An Extension of Security Price Reactions Around Product Recall Announcements

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We examine 269 non-automotive product recall announcements that were published in the Wall Street Journal Index between January 1984 and December 2003. Consistent with previous research, we find statistically significant negative abnormal returns on, and one day prior to, the announcement date. Mean cumulative abnormal returns are not statistically significant over the pre- and post-announcement periods, however, providing evidence in support of the efficient market hypothesis (EMH). These results are robust with respect to the selected index, beta estimation method, and assumption about the behavior of residuals. Moreover, empirical results suggest that important differential industry effects exist and that companies in the drugs/cosmetics industry suffer most from their recall announcements.

Introduction

Product recalls have increased dramatically in the United States in recent years. Smith, Thomas, and Quelch (1996) point out that the United States Consumer Product Safety Commission (CPSC) was involved in 221 recall cases covering roughly 8 million consumer products in 1988. By 1993, however, the CPSC was engaged in 367 recall cases covering approximately 28 million product units. This growth in recalls is consequential because product recalls long have been recognized as important economic events. For example, Crafton, Hoffer, and Reilly (1981) and Reilly and Hoffer (1983) report that automobile recalls have a negative influence on short-term demand for the recalled automobiles. Additionally, Jarrell and Peltzman

0747-5535/05/1400 & 1500/00033/$2.50
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(1985) and Hoffer, Pruitt, and Reilly (1987) report that automobile recall announcements have a negative influence on share prices. Unsurprisingly, Pruitt and Peterson (1986) report a similar negative share price impact for non-automotive recalls as well.

The *Wall Street Journal (WSJ)* publishes product recall announcements in its daily press release, and the *Wall Street Journal Index* started categorizing product recalls separately in 1968. The U.S. government has devoted substantial resources to protect consumers and to improve and enhance product safety. Founded in 1970 under the Highway Safety Act, the National Highway Traffic Safety Administration (NHTSA) became responsible for reducing deaths, injuries, and economic losses associated with motor vehicles and vehicle equipments. In 1972 the United States CPSC was established under the Consumer Product Safety Act in order to protect the public from unreasonable risks of injury or death associated with dangerous consumer products.

Product recalls ordinarily occur when a product contains a defect that: 1) could generate a substantial danger to consumers; 2) involves hazardous material that could create severe exposure to consumers; 3) may cause a potential risk of serious injury or death from improper use; or 4) violates a consumer product safety standard or regulation. The recall process customarily begins with the discovery of a questionable product by a manufacturer, distributor, importer, retailer, end user, or responsible federal agency. The decision to recall a product typically is made and announced by the responsible agency, the company involved, or both parties jointly. These recall announcements increase the manufacturer's costs and reduce the recalling firm's market value because the majority of the costs associated with recalls such as advertising, shipping, and product repair and replacement costs are borne by or transferred to the manufacturing company. Additionally, because the estimated total costs of recalls rarely are reported in press releases and those costs are not easily determined by market participants, recall announcements may tend to have prolonged effects on equity prices.

Wynne and Hoffer (1976), Crafton, Hoffer, and Reilly (1981), and Reilly and Hoffer (1983) document a significantly negative correlation between automobile recalls and market demand. Moreover, findings suggest that automobile recalls substantially reduce not only the sales of the model recalled, but also the sales of substitute models of other manufacturers. Hartman (1987) finds that automotive recalls reveal unanticipated quality problems of the manufacturers and, thus, these recalls have strong negative effects on the resale prices of the recalled automobiles. Hoffer, Pruitt, and Reilly (1987) examine automobile recalls and find that the market does not respond on the date that the manufacturer notifies the NHTSA. On that day or the following day, the recall information is posted in the Technical Reference Library of the NHTSA. They find that the market immediately responds to the recall announcements on the *WSJ* publication date. These findings could be considered to be inconsistent with the efficient market hypothesis because markets moved on only the second release date. Pruitt and Peterson (1986) report that non-automotive recalls result in negative market reactions on the *WSJ* publication dates and that security prices continued to react to the announcements over extended intervals of time after the initial press releases.

Numerous researchers have examined the effects of automotive recalls on the equity prices of the responsible automotive manufacturers because of the consistently high frequency of recall in this industry. Few researchers have studied the price effects of non-automotive product recalls or recalls initiated by companies in a particular industry. For instance, Pruitt and Peterson (1986) examine the security price reactions of 156 non-automotive product recalls from January 1968 to December 1983, while Jarrell and Peltzman (1985) study the impact of product recalls on the wealth of the producers of drugs and automobiles.

This paper has three purposes: 1) to extend tests of the impact of product recalls into a different period of calendar time, 2) to compare the Pruitt and Peterson results from the 1968 to 1983 time period with the 1984 to 2003 time period, and 3) to provide new tests not previously conducted.

