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Does a Firm's Product Recall Strategy Affect Its Financial Value?

Yubo Chen, Shankar Ganesan, and Yong Liu

During a product recall, the market uses a firm's choice of recall strategies to assess its potential impact. Surprisingly, this study finds that proactive strategies may have a negative effect on a firm's financial value when compared to more passive strategies.

Report Summary

Product-harm crises often result in product recalls, which can spoil carefully developed brand equity, damage a company's reputation, and lead to revenue and market-share losses. For instance, Merck's stock price plummeted from \$45.07 to \$33.00 in a single day on September 30, 2004, when its product, Vioxx, was recalled.

In this study, the authors examine the impact of product-recall strategies on stock returns, using Consumer Product Safety Commission product recall data from 1996 through 2007. They match the recalls with stock return data from CRSP (Center for Research in Security Prices at the University of Chicago) and firm characteristics from sources such as *Fortune* magazine's annual Fortune 500 company survey and its surveys of "America's Most Admired Companies."

Through an event study method, they show that proactive strategies have a *negative* effect

on firms' financial value when compared to more passive strategies. One explanation for this surprising finding is that the stock market may interpret a proactive strategy as a signal for substantial financial losses to the firm rather than as a signal for socially responsible actions.

In general, proactive strategies tend to be used more often by firms that are smaller and less reputable, have a smaller volume of defective products, and are subject to the potential spillover of the negative consequences from the recall to their other products. Their results suggest that during the recall, the financial market uses the firm's strategic choice of particular recall strategies to assess the potential impact of the recall. Their results also point to an inconsistency in the ways the market may interpret socially responsible corporate policies. The authors suggest that firms need to be sensitive to how the stock market may interpret a proactive strategy and be aware of its potential drawbacks. ■

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Introduction

Incidents of negative publicity are ubiquitous in the marketplace, ranging from lead-paint contaminated toys, faulty tires, tainted pet foods, and unhygienic food products. These well-publicized incidents are generally referred to as product-harm crises (Dawar and Pillutla 2000). They occur when a firm's product fails to meet a mandatory safety standard, contains a defect that could cause substantial harm to consumers, creates an unreasonable risk of serious injury or death, or fails to comply with a voluntary standard adopted by the specific industry (Mullan 2004).

Often, the consequence of a major product-harm crisis involves product recalls wherein the implicated firm has to retrieve recalled products from all distribution channels as well as from the end consumers. According to the Consumer Product Safety Commission (CPSC), more than 400 consumer products were recalled in 2007 due to safety concerns (<http://www.cpsc.gov/cpscpub/prerel/prerel.html>). It is widely believed that product recalls are likely to occur more often in the future because of increased globalization of production, greater complexity of products, higher demands by consumers for better quality and safer products, and closer monitoring by both the manufacturers and government agencies (Berman 1999).

Product-harm crises in general and product recalls in particular have the potential to damage carefully developed brand equity, spoil consumers' quality perceptions, tarnish the company's reputation, and lead to revenue and market-share losses (e.g., Laufer and Coombs 2006; Rhee and Haunschild 2006; Siomkos and Kurzbard 1994; Sullivan 1990; Van Heerde, Helsen, and Dekimpe 2007). In the worst case, they could destroy the confidence of investors in the firm, which in turn, can lead to either a decline in the financial value of publicly traded firms or the unwillingness of investors to continue funding private firms.

Thus, the long-term sustainability of the entire firm may be at risk. For instance, Merck's stock price plummeted from \$45.07 to \$33.00 in a single day, on September 30, 2004, when Vioxx was recalled. As another example, Topps, one of the largest makers of frozen hamburgers in the United States, went bankrupt after it was forced to recall 21.7 million pounds of frozen hamburger on September 29, 2007.

