THE EFFECTS OF FOOD SAFETY ISSUES ON DIVERSIFIABLE AND NONDIVERSIFIABLE AGRIBUSINESS RISK

Christine A. Wilson

and

Allen M. Featherstone*

Selected Paper for 2002 AAEA Annual Meetings

Long Beach, California

*The authors are assistant professor in the Department of Agricultural Economics, Purdue University and professor in the Department of Agricultural Economics, Kansas State University, respectively.

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ABSTRACT

This effects of food safety issues on food and agribusiness firm financial risk and return are quantitatively examined using a Bayesian switching model. A capital asset pricing model is estimated to examine the pre- and post-issue on the firm. In addition, the diffusion process on other firms in the industry is also analyzed.

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Public concern about food safety has increased rapidly during the last decade. Food safety concerns are a priority and are at the forefront of much of the work in the food and agribusiness industry. Food safety involves a wide array of issues including but not limited to microbiological food borne pathogens, chemical toxins, labeling, bioterrorism, and technological and new product developments. Such food safety events include the Starlink corn controversy, the alar issue within the apple industry and the *e-coli* issues in the meat packing industry. While, previous research has generally explored consumer preferences and consumer reactions to food safety issues (Baker; Henneberry, Piewthongngam, and Qiang; Misra, Huang, and Ott), recent work has expanded the area of inquiry to include the examination of the reaction of stock returns of publicly traded firms to specific food recall events (Salin and Hooker). In a limited event study of three firms and three food recall events, Salin and Hooker examine the social costs of food recalls linked to specific firms and provide a starting point for understanding return and risk responses to food safety issues. However, additional research in this area is necessary to more completely quantify shareholder and market reaction to food recalls and other food safety issues. This research will provide additional insight into the area of food safety issues and concerns and their impacts on companies.

One such food safety issue is that of genetically modified organisms (GMOs) and human consumption. Several events have focused around Starlink corn and the controversy over its use in human foods. Several food recalls have occurred and a number of food and agribusiness firms have been either involved or impacted by these events. Two events involving the recall of food

contaminated with Starlink corn, which had not been approved for use in food, are the Kraft Foods recall of Taco Bell taco shell products from grocery stores on September 22, 2000, and the Kellogg recall of Morningstar Farms Corn Dogs on March 14, 2001. Although these are the dates of the official recalls by the firms, news concerning the Kraft issue began hitting the press on September 18, 2000 in the *Washington Post*, and news of the Kellogg issue was published in the *Los Angeles Times* on March 8, 2001.

The general objective of this research is to quantitatively examine the effects of Starlink corn and the Kraft Foods recall of Taco Bell taco shell products and the Kellogg recall of Morningstar Farms Corn Dogs on the diversifiable risk, nondiversifiable risk, and the returns of food and agribusiness firms. Specifically, a partial event analysis is used to measure and analyze the risks and returns of specific firms before and after these two specific food safety recalls. We test the null hypothesis that such events have no impact on the amount of risk associated with the firm and on the firm's returns.

RELATED WORK

Related work on examining the effect of food safety on the performance of the food industry is classified in three ways. The first examines the use of the event study methodology in finance to explain financial market reaction to new information. Secondly, related literature in agricultural economics will be examined that explores research examining food safety concerns. The final analysis will examine the interaction of the food safety issue examination and event study analysis.

Event Study Analysis

Perhaps the most comprehensive analysis of the event study methodology has been published by MacKinlay in the *Journal of Economic Literature*. The event study methodology

rests on the notion of market efficiency. Given the semi-strong form of market efficiency any new information will be quickly bid into the equity markets of those affected firms. Based upon Mandelbrot and Samuelson who show that successive price changes are independent in an efficient market, Fama et. al. propose the event study methodology to examine the speed of adjustment to "new" information. MacKinlay indicates that the methodology proposed by Fama et.al. is that which is essentially used today.

The event study methodology follows a number of steps which are generally the same. The first step is to define an abnormal return ($AR_{i\tau}$) which MacKinlay defines as:

$$AR_{i\tau} = R_{i\tau} - E(R_{i\tau}|X_\tau) \quad (1)$$

where $R_{i\tau}$ is the actual return and $E(R_{i\tau}|X_\tau)$ is the normal return for the time period τ. MacKinlay discusses the fact that there are other common choices for modeling the normal return $[E(R_{i\tau}|X_\tau)]$, the constant mean return model, the market model, and the factor model. In this manuscript, we adopt the market model where the normal return is defined as:

$$E(R_{i\tau}|X_\tau) = \alpha_i + \beta_i R_{m\tau} \quad (2)$$

where α_i and β_i are the parameters estimated from a period excluding the period of interest, and $R_{m\tau}$ is the market return for the period of interest. After determining the abnormal return series, the level of significance must be determined. Both parametric and nonparametric tests have been used for testing whether the abnormal returns are statistically distinct from the normal return.