Data

The initial sample consists of 394 non-automotive product recall announcements that were listed in *The Wall Street Journal Index* from January 1984 through December 2003. Each company's security price information and the associated index returns are from the University of Chicago's Center for Research in Security Prices (CRSP) database.

The initial sample excludes automotive recalls due to the consistently high frequency of recall in that industry. Pruitt and Peterson (1986) report that the number of automotive recalls from the three largest U.S. manufacturers during the period from 1968 to 1983 is approximately twice as large as the number of all other recalls combined. Therefore, this suggests that the inclusion of automotive recalls in recall analysis would result in a significant sample bias.

We also excluded three recall announcements that were issued by the United States Food and Drug Administration (FDA) because the *WSJ* did not identify the manufacturers. In addition, we excluded 105 announcements because the responsible company's daily return information is either insufficient in length or missing from the CRSP database. Finally, we excluded 17 announcements because of overlapping time interval problems that may diminish the accuracy of the determination of the market's reaction to each individual recall announcement.

Table 1 summarizes the descriptive statistics of our final sample of 269 product recall announcements along with those reported by Pruitt and Peterson (1986). Panel A presents the final sample in the six industry categories utilized by Pruitt and Peterson. The comparison of our sample to that of Pruitt and Peterson is intriguing. Of the

Table 1—Descriptive Statistics of the Product Recall Sample

	Our Sample	Pruitt & Peterson
Panel A: Recalls by Product Category		
Drugs/Cosmetics	52/19.3%	36/23.1%
Electric/Electronic	71/26.4%	25/16.0%
Food/Consumables	71/26.4%	29/18.6%
Rubber/Automotive Parts	14/5.2%	21/13.5%
Toys/Small Appliances	25/9.3%	17/10.9%
Miscellaneous	36/13.4%	28/17.9%
Total	269	156
Panel B: Sample Product Recall Incidence by Year		
	1984: 4	1968: 1
	1985: 10	1969: 3
	1986: 18	1970: 4
	1987: 9	1971: 15
	1988: 9	1972: 9
	1989: 8	1973: 7
	1990: 15	1974: 17
	1991: 11	1975: 16
	1992: 11	1976: 9
	1993: 4	1977: 10
	1994: 18	1978: 18
	1995: 17	1979: 17
	1996: 19	1980: 10
	1997: 20	1981: 4
	1998: 24	1982: 9
	1998: 23	1983: 7
	2000: 30	
	2001: 15	
	2002: 3	
	2003: 1	
Panel C: Market Size of the Firms in the Recall Sample		
Over $1 Billion	200/74.3%	71/45.5%
Between $250 Million and $1 Billion	34/12.6%	43/27.6%
Under $250 Million	35/13.0%	42/26.9%
Total	269	156
Panel D: Frequency of Product Recalls for the Sample Firms		
One Recall	100/37.2%	72/46.2%
Two Recalls	22/8.2%	25/16.0%
Three Recalls	18/6.7%	7/4.5%
Four Recalls	5/1.9%	2/1.2%
Five Recalls	6/2.2%	1/0.6%
Six Recalls	2/0.7%	
Seven Recalls	0/0.0%	
Eight Recalls	1/0.4%	

six categories we study, there is little change in the percentage of recalls in the toys/small appliances category as they make up roughly 10 percent of each sample. Two categories, electric/electronic and food/consumables, make up a larger percentage of recalls in our sample than in Pruitt and Peterson's sample. The food/consumables category makes up approximately 26 percent of our sample as opposed to 18.6 percent of Pruitt and Peterson's sample. The electric/electronic category also makes up approximately 26 percent of our sample as opposed to only 16 percent of recalls in Pruitt and Peterson's sample. The food/consumables and electric/electronic categories are also tied as our largest categories with 71 recalls each. Of the categories that have a decreased representation in our sample, the only category that stands out as having a remarkable change is the rubber/automotive parts category. The rubber/automotive parts category also has the smallest number of recalls in our sample at 5.2 percent.

Panel B displays the timing of the recalls chronologically. Although sporadic during the late 1960s through the early 1990s, the number of recalls steadily increased in the late 1990s and reached its peak in year 2000. The average number of recalls per year during Pruitt and Peterson's sample was 9.75 compared to 13.45 recalls per year in our sample. Moreover, the variance of recalls has increased from slightly less than 30 to slightly greater than 60, and the F-test rejects the hypothesis of equal variance between the two samples. While the difference in the average number of recalls per year between the two samples appears large, homoskedastic t-test results suggest that the difference is not statistically significant at the 10 percent level (p-value = .1026). Given the small number of observation years, the power of the test is low; therefore, it is not surprising that homoscedastic t-test results fail to reject the null hypothesis. The finding of a higher average number of recalls was expected, however, and was one of the motivating factors that led us to undertake this study.