Given the increased frequency of product recalls and the potentially devastating consequences for the firms involved, managing such crises effectively has become a top priority for many firms. Previous literature has classified crisis management strategies into four distinct categories: denial, involuntary recall (or forced compliance), voluntary recall, and super-effort (Dawar and Pillutla 2000; Laufer and Coombs 2006). These four strategies make up the so-called "company response continuum." At one extreme, firms forsake (or try to forsake) any responsibility for the defective product by denying culpability and delaying the recall process. At the other extreme, firms respond to consumer complaints early, issue speedy voluntary recalls, communicate extensively with consumers and other stakeholders, and often provide additional compensation beyond the legal requirement. Thus, a major distinction among various product-recall strategies is whether the firm acts passively and defensively, or proactively and responsibly (Siomkos and Kurzbard 1994).¹ A fundamental question is whether a proactive strategy would help attenuate the negative effects of product recalls on firm value. The theoretical and empirical evidence for this question remains equivocal.

Only a limited number of marketing studies have investigated the impact of product harm-crisis management strategies by focusing on consumer evaluations of products and services (e.g., Ahluwalia, Burnkrant, and Unnava 2000; Dawar and Pillutla 2000). These studies provide strong insights into how consumers perceive and respond to product-recall strategies.

Most of these studies were conducted in a laboratory setting, and the broader issue of how different crisis management strategies might influence firms' financial value has not been studied. This paucity in research is quite glaring as there has been increased attention on understanding the linkage between firm strategies and stock market performance, as evidenced by the call for papers for a special issue of the *Journal of Marketing* on "Marketing Strategy Meets Wall Street." Moreover, most consumer-based strategies have the ultimate goal of maximizing shareholder value. Compared with other consumer-level and firm-level measures (e.g., Ramani and Kumar 2008), stock return provides a direct assessment of stockholder value (Prince and Rubin 2002). Therefore, an examination of how product-recall strategies influence stock returns is definitely warranted.

Several studies in economics and finance have examined the overall impact of product recalls on firms' financial value, but the results are mixed (e.g., Davidson and Worrell 1992; Hoffer, Pruitt, and Reilly 1988; Jarrell and Peltzman 1985; Thomsen and McKenzie 2001). For example, Jarrell and Peltzman (1985) find that automobile and drug recalls are associated with negative abnormal stock returns. Hoffer, Pruitt, and Reilly (1988) reexamined the same data and found that recall announcements did not significantly affect a firm's value after controlling the effects of confounding events. Thomsen and McKenzie (2001) find significant shareholder losses when publicly traded food companies were involved in a serious food recall. Most of these studies have focused on the automobile, food, or pharmaceutical industries. One exception is Davidson and Worrell's (1992) study that examined non-automobile recalls. However, their sample includes only recalls reported in the *Wall Street Journal*. The recall effects across a broad range of consumer products such as toys, electronics, and household products, which have received a great amount of public attention in recent years, remain

largely unexamined. More important, when examining the impact of product recalls on a firm's financial value, these studies have not considered the role of recall strategies.

Our paper focuses on two main objectives. First, we investigate how proactive (versus passive) recall strategies during the recall process influence stock returns. Second, we examine the antecedents of firms adopting different recall strategies. The theoretical predictions are tested using data obtained from multiple sources dealing with product recalls, firms' strategies, and firm/product characteristics in different consumer product categories (e.g., toys, child products, household products, sports and recreation products, and outdoor products). In reality, it is very difficult for researchers to directly observe and measure how firms manage product recalls. Fortunately, we were able to identify a viable measure of recall strategies (i.e., proactive versus passive) from the CPSC recall announcements. We study CPSC product recalls over a 12-year period from 1996 through 2007, and collect recall details from the official CPSC announcements. This long time span enables us to have a sufficient sample of recalls even after excluding any recalls for which the effects on stock returns may have been contaminated by confounding events or for which there was a potential information leak prior to the recalls. As previous studies have pointed out, this is a critical methodological issue for event studies (Mackinlay 1997; McWilliams and Siegel 1997). We match the CPSC recalls with stock return data from CRSP (Center for Research in Security Prices at the University of Chicago) and the characteristics of these firms from sources such as *Fortune* magazine's annual Fortune 500 company survey and its surveys of "America's Most Admired Companies."

