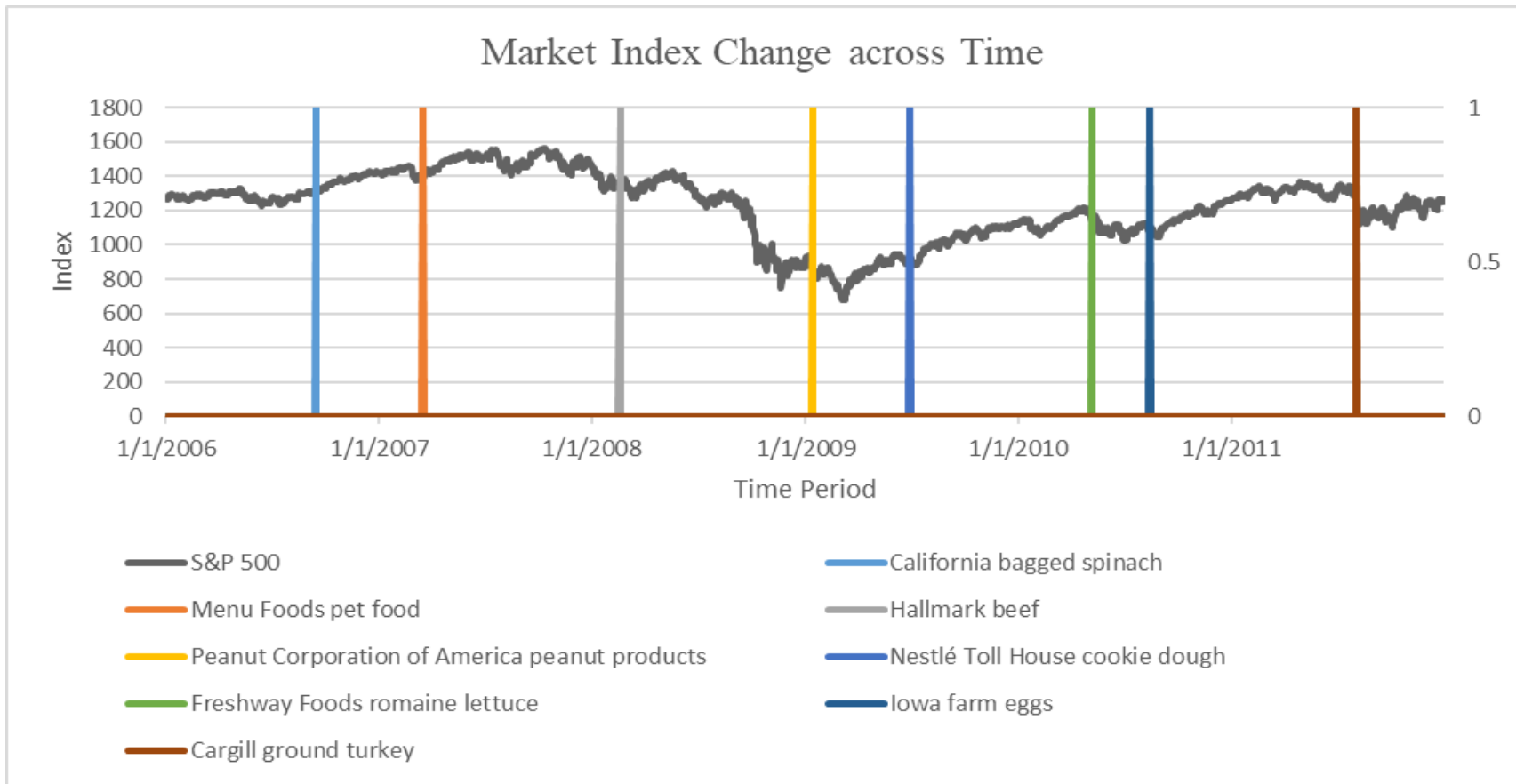
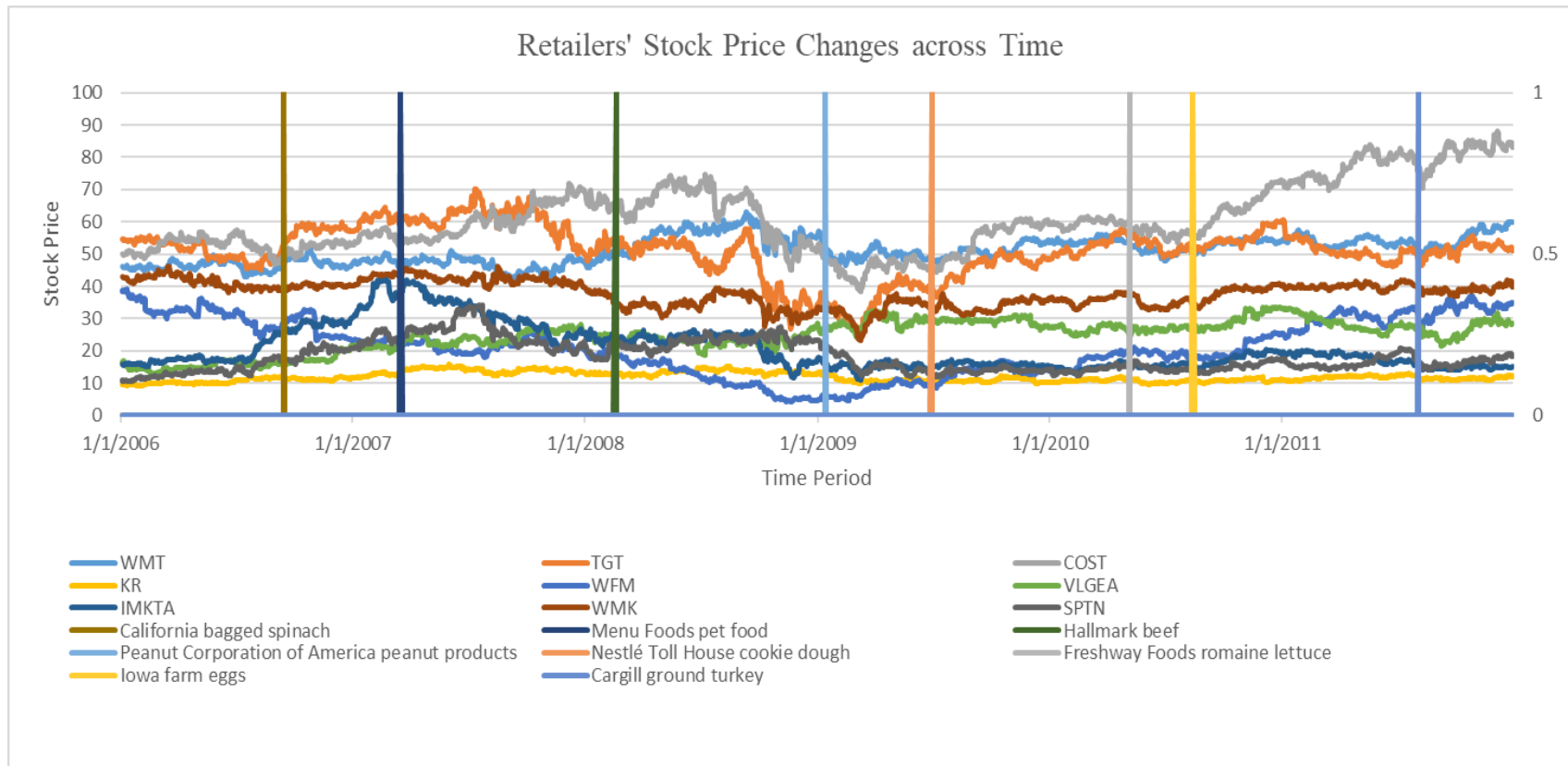


