THE IMPACT OF EXTERNAL PARTIES ON BRAND-NAME CAPITAL: THE 1982 TYLENOL POISONINGS AND SUBSEQUENT CASES

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An examination of the 1982 Tylenol poisonings reveals stock market losses to Johnson & Johnson that far exceed direct costs and losses shared with other pain-reliever producers; this evidence provides support for the Klein and Leffler [1981] theory of brand names as quality-assuring mechanisms. Of the subsequent cases, only the 1986 Tylenol poisonings were associated with significant stock market losses. Prior to the 1982 and 1986 Tylenol poisonings, Tylenol was the number one pain reliever, whereas the other pain relievers that were poisoned had a much lower level of brand-name capital to lose.

I. INTRODUCTION

On September 30, 1982 Johnson & Johnson announced that three people had been killed as the result of ingesting cyanide-laced Tylenol capsules.[1] Four more Tylenol-related deaths were reported within the next two days. Culminating in 125,000 stories in the print media alone, the poisonings were an event without precedent in American business (*Dun's Business Month* [1983]). The Tylenol brand received over $1 billion in adverse publicity.[2] As a result, many analysts claimed the brand was dead. But the company president, James Burke, ignoring the advice of government officials and even some of his close associates, decided to spend millions to revive Tylenol. Burke's decision will be studied in business schools for years to come. The general opinion today is that Johnson & Johnson and Tylenol made a prodigious comeback, one unparalleled in American business.

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1. In researching the Tylenol poisonings, I examined over two hundred articles in nonacademic publications including *Advertising Age*, *Drug Store News*, *Fortune*, and *Wall Street Journal* for dates, market share figures, advertising expenditures, and so forth. To save space and facilitate the flow of the paper, many of the articles used are not cited. For the interested reader, a complete list of all articles is available.

2. According to *Drug Store News* [1982], it would have cost Johnson & Johnson over $1 billion to purchase a similar amount of air time and print space.

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The event provides an opportunity to study the effect that an external party can have on the brand name or reputation of a firm. That is, to what degree does a firm's brand name suffer a loss in value even when the firm clearly did not intentionally lower product quality? In other words, do consumers hold firms responsible for the damaging actions of parties not associated with that firm? What is the proper gauge to use in measuring the recovery from such an event? Many would favor market share, while others might argue that the stock price is a better barometer to measure recovery. This study attempts to resolve these issues.

II. BRAND NAMES AND PRODUCT TAMPERING

The theory of brand names as quality-assuring devices has emerged formally in the last decade. Klein and Leffler [1981], following the arguments by Klein, Crawford and Alchian [1978], developed a model in which the presence of firm-specific sunk capital investments, such as those incurred in developing a brand name, provide a mechanism for assuring contractual performance.[3] According to their model, if a firm cheats by reducing product quality below the expected level, the value of its brand-name capital declines to zero and the price premium which consumers were willing to pay for the firm's products is lost. Recent empirical studies by Jarrell and Peltzman [1985], Chalk [1986; 1987], Mitchell and Maloney [1989] and Benjamin and Mitchell [1989] have presented evidence in support of the theory.

Can a firm suffer a loss in brand-name capital even if management did not intentionally cheat and lower product quality or fail to prevent cheating by distributors and retailers? While the development of a brand name is largely under the control of management with firm-specific capital investments and consistent product quality, forces external to a firm may seriously damage the value of its brand name. The classic example is product tampering.

To the extent that product tampering reduces the expected safety level of a product, consumers will shy away from that product. If consumers perceive that the tampering is targeted at a firm, they will reduce their demand for similar products produced by the firm as well, at least until the tamperer is captured, the safety level is improved so that tampering cannot occur again, or the firm eliminates whatever may have triggered the tamperings. Additionally, when product tampering reveals information about the safety level of similar products produced by other firms, consumers will reduce their demand for products of those firms as well. However, as long as consumers perceive the tampering was directed at a specific firm, demand for the tampered product will exhibit a reduction relative to competing products. To

3. See also Barzel [1982], Benjamin [1978], Shapiro [1983] and Telser [1980].

summarize, the decline in the expected safety level of a product should cause consumers to revise their consumption patterns and shy away from that product, and to the extent that the product is identified with the firm, the brand-name capital of the firm itself will depreciate as well.

III. JOHNSON & JOHNSON AND THE TYLENOL CRISIS

During a three-day period in late September and early October of 1982, seven Chicago-area residents died after taking Extra-Strength Tylenol capsules contaminated with cyanide. Johnson & Johnson immediately recalled the lots from which the contaminated bottles had come and halted advertisements for the entire Tylenol product line. Within days, it became clear to investigators that the tampering had occurred at the retail level.[4] Apparently, a few bottles of Extra-Strength Tylenol capsules had been removed from store shelves, the cyanide added, and the bottles returned to the shelves. Learning this, Johnson & Johnson withdrew all Tylenol capsules from the market.

