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THE DETERRENT TO DUBIOUS CORPORATE BEHAVIOR: PROFITABILITY, PROBABILITY AND SAFETY RECALLS

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In response to findings of abnormal stock market reactions following such dubious corporate behaviors as bribery, fraud, and the production of hazardous products, some researchers have argued that the stock market reaction is a sufficient deterrent to these behaviors so that additional regulation is not necessary. In this paper we examine stock market returns as a deterrent to dubious behavior in the production of defective automobiles. Relying on a broader range of assumptions about managerial behavior than are used in previous studies, we question the efficacy of the market as an instrument of social control.

Some researchers have argued that stock market reactions to announcements of dubious behaviors deter such behavior. For example, Strachan, Smith and Beedles find abnormal reductions in stock prices following accusations of bribery, fraud, and illegal political contributions. They argue that an awareness of these losses can help managers 'resist the temptation' (1983: 121). Similarly, Jarrel and Peltzman (1985) conclude that shareholder losses suffered after auto recalls are a sufficient deterrent to the production of hazardous products. This paper critically examines the assumption that stock market losses act as a deterrent to dubious corporate practices.

The market deterrent to dubious corporate behavior depends on managerial perceptions. If managers do not perceive the market losses, the market cannot act as a deterrent. The first part of the paper presents three perspectives on how managers might perceive the stock market reactions following the disclosure of information about dubious practices: an aggregate perspective in which managers assess the market responses by combining them over time and across companies; a partially aggregated perspective in which managers consider the responses by company, time period, or both; and a disaggregated perspective in which managers assess isolated, individual returns.

Estimates of the stock market's reactions to auto safety recalls are then calculated. In the aggregate case a significant rebound in market prices occurs about a week after the recalls, thereby negating most of the recalls' effect. This rebound may be an anomaly. Further research is needed to determine how common rebounds are after unexpected disclosure of negative information, how soon they occur, and what they mean about efficient market theory. In the partially aggregated case, losses to shareholders are largely restricted to periods of vigorous enforcement (1977–78) and to a vulnerable manufacturer (Chrysler). In the disaggregated case a pattern of systematic reductions in shareholder wealth is not apparent. These findings place in doubt the contention that the market is a sufficient deterrent to dubious behavior.

To complete the argument, we inquire further about why managers engage in dubious behavior. The second part of the paper clarifies the nature

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of the problem and develops some of the implications. The decision to engage in dubious behavior is not simply a function of the losses incurred if dubious behavior is discovered as Strachan *et al.* (1983), and Jarrel and Peltzman (1985) seem to assume. Even from an economic framework this assumption is not sufficient. A more sophisticated model developed by Becker (1968) suggests that the decision to engage in dubious behavior is a function of the probability of detection, times the losses, minus the income that can be gained from selling defective products. This model is applied to a company that is forced to recall 1.5 million defective vehicles. Using the assumptions about managerial cognition developed in the first part of the paper, the high and low values of the variables in the model are estimated. We conclude that unless enforcement is vigorous, and the expectation of a recall very great, the market does not deter the production of defective vehicles. As an instrument of corporate social control (see Friedman, 1970; Stone, 1975; and Schelling, 1978) the market is limited.

STOCK MARKET REACTIONS TO RECALLS

Assuming that managers try to maximize shareholder wealth (Friedman, 1970), they will be deterred from engaging in dubious practices only if they have knowledge of the impact of their acts on stock prices. Managers may employ a number of perspectives in estimating the impact of their dubious acts on stock prices: (1) an aggregate one in which they combine the market reaction over time and across companies; (2) a partially aggregated one in which they combine the market responses by company, time period, or both; and (3) a disaggregated one in which they assess the market reaction on a case-by-case basis.

The first perspective assumes that managers perceive the market's reaction to be stable across time and companies. The best estimate of the effect of recalls is thus the average effect of the recalls for the entire sample. For this perspective to deter the production of defective products, managers must calculate the abnormal returns for a portfolio of firms experiencing recalls.

Managers may not want to rely on the aggregate results. Aggregate results can be misleading under a variety of conditions; for example, if the stock market's reaction to recalls differs across time or companies or if there is an outlier in the sample. Managers may decide that only the effects for a particular time period or a particular company are relevant, and may not pay attention to the overall pattern. Their concern, appropriately, would be with the market response to their company, or to their company in a given time period. For stock market valuations to dependably discourage managers from engaging in dubious behavior, market reactions must be significant for specific companies and specific time periods. Recalls would have to significantly lower shareholder wealth by company, by time period, and by company and time period.

Simon (1947), Cyert and March (1963), and others maintain that managers are mainly concerned with behavior that is closely related to their role and function in an organization (Halpern, 1979). For example, Simon (1959) observes that:

> The decision-maker's model of the world encompasses only a minute fraction of all the relevant characteristics of the real environment, and his inferences extract only a minute fraction of all the information that is present.

Managers who work on product development or manufacturing participate directly only in a handful of recalls, observe only a few of them, and are likely to perceive stock market reactions on a case-by-case basis. Anecdotal evidence suggests that managers view stock market returns in this manner. In the Pinto case a financial officer reported that the Ford's stock price dropped on the day of the acquittal in one of the Pinto trials, whereas it went up after the announcement of a quarterly loss and a substantial reduction in dividend (Fisse and Braithewaite, 1983). Because this manager focused on a few isolated examples, he concluded that the stock market was an unreliable indicator of corporate performance.

In Strachan *et al.*'s (1983) analysis, the market reaction to alleged corporate crimes was *positive* in over 40 percent of the cases. Thus, if managers observe isolated cases without being aware of the aggregate results (as predicted by the behavioral model; see Tversky and Kahneman, 1974), they will have a two in five chance of coming to the conclusion that investors actually *reward* questionable practice and illegal behavior. If managerial perceptions are going to be influential in restricting product defects, a significant percentage of the individual recalls also will have to lower the value of shareholder wealth.

The effect of unanticipated information on stock market prices

Efficient market theory holds that stock prices reflect all available information (Fama, 1976), and thus that unanticipated announcements or new information should result in nearly instantaneous adjustments in stock prices. These stock price adjustments are supposed to reflect the change in expected cash flows of the company or estimates of its systematic risk. In short, a security's price at a given moment should equal the expected net present value of all future cash flows to the company.