Figure 3. Retailers' Stock Price Changes across Time.



Then I calculated the actual return of each stocks in equation (2)

$$(2) \quad R_{it} = \ln(P_{it} / P_{it-1}) * 100$$

Where:

R_{it} is the return of stock i on day t

P_{it} is the closing price of stock i on day t

P_{it-1} is the closing price of stock i on day t-1

The stock return to stock i at time t can expressed as the following linear function in equation (3):

$$(3) \quad R_{it} = A_i + \beta_i R_{mt} + e_{it}$$

Where:

A_i is the firm-specific constant

β_i is the estimate of the true parameter obtained via ordinary least squares (OLS) regression

R_{mt} is the market return on day t, the average of returns for all firms included in the market index

e_{it} is the normally distributed random error term that is uncorrelated with the market return with zero mean and constant variance

$\beta_i = cov(R_{it}, R_{mt}) / var(R_{mt})$ stands for the sensitivity of an individual stock return to the market return, which is also a measure of risk. I selected nine retailers. R1 Walmart (WMT), R2 Target (TGT), R3 Costco(COST), R4 Kroger Co. (KR), R5 Whole Foods Market (WFM), R6 Village Super Market (VLGEM), R7 Ingles Markets (IMKTA), R8 Weis Markets(WMK), R9 SpartanNash (SPTN), Rg1 (R1-R5), Rg2 (R6-R9) and Ravg (R1-R9).

I used an OLS regression to estimate the β_i and ϕ_{is} in equation (4):

$$(4) \quad R_{it} = A_i + \beta_i R_{mt} + \sum_{s=1}^8 \phi_{is} D_s + e_{it}$$

Where:

D_s is a dummy variable for event s

H0: the food recall event did not affect retailers' stock price.

H1: the food recall event affected retailers' stock price.

Since the investigation shows food companies took an average of 57 days to recall items after the FDA was informed of the potential danger, I included 57 days (in market) after food recall announcement as "1". The others are "0". I chose eight events of major food recalls happened during 2006-2011. California bagged spinach (1) Menu Foods pet food (2) Hallmark beef (3) Peanut Corporation of America peanut products (4) Nestlé Toll House cookie dough (5) Freshway Foods romaine lettuce (6) Iowa farm eggs (7) Cargill ground turkey (8)

For further analyzing which week has the most significant effect, I made the following hypotheses:

H0: each week has the same effect on retailers' stock price.

H1: at least one week has the different effect on retailers' stock price.

Take the 20-week event window, 10 weeks after each announcement date and 10 weeks before that. For analyzing the CAR over the w -week event window, the regression in equation (5) employs dummy variables corresponding to the weeks of the event window

$$(5) \quad R_{it} = A_i + \beta_i R_{mt} + \sum_{s=1}^w \Phi_{is} D_s + e_{it}$$

Where:

D_s is a dummy variable for week s

For searching if the effect is sensitive to the length of event window, I calculated cases of 20-week, 16-week, 12-week, 8-week, and 4-week event window (where $w=20, 16, 12, 8, 4$) separately to observe the difference.

4. RESULTS:

Table 1 presents the relationships between the return of nine retailers to the general market return. The first row shows the basic relations between retailers and the market return. We can see that except for Target and Ingles Markets, the others do not have a same trend of market return. In the second row, I researched the difference when I add eight event dummy variables. Then, the next five rows show that when I add the different event windows what is the relationships looks like.

In the Table 2, I run the regression between nine retailers and eights events, the data showed the relationships between each retail and event. At the 90% significant level, we can say that for Kroger, the coefficient of Nestlé Toll House cookie dough event is statistically significant and for Whole Foods Market, the coefficient of Peanut Corporation of America peanut products is statistically significant as well.

