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Spillover Effects during Product Crises: Evidence From the Food Industry

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***Selected Poster prepared for presentation at the 2018 Agricultural & Applied Economics Association
Annual Meeting, Washington, D.C., August 5-August 7***

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Introduction

- Over the last 10 years, the number of food recalls in the U.S. has increased by more than four times (Food and Drug Administration, 2018). The huge spike in the number of recalls is caused by multiple reasons. One of the contributing factors is the complexity of the food supply chain.
- In the literature, spillover effects during product crises have been studied across product categories, from one product attribute to another, as well as from one brand to another. In the food industry, this topic has been mostly studied by analyzing retail sales responses after a food recall incident. (Bakhtavoryan, Capps and Salin, 2012)
- However, these responses represent only part of the potential economic repercussions that firms may encounter after experiencing this type of product crisis. Therefore, a more comprehensive analysis is warranted to understand how other firms in the food industry, not directly involved on a particular food safety incident, are affected.
- This issue has immense implications for how firms and industries may be affected by industry-wide food safety enhancement investments. This study directly addresses this important gap in information.

Objectives

- The objective of this study is to evaluate spillover effects during product crises using evidence from food recalls.
- More specifically, this study quantifies the economic impact of food recalls on the value of related firms within the food processing industry.
- In this study, we focus our analysis on meat and poultry products that have been recalled because of foodborne pathogens, misbranding, undeclared allergens, and foreign matter contamination.

Data

- Meat and poultry products recalls are carried out under the supervision of the Food safety Inspection Service (FSIS), and are conducted by firms either by their own initiative or by request of FSIS.
- In this study, we use three different data sets corresponding to the period from January 1994 to June 2017:
 - FSIS recall data
 - Firm-level data
 - Daily stock price data
- Overall, 187 food products recalls caused by various reasons, issued by 35 publicly traded firms, have been identified.

Research Methods: Non-parametric Approach

- We analyze the economic impact of these recalls by looking at price reactions in financial markets using a non-parametric approach. This approach allows us to *obtain* a measure of the conditional probability of a stock return by applying a local polynomial regression to time series data.
- We compute the logarithmic daily percentage index returns using the identity of:

$$R_{i,t} = LN(P_{i,t}/P_{i,t-1})$$
 - Where $R_{i,t}$ is the return on the index for period t , $P_{i,t}$ is the price of the firm at the end of period t , and $P_{i,t-1}$ is the price of the index at the end of period $t - 1$
- We analyze the value of conditional probability of a return. The abnormality in the return corresponds to conditional probability in the interval (0.1; 0.30]. Where this probability is 10% or less, we interpret the return as extreme.
- Bellow is the non-parametric estimation implemented in this paper:

$$\sum_{i=1}^n (Y_i - \beta_0 - \beta_1(X_i - x_0))^2 K_h(X_i - x_0)$$
 - Where $Y_i = I(R_{i,t} \leq r_t)$ with r_t standing for empirically observed (realization) return on the day of terrorist attack t , $i = (1, \dots, n)$, n is a sample size and $n = 200$; $X_i = R_{i-1}$, $x_0 = r_{i-1}$, $h = 2.34\sigma_s n^{-1/5}$ is a bandwidth, and K_h is a Kernel function.
- Implementation of this model leads to point estimates $\hat{\beta}_0$ and $\hat{\beta}_1$. Where $\hat{\beta}_0$ corresponds to a conditional probability of return on firm (Fan and Yao, 2003).

Results

- Overall, the average non-parametric conditional CDF across firms is 0.5, which we consider as normal return.
- Tables 1 and 2 shows the spillover effect in two different recalls, the first recall comes Kroger and the second recall comes from Conagrabands. Using Kroger conditional probability as an example, we obtain the results based on 200 observations when conditioning is done on the return on a day before the recall.
- Results from both tables shows that when a firm experiences abnormal return from a product crises, it often causes a negative spillover effect on other firms in the same industry on the same day of the recall or few days after the event.
- Results from the study also show that if the firm issues a recall and do not experience abnormal return, the spillover effect will not be trigger.

Table 1. Spillover effect of a recall from Kroger Co.

Days	KR	PPC	SVU	UVV	WMK	CAG
0	0.274*	0.194*	0.440	0.762	0.089	0.524
1	0.274*	0.841	0.540	0.492	0.638	0.524
2	0.516	0.194*	0.540	0.492	0.491	0.589
3	0.516	0.194*	0.273*	0.537	0.609	0.473
4	0.273*	0.194*	0.595	0.762	0.455	0.482
5	0.464	0.194*	0.466	0.198*	0.886	0.548
6	0.464	0.144*	0.574	0.199*	0.089	0.473
7	0.427	0.825	0.253*	0.760	0.089	0.482
8	0.418	0.529	0.252*	0.762	0.461	0.482
9	0.425	0.529	0.782	0.198*	0.495	0.511
10	0.425	0.529	0.252*	0.604	0.089*	0.480
11	0.573	0.529	0.252*	0.604	0.886	0.480
12	0.261*	0.825	0.252*	0.458	1.000	0.196*
13	0.262*	0.144*	0.432	0.371	0.635	0.197*
14	0.582	0.1625*	0.570	0.401	0.437	0.197*

Table 2. Spillover effect of a recall from Conagra Brands Inc.

Days	CAG	GIS	HRL	SVU	UVV	WMK
0	0.116*	0.527	0.229*	0.626	0.254*	0.720
1	0.236*	0.658	0.231*	0.200*	0.495	0.960
2	0.701	0.548	0.533	0.888	0.253*	0.106*
3	0.701	0.435	0.448	0.522	0.454	0.960
4	0.702	0.474	0.386	0.595	0.478	0.406
5	0.517	0.581	0.421	0.595	0.792	0.953
6	0.413	0.328	0.436	0.600	0.793	0.114*
7	0.495	0.582	0.647	0.600	0.795	0.114*
8	0.313	0.582	0.539	0.673	0.275*	0.114*
9	0.314	0.474	0.539	0.410	0.247*	0.678
10	0.331	0.287*	0.607	0.617	0.516	0.678
11	0.626	0.287*	0.472	1.006	0.516	0.960
12	0.551	0.270*	0.576	0.463	0.482	0.960
13	0.548	0.606	0.221*	0.463	0.516	0.556
14	0.488	0.499	0.221*	0.201*	0.516	0.556

Conclusions

- Findings provide evidence of spillover effects of product recalls across firms in the same industry. , A disaster for one brand can be "contagious," such that it influences both the product category and competing brands
- With only conditional probability, there is no indication if firm can benefit from competitor firms.

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