Our key findings can be summarized as follows. First, we find that a proactive recall strategy has a more *negative* effect on the firm's stock returns than a passive recall

strategy. These results are quite different from the existing marketing literature, which indicates that when a firm accepts the responsibility for the product recall, the negative effect on brand equity and consumer perceptions is reduced (e.g., Dawar and Pillutla 2000, Siomkos and Kurzbard 1994). The positive effect found in the previous literature may be because consumers interpret the proactive recall strategy as a signal that the focal firm is socially responsible. Since a socially responsible corporate policy may have a positive impact on stock returns (Margolis, Elfenbein, and Walsh 2007; Orlitzky, Schmidt, and Rynes 2003), proactive recall strategy can have a positive influence on a firm's financial value. In contrast, our findings suggest that the financial market may view a proactive recall strategy as a signal for severe product hazard and financial losses to the firm (e.g., expenses related to the recall process, potential litigation, liability, and penalty payment for damages to consumers or properties). Such perceptions will negatively influence the stock returns of the firm. Second, a proactive strategy tends to be used more often by firms that are smaller and less reputable, have a smaller volume of defective products, and are subject to a greater degree to the potential spillover of the negative consequences from the recall to their other products. Third, our results show that the recall strategy completely mediates the impact of all firm- and product-related factors (except size, which is partially mediated), suggesting that during the recall, the financial market uses the firm's strategic choice of particular recall strategies as a proxy for assessing the potential impact of the recall. In contrast to the previous literature that has focused mainly on positive consequences, our results show that there could be important repercussions associated with proactive recall strategies. Thus, a firm needs to be sensitive to how the stock market may interpret a proactive recall strategy, underscoring the importance of linking the firm's strategies to financial market value when studying product recalls.

The remainder of this paper is organized as follows. First, we provide an overview of the product-recall process and discuss two strategic alternatives (proactive versus passive strategies) available to firms. Next, we examine how these strategies influence a firm's value in terms of stock returns. In this section, we first discuss the conceptual background used to develop the hypotheses and then the details of the study and its results. In the next section, we examine the antecedents of a firm's recall strategy. Once again, we discuss the conceptualization followed by the methodology and empirical results. In the final section of the paper, we examine the mediating role of a firm's recall strategy. The paper concludes with a summary and discussion of managerial implications.

Managing Product Recalls: Proactive versus Passive Strategies

In the United States, product safety is overseen by several federal government agencies, depending on the product category. The National Highway Traffic Safety Administration (NHTSA) is responsible for safety issues related to motor vehicles and related equipment. The Food and Drug Administration (FDA) has jurisdiction over safety recalls involving foods, drugs, medical devices, and cosmetics. The Consumer Product Safety Commission (CPSC) is responsible for product safety for most "consumer products." These include products used in households, outdoors, sports and recreation, and by children.

The basic process that leads to a potential product recall is relatively straightforward. The recall process used by CPSC is as follows: In the beginning, either the firm or CPSC receives information from consumers or channel members about the potential hazard of a product. Very often such information comes from consumer complaints either directly to the firm or to the federal agency. For example,

CPSC receives about 400,000 calls annually from consumers through its 24-hour hotline (Schoem 2001). A firm has the obligation to report to CPSC within 24 hours if it receives information or evidence that “reasonably supports the conclusion” that safety issues exist (Mullan 2004).² CPSC and the firm are then involved in “risk analysis” to identify patterns or data that suggest the product “creates a substantial product hazard.” If a product is identified as potentially harmful and it is determined that a recall is in order, the firm and CPSC could decide to issue a product recall at any time. A firm can also issue a “fast track” recall without waiting for the “risk analysis” to be completed.

In either case, CPSC initiates an official recall announcement jointly with the firm. The firm is not allowed to provide its own news release prior to the CPSC announcement. Such recalls are “voluntary” recalls. In very rare cases, the firm does not agree with the agency’s decision that a recall is warranted. The agency then needs to decide whether to impose a mandatory (i.e., involuntary) recall. Since involuntary recalls require elaborate legal proceedings before an administrative judge, which can be lengthy and costly and involve uncertain outcomes, it is usually in the interest of the agency and the firm to cooperate in the recall process. For example, in the case of CPSC, almost all recalls are voluntary. The mandatory recall process is used less than once a year (Mullan 2004). Regardless of the type of recall, the main purpose of a recall is to locate and remove all defective products as quickly as possible from consumers and channel members, and to give the public, in a timely manner, accurate and understandable information about the product defect, the extent of hazard the product poses, and the firm’s corrective plan (CPSC 1999).