Panels C and D categorize the recalls by the market capitalization of the recalling companies and by the frequency of the recall announcements by a given firm, respectively. As shown in Panel C, not only do large firms (greater than $1 billion in market capitalization) continue to make up the majority of the recallers, they also have dramatically increased their representation in our sample (increasing from 45.5 percent of Pruitt and Peterson's sample to 74.3 percent of our sample).

As shown in Panel D, most companies in our sample have only one recall announcement within the time period investigated (37.2 percent). Pruitt and Peterson report similar qualitative results but the proportion of single recalls was higher in their sample at 46.2 percent. Again, large companies with market values of more than $1 billion appear to have more frequent recalls. These results are not surprising because large companies, such as Johnson & Johnson (eight recalls), Kellogg Co. (six recalls), Mattel Inc. (six recalls), etc., usually operate numerous divisions across various industries and produce a larger number of products than smaller firms produce. Data in Table 1 suggest that product recalls during the sample time period examined in this analysis are a relatively infrequent occurrence on a firm-specific basis and that product recalls are a widespread phenomenon in all industries in the United States.

Methodology

Our base methodology is identical to that applied by Pruitt and Peterson (1986); we employ a single factor market model, estimate betas using the Scholes and Williams (1977) method, and use the return of the value-weighted (VW) CRSP market index as the market proxy. The publication date of the product recall announcement in the *WSJ* is defined as the event date, t = 0. For each security, 182 daily returns are used, starting at day 121 before the event date and ending at day 60 after the event date. The first 100 days in this period (days t = -121 through t = -22) are designated the *estimation period*, and the following 82 days (days t = -21 through t = +60) are designated the *event period*. For details concerning the methodology and test statistics, see Pruitt and Peterson (1986).

Since the publication of Pruitt and Peterson's (1986) study, research on the event study methodology has shown that some methodological extensions may be warranted. Therefore, as an extension of the work of Pruitt and Peterson, and to ensure the robustness of our event-study results, we also utilize ordinary least squares (OLS) beta estimates in addition to the Scholes and Williams (1977) beta estimates. Scholes and Williams (1977) argue that nonsynchronous trading causes OLS estimators of market model parameters to be biased and inconsistent. This would lead researchers, such as Pruitt and Peterson (1986), to prefer the Scholes and Williams method of estimating betas. Cowan (1992) compares the results of using both the Scholes and Williams and OLS beta estimates and concludes that neither is uniformly superior. Therefore, it is prudent to use both methods to examine the robustness of the results.

Another methodological breakthrough since 1986 has been autoregressive conditional heteroskedasticity (ARCH) models. Therefore, as the homoskedasticity assumption of the traditional market-model approach may be violated, we also utilize both generalized autoregressive conditional heteroskedasticity (GARCH) and exponential generalized autoregressive conditional heteroskedasticity (EGARCH) models to ensure that our results are robust. The GARCH model, proposed by Bollerslev (1986), allows the conditional variance to change as a function of the past-realized residuals and past variances. The EGARCH model proposed by Nelson (1990) does not impose the non-negativity constraints on the coefficient estimators of the market model parameters and allows past residuals of different signs to have a differential impact on future volatility compared to the standard GARCH model. Akgiray (1989) and Corhay and Tourani Rad (1994) found that the variance of daily stock returns exhibits strong autoregressive conditional heteroskedasticity properties. Boehmer, Musumeci, and Poulsen (1991) and Corhay and Tourani Rad (1996) provide evidence that event-study regression models that account for time-varying conditional

Table 2—Mean Abnormal Returns, Z Test Statistics, and Mean Cumulative Abnormal Returns (MCARs)

	Our Sample			Pruitt & Peterson		
Event Date	Mean Abnormal Return	Z Test Statistics	MCAR	Mean Abnormal Return	Z Test Statistics	MCAR
-21	-0.004	-1.351	-0.004	0.002	0.434	0.002
-5	-0.002	-1.602	-0.004	0.001	0.996	-0.004
-4	-0.000	-1.137	-0.005	-0.000	-0.479	-0.004
-3	-0.002	-0.934	-0.006	-0.003	-1.469	-0.007
-2	0.001	0.258	-0.005	-0.001	-0.576	-0.008
-1	-0.011	-5.485**	-0.016	-0.004	-3.121**	-0.012
0	-0.006	-1.912$	-0.022	-0.004	-2.693**	-0.015
1	0.004	1.122	-0.019	-0.005	-3.415**	-0.020
2	-0.003	-0.972	-0.022	-0.001	-0.114	-0.021
3	-0.000	-0.770	-0.022	0.001	1.623	-0.020
4	-0.002	-1.845$	-0.023	-0.001	-0.690	-0.021
5	0.001	-0.455	-0.022	0.002	1.288	-0.018
20	0.005	1.373	-0.031	-0.002	-1.296	-0.017
60	0.001	0.585	-0.012	-0.000	-0.708	-0.034

The symbols $,*, ** denote statistical significance at the 10 percent, 5 percent and 1 percent levels, respectively (two-tailed test)

variance properties and stochastic parameters generate more efficient estimators of regression parameters and thus lead to a more robust conclusion than traditional event-study methodology. Therefore, it is prudent to employ these model specifications as well to further ensure our results are not spurious or the result of our choice of model.