How the stock market reacts to the announcement of new information depends on the extent to which the information is unanticipated. Stock prices do not decline around payday because this information is anticipated. Although recalls are not as regular as paydays, neither are they a total surprise. Indeed, in many recall situations there are indications in advance that a recall will take place. Prior to the Pinto recall, for example, there were pressures from the government, the media, and consumer groups to undertake such a recall. Thus the market may partially anticipate a recall before it is announced, and what occurs near the announcement day is a correction of these anticipations. Moreover, if there are two or three major recalls per year (as Jarrel and Peltzman, 1985, maintain), it is likely that the market factors this possibility into its evaluation of the expected cash flows of the auto manufacturers.

If information has become available that allows the market to anticipate a recall, the market's reaction to the actual recall is hard to interpret. The reaction to the actual recall will depend on the size and cost of the anticipated recall compared to the recall that actually occurs. Since the anticipated recall could be larger or smaller than the actual recall, both increases and decreases in stock returns are quite reasonable following the actual recall. In the research presented here, care has been taken to eliminate these difficult-to-interpret instances where prior leakage of information has taken place.[1] We have tried systematically to exclude them from our analysis.

How should the market react to unanticipated recalls? Investors expect a 'normal' number of recalls, though their specific time, size, and impact are not known. The occurrence of unanticipated recalls can be viewed as a Poisson process in which investors expect a certain frequency of recalls in a given time period, the number of recalls expected is proportional to the length of the time period, and the recalls are independent of each other. The market is assumed to have a constant memory; it uses data up to a constant lag in estimating the parameter of the Poisson process (i.e. the recall frequency). Increases in the expected number of recalls are assumed to lower stock prices. The Poisson

[1] In their analysis of the auto safety situation, Jarrel and Peltzman (1985) handle the problem of possible leakage of information in the following way. First, they seek to identify the earliest possible date at which news of a recall may become known. For most recalls the first hint is publication of news about the actual recall in the *Wall Street Journal (WSJ)*. However, in some cases a story that a serious safety defect exists appears many days before the actual recall announcement. In these cases, Jarrel and Peltzman (1985) attempt to use the date of the first story about the troubled product rather than the date of the actual recall. Even if information about a possible recall precedes the formal announcement, Jarrel and Peltzman (1985) argue that the market response to recalls 'will understate the total costs borne by shareholder' (p. 514). The market understates the total shareholder cost because uncertainty about whether there is going to be a recall is likely to be resolved within a given time period, and within this time period either the product is recalled with costs (C) to shareholders, or no recall takes place and returns (R) remain constant. Thus, returns to shareholders if there is no recall equal R, and, if there is a recall, they equal $R - C$. At the beginning of the period the value of the firm is simply the value of the firm at the end of the period if there is no recall times the probability that there will be no recall $[(1-p)R]$, plus the value of the firm if there is a recall times the probability of a recall $[p(R-C)]$; i.e., the stock price equals $(1-p)R + p(R-C)$. Jarrel and Peltzman (1985) maintain that shareholders gain if a recall does not occur (during this time period). The gain is equal to the probability of a recall times the cost, or pC. On the other hand, if a recall occurs, shareholders suffer the full loss, C, only if the recall is entirely unexpected. If a recall is anticipated, returns are diminished by the unexpected component of the recall cost or $(1-p)C$. Jarrel and Peltzman (1985) adjust their computation of returns by $1-p$, using 0.10 as their estimate of the probability of a recall. They base this probability on the fact that the companies in their sample experienced an average of two or three major recalls per year in the 1967–81 period, or about one in every ten 2-week periods. They conclude that this adjustment had no substantial effect on their results (p. 529).

distribution is described fully by its mean arrival rate, which in this case would be the recalls per time period. To determine the expected income stream of the corporation, the capital market participants must estimate the expected number of recalls in the forecast period, their expected size, and their expected impact. Investor estimates of recall frequency, size, and impact are heavily influenced by the average frequency of recalls in the memory period. If the corporation is experiencing a period without recalls, the number of recalls in the memory period on average will be declining as previous recalls are eliminated from the memory period but new ones are not added. As previous recalls are eliminated there will be a reduction in the expected recall frequency and consequently an increase in expected firm value. If a recall then occurs, it influences firm value in two ways. First, the recall is added to the memory period and, assuming that another recall does not drop from the memory period at that moment, the estimated recall frequency rises, which lowers the expected value of the firm's net cash flows. Second, the recall imposes direct costs on the firm, which also lower the firm's expected value.

Note that in this model the stock market does not expect a given recall, but rather expects an average recall rate. The combination of direct costs and changes in expectations may result in a market reaction that is larger than the direct costs of the recall. If this model is correct, then estimates of stock market reaction to recalls will be greater than the direct costs. In addition, in periods when there are no recalls, stock prices will rise slowly.[2]

Assessing the effect of new information on the stock market

To assess the effect of new information, the extent to which price performance around the time of a recall is 'abnormal' has to be examined. Jarrel and Peltzman (1985) use the Scholes excess return file at the University of Chicago's Center for Research in Security Prices to estimate abnormal returns. An alternative procedure, mean adjusted returns, has been found to perform as well as the other standard procedures (Brown and Warner, 1980 and 1985) and is used here (see also Eades, Hess and Kim, 1984; Alexander, Benson and Kampmeyer, 1984; and Strachan *et al.*, 1983).

Since the methodology which is followed (mean adjusted returns) is standard and well-described in Brown and Warner (1985), and in particular in Strachan *et al.* (1983), the basic procedure is only briefly discussed. (For specific equations, see Strachan *et al.*) For a given portfolio of stocks, the mean adjusted abnormal returns for a given day or set of days (window) are calculated by taking the average return on the stock or portfolio for some previous period (the normal return) and subtracting it from the return(s) on the day(s) of interest to give the abnormal returns. Using an estimate of the variance of returns from the normal return period, a *t*-test can be used to determine whether the abnormal returns differ significantly from zero. Thus, a series of 'portfolios' have been formed, composed of the events conforming to a given set of assumptions. The abnormal returns for that portfolio have been calculated and whether they differ significantly from zero has been tested. A normal returns period, that starts 244 days before the event and ends 16 days before it, has been used. Since the normal returns period provides 229 observations with which to estimate the mean and variance of the distribution of interest, the degrees of freedom to be used for the test are based on 229 observations (see Alexander *et al.*, 1984).