To begin the formal testing for abnormal returns, the period to which the normal return is estimated must be defined. Information during this window of time is used to define that normal return through the estimation of α and β. Normally this period of time will end at some point before the event occurs. Often, the returns just before the event window will be examined to assess the behavior during the pre-release. If abnormal returns occurred during this period of time

it could perhaps be an indication of a violation of the strong form of market efficiency. Next, the abnormal returns after the release day are assessed.

According to MacKinlay, it is often assumed that the abnormal returns are jointly normally distributed with a mean of zero and a variance of:

$$\sigma^2(AR_{i\tau}) = \sigma^2_{\varepsilon} + \text{sampling adjustment.} \quad (3)$$

The first term of the variance occurs due to the variance associated with the abnormal return while the second factor accounts for the sampling error that arises due to the estimation of the market model. These errors are then aggregated to account for the cumulative effect of the window of observation. The variance above (3) is then multiplied by a factor to take into account the length of the period of window. Brown and Warner examined the properties associated with the used of daily stock data for event studies. They found that significant autocorrelation may exist in daily excess returns and that the variance may not be homoskedastic over the test period. Brown and Warner suggest that these conditions may need to be accounted for in event studies.

Nonparametric tests have been used to test for abnormal returns to address some of the concerns raised by Brown and Warner. These nonparametric tests include a sign test which has a condition that the abnormal returns cannot be skewed. Corrado proposed an alternative nonparametric rank test to examine the behavior of abnormal returns for the event period that does not rely on the skewness measure. Campbell and Wasley found that Corrado's rank test provided more reliable inferences than do nonparametric tests, although they suggest that both parametric and nonparametric tests should be used.

An alternative measure to comparing the means of two independent samples in the Wilcoxon rank-sum test (Malik and Mullen). The Wilcoxon test, also known as the Mann-Whitney or the rank-sum test, examines whether two samples came from populations with the

same distribution. To perform the Wilcoxon test, the observations are combined and ranked according to size. The smallest observation has a rank of one and the highest has the rank of the addition of the sample size. For example, if each sample size had 5 observations, the highest rank would be 10. The ranks of the observations of the abnormal returns are summed and compared to the critical values. The distributions are approximately normally distributed with a mean of one-half of the product of the samples and a variance equal to the product of the sample sizes times the sum of the sample sizes plus one, all divided by 12 (Malik and Mullen).

Event Studies and Food Safety Issues

Several studies have begun to use the event study methodology to examine the performance of food sector to food safety related issues. Salin and Hooker examine the effect to stocks of *Escherichic (E.) coli* (O157:H7) in apple juice and ground beef. In addition, they examined the recall of hot dogs and deli meat products to the contamination of *Listeria*. They assumed normality of returns and used the market based method to estimate the normal return. They only looked at the effect of the recalls on the affected firm and did not consider the effects on other firms. They found that the market reaction differed by incident and by firm.

Lusk and Schroeder examined the effect of meat recalls on live cattle and lean hog futures prices. They found that the announcement of recalls did not have a strong effect on either series. McKenzie and Thomsen examined the effect of *E. Coli* O157:H7 on beef prices using both parametric and nonparametric tests. They defined the normal return as the arithmetic mean computed over an eight-day normal period. They found that the price for boneless beef reacted negatively to recalls, but that there was little reaction in boxed beef prices and no reaction in live cattle prices suggesting that these events do not transmit back to the farm level.

Thomsen and McKenzie further examined losses from meat and poultry recalls and found

that significant shareholder losses occurred when publicly traded food companies are implicated in serious food safety hazards. However, no evidence was found that the market reacts negatively to less severe hazards. They defined the normal return using the market model and tested for abnormal returns using both parametric and nonparametric tests.

Henson and Mazzocchi examined the effect of Bovine Spongiform Encephalopthy on the equity prices for several companies in the United Kingdom. They calculated abnormal returns using a simple market model, a Scholes-Williams approach, and an autoregressive distributed lag approach and tested for them using a parametric test. They found that the autoregressive distributed lag fit the data the best and resulted in significant abnormal returns in the beef, pet food, animal feed, and dairy sectors and positive abnormal returns in other meat sectors.