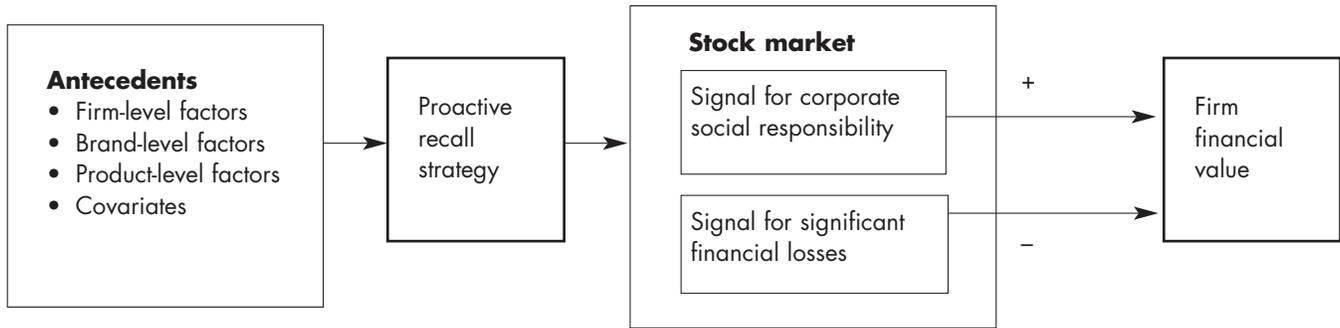
The recall process gives the firm the opportunity to act strategically on whether and when to cooperate with the regulatory agent to issue (or agree to issue) a recall. It can work with

the agency to do so earlier in the investigation process, or delay to the maximum extent until there is no other choice. As discussed earlier, previous literature has found that firms differ considerably in terms of when they announce a recall and the manner in which they handle a recall incident (e.g., Dawar and Pillutla 2000; Laufer and Coombs 2006; Siomkos and Kurzbard 1994).

Following the framework offered by Siomkos and Kurzbard (1994), firms’ recall strategies can be categorized based on their responsiveness to the recall incident. Some firms adopt a *proactive* recall strategy. If the firm or the federal agency discovers a product flaw that might necessitate a potential recall, the firm adopting the proactive strategy is more likely to work with the agency and issue a voluntary recall early in the process. Such recalls often occur once the firm becomes aware of a potentially hazardous product through internal inspections, and before any consumer safety incidents have been reported to the firm or agency (CPSC 1999). For example, in September 4, 2007, Mattel announced the recall of 675,000 toys, after its internal testing discovered excessive levels of lead in the surface paint on the toys (Mattel 2007). This proactive recall was initiated even though there were no incidents or injuries reported by consumers (CPSC 2007).

Other firms, however, could adopt a *passive* strategy to manage product recalls. The passive approach may entail delaying the recall process and/or trying to shift the responsibility to other firms or entities. In addition, these recalls tend to be issued much later in the investigative process and usually happen after there have been serious consumer complaints to the firm or to CPSC. Unfortunately, such recalls are often issued after serious injuries and/or death to the consumers. As an example, Playskool recalled about 255,000 of its Tool Bench toys only after receiving the death reports of two toddlers (CPSC 2006).

Figure 1
Product-Recall Strategy and Firm Financial Value



In the next section, we discuss the conceptualization of proactive versus passive recall strategies and provide theoretical predictions for their impact on stock market returns. We then present the empirical method and results.

Effects of Product-Recall Strategies on Firms' Financial Value

Theory and hypotheses

It is well known that a significant amount of information asymmetry exists between firms and the stock market (Myers and Majluf 1984). This information asymmetry is accentuated during crisis events such as product recalls. Due to the complexity in the production and distribution processes, as well as the focal firms' proximity to consumer information and the communication with the regulatory agencies,³ these firms often possess a great amount of private information on the nature of the product hazard and its potential consequences. In contrast, the stock market relies on a multitude of external information sources (e.g., corporate or government news releases, third-party business publications) to determine the impact of a significant event on the focal firm. In addition to publicly available information, the stock market frequently pays close attention to a firm's actions and strategies, and tries to interpret these as signals of future earnings and the firm's value (Ross 1977).