Under the assumption of constant effects across companies and over time, the returns for 15 days before, and 10 days after, the event are examined. The day of the event is defined to be the day on which its announcement appeared in the *Wall Street Journal (WSJ)*. For portfolios by company, time period, company in each time period, and

[2] More complex variations of this model could easily be developed in which, rather than a finite memory period, the market used a Bayesian updating procedure, i.e. it takes its previous frequency estimate and adjusts it each time it gets new data as to whether or not a recall has occurred. If a recall occurs, obviously the estimate of recall frequency will increase: and if a recall does not occur then the recall frequency estimate will decline. One could think of this updating as occurring daily or even continuously. Thus, new periods without recalls would also lead to lower expected recall frequencies and higher firm values. Likewise, recalls would lead to increased expected recall frequencies and lower firm prices. The size of recall might also be incorporated into the market's forecast of the size of the recall to be expected.

the individual recalls, stock returns are evaluated for: (a) the day of the announcement and the day before, and (b) the day of the announcement. The former method is commonly used because news of the announcement may be public and the market may react before an announcement actually appears in the *Wall Street Journal* (Ruback, 1982). The same procedures applied to portfolios are applied to individual recalls.

Sample

Using the *WSJ*, recalls in *four periods* (1967–68, 1972–73, 1977–78, and 1982–83) have been identified. The first period is before the creation of National Highway Traffic Safety Administration (NHTSA), as the National Traffic and Motor Vehicle Safety Act of 1966 was initially administered by the Federal Highway Administration and NHTSA was not created until 1970. The second period is prior to the 1974 amendments to the 1966 Safety Act, which required that the auto manufacturers pay for all repairs made during recalls. The third period includes the Carter administration, when NHTSA, headed by Nader associate Joan Claybrook, vigorously enforced the recall program, with more cars being recalled than were produced. The final period includes parts of the Reagan administration when NHTSA was accused of 'lacking purpose', 'losing vigor', and 'failing to enforce the law' (see Claybrook, 1984). A manager or stockholder might reasonably view the impact of recalls differently in each of these periods.

Returns for all the major American manufacturers have been examined using Jarrel and Peltzman's (1985) procedure for distinguishing between major and minor recalls. Thus, a major recall is based on the relative market share of the manufacturer. For GM a major recall involves more than 50,000 cars; for Ford it involves more than 20,000 cars, for Chrysler more than 10,000 cars, and for American Motors more than 2000 cars. Only a major recall is likely to lead to a revision in expectations with a statistically significant impact on stock prices. By using this method, 147 major recalls were identified.

Steps to mitigate the prior leakage of information

Steps have been taken to mitigate the effect of prior leakage of information. For all the recalls for which abnormal returns are calculated, the current and previous calendar year's *WSJ* indexes have been searched for information that may relate to that recall. *All recalls for which previous information was available have been eliminated from the sample*. Ninety-one of the 147 major recalls identified had no prior notice or indication in the *WSJ* in the year prior to the recall. *Thus, in these 91 instances it is assumed the recall has not been anticipated*. Table 1 presents the cases used in the analysis by manufacturer and time period. As can be seen, the number of unanticipated recalls peaked in 1977–78. Overall, Ford had the most major unanticipated recalls. A test for prior leakage of information is presented later in the paper.

Results

Results are presented for: (1) the aggregate perspective; (2) the partially aggregate perspective; and (3) the individual returns perspective.

The aggregate perspective

Table 2 reflects the performance of the portfolio of 91 events on each of the 15 days preceding and 10 days following the recall announcement. A significant reduction in stock price occurs on

Table 1. Major auto recalls without prior notice

	1967–68	1972–73	1977–78	1982–83	Totals
AMC	1	2	6	2	11
Chrysler	6	8	5	2	21
Ford	6	7	8	12	33
GM	3	6	9	8	26
Number of recalls	16	23	28	24	91

the day before and the day of the recall announcement, which is consistent with efficient markets theory in finding the significant effects in the period immediately around the announcement day. However, observe that the *largest* abnormal return, which occurs on day six, is *positive*. The postive abnormal returns on days six and seven are larger (1.11 percent) than the negative abnormal returns on days minus one and zero (0.64 percent). This finding, which suggests that there is a rebound in stock prices about a week after a recall, is contrary to Jarrel and Peltzman, who not only maintain that 'average CERs are significantly negative for every event window', but that 'the average gets larger absolutely as the windows widen' (1985: 527). None of Jarrel and Peltzman's windows included the sixth day after the event, where we find the largest positive abnormal return. Indeed cumulative excess returns between 3 days before the announcement (when negative abnormal returns start to appear) and 7 days after are close to zero (0.15 percent) and are well within the normal variability of the portfolio (standard deviation of 0.20 percent).

These findings are consistent with an emerging school in finance (the investor behavior school: see Arrow, 1982; De Bondt and Thaler, 1985), which holds that the efficient market theory gives investors too much credit for rational decision-making. Investors often overreact to unexpected

Table 2. Abnormal returns for a portfolio of 119 major recalls

Trading day	Raw return (%)	Abnormal return (%)	*t*-test[a]	Cumulative abnormal return (%)
−15	−0.03	−0.10	−0.50	−0.10
−14	−0.01	−0.08	−0.41	−0.18
−13	0.20	0.13	0.66	−0.05
−12	0.30	0.23	1.19	0.19
−11	−0.08	−0.15	−0.78	0.03
−10	0.39	0.32	1.64	0.35
−9	0.34	0.27	1.37	0.62
−8	0.10	0.03	0.14	0.65
−7	−0.05	−0.12	−0.63	0.53
−6	0.33	0.26	1.31	0.78
−5	0.27	0.20	1.04	0.99
−4	0.21	0.14	0.73	1.13
−3	0.01	−0.07	−0.33	1.06
−2	−0.17	−0.24	−1.23	0.82
−1	−0.25	−0.32	−1.64*	0.50
0	−0.25	−0.32	−1.61*	0.19
1	0.06	−0.01	−0.05	0.18
2	0.06	−0.01	−0.03	0.17
3	−0.11	−0.18	−0.90	−0.01
4	−0.18	−0.25	−1.27	−0.25
5	0.12	0.05	0.27	−0.20
6	0.90	0.83	4.25**	0.63
7	0.35	0.28	1.44	0.91
8	−0.22	−0.29	−1.46	0.63
9	−0.12	−0.19	−0.97	0.44
10	−0.22	−0.29	−1.49	0.15

[a] Since prior research suggested that the recalls should have a negative effect, a one-tailed test was employed for the day of the recall and the day before. For all other days, a two tailed test was employed.
Normal return = +0.0683 percent.
Standard deviation = 0.1958 percent.
* Significant at the 0.10 level, one-sided test.
** Significant at the 0.05 level, two-sided test.

or dramatic news, especially negative news, which causes stock prices to fall further than they should. If the market ultimately is anchored in fundamental values, any irrational movement away from these values should ultimately reverse itself and, when investor impressions change, the market should rebound. Further research is needed to determine if our results are an anomaly or if the market generally rebounds from downward movements due to announcements of dubious behavior.