EMPIRICAL METHODS

Data in this study consist of daily rates of return to common stock for 17 food and agribusiness firms that were directly or potentially indirectly affected by two Starlink corn food recalls during 2000-2001. Various firms within the industry are examined to determine the diffusion of the impact of the recall to other firms in the industry in addition to the company directly involved. The companies examined are Kraft, Dannon, Sara Lee, General Mills, Heinz, Kellogg, ConAgra Foods, Quaker Oats, Frito-Lay, Keebler, Archer Daniels Midland (ADM), Corn Products International, Lance, Inc., Taco Bell, Aventis, Unilever (UK), and Unilever (Netherlands, NV).[1] Data also include rates of return for the *Center for Research and Security Prices* (CRSP) Value Weighted market index. All return data are obtained from the *Center for*

[1]During the study period, Kraft was owned by Philip-Morris; Quaker Oats was acquired by Pepsico in August 2001; Frito-Lay was owned by Pepsico; Keebler was acquired by Kellogg in March 2001; Taco Bell was owned by Tricon Global Restaurants; Unilever (UK) and Unilever (NV) trade separately. These issues are accounted for in the stock returns used.

Research and Security Prices Database (CRSP). The Starlink Corn food safety event dates are determined through news releases and web sites. Kraft Foods announced a voluntary recall of all Taco Bell taco shells contaminated with Starlink Corn from grocery stores shelves on September 22, 2000; however, news discussing the possible incident hit the papers on September 18, 2000. Kellogg announced a recall of Morningstar Farms Corn Dogs on March 14, 2001; however, news of this incident was published on March 8, 2001. The event dates used in this study are those corresponding to the first news of the food contamination (September 18, 2000 and March 8, 2001) since those are the dates when the market first potentially reacted to the news.

The normal returns for each firm are estimated prior to each of the two study recall events using a 120 calendar day benchmark market model with the 5 days prior to the event day omitted in order to remove the impact of any possible information leaks. These models are used to estimate the normal returns that would be expected to occur in the absence of the product recalls. Abnormal returns are estimated for each of the companies for both recall events as the difference between the actual observed return on a given date and the predicted normal return for that date. The abnormal (excess) returns are further aggregated over intervals of 5, 10, 30, 50, and 100 days after the event date to examine the cumulative impact of the recall over time. An initial window of (-5, +10) days is used to examine the effects of the recalls on the firms' returns. The nonparametric Wilcoxon rank-sum test is used for -5, +5, and +10 days to test the null hypothesis that the food recalls do not change the stock returns of the publicly traded agribusiness firms. Additionally, post-event market models (also referred to as the Capital Asset Pricing Model (CAPM) in finance literature) are estimated for 30, 50, 100, 120, and 150 day periods after the event to assess the changes in the market regime, the systematic risk, and the unsystematic risk of the firm and the pricing of that risk by the market due to the recall event.

RESULTS

Tables 1 and 2 report the excess return estimates by day for the 17 companies for the two recall events for the period (-5, +10). Table 3 reports the results of the Wilcoxon rank-sum tests for -5, +5, and +10 days. Table 4 presents the cumulative excess returns for 5, 10, 30, 50, and 100 days after the event dates. Tables 5 and 6 report the beta estimates and the R-squares from the CAPM (market model) for various time periods after the recall dates.

Kraft Foods September 18, 2000 Taco Bell Taco Shells Event

Table 1 indicates that 13 of the 17 firms experienced negative excess returns on the event date when the news was first released about the potential issue. However, four days later, on September 22, 2000, when Kraft announced the actual recall, only two firms, Keebler and Taco Bell, experienced negative excess returns. Kraft experienced negative excess returns on the event date, two days after the event date, and one through four days prior to the event date. Somewhat similarly, Taco Bell experienced negative excess returns on the event date, one and four days after the event date, and two, four, and five days prior to the event date. The Wilcoxon nonparametric rank-sum tests for -5, +5, and +10 days, however, indicate that only Sara Lee and Keebler experienced actual returns that were statistically different at the α=0.05 level from the expected normal returns (Table 3).

Cumulative excess (abnormal) returns for several time periods after the event dates are reported in Table 4. Results indicate that at most five firms experienced negative cumulative returns for any of the post-event time periods examined, and this result occurred for the +5 day window.

Kellogg March 8, 2001 Morningstar Farms Corn Dogs Event

Table 2 indicates that only 4 of the 17 companies experienced negative excess returns on

the event date of March 8, 2001, and Kellogg was not one of these firms. However, four trading days later, on March 14, 2001, when Kellogg officially announced the recall, 14 of the 17 companies experienced negative excess returns; only Dannon, Keebler, and Corn Products International experienced positive excess returns. Kellogg experienced negative excess returns on one and four days prior to the event, and on one, two, four, and six through nine days after the event date, but not on the event date. The Wilcoxon nonparametric rank-sum tests indicate that Kraft, Dannon, and Lance, Inc. experienced actual returns that were statistically different from the expected normal returns for 5 days prior to the event date (Table 3). Kraft, General Mills, Heinz, Quaker Oats, Frito-Lay, ADM, Unilever (LTD), and Unilever (NV) experienced statistically different returns for 10 days after the event, and Kraft, General Mills, Quaker Oats, Frito-Lay, Taco Bell, Unilever (LTD), and Unilever (NV) experienced statistically different returns for 5 days after the event (Table 3). Kellogg did not experience significantly different returns based on the Wilcoxon test.