Next, I further researched the event windows' effect of each events. The table 3 showed the 20 weeks' event window, at this time, I found that at the 90% significant level, for Walmart, the coefficients of Week 4, Week 14 and Week 19 are statistically significant; for Target, the coefficients of Week 5 and Week 10 are statistically significant; for Kroger, the coefficient of Week 13 is statistically significant; for Whole Foods Market, the coefficients of Week 10, Week 14 and Week 16 are statistically significant; for Village Super Market, the coefficient of Week 10 is statistically significant; for Ingles Markets, the coefficients of Week 3 and Week 6 are statistically significant; for Weis Markets, the coefficient of Week 15 is statistically significant. For group 1 retailers, the coefficient of Week 14 is statistically significant; for group 2 retailers, the coefficient of Week 6 is statistically significant.

Table 4 showed the 16 weeks' event window. Here, I found that at the 90% level, for Walmart, the coefficients of Week 4 and Week 14 are statistically significant; for Target, the coefficients of Week 5 and Week 10 are statistically significant; for Costco, the coefficient of Week 9 is statistically significant; for Kroger, the coefficient of Week 13 is statistically significant; for Whole Foods Market, the coefficients of Week 10, Week 14 and Week 16 are statistically significant; for Village Super Market, the coefficient of Week 10 is statistically significant; for Ingles Markets, the coefficients of Week 3 and Week 6 are statistically significant; for Weis Markets, the coefficients of Week 13 and Week 15 are statistically significant; for group 1 retailers, the coefficient of Week 14 is statistically significant; for group 2 retailers, the coefficients of Week 6 and Week 10 are statistically significant.

Table 5 presented the 12 weeks' event window. These results showed that at the 90% significant level, for Walmart, the coefficient of Week 14 is statistically significant; for Target, the coefficients of Week 5 and Week 10 are statistically significant; for Costco, the coefficient of Week 9 is statistically significant; for Kroger, the coefficient of Week 13 is statistically significant; for Whole Foods Market, the coefficients of Week 10, Week 14 and Week 16 are statistically significant; for Village Super Market, the coefficient of Week 10 is statistically significant; for Ingles Markets, the coefficient of Week 6 is statistically significant; for Weis Markets, the coefficients of Week 13 and Week 15 are statistically significant; for group 1 retailers, the coefficient of Week 14 is statistically significant; for group 2 retailers, the coefficients of Week 6 and Week 10 are statistically significant.

Table 6 revealed the 8 weeks' event window. Based on it, I realized that at the 90% significant level, for Walmart, the coefficient of Week 14 is statistically significant; for Target, the coefficient of Week 10 is statistically significant; for Kroger, the coefficient of Week 13 is statistically significant; for Whole Foods Market, the coefficients of Week 10 and Week 14 are statistically significant; for Week 6, the coefficient of Week 10 is statistically significant; for group 1 retailers, the coefficients of Week 10 and Week 14 are statistically significant; for group 2 retailers, the coefficient of Week 10 is statistically significant.

Finally, table 7 indicated the results from the 4-week event window. Results here presented that at the 90% significant level, for Target, the coefficient of Week 10 is statistically significant; for Whole Foods Market, the coefficient of Week 10 is statistically significant; for Village Super Market, the coefficients of Week 10 and Week 11 are statistically significant; for group 2 retailers, the coefficient of Week 10 is statistically significant.

Table 1. Relationships between the return of retailers and market return

	Walmart	Target	Costco	Kroger	Whole Foods Market	Village Super Market	Ingles Markets	Weis Markets	SpartanNash
Just add market return	0.598	0.979	0.699	0.574	1.065	0.826	1.097	0.701	0.821
Market return (add 8 events)	0.529	0.979	0.698	0.576	1.066	0.828	1.098	0.703	0.821
Market return (add 20 weeks)	0.531	0.980	0.699	0.577	1.067	0.831	1.092	0.699	0.822
Market return (add 16 weeks)	0.529	0.979	0.697	0.576	1.068	0.829	1.094	0.700	0.820
Market return (add 12 weeks)	0.530	0.980	0.698	0.576	1.069	0.827	1.097	0.701	0.821
Market return (add 8 weeks)	0.530	0.981	0.698	0.576	1.068	0.827	1.095	0.702	0.820
Market return (add 4 weeks)	0.529	0.982	0.698	0.573	1.067	0.827	1.098	0.701	0.820

Table 1. Continued

	Group 1 retailers	Group 2 retailers	Average 9 retailers
Just add market return	0.770	0.861	0.810
Market return (add 8 events)	0.770	0.862	0.811
Market return (add 20 weeks)	0.771	0.861	0.811
Market return (add 16 weeks)	0.770	0.861	0.810
Market return (add 12 weeks)	0.771	0.862	0.811
Market return (add 8 weeks)	0.771	0.861	0.811
Market return (add 4 weeks)	0.770	0.861	0.811