In the mid-1970s, a consumer-oriented promotion campaign made Tylenol the biggest selling item in drug, food, and mass merchandising outlets, breaking an eighteen-year dominance by Proctor & Gamble's Crest toothpaste. By 1982, the Tylenol product line controlled 37 percent of the over-the-counter analgesics market, in which sales totaled $1.2 billion. Immediately following the cyanide poisonings, the market share of the entire Tylenol line fell from 37 to 7 percent.[5] Although the company and its manufacturing procedures were quickly cleared of any possible direct role in the disaster, some question remained concerning the brand's survivability. Johnson & Johnson made clear its commitment to regaining Tylenol's pre-poisonings status. A month after the poisonings the company resumed regular advertising of the non-capsule products in the Tylenol line. A few weeks later Johnson & Johnson repackaged the capsules with a triple safety seal and began an advertising campaign focusing mainly on the new packaging. The capsules gradually reappeared on the shelves in late December of 1982. Even before the return of the Tylenol capsules, the market share of Tylenol tablets appeared to rebound, despite heavy competition from brands never before advertised.[6] Tylenol rebounded to a 30 percent market share within six months. By August 1983, Tylenol was firmly established once again as the nation's leading pain reliever.

4. The cyanide-laced capsules were from bottles produced in two different states, Texas and Pennsylvania, making it unlikely that contamination occurred at the plant level.

5. Noncapsule products in the Tylenol line were never removed from the shelves.

6. Information Resources Inc., which surveys sales in grocery outlets in four U.S. towns, claimed Tylenol recaptured 95 percent of its prior total market share by mid-December. In the first week of December alone, Tylenol's market share climbed 47 percent. However, much of this may be attributed to the $2.50 coupons Johnson & Johnson offered in thousands of newspapers in order to win back customers [*Advertising Age* 1982b].

This evidence suggests Johnson & Johnson was successful in reestablishing confidence in the brand. Over 90 percent of consumers questioned in a survey felt that Johnson & Johnson was not to blame, according to the *Wall Street Journal* [1982]. Many analysts felt that the company had exceeded its responsibility and deserved the Comeback of the Year award. To this day, other companies' reactions to product tampering are judged relative to Johnson & Johnson's handling of the Tylenol disaster.[7] The name Tylenol, as well as Johnson & Johnson, seems to mean just as much as it did before the incident.

IV. STOCK-PRICE EFFECTS OF 1982 TYLENOL POISONINGS

Stock market event analysis an often-used technique in estimating the impact of events such as the 1982 Tylenol poisonings. It involves the identification of an event that causes investors to change their expectations concerning the discounted future cash flows of a security. The analysis is based on the theory of efficient markets, which assumes that the price of any security incorporates at each instant all currently available information and adjusts to new information as soon as the information is accessible to investors.

The objective of the empirical model is to obtain a well-specified time series of security returns for the firm; a widely accepted way of achieving this is the market model

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

$$\varepsilon_{it} \sim N(0,\sigma^2),$$

which assumes that the return to a security i at time t, R_{it}, is a linear function of the market return, R_{mt}, plus a random error term, ε_{it}, which is uncorrelated with the market return.

By estimating the market model for a period different from the event period, the returns on security i can be forecasted, conditional on the parameter estimates $(\hat{\alpha}_i,\hat{\beta}_i)$ and the actual return on the market index, R_{mt}, for each day of the event period. The abnormal return

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt})$$

measures the impact of the event on security i at time t. For events lasting more than one day, the abnormal returns are summed to obtain the cumulative abnormal return

7. According to *Advertising Age* [1986b, 3], "Johnson & Johnson is widely viewed as having written the textbook on corporate response to devastating news."

$$CAR_{iT} = \sum_{t=1}^{T} AR_{it}$$

where T is the length of the event window.

The daily stock returns tapes from the Center for Research in Security Prices (CRSP), University of Chicago, were used to estimate the market model for Johnson & Johnson for the one-year period (253 trading days) prior to the poisonings. The CRSP equally-weighted market return of all NYSE and AMEX stocks proxies R_{mt} in the empirical tests.[8] Table I displays estimates of the market model parameters with standard errors in parentheses.

Several measures were taken to test the stability of the market model estimates reported in Table I. For example, the presence of nonsynchronous trading may bias the coefficient estimates of the market model parameters. To test this potential bias, the market model was replicated using the Dimson [1979] technique with $R_{m,t-1}$ and $R_{m,t+1}$, in addition to R_{mt}, as the independent variables. The abnormal returns generated from this technique are not significantly different from those reported in the text and are available on request as are the Dimson market-model estimates and all other results mentioned but not reported. Also, estimation periods of 100 ($\hat{\beta} = 1.35$), 150 ($\hat{\beta} = 1.46$) and 200 ($\hat{\beta} = 1.40$) trading days prior to the poisonings yielded no significant differences from the market model estimates reported.[9]

To account for factors unique to the over-the-counter drug industry, the rate of return of the drug industry has been substituted as the independent variable in place of the market return.[10] In order to discern the effects of the poisonings on the drug industry, the market model was also estimated with the drug industry return substituted as the dependent variable. Estimates from these two versions of the market model are displayed in Table I with standard errors in parentheses. The estimates of α and β from the three models shown in Table I were then used to forecast the *CAR*s over the event period.