The number of negative cumulative excess (abnormal) returns for the Kellogg Starlink corn recall are much greater in number than those for the Kraft recall (Table 4). Results in Table 4 indicate that negative cumulative returns were experienced in 80% of the company and post-event time periods examined. Positive cumulative returns were experienced in only 17 of the 68 situations examined. This is a substantially greater number than that experienced for the Kraft recall event, suggesting either that the Kellogg recall had a larger total negative impact in the market than the Kraft recall or that in general this was a negative time period in the market.

Diversifiable and Nondiversifiable Agribusiness Risk

Risk is important to investors as well as to business managers, and one focus of this study is to examine the impact of the Starlink corn food recall events on the levels of risk observed for

each of the companies in the study. The total risk of a firm consists of two components: diversifiable risk (also known as unsystematic or unique risk) and nondiversifiable risk (also known as systematic or market risk). Of interest is how does the financial risk of the firm change around the time of the food safety events, i.e., the Starlink corn recalls. Tables 5 and 6 report the results of estimating the CAPM (the market model) prior to the Starlink recalls and for 30, 50, 100, 120, and 150 days after the recalls. The beta estimate is a measure of market or systematic risk and indicates the stock's marginal contribution to a well-diversified portfolio. The R-square provides a measure of the unsystematic or diversifiable risk of the firm.

Results presented in Table 5 indicate that the most substantial changes in unsystematic risk of the firm occur during the 30 day window after the event, reflecting the increase in the firm-specific risk possibly attributable to the concerns about the recall event. Results further seem to indicate that as more time elapses after the recall, diversifiable risk decreases. Kraft, Dannon, Kellogg, Frito-Lay, Keebler, Taco Bell, and Aventis experience the largest increases in diversifiable risk of the companies for the 30 day post-event period of the Kraft Foods September 18, 2000 Taco Bell Taco Shells recall. Results indicate even larger changes in the R-square values for the 30 day post period of the Kellogg Morningstar Farms Corn Dog recall, with Kraft, Dannon, Kellogg, Quaker Oats, Frito-Lay, ADM, Corn Products International, Lance, Inc, Aventis, and Unilever experiencing dramatic changes in this risk measurement. Direct comparison of the 120 day pre-event models to the 120 day post-event models indicate consistent results. Results for the beta estimates presented in Table 6 generally indicate similar responses, with larger changes being observed for the 30 day period, but changes still observed for the 120 day period.

CONCLUSIONS

Interest in food safety issues are at a high level in the U.S., and the impacts affect business

and industry, consumers, and the general public. Previous research has found shareholder losses occur when companies are implicated in serious food safety hazards (Thomsen and McKenzie) and that stock market reaction to food safety issues differed by incident and by firm (Salin and Hooker).

Results of this event study provide several insights on the effects food safety issues, specifically two Starlink corn food recalls, on firm financial risks and returns. Results of this study indicate the sensitivity of Wall Street to the Starlink corn recalls varies by firm and by recall event. The company enacting the recall does not necessarily experience the largest or even significant effects to its stock returns. Company risk, both in the form of diversifiable and nondiversifiable risk, are generally increased during the event period time, with the greatest changes being observed in the nearer-term time periods. As is the case with the returns, the impacts on the risks of the firms from the recall events are not always the greatest for the company announcing the recall. Diffusion to other firms in the industry of the impact of the recall does occur, and in some cases greater effects may occur to other firms. Additionally, the timing of the impacts varies as well.

As additional information in incorporated in the market, the impacts of food safety issues such as recalls may increase. The Starlink corn controversy may serve as an example of a food safety issue that has a cumulative impact effect. This study examined two recall events related to Starlink corn. The Kraft Foods recall occurred nearly 6 months before the Kellogg recall, however, results suggest that the Kellogg recall had more of an impact on firms' risk and returns and had an impact on a greater number of firms. Perhaps as additional food safety events occur that relate to prior events, the impacts become stronger. Results of our study are consistent with previous findings. Further analysis of additional food safety events will be interesting and will

continue to provide information on the impacts of food safety-related information on food and agribusiness firms.