Table 2: CAR across the 8 food safety recall events

	California bagged spinach	Menu Foods pet food	Hallmark beef	Peanut Corporation of America peanut products
Walmart	-0.134 (-0.91))	0.087 (0.59)	0.216 (1.48)	0.105 (0.72)
Target	0.069 (0.31)	-0.000 (-0.00)	-0.064 (-0.29)	0.151 (0.68)
Costco	0.038 (0.22)	-0.031 (-0.18)	0.135 (0.79)	0.010 (0.06)
Kroger	-0.173 (-0.87)	0.046 (0.23)	-0.122 (-0.61)	-0.260 (-1.31)
Whole Foods Market	-0.397 (-1.15)	-0.353 (-1.03)	-0.301 (-0.87)	0.765 (2.22)
Village Super Market	0.043 (0.15)	-0.026 (-0.09)	-0.055 (-0.19)	0.433 (1.46)
Ingles Markets	0.023 (0.08)	-0.278 (-0.93)	-0.197 (-0.66)	0.113 (0.38)
Weis Markets	-0.048 (-0.25)	-0.172 (-0.89)	-0.235 (-1.22)	-0.038 (-0.20)
SpartanNash	0.149 (0.42)	0.116 (0.33)	-0.245 (-0.69)	-0.376 (-1.06)
Group 1 retailers	-0.119 (-0.95)	-0.050 (-0.40)	-0.027 (-0.22)	0.154 (1.23)
Group 2 retailers	0.042 (0.24)	-0.090 (-0.51)	-0.183 (-1.03)	0.033 (0.18)
Average 9 retailers	-0.047 (-0.42)	-0.068 (-0.60)	-0.096 (-0.85)	0.100 (0.88)

Table 2. Continued

	Nestlé Toll House cookie dough	Freshway Foods romaine lettuce	Iowa farm eggs	Cargill ground turkey
Walmart	-0.095 (-0.65)	-0.089 (-0.61)	0.050 (0.34)	0.175 (1.20)
Target	0.128 (0.58)	-0.029 (-0.13)	-0.075 (-0.34)	0.234 (1.05)
Costco	0.197 (1.14)	-0.049 (-0.28)	0.107 (0.62)	0.211 (1.22)
Kroger	-0.345 (-1.73)	-0.117 (-0.59)	-0.112 (-0.56)	-0.117 (-0.59)
Whole Foods Market	0.424 (1.23)	0.097 (0.28)	0.030 (0.09)	0.267 (0.78)
Village Super Market	-0.296 (-1.00)	0.169 (0.57)	0.068 (0.23)	0.013 (0.04)
Ingles Markets	-0.125 (-0.42)	0.210 (0.70)	0.209 (0.70)	-0.063 (-0.21)
Weis Markets	-0.259 (-1.34)	-0.074 (-0.38)	0.094 (0.49)	-0.022 (-0.12)
SpartanNash	-0.070 (-0.20)	-0.028 (-0.08)	0.077 (0.22)	0.044 (0.13)
Group 1 retailers	0.061 (0.49)	-0.037 (-0.30)	0.000 (0.00)	0.154 (1.23)
Group 2 retailers	-0.187 (-1.05)	0.069 (0.39)	0.112 (0.63)	-0.007 (-0.04)
Average 9 retailers	-0.049 (-0.43)	0.010 (0.09)	0.050 (0.44)	0.082 (0.72)

Table 3. CAR over the 20-week event window

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Walmart	0.210 (1.39)	0.004 (0.03)	0.024 (0.16)	-0.296 (-1.97)	0.036 (0.24)	-0.064 (-0.43)	0.005 (0.04)
Target	0.112 (0.50)	0.198 (0.87)	0.181 (0.80)	-0.132 (-0.58)	-0.403 (-1.77)	0.139 (0.61)	0.302 (1.33)
Costco	0.158 (0.89)	0.138 (0.78)	-0.033 (-0.19)	-0.220 (-1.25)	-0.268 (-1.51)	-0.192 (-1.09)	0.093 (0.53)
Kroger	0.164 (0.80)	0.002 (0.01)	0.049 (0.24)	0.013 (0.07)	0.150 (0.73)	0.031 (0.15)	0.080 (0.39)
Whole Foods Market	-0.147 (-0.42)	-0.334 (-0.95)	-0.329 (-0.93)	-0.227 (-0.65)	-0.020 (-0.06)	-0.283 (-0.80)	0.123 (0.35)
Village Super Market	0.407 (1.34)	-0.115 (-0.38)	-0.294 (-0.97)	0.253 (0.83)	-0.331 (-1.09)	0.341 (1.12)	0.002 (0.01)
Ingles Markets	-0.160 (-0.52)	-0.137 (-0.45)	0.619 (2.01)	-0.189 (-0.61)	-0.011 (-0.04)	0.766 (2.49)	0.356 (1.16)
Weis Markets	-0.075 (-0.38)	-0.215 (-1.09)	0.284 (1.44)	0.127 (0.64)	0.077 (0.39)	-0.121 (-0.61)	0.069 (0.35)
SpartanNash	0.509 (1.41)	-0.069 (-0.19)	0.462 (1.28)	-0.018 (-0.05)	-0.254 (-0.70)	0.372 (1.03)	-0.298 (-0.82)
Group 1 retailers	0.099 (0.77)	0.001 (0.01)	-0.021 (-0.17)	-0.172 (-1.35)	-0.101 (-0.79)	-0.073 (-0.57)	0.121 (0.94)
Group 2 retailers	0.170 (0.93)	-0.134 (-0.74)	0.267 (1.47)	0.043 (0.24)	-0.129 (-0.71)	0.339 (1.86)	0.032 (0.18)
Average 9 retailers	0.130 (1.12)	-0.058 (-0.50)	0.107 (0.92)	-0.076 (-0.66)	-0.113 (-0.97)	0.110 (0.94)	-0.081 (0.70)