8. The CRSP value-weighted market return was also used as a proxy for the market return, but did not alter the results.

9. I also estimated the market model for post-event periods of 100 ($\hat{\beta} = 0.88$), 150 ($\hat{\beta} = 0.87$), 200 ($\hat{\beta} = 0.95$) and 250 ($\hat{\beta} = 0.96$) trading days, beginning 20 trading days after September 30, 1982 (the first day of the event window). Given the stability in the β estimates across the pre-poisoning estimation periods, the stability in the β estimates across the post-poisoning estimation periods, and the difference in the β estimates between the two periods, this evidence suggests that the difference in β between the pre- and post-poisonings estimation periods was due to the poisonings. A computation of moving-average betas of 50 trading days for a 500-trading-day interval symmetric around the poisonings also suggests the shift in beta resulted from the poisonings. Furthermore, there was no change in Johnson & Johnson's capital structure, asset size, and operations after the Tylenol poisonings that would be predicted to have altered beta.

10. The drug industry portfolio is equally weighted and excludes Johnson & Johnson. It consists of twenty-two firms that produce over-the-counter drug products, most of which are found under Standard Industrial Classification (SIC) code 2834 (pharmaceutical preparations). A value-weighted drug industry portfolio was also used, but did not alter the results.

TABLE I
Market Model Estimates[a]

Estimation Period: September 30, 1981 – September 29, 1982 (252 trading days)

Dependent Variable	Independent Variable	$\hat{\alpha}$	$\hat{\beta}$	R^2
Johnson & Johnson Return	Market Return	0.0007 (0.0010)	1.3544 (0.1337)	0.29
Johnson & Johnson Return	Drug Industry Return	–0.0001 (0.0009)	1.1376 (0.0880)	0.40
Drug Industry Return	Market Return	0.0008 (0.0003)	1.1896 (0.0463)	0.72

[a]The standard errors are in parentheses.

Data source: Center for Research in Security Prices, daily stock returns tapes 1981–82 (University of Chicago).

Two event periods are examined. The first represents investors' initial reaction to the poisonings. This period should be long enough to include any substantial new information about the poisonings, and yet not be too long so as to incorporate other events which would influence the estimates. Second, after investors formed a prediction about the event, did Johnson & Johnson recover? This would occur if, after some point, investors realized that they had been wrong about their initial forecast of the response of consumers to Johnson & Johnson, especially Tylenol, following the poisonings. In the test for recovery, the null hypothesis of no recovery is the estimated value of the *CAR* in investors' initial forecast of the effects of the poisonings, and recovery is measured relative to this estimate.

No one can say precisely how long it took for investors to become confident about the accuracy of the information on the magnitude of the disaster. The event began on Thursday morning, September 30, 1982, when the stock market received notice of the first two victims. All seven victims were accounted for within the next two days. By Monday, October 4, it was suspected the tampering occurred at the retail level. These suspicions were confirmed by the end of the week and no substantial new information materialized after this, based on reports from the *Wall Street Journal*, major newspapers and trade magazines.

Table II contains three measures of the *CAR* for twenty trading days following the poisonings, corresponding to the three market models in Table I.

The first two measures, CAR_{jj}^{m} and CAR_{jj}^{di}, are based on Johnson & Johnson's relationship with the overall market and drug industry, respectively. For both measures, the *CAR* declined markedly during the first few days in the aftermath of the poisonings, and then leveled off. In both cases, the *CAR* is statistically different from zero for all twenty trading days at the 1 percent level of significance using a one-tail test.[11] Hence, an abnormal decline in the value of Johnson & Johnson immediately following the Tylenol event is indicated with a high level of statistical confidence.

The *CAR* for Johnson & Johnson declines less based on its relationship with the drug industry, CAR_{jj}^{di}, than with its relationship with the overall market, CAR_{jj}^{m}, indicating that the other over-the-counter drug companies suffered losses as well. The third measure of the *CAR* in Table II, CAR_{di}^{m}, was forecasted for the drug industry (excluding Johnson & Johnson), based on its relationship with the market. During the first six or seven trading days following the poisonings, there appears to be no impact on the other drug companies. However, CAR_{di}^{m} begins to decline around the eighth trading day and is statistically significant at the 1 percent level of significance for the eleventh through twentieth trading days after the poisonings, although the value of CAR_{di}^{m} is much less than for CAR_{jj}^{m} over this period.

It is not obvious why CAR_{di}^{m} does not decline immediately following the poisonings. One possible explanation is that it took a few days before it became apparent that it was not solely a Tylenol problem, but could have occurred to other capsule makers as well. An examination of the *Wall Street Journal* and trade magazines revealed no other significant events during this period that may have contributed to the significant decline.