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Table 1. Abnormal Returns around the Kraft Foods 9/18/00 Taco Bell Taco Shells Event

Event Day	Kraft	Dannon	Sara Lee	General Mills	Heinz	Kellogg	ConAgra	Quaker Oats	Frito-Lay	Keebler	ADM	Corn Products Int'l	Lance, Inc	Taco Bell	Aventis	Unilever, LTD	Unilever, NV
-5	0.0038	-0.0171	-0.0051	-0.0123	-0.0100	-0.0221	-0.0052	-0.0151	0.0042	-0.0114	0.0038	-0.0120	-0.0108	-0.0007	-0.0018	-0.0239	-0.0154
-4	-0.0026	0.0122	0.0139	0.0248	0.0050	0.0213	0.0015	0.0074	0.0262	-0.0033	0.0112	0.0077	-0.0074	-0.0105	0.0366	0.0172	0.0168
-3	-0.0389	0.0083	0.0194	0.0122	-0.0095	-0.0147	0.0045	0.0108	0.0170	-0.0189	0.0077	0.0112	-0.0204	0.0007	-0.0010	-0.0019	-0.0050
-2	-0.0245	-0.0312	-0.0084	-0.0092	-0.0102	-0.0072	0.0046	-0.0039	-0.0096	-0.0378	-0.0126	-0.0080	0.0187	-0.0123	0.0100	-0.0146	-0.0160
-1	-0.0144	-0.0253	-0.0077	0.0118	-0.0223	0.0163	0.0050	0.0124	-0.0119	-0.0004	0.0279	-0.0208	0.0047	0.0256	-0.0122	0.0153	0.0004
0	-0.0196	-0.0248	-0.0042	-0.0086	0.0017	-0.0247	-0.0046	-0.0039	0.0077	-0.0409	-0.0047	-0.1301	0.0137	-0.0092	-0.0288	-0.0022	0.0038
1	0.0173	0.0386	0.0126	0.0060	0.0083	0.0109	0.0108	-0.0039	-0.0101	-0.0059	0.0110	-0.0602	-0.0023	-0.0437	0.0305	0.0075	0.0111
2	-0.0440	-0.0290	-0.0537	0.0109	0.0075	-0.0305	-0.0084	0.0000	-0.0417	-0.0089	-0.0451	-0.0335	0.0097	0.0055	-0.0230	-0.0088	-0.0072
3	0.0165	-0.0131	0.0206	0.0201	-0.0001	0.0140	0.0015	0.0158	0.0357	0.0043	0.0042	0.1047	0.0030	0.0188	0.0247	0.0198	0.0226
4	0.0404	0.0949	0.0164	0.0288	0.0233	0.0216	0.0211	0.0181	0.0445	-0.0140	0.0003	0.0188	0.0002	-0.0186	0.0132	0.0287	0.0338
5	0.0042	-0.0366	-0.0204	-0.0115	-0.0186	-0.0226	-0.0181	-0.0021	-0.0126	-0.0060	-0.0181	-0.0166	0.0028	0.0228	-0.0116	-0.0109	-0.0135
6	0.0061	0.0141	-0.0111	0.0244	-0.0011	0.0166	0.0416	0.0111	-0.0079	-0.0026	0.0207	-0.0020	0.0041	0.0058	0.0065	-0.0005	0.0071
7	0.0331	0.0052	-0.0084	0.0214	-0.0061	0.0058	0.0046	0.0225	0.0233	0.0036	0.0250	0.0130	0.0020	-0.0150	0.0084	0.0038	0.0010
8	0.0401	0.0079	0.0157	0.0146	0.0354	-0.0023	0.0132	0.0035	-0.0102	0.0041	-0.0363	0.0156	0.0221	0.0047	0.0373	0.0263	0.0273
9	-0.0320	-0.0297	0.0173	-0.0087	-0.0071	0.0059	0.0144	0.0099	0.0176	-0.0240	0.0368	0.0154	0.0417	0.0393	-0.0420	0.0318	0.0190
10	0.0037	-0.0331	-0.0203	0.0046	0.0031	-0.0123	0.0202	-0.0084	0.0299	-0.0301	0.0623	-0.0078	-0.0194	0.0102	0.0070	-0.0031	0.0027

Table 2. Abnormal Returns around the Kellogg 3/8/01 Morningstar Farms Corn Dogs Event