As a final test of robustness, we also use the CRSP equally weighted (EW) index as a second market proxy to mitigate benchmark bias. These robustness tests are particularly vital in light of the findings of Lehmann and Modest (1987) who furnish empirical evidence that the selection of the market proxy affects risk-adjusted performance. The choice of the CRSP VW index is important because it is closer in spirit to the essence of CAPM, whereas our motive for using the CRSP EW index is that Kothari and Warner (1997) find that it mitigates some size-related bias and produces the least model misspecification.

Empirical Results

Table 2 presents a summary of the mean abnormal returns (MARs), their associated Z-test statistics, and the mean cumulative abnormal returns (MCARs) for selected days surrounding the *WSJ* product recall announcement date (event day 0). Columns two through four present the results for our sample while columns five through seven present the results reported by Pruitt and Peterson.

The results shown in Table 2 provide impressive evidence that product recall announcements have a meaningful negative effect on the common stock price of the responsible companies. Our MAR on the day prior to the announcement date (t = -1) is -1.11 percent, which is significantly different from zero at the 0.1 percent level. The MAR is -0.64 percent on the event date (t = 0), which is statistically significant at the 10 percent level. Approximately, 60 percent of the abnormal returns are negative on day -1 and 55 percent of the abnormal returns are negative on day 0. Pruitt and Peterson's results closely parallel our own as they too report a large negative reaction to the recalls on both event day –1 and event day 0.

The results indicate that, on average, the market reacts to the recall announcements on the trading day preceding the *WSJ*'s publication day and also on the *WSJ*'s publication day. We agree with Pruitt and Peterson that this two-day reaction presumably results because the announcement was made to the public on the day prior to the publication in the *WSJ*. Therefore, the market would be expected to react on event day -1. The market, however, can react only if the announcement was made in time that market participants actually could place a trade based on the information release. In cases where information releases were made near, or after, the market close, traders would be forced to wait until the next trading day to act on the new information. Given this situation, the expectation would be that both days would be expected to exhibit a reaction to news because some announcements would be reacted to on event day –1 while others would be reacted to on event day 0. Also, the reaction on both event days should be in the same direction.

Daily mean cumulative abnormal returns (MCARs) for selected event days also are displayed in Table 2 and are graphed in Figure 1. Except for a slight downward drift on day -12, the MCARs are comparatively stable during the pre-event period. The negative MCARs begin increasing over the post-event period, hover around 3 percent from day 13 to 36, and decline toward the end of the post-event period. The largest MCAR is -3.55 percent and appeared on event days 19 and 20.

In order to test whether the negative MCARs are significant and whether the impact of recall announcements is permanent, we test the MCARs for statistical significance. Table 3 presents the MCARs and their associated Z-statistics for different intervals over the event period. Columns two and three present our results while columns four and five present the results reported by Pruitt and Peterson. The MCAR for our two-day event period comprising day -1 and 0 is -1.77 percent which is significant at the 0.1 percent level. Our MCAR is smaller in magnitude but stronger in statistical significance than the result reported by Pruitt and Peterson. Our MCARs over the intervals from day -21 to -12 and from day 41 to 50 are statistically significant at the 5 percent level. For both the entire pre-event period from day -21 to -2 and the entire post-event period from day 1 to 60, however, no statistically significant MCARs are detected. Thus, our results are largely consistent with those of Pruitt and Peterson despite the difference in the time periods and compositions of our samples.

Figure 1—Mean Cumulative Abnormal Returns (MCARs)

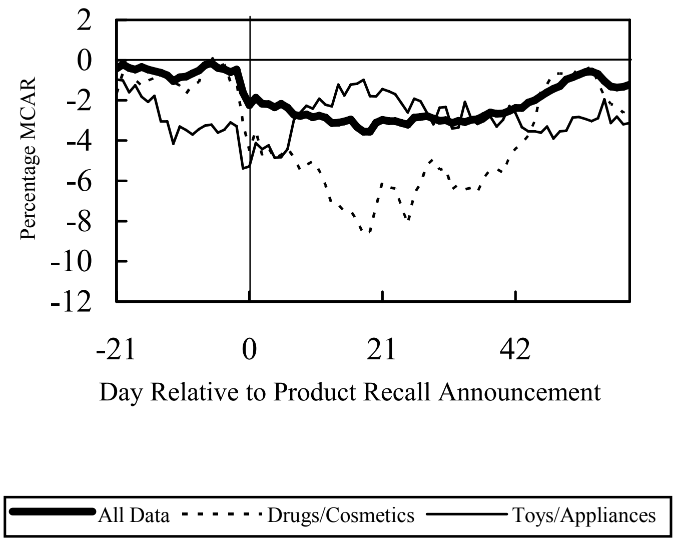

Table 4 presents the analysis of MCARs by magnitude and frequency over the post-event period. Results for our sample are reported in column two and the results of Pruitt and Peterson's sample is reported in column three. The mode for both samples is the grouping of between –5 percent and 5 percent and neither sample appears to have a significant number of outliers that would influence results. It appears that our sample is slightly less peaked and has slightly fatter tails. Nevertheless, despite the differences of our respective samples, the reported metrics are qualitatively similar.