After the tenth trading day, the two measures of the *CAR*s for Johnson & Johnson appear to have subsided somewhat. Rather than reporting the *CAR*s for a specific date as indicative that investors were confident about the magnitude of the poisonings, the *CAR*s were averaged over a ten-day trading period, beginning on the eleventh day after the event and ending on the twentieth day (October 14–27). The *CAR*s were averaged over the ten-day

11. The standard error of the *CAR* is

$$\hat{\sigma}_{car} = \left\{\hat{\sigma}^2_{et}\left[\sum_{x=1,Nf}(1 + 1/N_e + (R_{mt} - \bar{R}_m) / CSSR_{mt})\right] + N_f(N_f - 1) / N_e\right\}^{1/2}$$

where $\hat{\sigma}^2_{et}$ is the residual variance from the estimation period, N_e is the number of observations in the estimation period, $\bar{R}_m$ is the estimation period sample mean of the market return, $CSSR_{mt}$ is the corrected sum of squares for the market return during the estimation period, and N_f is the period over which the abnormal returns accumulate. In the past, studies generally have used only the first term in braces in calculating the standard error of the *CAR*. Cantrell, Maloney and Mitchell [1989] show that the abnormal returns over an event window are not independent even if they are independently distributed. The second term in braces adjusts for this. This term is positive (except for the first day of the event window, when it is zero), implying that the true standard error of the *CAR* is higher than previously assumed.

TABLE II
Cumulative Daily Abnormal Returns Following the 1982 Tylenol Poisonings for Johnson & Johnson and the Drug Industry

Day	CAR_{jj}^{m}	t-value[a]	CAR_{jj}^{di}	t-value	CAR_{di}^{m}	t-value
1	−.060	−3.01	−.050	−2.98	−.009	−0.42
2	−.054	−2.44	−.050	−2.46	−.003	−0.42
3	−.111	−4.10	−.103	−4.16	−.006	−0.68
4	−.173	−5.54	−.162	−5.65	−.009	−0.88
5	−.129	−3.67	−.130	−4.02	.001	0.10
6	−.186	−4.83	−.186	−5.25	.000	0.02
7	−.148	−3.56	−.145	−3.79	−.003	−0.19
8	−.156	−3.50	−.139	−3.38	−.015	−0.98
9	−.206	−4.34	−.176	−4.05	−.026	−1.57
10	−.229	−4.56	−.184	−3.98	−.040	−2.30
11	−.233	−4.43	−.172	−3.54	−.054	−2.97
12	−.258	−4.69	−.194	−3.83	−.057	−2.97
13	−.219	−3.81	−.147	−2.78	−.064	−3.19
14	−.219	−3.66	−.151	−2.76	−.059	−2.85
15	−.249	−4.01	−.179	−3.14	−.061	−2.86
16	−.226	−3.52	−.149	−2.53	−.068	−3.05
17	−.253	−3.82	−.155	−2.56	−.086	−3.73
18	−.272	−3.98	−.181	−2.88	−.080	−3.39
19	−.241	−3.43	−.154	−2.39	−.077	−3.15
20	−.265	−3.67	−.176	−2.65	−.078	−3.13
$\overline{CAR}_{11,20}$ (October 14–27)	−.244	−3.85	−.166	−2.80	−.068	−3.09

[a]See Footnote 11 for computation of the t-statistic.

Data source: Daily stock returns tapes, Center for Research and Security Prices, University of Chicago, 1982.

trading period simply because it is impossible to judge the exact date when most of the information concerning the poisonings was accessible to investors. In any event, the choice of forecasts of Johnson and Johnson's losses is inconsequential for the analysis since all the *CAR*s are negative and significant following the initial decline. These averages are reported at the bottom of Table II; they are all statistically significant at the 1 percent level, using a one-tail test. The $\overline{CAR}_{11-20}$ for Johnson & Johnson based on its relationship

with the overall market is −24.4 percent.[12] Based on the market price of Johnson & Johnson common stock on September 9, 1982, the day before the market received notice of the poisonings, the estimated loss to Johnson & Johnson stockholders is $2.11 billion. The $\overline{CAR}_{11-20}$ for the other over-the-counter drug companies is −6.8 percent; the estimated loss to shareholders of these firms is $4.06 billion. Thus, the total decline in wealth attributed to the poisonings is over $6 billion, which arguably is a lower-bound estimate considering that the poisonings likely increased consumers' expectations of product tampering in other industries as well.

After the initial reaction, did Johnson & Johnson recover? By December 1982, Johnson & Johnson had regained most of its market share. But regaining previously held market share during this period might have been temporary, due to the $2.50 coupons Johnson & Johnson offered in newspapers across the country to win back customers. Even so, the market share increase may have demonstrated that Johnson & Johnson had regained their customers' confidence. Six months after the poisonings Tylenol had regained most of its market share, and by August of 1983, Tylenol was once again the nation's leading pain reliever. The latter market share recovery is more qualified than the December recovery, since the December recovery was attributed in large part to the $2.50 coupons. Had Johnson & Johnson actually recovered or had it simply regained its top position in the market by way of increased advertising or price decreases?