Event Day	Kraft	Dannon	Sara Lee	General Mills	Heinz	Kellogg	ConAgra	Quaker Oats	Frito-Lay	Keebler	ADM	Corn Products Int'l	Lance, Inc	Taco Bell	Aventis	Unilever, LTD	Unilever, NV
-5	0.0039	0.0013	-0.0115	0.0030	0.0044	0.0501	0.0037	-0.0010	-0.0053	0.0001	-0.0091	0.0307	-0.0242	0.0090	0.0050	0.0310	0.0292
-4	0.0179	-0.0215	-0.0002	0.0110	0.0054	-0.0312	-0.0219	-0.0063	-0.0216	-0.0013	0.0058	-0.0073	-0.0017	-0.0158	0.0116	0.0111	0.0051
-3	-0.0092	-0.0064	-0.0203	0.0099	0.0032	0.0068	0.0055	0.0054	0.0190	0.0000	-0.0015	-0.0080	-0.0098	-0.0127	0.0116	-0.0040	-0.0047
-2	-0.0097	-0.0063	-0.0148	-0.0205	-0.0236	0.0048	-0.0046	0.0026	0.0073	-0.0003	-0.0018	-0.0070	-0.0331	-0.0249	0.0010	-0.0048	0.0006
-1	0.0232	-0.0169	0.0027	-0.0034	-0.0271	-0.0074	0.0192	-0.0001	0.0096	-0.0002	-0.0159	-0.0009	-0.0381	0.0053	-0.0122	0.0002	0.0014
0	0.0118	0.0166	0.0335	-0.0082	0.0180	0.0094	-0.0023	0.0107	0.0193	-0.0004	0.0247	0.0139	0.0494	0.0413	-0.0349	0.0208	0.0153
1	0.0044	-0.0007	-0.0040	-0.0081	-0.0091	-0.0023	0.0021	-0.0076	-0.0160	0.0001	-0.0307	0.0121	-0.0514	0.0098	0.0043	-0.0134	-0.0101
2	-0.0617	-0.0185	-0.0009	-0.0073	-0.0126	-0.0243	0.0050	-0.0110	-0.0279	0.0000	-0.0266	0.0030	-0.0033	-0.0159	-0.0279	-0.0281	-0.0386
3	0.0105	-0.0634	0.0031	-0.0079	-0.0043	0.0257	-0.0035	-0.0030	-0.0113	-0.0001	-0.0177	0.0027	0.0343	-0.0387	-0.0342	-0.0093	-0.0062
4	-0.0430	0.0070	-0.0222	-0.0224	-0.0119	-0.0246	-0.0175	-0.0026	-0.0184	0.0001	-0.0240	0.0033	-0.0076	-0.0208	-0.0174	-0.0259	-0.0324
5	-0.0187	0.0049	0.0087	-0.0039	0.0135	0.0171	0.0102	-0.0064	-0.0040	-0.0004	0.0104	0.0010	0.0475	-0.0178	0.0128	-0.0158	-0.0110
6	0.0071	-0.0080	0.0048	-0.0072	-0.0264	-0.0101	-0.0150	-0.0205	-0.0280	-0.0004	-0.0465	0.0041	-0.0573	-0.0043	-0.0321	-0.0186	-0.0226
7	-0.0175	0.0259	0.0067	-0.0079	-0.0036	-0.0081	0.0008	-0.0043	-0.0022	0.0008	0.0240	-0.0001	-0.0022	0.0184	0.0133	0.0182	0.0235
8	-0.0603	0.0080	-0.0106	-0.0012	-0.0299	-0.0293	-0.0195	-0.0174	-0.0298	-0.0006	-0.0403	-0.0026	0.0090	0.0029	-0.0010	-0.0232	-0.0232
9	-0.0246	-0.0064	-0.0139	0.0029	-0.0255	-0.0186	-0.0049	-0.0052	0.0055	0.0017	-0.0224	0.0096	-0.0152	0.0081	0.0077	-0.0333	-0.0421
10	-0.0372	-0.0242	-0.0165	-0.0265	0.0051	0.0021	0.0016	0.0064	0.0135	-0.0004	-0.0254	0.0009	-0.0018	-0.0328	-0.0675	-0.0330	-0.0293

Table 3. Results of the Wilcoxon Rank-Sum Tests

	---9/18/2000 Event---			---3/8/2001 Event---		
	5 Day Pre-Event	10 Day Post Event	5 Day Post Event	5 Day Pre-Event	10 Day Post Event	5 Day Post Event
Kraft	20	135	35	**15**	**55**	**15**
Dannon	25	105	25	**17**	89	24
Sara Lee	**15**	**55**	**15**	24	94	27
General Mills	30	135	35	30	**69**	**15**
Heinz	20	119	34	29	**77**	24
Kellogg	25	115	30	30	83	27
ConAgra	35	135	30	30	91	28
Quaker Oats	30	115	25	26	**65**	**15**
Frito-Lay	30	105	25	30	**74**	**15**
Keebler	**19**	**81**	20	23	98	27
ADM	35	121	28	20	**75**	20
Corn Products Int'l	25	105	25	23	117	31
Lance	25	133	36	**15**	97	25
Taco Bell	26	118	29	25	86	**18**
Aventis	29	122	30	35	95	25
Unilever, LTD	25	115	30	28	**66**	**16**
Unilever, NV	21	133	30	29	**67**	**17**

Bold numbers indicate reject H0 at the 0.05 level.