Table 3—Mean Cumulative Abnormal Returns (MCARs)

	Our Sample		Pruitt & Peterson	
Event Date	MCAR	Z Test Statistic	MCAR	Z Test Statistic
-21 to -12	-0.010	-1.998*	-0.001	-0.627
-11 to -2	0.005	0.394	-0.006	-1.301
-1 to 0	-0.018	-5.230**	-0.007	-3.708*
1 to 10	-0.006	-1.198	0.000	0.297
11 to 20	-0.003	-0.076	-0.002	-0.371
21 to 30	0.002	-0.285	-0.004	-0.838
31 to 40	0.004	0.412	-0.011	-2.297*
41 to 50	0.016	1.013*	-0.001	-0.585
51 to 60	-0.002	-1.183	-0.001	-0.459
-21 to -2	-0.004	-1.060	-0.008	-1.364
1 to 60	0.007	-0.189	-0.019	-1.816

The symbols $,*, ** denote statistical significance at the 10 percent, 5 percent and 1 percent levels, respectively (two-tailed test)

Table 4—Breakdown of the Mean Cumulative Abnormal Returns (MCARs) by Magnitude and Frequency During Event Period 1-60

	Our Sample	Pruitt and Peterson
Less than -30%	21/7.8%	6/3.8%
Between -30.0% and -20.01%	21/7.8%	14/9.0%
Between -20.0% and -10.01%	41/15.2%	27/17.3%
Between -10.0% and -5.01%	21/7.8%	17/10.9%
Between -5.0% and 5.0%	54/20.1%	45/28.8%
Between 5.01% and 10.0%	38/14.1%	19/12.2%
Between 10.01% and 20.0%	31/11.5%	17/10.9%
Between 20.01% and 30.0%	18/6.7%	7/4.5%
Greater than 30.0%	24/8.9%	4/2.6%
Less than -5.0%	104/38.7%	64/41.0%
Greater than 5.0%	111/41.3%	47/30.1%

Combined, the evidence presented in Tables 2 through 4, suggests that the market views product recalls as unfavorable and unexpected events. The market reacts immediately once the recall information is released, and it appears that the market resolves the issue of the magnitude of the impact quickly as we find no significantly persistent effects over the two-month post-event period.

As discussed earlier, one important issue is whether the results we obtained are robust to the choice of benchmark index, beta estimation methodology, or assumption about the residuals. Therefore, we utilized several additional methodologies and performed tests using both the CRSP-VW and CRSP-EW indices. Table 5 presents event study results for days -5 through +5 using the CRSP-VW index. We repeat, in column two, the results using the Scholes-Williams beta estimates for easy comparison. Columns three through five present results using OLS beta estimates, GARCH, and EGARCH methods, respectively. In Table 5, MARs are presented on the top line and the appropriate test statistic is presented in parenthesis below the MAR.

Results in Table 5 reveal that our conclusions are not altered by the choice of event study methodology. Notably, the magnitude of the MARs is similar despite the estimation method. Also, the statistical significance of the MARs is similar among methods. Importantly, none of the methods detect any significant MARs before day -1 or after day +3. All methods find day -1 to be negative (1.09 percent to 1.15 percent) and significant at the 0.1 percent level. The most significant difference among the various tests is that the reported statistical significance on day +1, +2 and +3 differ. The GARCH and EGARCH methods result in slightly higher statistical significance than do the OLS or Scholes-Williams tests.

Table 6 repeats the analysis in Table 5 but utilizes the CRSP-EW index in place of the CRSP-VW index. This allows us to assess the influence of index selection on our results. Results in Table 5 and those in Table 6 are very similar. Again, none of the methods detect any significant MARs before day -1 or after day +3. All methods find day -1 to be negative (1.08 percent to 1.15 percent) and significant at the 0.1 percent level. The most significant difference among methods is that the reported

Table 5—Robustness of Estimated Mean Abnormal Returns (MARs) and Test Statistics for the Overall Sample of Recalls using the CRSP-VW Index