Recalls by time and by company

A manager would also want to consider whether the stock market response was consistent over time, and whether it varied by company. Table 3 presents the results by time period and manufacturer. For all companies averaged over each of the four time periods, significant effects exist *only* in the 1977–78 time period. For individual companies the average returns for the four companies are negative, but *none* is statistically significant. Event day means vary from 0.02 percent for General Motors to −0.87 percent for AMC, while the 2-day window varies from −0.23 percent for Ford to −0.67 percent for AMC. Given the contoversy over the correct technique for comparing means with differing standard deviations, a proper test of these differences cannot be executed.

The most interesting differences are the results for the individual companies by time period. Only Ford and Chrysler in 1977–78 have significant abnormal returns, Ford only for the 2-day window and Chrysler for both windows at the 0.05 level

Table 3. Daily average abnormal returns by year and company (percentages)

	Company Averages	Individual company recall period averages			
		1967–78	1972–73	1977–78	1982–83
AMC					
Day before and day of	−0.67	2.92	0.80	−1.15	−2.52
recall	(−1.12)	(1.16)	(0.70)	(−1.47)	(−1.41)
Day of recall	−0.87	−0.13	0.79	−1.44	−1.17
	(−1.02)	(−0.04)	(0.49)	(−1.31)	(0.46)
Chrysler					
Day before and day of	−0.41	0.66	−0.71	−1.01*	−0.94
recall	(−1.39)	(1.17)	(−1.24)	(−2.07)	(−0.53)
Day of recall	−0.59	0.55	−0.71	−1.19*	−2.00
	(−1.40)	(0.69)	(−0.87)	(−1.72)	(−0.79)
Ford					
Day before and day of	−0.23	−0.08	−0.04	−0.69*	−0.10
recall	(−0.92)	(−0.23)	(−0.14)	(−2.10)	(−0.17)
Day of recall	−0.23	−0.17	0.03	−0.74	−0.07
	(−0.65)	(−0.32)	(0.06)	(−1.58)	(−0.09)
GM					
Day before and day of	−0.21	0.49	−0.01	−0.32	−0.50
recall	(−1.27)	(0.97)	(−0.02)	(−1.51)	(−1.10)
Day of recall		0.42	−0.15	−0.08	0.12
	0.02	(0.59)	(−0.34)	(−0.26)	(0.19)
	(0.10)				
Time period totals					
Day before and day of		0.49	−0.19	−0.73**	−0.50
recall		(1.56)	(−0.72)	(−3.21)	(−1.37)
Day of recall		0.22	−0.21	−0.75**	−0.26
		(0.49)	(−0.55)	(−2.36)	(−0.50)

t-tests are in parentheses.
* Significantly less than zero at the 0.05 level, one-sided test.
** Significantly less than zero at the 0.01 level, one-sided test.

with a one-sided *t*-test. These findings suggest that the aggregate effects may be strongly influenced by the Chrysler and Ford experiences in this time period. The results for Chrysler probably are being affected by the heightened risk of bankruptcy that the company faced in this period (see e.g. Reich and Donahue, 1985). This interpretation of the Chrysler findings is consistent with the very small market reaction to the 1967–68 Chrysler recalls. When Chrysler was in less danger the market actually showed some gain in stock price on days when recalls were announced. In a similar manner, the market's reaction to Ford recalls may be heightened in 1977–78 by the massive publicity associated with the Pinto safety problems which led up to the Pinto recalls in 1978.

Thus, the stock market evaluation of the impact of recalls on a corporation's long-term performance appears to vary over time (the reaction under the Carter administration (1977–78) quite reasonably should be different from the reaction under the Reagan administration (1982–83)) and across companies. The results for Chrysler may be an anomaly—the reaction of anxious investors to a company that was already more vulnerable because of the energy crisis, the larger size of its fleet, managerial problems, and the threat of bankruptcy. A decision-maker examining these findings could reasonably conclude that significant effects are restricted to periods of vigorous enforcement (the 1977–78 period) and to vulnerable manufacturers (Chrysler). The finding suggest that, although a market decline in response to a recall should be expected, the decline is not likely to be large relative to normal price variability unless special conditions prevail.

Individual recalls

Let us now look at the results that might be reasonably perceived by a corporate manager working in a limited area for a short period of time. Table 4 summarizes what such managers would observe on an event-by-event basis. The results are little different from what one would expect by *chance*—about 5 percent of the tests are significant at the 0.05 level, and about 10 percent are significant at the 0.10 level. Over 40 percent of the cases, as Strachan *et al.* (1983) found, had *positive* results. The manager looking

Table 4. Individual case analysis

		Totals	Day before and day of the recall	Day of the recall
Total number of cases		182	91	91
Number significantly negative*	<0.05	3	2	1
	<0.10	10	5	5
Number significantly positive*	<0.05	5	3	2
	<0.10	8	5	3
Percentage of significant cases*	<0.05	4.4%	5.5%	3.3%
	<0.10	9.9%	11.0%	8.8%
Percentage of cases with positive returns		41.2%	39.6%	42.9%
Percentage of cases with other announcements on day of the recall		64%		

* Two-sided *t*-test.

at a few cases one at a time would not perceive a substantial pattern of stock price reductions and might misinterpret the results to mean that investors actually rewarded dubious behavior.

Even if a manager saw some pattern of price reductions, inferring the cause would be problematical. When dealing with individual event returns, averaging does not 'wash out' the effect of other events that occur on the same day. Indeed, on the days on which recalls were announced, the *Wall Street Journal* published other stories on the same company in 64 percent of the cases. This fact, which helps explain the weak results of the event-by-event analysis, would make it very difficult for a manager to interpret the stock market reaction.

Prior information and changing risk

This section addresses two potential challenges to the validity of these findings. The first challenge is that the recalls may in fact have been anticipated by the market, and the second is that recalls may have damaged the firm's value by changing its systematic risk.