The type of recall strategy (proactive or passive) adopted by the focal firm can be such a signal. In Figure 1 we depict two fundamentally different ways in which a proactive (versus passive) strategy may be interpreted by the stock market, leading to opposite effects on a firm's financial value. We refer to these opposing views as the corporate social responsibility (CSR) signal and the financial losses signal.

Signal for Corporate Social Responsibility. A proactive recall strategy, in which the firm acts early and quickly to take responsibility for product defects and potential hazard, can be interpreted by the stock market and the general public as a signal that the firm is responsible, trustworthy, and cares about its consumers. For example, Mattel was recently selected by *Fortune* magazine for its 2008 list of "100 Best Companies to Work For" mainly because of its quick and responsible actions in recalling defective toys in 2007.⁴ The literature on CSR has shown that practicing CSR would benefit the firm in a number of ways, ranging from a higher level of quality perception (Siegel and Vitaliano 2007) to positive stock market reactions (Margolis, Elfenbein, and Walsh 2007; Orlitzky, Schmidt, and Rynes 2003). As a result, firms with a CSR orientation will be more likely to receive positive evaluations from the stock market, which helps reduce the negative impact of product recalls on stock returns. Moreover, Siegel and Vitaliano (2007) show

that CSR can work as a signal for product quality, and socially responsible firms tend to produce high-quality products. This indicates that the socially responsible signal conveyed by a proactive strategy will help reduce the concern for inherent product quality of the focal firm. In the specific context of managing a product-harm crisis, Siomkos and Kurzbard (1994) found that more active responses from the firm reduced the negative impact on consumers' perception and their future purchase intentions. This suggests that future sales of the firm will benefit from a more proactive recall strategy.

To the extent that the stock market reflects future earning potential, firms adopting a proactive recall strategy are less likely to face a negative impact on stock returns in comparison with those adopting a passive strategy. Therefore, if the stock market interprets proactive recalls as a signal that the firm is behaving in a socially responsible manner, it should reduce the negative consequences of recall on stock returns.

Signal for Financial Losses. In addition to the CSR signal, a firm's proactive recall strategy can also be interpreted as a signal for significant financial losses to the firm. Specifically, by observing that the firm is moving quickly and early to initiate the recall and managing it proactively, the stock market could speculate that the likely consequences are severe and the firm had no other choice but to move proactively to reduce the potential financial losses. Typically, such losses include expenses related to the recall process, potential litigation, liability, and penalty payment for damages to consumers or properties. Unlike the CSR perspective, in which investors pay greater attention to the sustainability and long-term value of the firm, financial losses are salient in the short term and related more closely to the recall event *per se*.

Therefore, if a proactive strategy is interpreted as a signal for significant financial losses, the

stock returns will be affected more negatively when the recall strategy is proactive rather than passive.

Based on the above, we propose the following two hypotheses:

H1a (Signal for CSR): Proactive recall strategies are *less* negatively related to the firms' financial value than passive strategies.

H1b (Signal for financial losses): Proactive recall strategies are *more* negatively related to the firms' financial value than passive strategies.

Data

We test these hypotheses with CPSC product recalls from January 1996 to December 2007 (<http://www.cpsc.gov/cpsc/pub/prerel/prerel.html>). We chose the recalls issued by CPSC for several reasons. First, CPSC does not allow any news releases or information leaks prior to the recall announcement (CPSC 2005). Once it is determined that a recall is to be issued, all official recall information originates from CPSC. This feature of the data allowed us to accurately measure the date on which a recall announcement was made to the public. The recall and the firm's recall strategy are unanticipated events to the public when the recall is announced by CPSC. This offers an ideal setting for the event study method (Mackinlay 1997).

Second, each CPSC recall announcement specifically indicates (by the time when the recall was issued) the number of safety incidents related to the recalled products that have been reported to the firm and the CPSC. If any, these incidents are mostly injuries, deaths, and severe property damage to the users of the products. These reports provide useful information that allows us to distinguish between proactive and passive recall strategies. If the firm and the agency have not received any incident report but a recall is issued, it suggests that the firm moved quickly in managing the crisis and adopted a proactive strategy.