Day	Scholes-Williams	OLS	GARCH	EGARCH
-5	-0.24%	-0.24%	-0.23%	-0.21%
	(-1.599)	(-1.602)	(-1.429)	(-1.285)
-4	-0.07%	-0.08%	-0.07%	-0.07%
	(-1.011)	(-1.137)	(-0.423)	(-0.412)
-3	-0.14%	-0.16%	-0.14%	-0.15%
	(-0.857)	(-0.934)	(-0.868)	(-0.900)
-2	0.13%	0.14%	0.15%	0.17%
	(0.180)	(0.258)	(0.941)	(1.029)
-1	-1.15%	-1.11%	-1.11%	-1.09%
	(-5.681***)	(-5.485***)	(-6.782***)	(-6.647***)
0	-0.62%	-0.64%	-0.63%	-0.61%
	(-1.875$)	(-1.912$)	(-3.828***)	(-3.743***)
+1	0.36%	0.35%	0.37%	0.38%
	(1.182)	(1.122)	(2.241*)	(2.311*)
+2	-0.30%	-0.31%	-0.28%	-0.26%
	(-0.880)	(-0.972)	(-1.730$)	(-1.578)
+3	-.01%	-0.01%	0.02%	0.02%
	(-0.857)	(-0.702)	(0.100)	(0.150)
+4	-0.16%	-0.16%	-0.14%	-0.16%
	(-1.902$)	(-1.845$)	(-0.880)	(-1.003)
+5	0.17%	0.11%	0.13%	0.12%
	(-0.080)	(-0.455)	(0.767)	(0.717)

The symbols $, *, **, and *** denote statistical significance at the 10 percent, 5 percent, 1 percent and 0.1 percent levels, respectively, using a two-tailed test

statistical significance on day +1, +2, and +3 differs. Again, the GARCH and EGARCH methods result in a slightly higher statistical significance than do the OLS or Scholes-Williams methods. The magnitudes of MARs in Table 5 are very similar to those in Table 6. Additionally, the pattern of statistical significance is identical, suggesting that our conclusions are not influenced by either the choice of index or the choice of event study methodology.[1]

Another important issue concerning product recalls is whether the recalls have a differential impact by industry. Intuitively, companies in some industries should suffer more from their product recall announcements than companies in other industries. For example, the drug industry should be more severely impacted than the rubber industry. One rationale is that bad drugs could definitely kill you whereas bad tires seldom do so. Moreover, bad tires are probably not a signal of problems with other products made by the firm, while bad drugs may be a powerful signal of other problems.[2]

To gain insight into this question, the final sample of 269 recalls is divided into the six industry categories presented in Panel A of Table 1. The food/consumable

[1] The pattern of MCARs presented in Table 3 is unaltered by the choice of methodology or index. Results are available from the corresponding author.

[2] We are grateful to an anonymous referee for bringing this important point to our attention.

Table 6—Robustness of Estimated Mean Abnormal Returns (MARs) for the Overall Sample of Recalls Using the CRSP-EW Index

Day	Scholes-Williams	OLS	GARCH	EGARCH
-5	-0.20%	-0.22%	-0.21%	-0.20%
	(-1.243)	(-1.350)	(-1.265)	(-1.172)
-4	-0.01%	-0.03%	-0.05%	-0.01%
	(-0.446)	(-0.599)	(-0.272)	(-0.051)
-3	-0.14%	-0.17%	-0.17%	-0.14%
	(-1.098)	(-1.184)	(-0.987)	(-0.819)
-2	0.03%	0.07%	0.09%	0.12%
	(-0.308)	(-0.146)	(0.511)	(0.711)
-1	-1.15%	-1.12%	-1.11%	-1.08%
	(-5.937***)	(-5.766***)	(-6.636***)	(-6.456***)
0	-0.60%	-0.62%	-0.62%	-0.59%
	(-1.808$)	(-1.855$)	(-3.708***)	(-3.519***)
+1	0.29%	0.32%	0.33%	0.37%
	(0.928)	(1.127)	(1.996*)	(2.209*)
+2	-0.27%	-0.27%	-0.26%	-0.22%
	(-0.757)	(-0.850)	(-1.576)	(-1.328)
+3	-.04%	-0.01%	0.02%	0.07%
	(-0.436)	(-0.577)	(0.106)	(0.413)
+4	-0.17%	-0.15%	-0.14%	-0.11%
	(-1.786$)	(-1.719$)	(-0.860)	(-0.675)
+5	0.23%	0.20%	0.18%	0.20%
	(0.447)	(0.256)	(1.055)	(1.203)

The symbols $, *, **, and *** denote statistical significance at the 10 percent, 5 percent, 1 percent and 0.1 percent levels, respectively, using a two-tailed test

and electric/electronic industries have the largest sample size of 71, while the rubber/automotive parts industry has the smallest sample size of 14.