Even though a prior year of *WSJ* indexes have been examined, and no prior leakage of information has been found in our sample, it is still possible that there was some leakage of information in sources other than the *WSJ*. All event studies suffer from this possibility. If a specific recall was foreshadowed, then estimates of the impact of the recall would be artificially low (see Balakrishnan, 1988). If information on recalls was public before the announcement, stocks should have negative abnormal returns prior to the event window. We examined this possibility for the portfolio composed of all companies in all time periods. The normal returns period was changed to include from 244 days before the event to 130 days before the event. Abnormal returns and cumulative abnormal returns were calculated for the period starting 129 days before the event and ending 2 days before the event.For the approximately 6-month period before the event the cumulative abnormal returns were a positive 6.06 percent. For the 3-month period before the event (65 days before to 2 days before), cumulative abnormal returns were a positive 4.04 percent. Given that knowledge of upcoming recalls should lower stock prices, these results seem to indicate that recalls were on average not widely anticipated within the 6 months prior to the announcements. Note that these positive abnormal returns in the pre-recall period are consistent with our model of the expectations process, as are the positive cumulate abnormal returns in the period directly before the recalls (see Table 2, between 15 and 4 days before a recall stock prices gained an average of 1.13 percent).

Recalls might also reduce a firm's value through a longer-run effect by increasing the risk of the firm without a commensurate increase in expected cash flows. *A priori*, it would appear that recalls should appear as unsystematic risk; i.e. they are not likely to change the covariance of a stock's price with the stock market average. Therefore there should be no relation between the number of recalls a company experiences and its systematic risk. In order to test this assumption, betas for the companies were collected from the Value Line service. Due to the start date for Value Line's calculating betas, betas could be found only for the last 5 years of the sample (1972, 1973, 1977, 1982, 1983). Although we could not compare a period before recalls were common and a period after they became common, as Table 1 indicates, the number of recalls varied substantially over time. Betas for each company were plotted against the number of recalls and then each company's beta was regressed against the number of its recalls. No association between number of recalls and betas was found. The regression results were negative (see Table 5); with one exception, the parameter estimates were insignificant, and the R^2 for the regressions were very low (AMC R^2 = 0.69, Chrysler R^2 = 0.18, Ford R^2 = 0.02, GM R^2 = 0.06). Adjusted R^2 values for the three major manufacturers were negative, ranging from −0.03 to −0.23. The parameter associating recalls with beta for AMC is significant at the 0.05 level but has a negative sign—increased recalls are associated with lowered risk. We are inclined to view this as simply a chance occurrence in the data, particularly given the extremely small number of recalls for AMC. Parameters associating recalls with betas were quite insignificant for the other companies. Examination of the plots did not suggest a strong relation using some other functional form. In short, no association between beta and recalls was found.

Table 5. Company betas regressed against the number of recalls for years 1972, 1973, 1977, 1982 and 1983[a]

	AMC	Chrysler	Ford	GM
Constant	1.17	1.00	1.00	1.01
Coefficient on recalls	−0.057	0.095	−0.003	−0.010
Standard error	0.019	0.103	0.009	0.021
T-ratio	−3.01	0.92	−0.28	−0.49
Probability level	0.04	0.41	0.79	0.65
R^2	0.69	0.18	0.02	0.06
Adjusted R^2-squared	0.62	−0.03	−0.23	−0.18
Mean beta	1.04	1.35	0.98	0.95
Standard deviation of beta	0.13	0.51	0.10	0.11
n	6	6	6	6

[a] Includes all recalls over specified sizes. Similar results were obtained using only recalls without prior notice.

THE DECISION TO ENGAGE IN DUBIOUS BEHAVIOR

Strachan *et al.* (1983) and Jarrel and Peltzman (1985) suggest that the decision to engage in dubious behavior is simply a function of the *costs* incurred if the behavior is punished. We believe that this model is too simple, that the decision to engage in dubious behavior is a function of the *probability* of detection times the *costs* of punishment if detected minus the *income* that can be gained from selling the product, all adjusted for the company's *preference for risk* (see Becker, 1968). In calculating the expected utility of misconduct, one must consider the probability of detection and punishment. Indeed, a common rationalization for misconduct is a belief that an activity is acceptable because it will not be discovered (Gellerman, 1986). The income that can be attained from dubious behavior also plays a role. A belief that an activity contributes financially to a company's or an individual's well-being tends to encourage misconduct (Gellerman, 1986). Finally, the preference for risk is important: the greater the preference for risk, the more likely that individuals will engage in dubious behavior.

Let us assume a company is risk-neutral, i.e. it maximizes expected income. Then:

$$G = I - P(R) \times C \qquad (1)$$

where G is the expected gain from producing a defective product, I is the increase in income from producing a defective product compared to the income from producing a product without defects, $P(R)$ is the probability of detection requiring a recall, and C is the cost of a recall. We wish to ask whether, given this model and appropriate estimates for the various items in it, the corporation would be well advised to undertake the production of hazardous products. In particular we wish to contrast direct estimates of the costs of a recall with stock price reaction estimates of the cost of a recall under differing assumptions concerning how managers estimate such reactions (see our earlier discussion of the different assumptions that managers might use). To apply this model, estimates of income, probability of recall, and costs have to be developed.

The variable in this model that is hardest to estimate is the probability that a decision to produce a particular automobile will result in a major safety recall. This is because the probability of a recall has two separate components: (1) the probability of substantial safety hazards given specific technological choices; and (2) the probability that a recall will occur given these safety hazards. Managers face uncertainty about the relations between their technological choices and the resultant safety outcomes. There is also uncertainty about whether a recall will take place given these safety problems. The problem of whether the corporation would be well advised to produce defective vehicles, therefore, has to be reformulated. Consequently, we examine at what subjective probability of a recall given a particular safety decision does it become rational to produce a defective car? To arrive at realistic estimates of the income and costs associated with a recall, reliance will be placed on various analyses of the Pinto recall (see, in particular Davidson, 1984; and Dardis and Zent, 1982).

Income from producing defective products

The income from producing defective products has at least two calculable components: savings from not correcting the defects (the costs of repair that have been avoided) and gains from introducing products earlier than otherwise would be possible (see Table 6). Additional income factors which cannot be calculated due to lack of data include increased sales from lower prices, and greater acceptance and recognition from early introduction.