If this is not the case, firms are relatively passive in managing the recall. Note that these incidents are those that were reported either to the firm or to CPSC, of which the media may not be aware. To ensure that any differential effects between proactive and passive strategies on stock returns is not due to investors' prior knowledge about safety incidents from media reports, we exclude all recalls for which there was media coverage before the formal recall announcement.

Third, among all federal agencies that regulate product recalls, CPSC is responsible for the most diversified range of consumer products. Many of the recent large-scale product recalls have occurred for nondurable goods such as toys and toothpaste, which fall under the regulation authority of CPSC. Thus, using the recall data from CPSC helps us enhance the generalizability of our findings.

Fourth, CPSC does not handle automotive-related recalls. Product recalls in the automobile industry are consistently higher than in other industries. For example, Davidson and Worrell (1992) report that the number of recalls from the "Big Three" automakers in their 20-year sample is larger than all other recalls combined. Pruitt and Peterson (1986) find the number of automobile recalls from the three automakers is about twice as large as all other recalls combined. The inclusion of a large number of automobile product recalls may lead to significant sample bias, unless one is focusing on the automobile industry itself.

We collected information for product recalls that were issued for firms listed on the New York Stock Exchange. The daily stock-return data are obtained from CRSP (University of Chicago's Center for Research in Security Prices). Since the CPSC regulations on reporting safety problems are different between manufacturers and retailers (Mullan 2004), we exclude all retailer recalls (e.g., Target and PetSmart) and focus on manufacturer recalls. We obtain key firm characteristics

such as reputation and firm size from third-party publications such as the Fortune 500 list and the annual "America's Most Admired Companies" survey by *Fortune* magazine (e.g., Fombrun and Shanley 1990).

Event study methodology

Event study has traditionally been employed in finance and accounting disciplines. Mackinlay (1997) provides a comprehensive review of the key considerations and methodological issues relevant to event studies. In marketing, event study has been used to examine the impact of various marketing strategies on stock returns, such as adding Internet distribution channels (Geyskens, Gielens, and Dekimpe 2002), celebrity endorsement (Agrawal and Kamakura 1995), brand extension announcements (Lane and Jacobson 1995), and the change of company names (Horsky and Swyngedouw 1987).

A major challenge to event study is establishing an investigation period during which there are no confounding events that could obscure the effects associated with the event under consideration (Mackinlay 1997; McWilliams and Siegel 1997). Sometimes the researcher has to use fairly long event windows if there is uncertainty about when the event actually occurred. Unfortunately, a long event window increases confounds due to a greater number of intervening events. Therefore, the existing literature has suggested that the event window should be set as short as possible (e.g., McWilliams and Siegel 1997). Consistent with this requirement, the CPSC data offer us an accurate event day, i.e., the day when a recall is announced. We exclude any observations for which the firm involved in a recall experienced other economically relevant events on the recall date to avoid potential confounds. Following the event study literature, we located the confounding events by searching the archives and index of the *Wall Street Journal*, since it is considered to be the most comprehensive news source for financially relevant events (e.g., McWilliams and Siegel 1997).

To reduce the impact of potential leakage of recall information before the event day, we follow Davidson and Worrell's (1992) suggestion and exclude all observations for which there were news reports in the *Wall Street Journal* prior to the recall announcement on safety issues related to the recalled product (e.g., safety incidents, product inspection). By doing so, we can uniquely examine the financial impact of unanticipated recall announcements. More importantly, it helps rule out the alternative explanation that the differential effect of a passive recall strategy occurs because investors might have more prior information about passive recalls (relative to proactive recalls) and are less likely to be surprised about such recalls.

After eliminating all observations subject to potential confounds, we obtained a final sample of 89 CPSC recalls for the event analysis. Among them, 24 recalls were issued before the firm or the CPSC had received any report of safety incidents. These recalls were categorized as proactive recalls. The remaining 65 recalls were classified as passive recalls. Our sample size is comparable to previous event studies. For example, there were 58 observations in Horsky and Swyngedouw (1987), 89 in Lane and Jacobson (1995), 110 in Agrawal and Kamakura (1995), and 93 in Geyskens, Gielens, and Dekimpe (2002).