Stated earlier, the null hypothesis of no recovery is the estimated value of $\overline{CAR}_{11-20}$ and recovery is measured relative to this estimate. An examination of the *CAR*s beyond the twentieth trading day following the poisonings does not reveal any significant recovery. The negative *CAR*s continued to mount after the period for which the initial forecasted losses were computed.[13] One year after the poisonings, the respective *CAR*s for Johnson & Johnson were: $CAR_{jj}^{m} = -63.5$ percent and $CAR_{jj}^{di} = -34$ percent. Other than the Tylenol poisonings, there was only one event specifically related to Johnson & Johnson mentioned in the *Wall Street Journal* more than once during

12. I also calculated *CAR*s for Johnson & Johnson using all the market model estimates discussed earlier. Based on the other pre-poisonings estimation periods and the Dimsen market model, the resulting *CAR*s are not different from those reported in Table II. *CAR*s based on the post-poisoning estimation periods are less negative than those reported in Table II; the average *CAR* for CAR_{11-20} is −17.8 percent. These less negative *CAR*s are due to the lower beta estimates from the post-poisonings estimation periods, which is arguably due to the poisonings themselves, and thus less confidence is placed in these results. Even so, these *CAR*s are statistically different from zero. Various other measures of abnormal performance were also computed. Cumulative net-of-market returns (i.e., beta asummed equal to one and alpha equal to zero) produced slightly less negative, though not significantly different results. In another test, abnormal returns were computed by substituting the mean market return over the event period for the daily market return. The resulting *CAR*s are not significantly different from those reported.

13. All measures of the *CAR*s were forecasted through December 1986 and are available.

the twelve months immediately following the poisonings. The event concerned Johnson & Johnson's removal of Zomax, a prescription pain reliever, after reports (see the *Wall Street Journal* [1983b]) of five people dying of allergic reactions to Zomax. The deaths were made public on March 4, 1983 and were associated with a negative abnormal return of 4.6 percent to Johnson & Johnson's stock price on that day. During the next four trading days, Johnson & Johnson stock declined an additional 3 percent. Given the grave consequences of the side effects of Zomax, a drug which Johnson & Johnson had been promoting heavily, this event may have hampered any significant recovery of Johnson & Johnson's stock price from the Tylenol poisonings.

While the *CAR* for Johnson & Johnson (and for the drug industry as well) continued to decline after their initial drop, this should not be interpreted as evidence of continued losses due to the Tylenol poisonings, as there was no new concrete information regarding the poisonings after the period for which Johnson & Johnson's initial wealth decline was calculated. Furthermore, an event study consisting of one event is plagued by the problem of confounding events which may bias the estimated *CAR*. This does not appear to be a major problem here in that the Zomax episode was the only other event directly related to Johnson & Johnson which received considerable publicity in the post-poisonings period. However, the evidence does imply that Johnson & Johnson's stock price never recovered. This lack of recovery indicates that investors' initial forecasts of Johnson & Johnson's losses were not overestimated. Investors perceived Johnson & Johnson would attempt to recover Tylenol's lost market share and could only do so by reducing the price of Tylenol and/or increasing its level of advertising. Since investors did not overestimate Johnson & Johnson's success with its recovery efforts, their initial forecasted losses are an unbiased estimate of Johnson & Johnson's permanent wealth decline due to the poisonings.

V. JOHNSON & JOHNSON'S BRAND-NAME CAPITAL LOSS

How much of the financial loss suffered by holders of Johnson & Johnson stock is due to the fact that the company brand name, Johnson & Johnson, and the product brand name, Tylenol, declined in value as a result of the poisonings? The value of the brand-name capital of a firm is determined by the firm's expected quasi-rents from future sales; thus the capital loss arising from an unanticipated decline in expected product quality comes in the form of the depreciation of the brand-name capital. Johnson & Johnson may have recovered sales of Tylenol capsules and any other of its products for which consumers have decreased their purchases; however, this recovery may be only achieved with a decrease in prices or an increase in brand-name capital investments (such as advertising) in order to revive the brand name.

In order to arrive at an estimate of the financial losses caused by brand-name capital depreciation, other losses must be netted out. Clearly, apart from the potential loss of brand-name capital, Johnson & Johnson suffered direct financial losses as a result of the out-of-pocket costs of recalling and destroying the capsules and designing a safer package. Also, during the fourth quarter of 1982 and part of the first quarter the following year, there was a loss of profits because Tylenol capsules were not on the shelves.[14] Another consideration is the lawsuits filed on behalf of the victims which Johnson & Johnson must indemnify. Finally, as mentioned in the previous section, the losses to Johnson & Johnson were greater based on its relationship with the overall market as opposed to the over-the-counter drug industry, simply because all capsules specifically, and other drug forms generally, became associated with a higher probability of tampering. Thus, the losses suffered by Johnson & Johnson that were shared with the other drug companies must also be accounted for in order to isolate losses solely due to the depreciation of Johnson & Johnson and Tylenol's brand names.

Johnson & Johnson assigned a $100 million cost to the disposal of the capsules and the subsequent repackaging. It also claimed a $50 million business interruption expense, which included loss of profits and fixed charges during the time capsules were off the market.[15] Also, Johnson & Johnson was subject to suits filed by families of four of the victims. According to the *Wall Street Journal* [1983a], each suit asked for $5 million in damages.[16] Neither the *Wall Street Journal* nor *Business Insurance* revealed any information as to the filing of suits on behalf of the other three victims.[17] Based on this information, an upper-bound estimate of the out-of-pocket costs resulting from the poisonings approaches $200 million.[18]

14. Although Johnson & Johnson attributed the decline in profits during this period to the fact that Tylenol capsules were not on the shelves, one might argue that the capsules could have been left on the shelves, and yet the same loss may have occurred. Furthermore, consumers could have substituted tablets for capsules since tablets were never removed.