Table 7 reports the results of the MARs of the six industries and their associated test statistics for selected days surrounding the event day. Of the six industries examined, three industries have statistically significant MARs on event day -1 (at the 5 percent level or better). The two industries most severely impacted by recalls are the drugs/cosmetics industry and the toys/appliances industry. The MAR from the drugs/cosmetics industry on event day -1 is -2.11 percent, which is significant at the 0.1 percent level. The MAR from the toys/appliances industry on event day -1 is -2.10 percent, which is significant at the 1 percent level. Thus, the evidence suggests that product recalls have the most significant stock price influence on firms in the drugs/cosmetics and the toys/appliances industries.

Industry results do not appear to hinge critically on index selection. Results of repeating industry tests using the CRSP-EW index suggest that there is no change in statistical significance for the food/consumables or toys/appliances categories for any event period in either Table 7 or Table 8. For electrical/electronic, event day -5 in Table 5 lost statistical significance as did both marginally significant event periods in Table 8. To summarize, it appears that changing the benchmark index may result in changing the statistical significance of an event slightly (either increasing or

Table 7—Mean Abnormal Returns (MARs) for Specified Industry Categories

Event Date	Food/ Consumables (N=71)	Drugs/ Cosmetics (N=52)	Miscellaneous (N=36)	Electrical/ Electronic (N=71)	Rubber/ Auto Parts (N=14)	Toys/ Appliances (N=25)
-21	-0.0026	-0.0172	-0.0011	0.0037	-0.0024	-0.0096
	(-0.115)	(-3.415)***	(0.068)	(1.030)	(-0.814)	(-1.003)
-5	0.0018	-0.0045	0.0069	-0.0047	-0.0063	-0.0040
	(-1.333)	(-0.968)	(2.351)*	(-1.681)$	(-0.943)	(-0.887)
-4	-0.0076	-0.0006	-0.0035	0.0054	0.0026	0.0014
	(-2.819)**	(-0.078)	(-0.087)	(1.024)	(0.166)	(-0.198)
-3	0.0009	-0.0094	0.0013	-0.0019	0.0032	0.0037
	(-0.454)	(-0.045)	(0.490)	(-0.517)	(0.225)	(0.609)
-2	0.0005	-0.0001	0.0005	0.0032	0.0091	-0.0019
	(-1.322)	(0.081)	(0.456)	(0.585)	(1.357)	(0.009)
-1	-0.0032	-0.0211	-0.0079	-0.0120	-0.0077	-0.0210
	(-2.644)**	(-4.161)***	(-1.604)	(-1.624)	(-0.658)	(-3.037)***
0	-0.0029	-0.0148	-0.0063	-0.0078	0.0030	0.0009
	(-0.293)	(-2.427)*	(-0.111)	(-1.043)	(0.635)	(-0.784)
1	0.0011	0.0100	0.0021	0.0017	-0.0067	0.0117
	(-0.151)	(1.191)	(0.392)	(0.440)	(-0.812)	(1.318)
2	-0.0060	-0.0115	0.0016	0.0028	0.0019	-0.0031
	(-0.898)	(-2.152)*	(0.762)	(0.969)	(0.338)	(-1.117)
3	-0.0012	0.0033	-0.0045	0.0002	-0.0001	0.0020
	(-0.567)	(-0.045)	(0.221)	(-1.052)	(-0.117)	(-0.188)
4	0.0013	-0.0046	-0.0032	-0.0001	-0.0015	-0.0062
	(0.066)	(-1.422)	(-0.287)	(-1.058)	(-0.992)	(-1.446)
5	0.0035	0.0028	0.0009	0.0008	-0.0017	-0.0002
	(0.690)	(-0.171)	(-0.311)	(0.418)	(-0.638)	(-1.035)
20	0.0005	0.0116	0.0087	0.0053	-0.0094	-0.0003
	(0.313)	(1.515)	(1.104)	(0.877)	(-1.844)$	(0.341)
60	-0.0018	0.0050	0.0014	0.0023	-0.0033	0.0006
	(-0.773)	(0.631)	(0.114)	(1.030)	(-0.393)	(0.281)

Notes:
1. N represents the sample size of each industry category
2. The numbers shown in parentheses are the corresponding Z statistics of the MARs
3. The symbols $, *, **, *** denote statistical significance at the 10 percent, 5 percent, 1 percent, and 0.1 percent levels, respectively, using a two-tail test

decreasing), but qualitative results remain the same. The same can be said of using other methodologies as well.[3]

Figure 1 displays the MCARs of these two industries along with the MCARs of the entire sample during the event period. The large negative daily MCARs in the drugs/cosmetics industry are the major contributors to the negative MCARs of the total sample data during the post-event period. Table 8 shows that none of the industries exhibit statistically significant MCARs during the entire post-event period from day 1 to 60. Overall, the product recall announcements have strong negative effects on all industries and appear to be a wide spread phenomenon in the United States. Based on the sample used in the analysis, the common stocks of firms in the

[3] Results are available from the corresponding author.

drugs/cosmetics and toys/appliances industries are relatively more sensitive to their recall decisions, while the stocks of firms in the rubber/auto parts industry tend to be less sensitive.