Table 4. Cumulative Excess Returns for Various Time Periods

	---9/18/2000 Event--- Days After Event					---3/8/2001 Event--- Days After Event				
	5	10	30	50	100	5	10	30	50	100
Kraft	0.0344	0.0854	0.2902	0.2285	0.4023	-0.1085	-0.2409	-0.1759	-0.1263	-0.4623
Dannon	0.0548	0.0192	0.1133	0.0399	0.0575	-0.0707	-0.0754	-0.0658	-0.0734	-0.0459
Sara Lee	-0.0245	-0.0313	0.0362	0.1253	0.0221	-0.0152	-0.0447	-0.0747	-0.0697	-0.0544
General Mills	0.0544	0.1108	0.2281	0.1916	0.1897	-0.0496	-0.0894	-0.1966	-0.1692	-0.1472
Heinz	0.0204	0.0446	0.1866	0.1934	0.2300	-0.0245	-0.1048	-0.0720	0.0367	0.0856
Kellogg	-0.0066	0.0072	0.0665	0.0708	0.1816	-0.0084	-0.0725	-0.0750	-0.0578	0.1173
ConAgra	0.0069	0.1010	0.1752	0.3869	0.4393	-0.0038	-0.0407	0.0816	0.1836	0.2782
Quaker Oats	0.0278	0.0664	0.0946	0.1307	0.1781	-0.0306	-0.0717	-0.1065	-0.1086	-0.2434
Frito-Lay	0.0157	0.0684	0.1103	0.0268	0.0914	-0.0776	-0.1187	-0.1107	-0.0010	0.0534
Keebler	-0.0305	-0.0795	-0.0977	-0.0882	-0.0877	-0.0003	0.0008	-0.0426	-0.0454	0.1221
ADM	-0.0478	0.0607	0.1480	0.1373	0.2060	-0.0887	-0.1993	-0.4128	-0.3924	-0.5739
Corn Products Int'l	0.0133	0.0474	0.1065	0.1640	0.2148	0.0222	0.0340	-0.0907	-0.0619	0.0154
Lance	0.0134	0.0639	0.0610	0.0802	0.1228	0.0195	-0.0479	-0.0665	-0.1171	-0.1005
Taco Bell	-0.0153	0.0298	-0.0873	0.0980	-0.1416	-0.0834	-0.0911	-0.1079	-0.1331	-0.2471
Aventis	0.0336	0.0509	-0.0438	0.0021	-0.0464	-0.0623	-0.1419	-0.0880	-0.1116	-0.1931
Unilever, LTD	0.0363	0.0945	0.1591	0.2978	0.2950	-0.0925	-0.1824	-0.0832	0.0230	0.1077
Unilever, NV	0.0468	0.1040	0.1632	0.2807	0.3000	-0.0983	-0.1920	-0.0580	0.0288	0.0850

Table 5. R-square Values for Various Period CAPMs

	-----9/18/2000 Event-----						-----3/8/2001 Event-----					
		Days After Event						Days After Event				
	Pre-Event	30	50	100	120	150	Pre-Event	30	50	100	120	150
Kraft	0.0006	0.0128	0.0451	0.0134	0.0580	0.0471	0.0571	0.3099	0.1765	0.1241	0.1306	0.0987
Dannon	0.0081	0.0902	0.0506	0.0703	0.0534	0.0498	0.0465	0.2099	0.1808	0.1204	0.1202	0.1090
Sara Lee	0.0015	0.0021	0.0029	0.0003	0.0131	0.0094	0.0264	0.0039	0.0046	0.0081	0.0109	0.0153
General Mills	0.0162	0.0008	0.0145	0.0015	0.0010	0.0006	0.0068	0.0003	0.0058	0.0298	0.0313	0.0239
Heinz	0.0225	0.0143	0.0174	0.0525	0.0650	0.0521	0.0755	0.0579	0.0100	0.0405	0.0464	0.0449
Kellogg	0.0000	0.0390	0.0259	0.0120	0.0080	0.0051	0.0257	0.0802	0.0185	0.0463	0.0549	0.0765
ConAgra	0.0004	0.0000	0.0266	0.0328	0.0609	0.0198	0.0158	0.0008	0.0009	0.0054	0.0122	0.0185
Quaker Oats	0.0000	0.0002	0.0012	0.0004	0.0004	0.0014	0.0015	0.2703	0.1476	0.1406	0.0806	0.0401
Frito-Lay	0.0092	0.1346	0.1458	0.0373	0.0662	0.0676	0.0358	0.2816	0.1753	0.1185	0.1147	0.0945
Keebler	0.0084	0.0681	0.0076	0.0037	0.0029	0.0033	0.0129	0.0004	0.0010	0.0113	0.0188	0.0383
ADM	0.0425	0.0142	0.0015	0.0009	0.0047	0.0043	0.0018	0.2880	0.2208	0.1700	0.1379	0.1409
Corn Products Int'l	0.0105	0.0004	0.0431	0.1256	0.0936	0.0681	0.0915	0.2280	0.1580	0.1173	0.0769	0.0711
Lance	0.0185	0.0004	0.0081	0.0030	0.0341	0.0297	0.0201	0.4134	0.2691	0.1895	0.1826	0.1846
Taco Bell	0.0547	0.2366	0.1562	0.0643	0.1161	0.1147	0.0634	0.0541	0.0780	0.0411	0.0523	0.0340
Aventis	0.0403	0.2245	0.0913	0.0612	0.0142	0.0129	0.0007	0.2193	0.1401	0.1155	0.1086	0.1042
Unilever, LTD	0.0043	0.0170	0.0830	0.1559	0.1192	0.0989	0.1101	0.3152	0.2199	0.1982	0.1844	0.1666
Unilever, NV	0.0021	0.0136	0.0239	0.1180	0.1242	0.1017	0.1393	0.3053	0.2420	0.2080	0.2024	0.1659