Table 3. Continued

	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
Walmart	0.057 (0.38)	-0.038 (-0.25)	-0.093 (-0.62)	0.006 (0.04)	-0.026 (-0.18)	-0.100 (-0.66)	0.316 (2.09)
Target	0.236 (1.04)	-0.031 (-0.14)	0.416 (1.83)	0.251 (1.10)	0.103 (0.45)	-0.032 (-0.14)	-0.040 (-0.18)
Costco	-0.174 (-0.99)	-0.267 (-1.51)	-0.158 (-0.89)	-0.093 (-0.53)	-0.063 (-0.36)	-0.010 (-0.06)	0.168 (0.95)
Kroger	-0.116 (-0.57)	0.058 (0.28)	0.080 (0.39)	-0.106 (-0.52)	-0.310 (-1.51)	-0.421 (-2.05)	0.051 (0.25)
Whole Foods Market	0.418 (1.18)	-0.164 (-0.46)	0.705 (1.99)	-0.168 (-0.48)	0.041 (0.12)	0.060 (0.17)	1.038 (2.94)
Village Super Market	0.071 (0.24)	0.278 (0.91)	-0.503 (-1.65)	0.472 (1.55)	0.293 (0.96)	-0.024 (-0.08)	-0.308 (-1.01)
Ingles Markets	0.098 (0.32)	0.086 (0.28)	0.096 (0.31)	0.144 (0.47)	0.317 (1.03)	0.177 (0.58)	-0.072 (-0.24)
Weis Markets	0.017 (0.09)	0.151 (0.76)	-0.239 (-1.21)	-0.002 (-0.02)	0.169 (0.85)	-0.325 (-1.64)	-0.110 (-0.56)
SpartanNash	0.386 (1.07)	-0.159 (-0.44)	-0.520 (-1.43)	0.192 (0.53)	-0.090 (-0.25)	0.014 (0.04)	-0.217 (-0.60)
Group 1 retailers	0.084 (0.65)	-0.088 (-0.69)	0.190 (1.48)	-0.022 (-0.17)	-0.051 (-0.40)	-0.100 (-0.78)	0.306 (2.39)
Group 2 retailers	0.143 (0.78)	0.089 (0.49)	-0.291 (-1.59)	0.201 (1.10)	0.172 (0.94)	-0.039 (-0.21)	-0.177 (-0.97)
Average 9 retailers	0.110 (0.94)	-0.009 (-0.08)	-0.023 (-0.20)	0.077 (0.66)	0.048 (0.41)	-0.073 (-0.63)	0.091 (0.78)

Table 3. Continued

	Week 15	Week 16	Week 17	Week 18	Week 19	Week 20
Walmart	-0.031 (-0.21)	-0.105 (-0.70)	0.002 (0.02)	-0.006 (-0.04)	-0.249 (-1.66)	-0.049 (-0.33)
Target	0.007 (0.03)	0.263 (1.15)	0.046 (0.20)	0.152 (0.67)	0.024 (0.11)	0.064 (0.29)
Costco	0.112 (0.63)	-0.072 (-0.41)	0.204 (1.15)	-0.097 (-0.55)	-0.169 (-0.96)	0.193 (1.10)
Kroger	-0.160 (-0.78)	0.021 (0.11)	-0.060 (-0.29)	-0.054 (-0.27)	0.143 (0.70)	0.044 (0.22)
Whole Foods Market	-0.015 (-0.04)	-0.745 (-2.11)	0.173 (0.49)	0.284 (0.81)	-0.318 (-0.90)	0.200 (0.57)
Village Super Market	0.009 (0.03)	-0.020 (-0.07)	-0.173 (-0.57)	0.040 (0.13)	0.436 (1.44)	0.054 (0.18)
Ingles Markets	-0.283 (-0.92)	0.018 (0.06)	-0.067 (-0.22)	-0.014 (-0.05)	0.219 (0.71)	-0.097 (-0.32)
Weis Markets	-0.396 (-2.00)	-0.179 (-0.91)	0.134 (0.68)	0.000 (0.00)	0.008 (0.04)	0.261 (1.32)
SpartanNash	-0.144 (-0.40)	-0.428 (-1.18)	-0.065 (-0.18)	0.028 (0.08)	0.476 (1.32)	-0.098 (-0.27)
Group 1 retailers	-0.017 (-0.14)	-0.127 (-0.99)	0.073 (0.57)	0.055 (0.43)	-0.113 (-0.89)	0.090 (0.71)
Group 2 retailers	-0.203 (-1.11)	-0.152 (-0.83)	-0.043 (-0.24)	0.013 (0.08)	0.285 (1.56)	0.029 (0.16)
Average 9 retailers	-0.100 (-0.85)	-0.138 (-1.18)	0.021 (0.18)	0.037 (0.32)	0.063 (0.54)	0.063 (0.55)

Table 4. CAR over the 16-week event window

	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10
Walmart	0.008 (0.06)	-0.294 (-1.97)	0.041 (0.28)	-0.059 (-0.40)	0.010 (0.07)	0.061 (0.41)	-0.058 (-0.39)	-0.093 (-0.62)
Target	0.165 (0.73)	-0.150 (-0.67)	-0.425 (-1.88)	0.117 (0.52)	0.279 (1.24)	0.211 (0.93)	-0.053 (-0.24)	0.400 (1.77)
Costco	-0.048 (-0.28)	-0.224 (-1.27)	-0.285 (-1.62)	-0.209 (-1.19)	0.076 (0.43)	-0.194 (-1.10)	-0.305 (-1.73)	-0.157 (-0.89)
Kroger	0.043 (0.21)	-0.002 (-0.01)	0.130 (0.64)	0.011 (0.06)	0.059 (0.29)	-0.137 (-0.68)	0.051 (0.25)	0.068 (0.33)
Whole Foods Market	-0.301 (-0.86)	-0.177 (-0.51)	0.014 (0.04)	-0.247 (-0.71)	0.160 (0.46)	0.458 (1.31)	-0.158 (-0.45)	0.758 (2.16)
Village Super Market	-0.301 (-1.00)	0.213 (0.71)	-0.375 (-1.24)	0.297 (0.98)	-0.044 (-0.15)	0.025 (0.08)	0.276 (0.91)	-0.532 (-1.75)
Ingles Markets	0.636 (2.08)	-0.186 (-0.61)	-0.002 (-0.01)	0.775 (2.54)	0.366 (1.20)	0.109 (0.36)	0.120 (0.39)	0.097 (0.32)
Weis Markets	0.306 (1.56)	0.148 (0.75)	0.079 (0.41)	-0.119 (-0.60)	0.071 (0.36)	0.022 (0.11)	0.155 (0.79)	-0.210 (-1.06)
SpartanNash	0.444 (1.23)	-0.071 (-0.20)	-0.300 (-0.83)	0.326 (0.91)	-0.347 (-0.96)	0.337 (0.94)	-0.159 (-0.44)	-0.565 (-1.57)
Group 1 retailers	-0.026 (-0.21)	-0.170 (-1.33)	-0.104 (-0.82)	-0.077 (-0.61)	0.117 (0.92)	0.079 (0.62)	-0.104 (-0.82)	0.195 (1.53)
Group 2 retailers	0.271 (1.49)	0.025 (0.14)	-0.149 (-0.82)	0.320 (1.76)	0.011 (0.06)	0.123 (0.68)	0.098 (0.54)	-0.302 (-1.66)
Average 9 retailers	0.105 (0.91)	-0.082 (-0.71)	-0.124 (-1.07)	0.099 (0.85)	0.070 (0.60)	0.099 (0.85)	-0.014 (-0.13)	-0.025 (-0.22)