15. In a lawsuit filed in January 1983 against its nine insurers, Johnson & Johnson claimed the above mentioned costs of $150 million. Johnson & Johnson sued for only $117 million as management did not expect to recover all of the losses claimed [*Wall Street Journal* 1983a]. However, Johnson & Johnson was unsuccessful in recovering any of the losses sustained in recalling the capsules as the courts ruled that Johnson & Johnson's product liability insurance did not cover its recall expenses and other charges. It was also noted by the courts that Johnson & Johnson had actually cancelled its recall insurance prior to the poisonings [*Wall Street Journal* 1986].

16. I was unable to determine the exact settlement of the suits. Based on articles in *Business Insurance*, *Wall Street Journal* and other sources, there was no indication that Johnson & Johnson contested the claims.

17. No class action suits were filed on behalf of Tylenol users.

18. Actually, the profits lost during the period that Tylenol capsules were unavailable for sale are not out-of-pocket costs. One may argue that they represent a brand-name loss since the capsules could have been left on the shelves and still would not have been purchased. I have included them in the estimate simply because Johnson & Johnson claimed this loss in its lawsuit. In any event, their inclusion decreases the likelihood of finding a brand-name loss.

To assess the loss in brand-name capital suffered by Johnson & Johnson due to the Tylenol poisonings, the out-of-pocket loss ($200 million) was subtracted from the decline in value experienced by equity investors. The initial forecasted loss based on the relationship between Johnson & Johnson and the over-the-counter drug market portfolio is used as the measure of losses from which to calculate the decline in brand-name capital. The argument for this is simple. The estimates based on the relationship between Johnson & Johnson and the overall market do not distinguish between the losses suffered uniquely by Johnson & Johnson and the losses suffered generally by the marketers of over-the-counter drugs. That is, Johnson & Johnson suffered some losses simply because over-the-counter drugs, primarily the capsule form, became associated with a higher probability of tampering; hence, these losses should not be included as part of the Johnson & Johnson and Tylenol brand-name capital loss, since they are shared by the other over-the-counter drug companies. The estimated loss to Johnson & Johnson based on its relationship with the over-the-counter drug market is $1.44 billion. Subtracting $200 million from this loss leaves $1.24 billion as a measure of the decline in the value of Johnson & Johnson and Tylenol's brand names. Thus it appears that over half of the total losses ($2.11 billion) suffered by Johnson & Johnson came in the form of the depreciation of its brand-name capital. Due to the brand-name capital loss alone, Johnson & Johnson stock suffered a 14.3 percent decline relative to its forecasted value.

VI. SUPPORTING EVIDENCE

The empirical evidence suggests that Johnson & Johnson suffered a substantial loss in the value of its brand-name capital. Additional events occurring in the aftermath of the poisonings support this finding: (1) the price of Tylenol declined relative to other over-the-counter pain relievers, (2) Johnson & Johnson made extensive attempts to downplay the connection between Johnson & Johnson and Tylenol, (3) Tylenol tablet sales declined although Tylenol tablets were not poisoned, (4) Tylenol's market share never attained the level that was forecasted before the event, and (5) Johnson & Johnson delayed the introduction of several new drugs.

The Klein and Leffler [1981] theory of brand names predicts that at least until Johnson & Johnson rebuilt the Tylenol brand name back to the pre-poisonings value, the price of Tylenol should continue to exhibit a reduction relative to similar pain relievers. According to *Advertising Age* [1982a], Johnson & Johnson was offering as much as 25 percent off the list price to retailers soon after the poisonings. This discount especially supports the brand name argument as it was for noncapsule Tylenol products since capsules were unavailable for sale until late December of 1982. Apparently no other companies were offering such lucrative discounts. During this period, a 17 percent discount was considered a good deal according to industry analysts

quoted in *Advertising Age* [1982a]. Also, *Value Line Investment Surveys* [1983] reported that the price of Tylenol had not returned to its premium level over the prices of other pain relievers.[19]

One would expect Johnson & Johnson to concentrate on reviving Tylenol's brand name as well as its own. They did just that, spending millions on increased advertising and promotions. Johnson & Johnson also worked diligently at insulating the company brand name. For example, during the middle of October 1982, the company ran a newspaper advertisement across the country advising consumers how to exchange their Tylenol capsules for a refund or tablets. The advertisement made no mention of Johnson & Johnson or its Tylenol-producing subsidiary McNeil Consumer Products; instead it referred only to the "makers of Tylenol." This suggests that Johnson & Johnson was fearful that consumers might associate the company name with the poisonings, thereby damaging its reputation across its entire product line, from band-aids to baby powder, in addition to the other products in the Tylenol line.