Table 6. Beta Estimates from Various Period CAPMs

	-----9/18/2000 Event-----						-----3/8/2001 Event-----					
		Days After Event						Days After Event				
	Pre-Event	30	50	100	120	150	Pre-Event	30	50	100	120	150
Kraft	-0.0681	-0.1921	-0.3309	-0.1722	-0.3831	-0.3506	-0.3853	0.6620	0.5080	0.4710	0.5315	0.4679
Dannon	0.1716	0.6886	0.4765	0.5131	0.4234	0.4126	0.3630	0.4611	0.4201	0.3569	0.3585	0.3342
Sara Lee	0.0569	0.0581	0.0655	0.0195	-0.1420	-0.1244	-0.2175	-0.0419	-0.0496	0.0820	0.0993	0.1194
General Mills	-0.1646	0.0232	0.1023	0.0347	-0.0278	-0.0239	-0.0789	0.0084	0.0449	0.1172	0.1210	0.1110
Heinz	-0.2733	0.1194	-0.1633	-0.2815	-0.3101	-0.2842	-0.3334	0.1464	0.0646	0.1528	0.1750	0.1683
Kellogg	0.0126	0.2976	0.2449	-0.1717	-0.1298	-0.1074	-0.2312	0.2028	0.1226	0.2183	0.2460	0.3063
ConAgra	0.0380	0.0000	-0.1636	-0.2029	-0.2884	-0.2401	-0.2353	-0.0206	0.0208	0.0641	0.1112	0.1363
Quaker Oats	-0.0001	0.0127	-0.0441	0.0249	-0.0225	-0.0409	-0.0377	0.2808	0.2332	0.2289	0.1922	0.2346
Frito-Lay	0.1602	-0.6107	-0.6172	-0.2747	-0.3505	-0.3629	-0.2392	0.4252	0.3621	0.3141	0.3259	0.3294
Keebler	-0.2572	0.2192	0.0655	0.0300	0.0235	0.0244	0.0107	0.0109	-0.0257	0.1008	0.1354	0.2064
ADM	0.4032	0.2088	-0.0587	-0.0390	-0.0887	-0.1021	-0.0679	0.5051	0.4920	0.5131	0.5019	0.5083
Corn Products Int'l	0.1605	0.0417	0.3563	0.4892	0.5035	0.4431	0.5074	0.2765	0.2188	0.2576	0.2790	0.2888
Lance	0.2918	-0.0227	0.1272	0.0877	0.2773	0.2968	0.2683	0.7669	0.6001	0.5608	0.6033	0.7279
Taco Bell	0.5684	1.0734	0.7999	0.4360	0.5538	0.5694	0.3850	0.2212	0.2623	0.2293	0.2622	0.2253
Aventis	0.3320	0.7122	0.3919	0.3016	0.1480	0.1429	0.0347	0.5538	0.4136	0.4160	0.4198	0.4152
Unilever, LTD	0.1072	-0.1281	-0.2870	-0.4170	-0.3692	-0.3489	-0.3659	0.4178	0.3529	0.3851	0.3789	0.3616
Unilever, NV	0.0851	0.1147	-0.1665	-0.3827	-0.4143	-0.3893	-0.4580	0.4224	0.3682	0.3953	0.3955	0.3641