Table 8—Mean Cumulative Abnormal Returns (MCARs) for Specified Industry Categories

Event Date	Food/ Consumables (N=71)	Drugs/ Cosmetics (N=52)	Miscellaneous (N=36)	Electrical/ Electronic (N=71)	Rubber/ Auto Parts (N=14)	Toys/ Appliances (N=25)
-21 to -12	0.0000	-0.0149	-0.0107	-0.0083	-0.0015	-0.0416
	(0.214)	(-1.709)$	(0.036)	(-1.458)	(-0.413)	(-1.988)*
-11 to -2	0.0031	-0.0025	0.0172	0.0045	0.0247	0.0088
	(0.537)	(-0.019)	(1.996)*	(-0.271)	(0.357)	(0.195)
-1 to 0	-0.0061	-0.0359	-0.0143	-0.0198	-0.0046	-0.0200
	(-2.091)*	(-4.658)***	(-1.212)	(-1.886)$	(-0.016)	(-2.702)**
1 to 10	-0.0098	-0.0041	0.0015	-0.0186	-0.0104	0.0288
	(-1.610)	(-0.293)	(1.595)	(-1.657)$	(-0.873)	(0.974)
11 to 20	0.0126	-0.0259	0.0037	-0.0118	0.0175	0.0060
	(2.168)*	(-1.159)	(-0.084)	(-1.463)	(1.115)	(0.405)
21 to 30	0.0049	0.0156	0.0172	-0.0072	0.0274	-0.0053
	(0.108)	(0.862)	(-0.713)	(-0.873)	(0.805)	(-0.638)
31 to 40	-0.0041	-0.0017	0.0229	0.0066	0.0215	-0.0061
	(-1.047)	(0.278)	(1.319)	(0.929)	(0.167)	(-0.532)
41 to 50	0.0112	0.0501	0.0087	0.0078	0.0275	-0.0052
	(0.572)	(2.738)**	(0.302)	(0.340)	(1.579)	(0.064)
51 to 60	-0.0087	-0.0158	0.0009	0.0133	-0.0242	0.0038
	(-0.574)	(-2.204)*	(-0.013)	(0.603)	(-0.844)	(-0.086)
-21 to -2	0.0030	-0.0174	0.0065	-0.0038	0.0232	-0.0328
	(0.228)	(-1.222)	(1.437)	(-1.223)	(-0.039)	(-1.268)
1 to 60	-0.0060	0.0182	0.0204	-0.0100	0.0594	0.0220
	(-0.157)	(0.097)	(0.991)	(-0.866)	(0.796)	(0.076)

Notes:
1. N represents the sample size of each industry category
2. The numbers shown in parentheses are the corresponding Z statistics of the MCARs
3. The symbols $, *, **, *** denote statistical significance at the 10 percent, 5 percent, 1 percent, and 0.1 percent levels, respectively, using a two-tail test

Conclusion

We examine the security price reaction of 269 non-automotive product recall announcements that were published in the daily press releases of the *WSJ* during the time period from January 1984 through December 2003. Companies in food/consumables and the electric/electronic industries have the highest recall incidences during the sample period investigated. Presumably, the high incidence of recalls in the electric/electronic industry is due to the rapid growth of high technology during the sample period. The sample data indicate that product recalls are not a firm-specific phenomenon, but a widespread phenomenon encompassing all industries in the United Sates.

Using event study methodology, we find statistically negative abnormal returns on, and one day prior to, the recall announcement date. Moreover, no significant mean cumulative abnormal returns (MCARs) are detected during the pre-announcement period. Consistent with the findings of Pruitt and Peterson (1986), the results suggest that recall announcements convey not only unexpected but also unfavorable information about the responsible companies. Additionally, security prices immediately incorporate all available information once it is released to the market. In contrast to the previous research, MCARs are not statistically significant during the entire post-announcement period. Security markets react quickly and efficiently to the information content of product recalls, and recall announcements do not have persistent effects on the security prices.

To gain additional insight into the topic of whether product recalls have differential effects on the security prices of the responsible companies in different industries, we also conducted a cross-industry event study. The results reveal that companies in the drugs/cosmetics industries suffer the most from their recall announcements, followed by the companies in the toys/appliances industry. Additionally, product recalls have the least influence on the security prices of the responsible companies in the rubber/auto parts industries. Our examination of the MCARs for each industry separately reveals that the EMH also holds over the pre- and post-announcement periods for each individual industry during the time period investigated.

Finally we examined our results for robustness. Our robustness tests utilized the CRSP-VW and CRSP-EW indices, OLS and Scholes-Williams beta estimates, and GARCH and EGARCH models. Results of these tests suggest that our results are robust and not sensitive to the selected benchmark, index, or model specification.

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