Table 4. Continued

	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16	Week 17	Week 18
Walmart	0.034 (0.23)	-0.019 (-0.13)	-0.091 (-0.61)	0.322 (2.15)	-0.026 (-0.17)	-0.099 (-0.66)	0.024 (0.16)	0.015 (0.10)
Target	0.242 (1.07)	0.099 (0.44)	-0.055 (-0.24)	-0.063 (-0.28)	-0.014 (-0.07)	0.240 (1.06)	0.032 (0.14)	0.152 (0.68)
Costco	-0.090 (-0.51)	-0.067 (-0.38)	-0.026 (-0.15)	0.149 (0.85)	0.095 (0.54)	-0.088 (-0.50)	0.199 (1.13)	-0.091 (-0.52)
Kroger	-0.110 (-0.54)	-0.332 (-1.63)	-0.442 (-2.17)	0.031 (0.15)	-0.180 (-0.88)	0.002 (0.01)	-0.068 (-0.33)	-0.062 (-0.31)
Whole Foods Market	-0.147 (-0.42)	0.044 (0.13)	0.096 (0.27)	1.072 (3.06)	0.019 (0.06)	-0.710 (-2.02)	0.198 (0.56)	0.285 (0.81)
Village Super Market	0.465 (1.54)	0.231 (0.76)	-0.071 (-0.24)	-0.352 (-1.16)	-0.034 (-0.11)	-0.064 (-0.21)	-0.187 (-0.62)	0.017 (0.06)
Ingles Markets	0.134 (0.44)	0.312 (1.02)	0.185 (0.61)	-0.062 (-0.21)	-0.273 (-0.90)	0.027 (0.09)	-0.071 (-0.23)	-0.027 (-0.09)
Weis Markets	-0.007 (-0.04)	0.148 (0.75)	-0.326 (-1.66)	-0.110 (-0.56)	-0.394 (-2.00)	-0.177 (-0.90)	0.131 (0.67)	-0.018 (-0.09)
SpartanNash	0.191 (0.53)	-0.149 (-0.42)	-0.033 (-0.09)	-0.262 (-0.73)	-0.190 (-0.53)	-0.474 (-1.32)	-0.074 (-0.21)	0.014 (0.04)
Group 1 retailers	-0.014 (-0.11)	-0.055 (-0.43)	-0.103 (-0.81)	0.302 (2.37)	-0.021 (-0.17)	-0.131 (-1.03)	0.077 (0.60)	0.059 (0.47)
Group 2 retailers	0.196 (1.07)	0.135 (0.74)	-0.061 (-0.34)	-0.197 (-1.08)	-0.223 (-1.23)	-0.172 (-0.95)	-0.050 (-0.28)	-0.003 (-0.02)
Average 9 retailers	0.079 (0.68)	0.029 (0.25)	-0.085 (-0.73)	0.080 (0.69)	-0.110 (-0.95)	-0.149 (-1.28)	0.020 (0.18)	0.031 (0.27)

Table 5. CAR over the 12-week event window

	Week 5	Week 6	Wek 7	Week 8	Week 9	Week 10
Walmart	0.054 (0.37)	-0.046 (-0.31)	0.026 (0.18)	0.077 (0.52)	-0.044 (-0.30)	-0.079 (-0.53)
Target	-0.435 (-1.94)	0.107 (0.48)	0.271 (1.21)	0.217 (0.97)	-0.062 (-0.28)	0.389 (1.73)
Costco	-0.276 (-1.58)	-0.201 (-1.15)	0.106 (0.61)	-0.191 (-1.09)	-0.297 (-1.70)	-0.147 (-0.84)
Kroger	0.134 (0.67)	0.015 (0.08)	0.057 (0.29)	-0.140 (-0.69)	0.055 (0.27)	0.073 (0.36)
Whole Foods Market	0.014 (0.04)	-0.247 (-0.71)	0.180 (0.52)	0.491 (1.41)	-0.153 (-0.44)	0.758 (2.17)
Village Super Market	-0.362 (-1.21)	0.310 (1.03)	-0.048 (-0.16)	0.038 (0.13)	0.290 (0.97)	-0.518 (-1.72)
Ingles Markets	-0.019 (-0.06)	0.758 (2.49)	0.338 (1.11)	0.085 (0.28)	0.100 (0.33)	0.078 (0.26)
Weis Markets	0.051 (0.26)	-0.147 (-0.75)	0.053 (0.27)	-0.009 (-0.05)	0.122 (0.63)	-0.241 (-1.24)
SpartanNash	-0.315 (-0.88)	0.310 (0.87)	-0.373 (-1.04)	0.319 (0.89)	-0.177 (-0.50)	-0.582 (-1.63)
Group 1 retailers	-0.101 (-0.80)	-0.074 (-0.59)	0.128 (1.01)	0.090 (0.72)	-0.100 (-0.79)	0.198 (1.57)
Group 2 retailers	-0.161 (-0.89)	0.308 (1.70)	-0.007 (-0.04)	0.108 (0.60)	0.084 (0.47)	-0.316 (-1.75)
Average 9 retailers	-0.128 (-1.11)	0.095 (0.83)	0.068 (0.59)	0.098 (0.85)	-0.018 (-0.16)	-0.029 (-0.26)