Ford, for example, believed that the benefits from early introduction of the Pinto were great. It rushed to get the car on the market in a record 38 months, rather than the 43 months that it normally takes to introduce a new car (Davidson, 1984). The unit cost to correct the gas tank problem that ultimately led to the recall has been estimated to be between $11 and $23 in 1981 dollars (Dardis and Zent, 1982). Thus, not correcting the gas tank problem prior to sale resulted in a cost savings between $16.5 million and $34.5 million based on 1.5 million unit sales. If Ford delayed introducing the Pinto for 5 months to make the repairs (i.e. if it took the normal 43 months to develop and market the car) it would have sold 95,000 fewer vehicles, based on monthly sales of 19,000 cars in the period after the car was introduced. If Ford had taken 8 months to find an appropriate solution to the fuel tank problem it would have sold 152,000 fewer cars. At $6500 per vehicle in 1981 dollars, the low estimate of lost sales is $62.8 million or about $12.4 million in pre-tax profits and the high estimate is $100.5 million or about $20.1 million in pre-tax profits (see Table 6) based on the industry's margin of sales over material and labor costs (see Jarrel and Peltzman, 1985).

These gains from not repairing a possible defect and introducing the product early have to be balanced against the potential losses. Calculable losses from sales of a defective product include legal and court costs, insurance costs, accident investigation costs, and medical and other costs that exist when damages are awarded. NHTSA's 1978 investigation of the Pinto showed 27 fatalities and 24 serious injuries (Davidson, 1984). As of June 1978, four lawsuits had been settled at a cost of $8.6 million, 29 suits were pending, and up to 21 additional suits were possible with a likely judgement of $0.5 million per suit (*Automotive News*, 1978a). Thus, the legal losses Ford sustained by introducing defective vehicles are between $23.6 and $33.6 million (see Table 6).

The bottom line here is that without the recall program, a company that had sold 1.5 million defective vehicles would have benefited by between $5.3 and $21.0 million (see Table 6). The tort system by itself would not have provided an adequate deterrent to this dubious behavior (see Posner, 1977).

Table 6. Income that can be generated from selling 1.5 million defective economy-size cars

	High estimate (in millions of 1981 dollars)	Low estimate (in millions of 1981 dollars)
Savings from not correcting the defect	+34.5	+16.5
Gains from early product introduction	+20.1	+12.4
Legal liabilities	−33.6	−23.6
	+21.0	+5.3

Sources: Dardis and Zent (1982), Davidson (1984), Jarrel and Peltzman (1985), and calculation.

The direct costs

The direct costs of a recall include the costs of mailing notices and of the parts and labor needed to repair a vehicle. Dardis and Zent (1982) add opportunity costs (the time spent in getting the repair done) which the owner must bear when a car is repaired. In an analysis of the 1978 Pinto recall they break these costs into the components listed in Table 7. A complication, which is accounted for in Table 7, is that over 30 percent of drivers who obtain notices will not go to the trouble of having their cars repaired.

Another aspect of the direct costs is lost sales. Crafton, Hoffer and Reilly (1981) find that there is a 5 percent decline in sales lasting for 1 month after a recall. The average monthly sales for Pinto in 1971–76 period were 17,000 cars. A 5 percent decline in sales would represent a loss of about $5.5 million if the cost of each vehicle is $6500 in 1981 dollars. Pre-tax profits would decline by about $1 million.

These estimates of lost sales may be low. Ford, for example, sold 33,000 fewer Pintos the year following the recall (*Automotive News*, 1978b) which amounts to a pre-tax profit loss of $33 million. Moreover, dealers received a bonus of $325 for each unit they sold during this period. With estimated sales of 200,000 cars the incentive program cost Ford $65 million due to lost sales (*Automotive News*, 1978b) to make the total cost of lost sales and incentives $98 million. Thus, a low estimate of the direct recall costs is $33.8 million and a high estimate is $150.8 million (see Table 7).

Expected returns from producing unsafe cars

The expected returns from producing an unsafe car are determined by the income from producing such a car minus the expected costs of a recall. The expected costs of a recall depend on the probability that an engineering decision results in a safety problem, and in turn that the safety problem causes a major recall. In developing estimates of the returns from producing defective vehicles we will rely on the high and low estimates of the income available from production of defective vehicles computed in Table 6, and will estimate expected returns under the assumptions that the probabilities of a recall are 10, 20 and 50 percent. Table 8 presents the results of these analyses. The last column shows our computation of the break-even point, that is the probability of a recall such that it is no longer profitable to produce a defective vehicle. ND means that there is no deterrent, that is even at 100 percent probability of a recall it is profitable to produce defective vehicles.

The probability of a recall given a defect is hard to estimate, although the probabilities appear to be reasonably under the 50 percent which we use as the highest estimate. Figures reported by the Center for Auto Safety indicate that for U.S. cars, light trucks, and vans in the period 1981–87, only seven out of 29 NHTSA recall requests resulted in any recalls at all, and only one resulted in a recall covering all the indicated vehicles (Center for Auto Safety, 1986). Overall, 11 percent of the vehicles or items of equipment for which NHTSA requested recall

Table 7. Direct costs of a recall of 1.5 million economy-size cars

	High estimate (in millions of 1981 dollars)	Low estimate (in millions of 1981 dollars)
Mailing the notice	0.2	0.2
Parts	21.0	15.8
Labor	22.1	16.8
Opportunity costs	9.5	0.0
Lost Sales	98.0	1.0
	150.8	33.8

Sources: Dardis and Zent (1982), Crafton *et al.* (1981), *Automotive News* (1978a) and calculation.