The poisonings were restricted to capsules, presumably because it would have been much harder to tamper with tablets. If consumers only attached a higher probability of tampering to capsules, but still highly valued the Tylenol product line, then some consumers would have substituted tablets for capsules during the period capsules were unavailable, thus implying a rise in tablet sales. Substitution did not occur along these lines. In fact, Tylenol tablet sales declined 25 percent after the onset of the poisonings. The significance of this reduction in Tylenol tablet purchases is magnified by the fact that Tylenol tablets were selling at a 25 percent discount during this period, a lower discount than the other companies were offering. Also, in a survey reported in *Fortune* [1982] one month after the poisonings, 58 percent of those polled said they would not buy Tylenol tablets in the future, even though they knew that it was capsules that were poisoned. Even sales of Tylenol cold remedies declined. This consumer reaction is consonant with the notion that the entire Tylenol product line suffered a depreciation in the value of its brand-name capital.

Actually, the empirical results demonstrate that the loss of brand-name capital for the entire Tylenol line is more than just a notion. According to *Value Line Investment Surveys* [1982], the estimated annual profits for the Tylenol line for 1982 were $80 million. Assuming a real interest rate of 5 percent, the present value of a perpetual stream of $80 million a year is $1.6

19. The 1982 and 1983 issues of *American Druggist Blue Book* provide additional price information. The data is limited, however, as only prices for the Anacin line are comparable to Tylenol over these two periods. According to this source, the wholesale price of Anacin increased 50 percent in 1983, while the price for Tylenol increased only 19 percent. Although this sample of price information is limited, it does lend support to the *Value Line Investment Surveys* and *Advertising Age* reports. Given this change in relative prices, it is not surprising that Anacin, which was Tylenol's largest competitor, was backordered following the poisonings.

billion which is roughly 33 percent greater than the estimated brand-name capital loss suffered by Johnson & Johnson; hence it figures that investors forecasted that most of the brand-name capital of the Tylenol line was destroyed. Admittably, the choice of the real interest rate is arbitrary. The point to be made is that the numbers do show that such a large brand-name capital loss is possible. It is also likely that some of the brand-name loss was due to the decline in the value of Johnson & Johnson's own brand name.

Prior to the poisonings, Tylenol controlled 37 percent of the over-the-counter pain reliever market and it was forecasted (in *Fortune* [1982]) that Tylenol would control 50 percent of the market by 1986. Tylenol had been taking over the over-the-counter drug market rapidly ever since it began an aggressive consumer advertising campaign in the mid-1970s. However, these expectations were not realized. In early 1986, prior to the second wave of Tylenol poisonings, Tylenol had a market share of only 34 percent, a little less than it held prior to the 1982 poisonings.

According to *Value Line Investment Surveys* [1982], Johnson & Johnson was also supposed to have stretched out its lead in the drug market by means of the introduction of a dozen or more new drugs by the mid-1980s. The introduction of the new drugs predicted earlier did not occur as soon as had been supposed. The reason for the delay of the new drugs is unknown. It could have been due to the actions of the Food and Drug Administration (FDA)--or to a management decision made in the face of lagging consumer acceptance of Johnson & Johnson drug products. On the other hand, many of Johnson & Johnson's competitors introduced new drug products soon after the poisonings in an effort to pick up shelf space vacated by Johnson & Johnson (reported in both Advertising Age [1983] and Chemical Week [1982]).

VII. EVIDENCE FROM SUBSEQUENT DRUG POISONINGS

Several drug poisoning incidents have occurred since the 1982 Tylenol poisonings; however, most of them were minor and do not warrant mention. Five of the subsequent drug poisoning cases received national attention, though nothing of the magnitude generated by the Tylenol poisonings. These five cases are listed in Table III, along with their associated abnormal returns on the announcement day of the poisonings and cumulative abnormal returns for event windows of two, five and ten trading days beginning the announcement day.

The *CAR*s in Table III were calculated using the same methodology presented in section IV. As a comparison, Table III also contains the *CAR*s associated with the 1982 Tylenol poisonings; these are from the first column of *CAR*s in Table II, CAR_{jj}^{m}. Recall that the first column of *CAR*s in Table II is based on Johnson & Johnson's relationship with the overall market.

TABLE III
Cumulative Daily Abnormal Returns Following Six Drug Poisoning Cases

Date	Firm	Drug	Deaths	Cumulative Abnormal Returns[a] Day 1	Day 2	Day 5	Day 10
9/30/82	Johnson & Johnson	Tylenol	7	−.060 (−3.95)	−.054 (−2.42)	−.129 (−3.67)	−.229 (−4.56)
12/9/82	American Home Products	Anacin	0	−.068 (−5.98)	−.012 (−0.75)	.020 (0.79)	.021 (0.61)
2/11/86	Johnson & Johnson	Tylenol	1	−.038 (−2.85)	−.061 (−3.28)	−.132 (−4.44)	−.117 (−2.74)
3/20/86	Smith Kline Beckman	Contac	0	.005 (0.47)	−.015 (−0.96)	−.011 (−0.44)	.012 (0.34)
5/28/86	American Home Products	Anacin	1	.001 (0.09)	−.006 (−0.41)	−.017 (−0.74)	−.030 (−0.91)
6/17/86	Bristol Meyers	Excedrin	2	−.012 (−1.01)	.024 (1.47)	.040 (1.55)	.033 (0.89)

[a]t-values are in parentheses.