Table 5. Continued

	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16
Walmart	0.048 (0.32)	-0.005 (-0.04)	-0.081 (-0.55)	0.304 (2.04)	-0.013 (-0.09)	-0.087 (-0.58)
Target	0.231 (1.03)	0.090 (0.40)	-0.052 (-0.23)	-0.090 (-0.40)	-0.024 (-0.11)	0.230 (1.02)
Costco	-0.080 (-0.46)	-0.058 (-0.34)	-0.027 (-0.15)	0.135 (0.77)	0.103 (0.59)	0.081 (-0.46)
Kroger	-0.105 (-0.52)	-0.326 (-1.61)	-0.432 (-2.14)	0.035 (0.18)	-0.175 (-0.87)	0.006 (0.03)
Whole Foods Market	-0.146 (-0.42)	0.039 (0.11)	0.060 (0.17)	1.053 (3.02)	0.019 (0.06)	-0.710 (-2.04)
Village Super Market	0.479 (1.59)	0.240 (0.80)	-0.084 (-0.28)	-0.315 (-1.05)	-0.021 (-0.07)	-0.050 (-0.17)
Ingles Markets	0.114 (0.38)	0.304 (1.00)	0.229 (0.75)	-0.102 (-0.34)	-0.291 (-0.96)	0.009 (0.03)
Weis Markets	-0.039 (-0.20)	0.121 (0.62)	-0.323 (-1.65)	-0.125 (-0.64)	-0.422 (-2.16)	-0.206 (-1.06)
SpartanNash	0.174 (0.49)	-0.159 (-0.45)	-0.005 (-0.01)	-0.287 (-0.80)	-0.206 (-0.58)	-0.490 (-1.37)
Group 1 retailers	-0.010 (-0.08)	-0.052 (-0.41)	-0.106 (-0.84)	0.287 (2.27)	-0.018 (-0.14)	-0.128 (-1.01)
Group 2 retailers	0.182 (1.01)	0.126 (0.70)	-0.045 (-0.25)	-0.207 (-1.15)	-0.235 (-1.30)	-0.184 (-1.02)
Average 9 retailers	0.075 (0.65)	0.027 (0.24)	-0.079 (-0.69)	0.067 (0.58)	-0.114 (-0.99)	-0.153 (-1.33)

Table 6. CAR over the 8-week event window

	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
Walmart	0.029 (0.20)	0.082 (0.55)	-0.039 (-0.27)	-0.074 (-0.50)	0.053 (0.36)	-0.000 (-0.00)	-0.076 (-0.52)	0.310 (2.09)
Target	0.281 (1.26)	0.223 (1.00)	-0.056 (-0.25)	0.395 (1.77)	0.237 (1.06)	0.097 (0.43)	-0.046 (-0.21)	-0.092 (-0.41)
Costco	0.128 (0.74)	-0.167 (-0.96)	-0.273 (-1.57)	-0.124 (-0.71)	-0.056 (-0.33)	-0.035 (-0.20)	-0.003 (-0.02)	0.153 (0.88)
Kroger	0.058 (0.29)	-0.139 (-0.69)	0.056 (0.28)	0.074 (0.37)	-0.104 (-0.52)	-0.325 (-1.62)	-0.431 (-2.14)	0.039 (0.20)
Whole Foods Market Village	0.216 (0.62)	0.540 (1.56)	-0.105 (-0.30)	0.806 (2.32)	-0.099 (-0.29)	0.087 (0.25)	0.108 (0.31)	1.101 (3.18)
Super Market Ingles Markets Weis Markets	-0.043 (-0.15)	0.045 (0.15)	0.297 (0.99)	-0.512 (-1.71)	0.485 (1.62)	0.246 (0.83)	-0.078 (-0.26)	-0.315 (-1.06)
	0.314 (1.04)	0.061 (0.20)	0.076 (0.25)	0.054 (0.18)	0.090 (0.30)	0.280 (0.92)	0.205 (0.68)	-0.126 (-0.42)
	0.087 (0.45)	0.028 (0.15)	0.160 (0.83)	-0.203 (-1.04)	-0.001 (-0.01)	0.159 (0.82)	-0.285 (-1.46)	-0.086 (-0.45)
SpartanNash	-0.345 (-0.97)	0.355 (1.00)	-0.141 (-0.40)	-0.546 (-1.54)	0.210 (0.59)	-0.123 (-0.35)	0.031 (0.09)	-0.257 (-0.72)
Group 1 retailers	0.143 (1.13)	0.107 (0.85)	-0.083 (-0.66)	0.215 (1.71)	0.006 (0.05)	-0.035 (-0.28)	-0.089 (-0.71)	0.302 (2.40)
Group 2 retailers	0.003 (0.02)	0.122 (0.68)	0.098 (0.55)	-0.302 (-1.68)	0.196 (1.09)	0.140 (0.78)	-0.031 (-0.18)	-0.196 (-1.09)
Average 9 retailers	0.080 (0.70)	0.114 (0.99)	-0.002 (-0.02)	-0.014 (-0.13)	0.090 (0.79)	0.042 (0.37)	-0.064 (-0.56)	0.080 (0.70)