Table 8. Expected returns (in millions of dollars) from producing defective cars: assuming a recall of 1.5 million economy-size cars

	Probability of a recall given a defective car						*P* where *E* (returns) zero	
	10%		20%		50%			
Income estimate:	Low	High	Low	High	Low	High	Low	High
Cost estimates								
Direct costs	1.92	5.90	−1.46	−9.16	−11.6	−54.04	0.16	0.14
Stock market								
Aggregate portfolio 2-day window	2.77	18.35	−0.18	15.69	−8.18	7.73	0.20	0.79
Aggregate portfolio 21-day window	4.46	20.16	3.62	19.32	1.09	16.79	0.63	ND
Ford—2-day window, all years	3.36	19.06	1.43	17.13	−4.39	11.31	0.27	ND
All manufacturers 2-day window, 1977–78	−0.85	14.85	−7.00	8.70	−25.45	−9.75	0.09	0.34
All manufacturers 2-day window, 1982–83	1.09	16.79	−3.12	12.58	−15.76	−0.06	0.13	0.50
Cognitive Limitations								
By year or by manufacturer adjusted by probability of significant effect	4.53	20.23	3.76	19.46	1.46	17.16	0.69	ND
Manufacturers in years adjusted by probability of significant effect	4.40	20.10	3.51	19.21	0.82	16.52	0.56	ND

ND = No deterrent: even at 100 percent probability of a recall, it is profitable to produce a defective vehicle.

were recalled, and the recall response rate for U.S. manufacturers was far below that for foreign cars and other vehicles (Center for Auto Safety, 1986). In addition, numerous accusations have been made that the number of investigations is far below the number of documented defects; General Accounting Office studies (e.g. U.S. General Accounting Office, 1983) indicate delays and violations of applicable guidelines resulting in postponements of up to 7 years (which, given an 8-year statute of limitations on correction of defects, results in numerous defects that will pass the limitation date for recalls under NHTSA). The probability of concern is the probability that a technical choice will result in a safety hazard, and that the safety hazard will result in a recall. Such a joint probability should be well below the figures noted above, which only address the likelihood of a documented defect resulting in a recall. Thus the lowest probability estimate examined here, 10 percent, may still be substantially higher than the true probability.

Direct cost estimates

The expected profitability from producing a defective product equals the income from such production minus the probability of a recall times the cost of a recall. As developed above, our low estimate of income from production is $5.3

million (Table 6) and our low estimate of the direct costs of the recall is $33.8 million (Table 7). Thus, for probabilities of a recall given production of a defective automobile of 10, 20 and 50 percent, we have expected returns of $1.92 million, −$1.46 million and −$11.6 million respectively (Table 8). With the high estimates of $21 million in income (Table 6) and $150.8 million in recall costs (Table 7), the expected profits for the three probabilities are $5.9 million, −$9.16 million and −$54.04 million (Table 8). The probability of a recall must be greater than 0.14 or 0.16 (depending on the estimates used) for the direct costs to be a deterrent. At probabilities less than these, it is profitable to produce unsafe vehicles.

Stock market estimates

The costs of a recall can be calculated as either the direct costs or the shareholder losses. Although shareholder losses can be different if the recall has substantial effects on expectations concerning the future earnings stream of the company beyond the direct cost effect, Jarrel and Peltzman (1985) propose that these two methods should be roughly equivalent. The direct costs should appear as nearly instantaneous declines in market returns.

To estimate the market reaction, we need to rely on the assumptions about managerial cognition noted above. We will start by assuming that managers believe that the market reacts to all recalls for all companies in the same manner. Thus we estimate the shareholder loss as the market's percentage change on the day before and day of the recall announcement times the market value of the company. We use the average stock price for the Ford Motor Company in January of 1981 ($20) times the number of shares of outstanding stock (210,600,000) to estimate the market value of the company ($4,212,000,000). The market reaction is a decline in value of 0.64 percent (see Table 2). Expected returns are equal to the income from producing defective vehicles ($5.3 million or $21 million, see Table 6), minus the probability of a recall (using 10, 20 and 50 percent), times the fractional change in the market value of the corporation (0.0064) and the value of the corporation ($4212 million). For the low estimate of income, expected returns are positive if the probability of recall is 10 percent, but negative otherwise. The break-even point is a 20 percent chance of a recall. At probabilities of a recall below 20 percent it is profitable to produce defective vehicles. For the high-income case the expected returns are positive for all three probabilities of recall. Production of defective automobiles would become unprofitable only with a probability of recall above 79 percent.[3]

In a manner similar to the prior estimates, the event window is widened to include 10 days before the announcement day and 10 days after the announcement day. Widening the window allows for the possibility of leakage of information before the announcement and late reactions after the announcement. The cumulative abnormal return for this period is −0.2 percent. For the low-income estimate, the expected gains (at probabilities of 10, 20 and 50 percent) are $4.46, $3.62 and $1.09 million; for the high-income estimate the expected gains (at these probabilities) are $20.16, $19.32 and $16.79 million. The production of defective automobiles is unprofitable only in the low-income estimate, and in this case only when the probability of a detection is greater than 63 percent. With the high-income estimate it is always profitable to produce defective vehicles no matter what the probability of detection.

Another assumption that may be made about managerial cognition is that managers believe that the market response varies across companies (but not over time). The appropriate estimate is then the market response to a specific company's (in this instance Ford's) recalls. Here we find an average abnormal return of −0.23% (see Table 3). This corresponds to a −0.46% abnormal return over the 2-day window. For the low-income estimate the expected returns at probabilities of 10, 20 and 50 percent are $3.63, $1.43, and −$4.39 million; for the high-income estimate the expected returns at these probabilities are $19.06, $17.13, and $11.01 million. When the probability

[3] In using the market reaction as an indicator of the actual decline due to a recall we assume that the recalls being considered were in fact unanticipated by the market. We believe this is reasonable given our search for prior information related to the recall in the *WSJ* and our analysis of pre-event abnormal returns. In addition, the model presented above suggests that, for events that are not anticipated by the market, the market reaction to a recall should be greater than the direct costs of the recall, since the recall should influence expectations of future recalls *and* impose immediate reductions in earnings.

of a detection is greater than 27 percent the production of defective automobiles is unprofitable with the low-income estimate. With the high-income estimate it is always profitable to produce defective vehicles, no matter what the probability of detection.

Another possibility is that managers believe that the market reacts differently in different time periods. If managers assume that the market reaction to recalls is constant across manufacturers, but varies over time, we can compare the market reactions in different time periods. The 1977–78 period was one of enforcement vigor; it was the only period when the market reaction was significantly negative (see Table 3). In contrast, 1982–83 was a period of lax enforcement; the market reaction was not significantly negative.

In 1977–78 the average abnormal return is −0.73 percent (see Table 3). For the low-income estimate the expected returns at probabilities of 10, 20 and 50 percent are −\$0.85, −\$7.00 and −\$25.45 million; for the high-income estimate the expected returns at these probabilities are \$14.85, \$8.70 and −\$9.75 million. The production of defective automobiles is unprofitable with the low-income estimate when the probability of detection exceeds 9 percent. With the high-income estimate the probability of detection has to be greater than 34 percent for it to be unprofitable to produce defective vehicles.