Data source: Daily stock returns tapes, Center for Research in Security Prices, University of Chicago, 1981–86.

Similarly, each *CAR* shown in Table III is based on the respective company's relationship with the overall market.

For the five subsequent poisoning cases, only the 1986 Tylenol poisonings are associated with statistically significant negative *CAR*s, whereas none of the other poisonings appear to have any stock market impact. On the announcement day of the 1986 Tylenol poisonings, the abnormal return was −3.8 percent and declined to -6.1 for the two-day cumulative abnormal return. Johnson & Johnson immediately decided to discontinue permanently the sale of Tylenol capsules, a step which the firm had refused to undertake following the 1982 poisonings. The negative stock price reaction resulting from the 1986 poisonings and the immediate discontinuance of capsules provides additional support for the argument that Johnson & Johnson suffered a loss of brand-name capital following the 1982 poisonings.

The *CAR*s displayed in Table III suggest that Johnson & Johnson suffered significant losses when Tylenol capsules were poisoned not only in 1982, but also in 1986, and yet the other drug companies were not affected when their capsules were poisoned. Why did Johnson & Johnson suffer enormous losses, whereas the other drug companies were hardly affected when their pain relievers were poisoned?

Several plausible reasons exist. First, Tylenol was not only the leader of over-the-counter pain relievers, but was increasing its lead prior to both the 1982 and 1986 poisonings. Being number one conveys to consumers that your product is superior along relevant quality dimensions, including safety, for which consumers are willing to pay a price premium. Evidence presented in the previous section shows that Tylenol lost its considerable price premium over other pain relievers after the 1982 poisonings. Second, the 1982 Tylenol poisonings were by far the most publicized and the 1986 Tylenol poisonings were the next most publicized of the six cases. It is not argued here that the negative publicity caused the stock market losses, but instead that the negative publicity was a by-product of the large negative returns. Third, Tylenol accounts for a much larger proportion of Johnson & Johnson's total profits than the other poisoned drugs account for their respective company's profits. For instance, Tylenol accounted for approximately 17 percent of Johnson & Johnson's profits prior to the 1982 poisonings and 13 percent prior to the 1986 poisonings. The other poisoned pain relievers accounted for only 2 to 4 percent of their respective company's profits. Fourth, the number of deaths was by far the largest for the 1982 Tylenol poisonings. For the 1982 Anacin III poisonings and the 1986 Contac poisonings, no deaths were reported, and the 1986 Anacin III poisoning was widely believed to be a suicide. It is also worth noting that over one-third of consumers questioned in a survey reported in *Advertising Age* [1986a] believed that the same party was responsible for both Tylenol poisonings. In the same survey, over one-half believed that the 1986 Tylenol poisonings were an internal job. Finally, the other drug companies did suffer substantial losses contemporaneous with the 1982 Tylenol poisonings. Thus, much of the adjustment in the probability of drug tampering had already taken place and consequently little stock market effect should be expected, especially given the relative size of the four non-Tylenol subsequent poisonings.

VIII. CONCLUDING REMARKS

The damage to a company due to the actions of a party not associated with that company potentially may be much greater than previously appreciated. This study shows that Johnson & Johnson suffered a $1.24 billion wealth decline (14 percent of the forecasted value of the company) due to the depreciation of the company brand name and the Tylenol brand name as a result of the 1982 Tylenol poisonings. This brand-name capital loss not only reflects the loss of Tylenol capsule sales, but also the loss of sales in the entire Tylenol line and possibly the delayed introduction of expected new drugs. Johnson & Johnson claimed out-of-pocket costs of $150 million, an amount that seemed large at the time. Yet considering evidence developed here, this sum was small relative to the loss of brand-name capital suffered by the firm.

Prior to the poisonings, the Tylenol brand name assured consumers of safe high-quality pain relievers. It may never be known why Johnson & Johnson was the target of the tamperer; but whatever the reason, the results imply that Johnson & Johnson was held responsible, as the assurance of product quality was severely weakened. In addition to the enormous losses suffered by Johnson & Johnson shareholders ($2.11 billion), the other over-the-counter drug companies realized a $4.06 billion wealth decline as the probability of drug poisoning increased for all drugs, especially those of the capsule variety.

Following the 1982 poisonings, Johnson & Johnson expended resources to restore the brand-name capital of the Tylenol product line and regain its top position in the pain-reliever market. Though its stock market losses were never recovered, Johnson & Johnson was successful in recovering its brand-name capital as Tylenol regained its position. However, the 1986 poisonings erased much of the brand-name capital that had been restored, as demonstrated by the contemporaneous stock market losses and permanent discontinuance of Tylenol capsules.

With the exception of the 1986 Tylenol poisonings, subsequent drug poisonings have not been associated with large losses. This can be largely explained by the fact that they were smaller cases and also did not account for nearly as high a proportion of their respective company's profits. In any event, firms must take into account possible actions by outside parties, especially when the product represents a significant proportion of the company's profits. They can be extremely painful.

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