Table 7. CAR over the 4-week event window

	Week 9	Week 10	Week 11	Week 12
Walmart	-0.054 (-0.37)	-0.089 (-0.61)	0.037 (0.26)	-0.015 (-0.11)
Target	-0.072 (-0.32)	0.380 (1.71)	0.222 (1.00)	0.081 (0.37)
Costco	-0.278 (-1.61)	-0.128 (-0.74)	-0.061 (-0.36)	-0.039 (-0.23)
Kroger	0.077 (0.38)	0.094 (0.47)	-0.084 (-0.42)	-0.305 (-1.52)
Whole Foods Market	-0.191 (-0.55)	0.720 (2.08)	-0.184 (-0.53)	0.001 (0.00)
Village Super Market	0.314 (1.06)	-0.494 (-1.66)	0.503 (1.69)	0.263 (0.89)
Ingles Markets	0.056 (0.19)	0.035 (0.12)	0.071 (0.24)	0.260 (0.86)
Weis Markets	0.171 (0.89)	-0.192 (-0.99)	0.009 (0.05)	0.170 (0.88)
SpartanNash	-0.131 (-0.37)	-0.537 (-1.52)	0.219 (0.62)	-0.114 (-0.32)
Group 1 retailers	-0.103 (-0.83)	0.195 (1.55)	-0.014 (-0.11)	-0.055 (-0.44)
Group 2 retailers	0.102 (0.57)	-0.297 (-1.66)	0.200 (1.12)	0.145 (0.81)
Average 9 retailers	-0.012 (-0.10)	-0.023 (-0.21)	0.081 (0.71)	0.033 (0.29)

Table 8. Summary table for the results using different specifications

	Walmart	Target	Costco	Kroger	Whole Foods Market	Village Super Market	Ingles Markets	Weis Markets	Spartan-Nash	Group 1 retailers	Group 2 retailers	Average 9 retailers
Table 2				Week 5	Week 4							
Table 3 (Week 1-20)	Week 4,14,19	Week 5,10		Week 13	Week 10,14,16	Week 10	Week 3,6	Week 15		Week 14	Week 6	
Table 4 (Week 3-D18)	Week 4,14	Week 5,10	Week 9	Week 13	Week 10,14,16	Week 10	Week 3,6	Week 13,15		Week 14	Week 6,10	
Table 5 (Week 5-16)	Week 14	Week 5,10	Week 9	Week 13	Week 10,14,16	Week 10	Week 6	Week 13,15		Week 14	Week 6,10	
Table 6 (Week 7-14)	Week 14	Week 10		Week 13	Week 10,14	Week 10				Week 10,14	Week 10	
Table 7 (Week 9-12)		Week 10			Week 10	Week 10,11					Week 10	

5. CONCLUSION AND IMPLICATIONS:

Based on the results, we can conclude that there are food recall events that affected the stock price of certain retailers. We can observe that the retailer Kroger was affected by Nestlé Toll House cookie dough event and retailer Whole Foods Market was affected by Peanut Corporation of America peanut recall event.

Moreover, for the overall event window analyses shown in Table 8, we can conclude that week 14 had a significant influence on retailer Walmart, the week 10 had a significant influence on retailer Target, the week 9 had a significant influence on retailer Costco, the week 13 had a significant influence on retailer Kroger, the week 10 and 14 had a significant influence on retailer Whole Foods Market, the week 10 had a significant influence on retailer Village Super Market, the week 6 had a significant influence on retailer Ingles Markets, the week 13 and 15 had a significant influence on retailer Weis Markets, the week 14 had a significant influence on group 1 retailers and the week 6 as well as 10 had a significant influence on group 2 retailers when food recall events happened. These result showed that the different week has different effect to each retailers' stock price.

Additionally, we can see that the two types of retailers are sensitive to different weeks. Meanwhile, they are also sensitive to the same week 10, which is the week before the food recall happened instead of the week 11 which is the first week after the announcement. Besides, the larger retailers are sensitive to the week 14, the fourth week after the event. It may imply that the large retailers' stock prices were affected by the costs of recall procedures. Because the sales of the small and medium retailers are not much, they did not hurt as the large retailers. We could notice that the

retailer SpartanNash was not affected by any weeks during the different event windows. It may be caused by the many other factors which affected this retailer significantly. The average return of the nine retailers was not affected by any weeks as well during the different event windows. It may imply that the average method is not suitable to measure the degree of effect.

Furthermore, we also found that when we changed the length of event windows, some coefficients become significant and some coefficients become insignificant, which means that the degree of effect is sensitive to the length of event window.

The retailer Whole Foods Market, an organic food based retailer, had the largest number of sensitive weeks. The reason behind this maybe is the food recall's cost to this kind of retailer is higher since it carries more organic products at a premium price. The other possible reason may be because this type of retailers is more likely to lose the trust of consumers after a food recall event.

One limitation of my project is its relatively small sample size of just 8 food recall announcements. However, they are the biggest ones during this time period. I just chose 9 retailers as the objectives to observe. There are many retailers that do not make their stock publicly traded, which may also affect this study. Moreover, the retailer's stock prices were affected by so many other factors, such as merger and acquisition, new competitors and so on, and these factors were not considered in my analysis.

Thus, based on the negative effects of food recall events on retailers' stock price, the retailers should take actions to make sure the food safety at each stages of production and distribution as

possible as they can to reduce their costs. Furthermore, retailers should play a more proactive role in managing their supply chain partners to avoid product safety issues related to more serious product hazards, but not just as gatekeepers in the supply chain.

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