The 1982–83 calculation is somewhat different. In 1982–83 the average abnormal return is −0.50 percent, giving a cumulative abnormal return of −1.0 percent (see Table 3). For the low-income estimate the expected returns at probabilities of 10, 20 and 50 percent are \$1.09, −\$3.12, and −\$15.76 million; for the high-income estimate the expected returns at these probabilities are \$16.79, \$12.58, and −\$0.06 million. When the probability of detection exceeds 13 percent, the production of defective automobiles is unprofitable with the low-income estimate. With the high-income estimate the probability of detection has to be greater than 50 percent for it to be unprofitable to produce defective vehicles.

Cognitive limitations

So far we have assumed that managers choose a given set of recalls to examine, either all that are available or ones that affect given companies in given time periods. But what if no choice is involved? What if cognitive limitations play a role? What is the probability that a manager looking at a given set of events will discern a significant effect? The expected profitability is then the probability that a significant effect will be observed times the size of that effect. Let us examine such probabilities for companies and years, companies by years, and individual events.

Examining the company and year totals in Table 3 we observe that only two of the 16 estimates differ substantially from zero. That is, a manager examining the numbers by company or by years has a 0.125 chance of observing a significant effect. The average significant effect is the cumulative return of 1.46 percent (to offer the highest reaction, the returns for 1977–78 using a 2-day window). Expected returns then are equal to income, minus the probability of a recall given a defective vehicle (10, 20 and 50 percent), times the probability that a manager will observe a significant market reaction (0.125), the size of that reaction, and the market value of the corporation. This calculation yields positive returns for all income estimates and probabilities of recall. If this type of cognitive limitation is present, the production of defective vehicles remains profitable in the low-income case until the probability of detection exceeds 0.69 percent. However, even at 100 percent detection it is profitable to produce defective vehicles in the high-income case.

Examining the companies by year totals in Table 3, we observe three significant reactions out of the 32 figures calculated. If we look only at the 2-day windows, the ratio is two out of 16. That is, a manager looking at the individual company and year totals has a 0.125 chance of seeing a significant effect. The average abnormal return based on the average of the abnormal returns from Chrysler 1978–79 and Ford 1978–79 (times 2, since the figure in the table is a daily average over the 2-day window) is 1.7 percent. Expected returns, calculated as in the prior example, show positive gains for all income estimates and probabilities of recall. Thus, if this type of cognitive limitation exists, the production of defective vehicles remains profitable unless the probability of detection exceeds 56 percent in the low-income case. In the high-income case it is profitable to produce defective vehicles even if detection is 100 percent.

The approach that may be most consistent with the way managers actually observe the market reactions is recall-by-recall. If the changes in stock price following a recall announcement are not markedly larger (and negative) than the normal, day-by-day changes in stock price, then it is unlikely that the manager will perceive these as substantial or real, and it is unlikely that they will influence the manager's behavior. Examining Table 4 we find that the number of recalls with significant abnormal returns is almost identical to what would be expected by chance, and the number of recalls with positive significant returns is very close to the number with significant negative returns. Applying such a significance test the manager is likely to see no reaction to recalls overall, and if applied to a small subsample the manager might decide the market rewarded corporations for recalls. Thus, if one believes that managers observed day-by-day reactions to announcements rather than performing aggregate statistical analyses, one would be likely to conclude that there is little chance they will perceive a serious stock price 'punishment' for recalls. There will be absolutely no deterrent.

DISCUSSION AND IMPLICATIONS

We have examined the expected gains from production of defective automobiles under a variety of assumptions concerning both the stationarity of the market's response to recalls and managerial cognition. These estimates indicate that the stock market reaction is not an effective instrument of social control. Let us summarize the more important shortcomings.

First, the market's responses to recalls varies substantially across time and companies. It appears plausible that these responses depend to some extent on both the condition of the company and the regulatory climate. For example, responses to Chrysler's recalls in later years are larger than responses to GM's, perhaps because Chrysler faced the threat of bankruptcy, and responses to recalls under the Carter administration are larger than responses to recalls under the Reagan administration, perhaps because the Carter administration enforced the laws about recalls more strictly.

Second, far from the extremely large reaction suggested by Jarrel and Peltzman, the deterrent effect of the stock market reaction is no greater than the deterrent provided by the direct costs of recall. These findings are in direct contradiction to Jarrel and Petlzman (1985). Table 8 indicates that direct costs deter the production of defective vehicles in 66.7 percent of the combinations examined, while the stock market deters the production of defective vehicles in only 33.3 percent of the combinations examined. Alternatively, the direct cost estimates indicate the production of defective automobiles becomes unprofitable at a probability of detection of 14–16 percent but only two out of 14 of the stock price reactions indicate unprofitable conditions at these probabilities.

Third, for a large majority of the combinations that we examined, the production of defective automobiles appears to be a profitable activity. Table 8 shows that 66.7 percent of the market reaction combinations have positive expected gains. In four of the 14 combinations examined, even if there is a 100 probability of a recall, it is profitable to produce defective vehicles.

Fourth, the consideration of managerial cognitive limitations substantially weakens the deterrent effect of the market reaction. If cognitive limitations are assumed, all of the estimates in Table 8 show positive expected gains.

Finally, if one examines the market's reactions to recalls on an event-by-event basis, asking of each event 'did the market react in a significant negative way', one finds little basis for thinking the market punishes companies for recalls. The percentage of abnormal reactions is no different from what would appear by chance. At least 40 percent of the individual reactions, moreover, are positive. A manager observing the market reaction to recalls on a case-by-case basis might conclude that the market actually rewarded the behavior that produced the recall.

These results suggest that the stock market is not a dependable deterrent to the production of defective automobiles. Such a finding is contrary to that of Jarrel and Peltzman (1985), but a number of differences between the two studies offer some explanation. First, note that the aggregate estimates of the impact of a recall on stock price are not grossly different: Jarrel and Peltzman find a −0.81 percent abnormal return between the day before and day after recall announcements. We examine the day before and day of the announcement and find −0.64 percent.

On the other hand, Jarrel and Peltzman do not consider the income side in detail, nor the probability of a recall given a defective automobile. In addition, they do not consider the possible cognitive effects, and do not consider very seriously the implications of differences across manufacturers or time (but they do find such differences). In summary, whether the assumption is of a manager who simply has the sense to look at changes over time for a given company, or the assumption is of a manager who looks at individual events, our findings indicate that shareholder losses do not dependably deter dubious practices in the production of defective automobiles, and more generally that they are not likely to be an effective mechanism of social control.

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