The "event" in our study is a product-recall announcement from CPSC. The official announcement date by CPSC is thus the event day (day 0). The theory of stock market efficiency from the finance literature indicates that the impact of recall strategy, if any, should appear on the event day. As commonly used in event studies (Mackinlay 1997), a period of 250 prior trading days, which is approximately 1 year in calendar days, is used as the *estimation period* (i.e., day -270 to day -21) to estimate normal returns.⁵ Specifically, we estimate normal returns by using the market model (Mackinlay 1997):

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}, \quad (1)$$

where R_{it} and R_{mt} are the day t ($t = -270, \dots, -21$) returns on stock i (the company for which the recall was issued) and a standard market portfolio m . We use the typical market portfolio, *S&P 500 Index*, in the estimation. Estimated parameters α and β are used for the event day to predict the expected return, which is then subtracted from the actual return to obtain the abnormal return (AR):

$$AR_{i0} = R_{i0} - \hat{\alpha}_i - \hat{\beta}_i R_{m0}. \quad (2)$$

Following the event study process in the literature (e.g., Agrawal and Kamakura 1995; Davidson and Worrell 1992; Geyskens, Gielens, and Dekimpe 2002; Lane and Jacobson 1995; Mackinlay 1997), we test our hypotheses by examining whether the abnormal returns for proactive and passive recall strategies are significantly different from zero, and whether the abnormal returns of the two groups are significantly different from each other in the positive or negative direction.

Results and discussion

Table 1 presents the event study results related to the effects of proactive (versus passive) recall strategies on stock returns. We utilize multiple test statistics to examine whether the abnormal stock returns are significantly negative for each type of recall. Besides the common t -test, Patell's (1976) test statistic (t -Patell) is used to reduce potential bias caused by stocks with large standard deviations in returns. The standardized cross-sectional test developed by Boehmer, Musumeci, and Poulsen (1991) (t -BMP) is applied to cope with any possible event-induced variance changes.

As shown in Table 1, part A, the average abnormal returns for the proactive recalls is -63%, significant at the 5% level for all three tests. In contrast, none of the three tests is significant for the passive recalls, indicating that a significantly negative abnormal return is associated with proactive recalls but not with passive recalls.

Table 1
The Impacts of Product-Recall Strategy on Firm Financial Value

A: Abnormal Stock Returns (AR) for Proactive vs. Passive Recalls

Recall strategy	N	AR	t-stat	t-Patel	t-BMP
Proactive	24	-.63%	-1.85*	-2.11*	-2.01*
Passive	65	.38%	1.54	1.32	1.27

B: Comparing Abnormal Returns (AR) between Proactive and Passive Recalls

Two-sample t-test		Wilcoxon Rank Sum Test	
AR Difference	t-stat	W-Score	Z-stat
-1.01%	-2.21*	854.5	-2.08*

* $p < .05$.

To further test Hypothesis 1a and 1b, we compare abnormal returns of different recalls by conducting a two-sample *t*-test and a non-parametric Wilcoxon rank sum test. As shown in Table 1, Part B, proactive recalls have a significantly more negative abnormal stock return than passive recalls: the difference is -1.01% and significant ($p < .05$). The rank sum of the abnormal returns (Wilcoxon score) for proactive recalls is 854.5, and the distribution of the abnormal returns for the proactive recalls is significantly shifted to the left of the distribution for passive recalls ($Z = -2.08, p < .05$).

Overall, these results provide consistent evidence that the proactive recalls are associated with significantly more negative abnormal returns than the passive recalls. Hypothesis 1b is thus supported, suggesting that the market interprets a proactive recall strategy as a signal for significant financial losses, rather than a signal of socially responsible behavior (see Figure 1). On average, the abnormal return for proactive strategies is 1% lower than that for passive strategies ($p < .05$).

In contrast to the previous literature that has focused mainly on the positive aspects of proactive recall strategies (e.g., Dawar and Pillutla 2000; Laufer and Coombs 2006; Siomkos and Kurzbard 1994), these findings

provide evidence regarding the potential drawback of proactive strategies by examining stock market reactions with a recall sample that spans a broad category of consumer products. Our results indicate that firms should not assume that socially responsible behavior will always be positively interpreted by the market. Thus, firms need to be sensitive to how the stock market may interpret such behavior.

Antecedents of Product Recall Strategies

From a firm's perspective, the choice of an appropriate strategy to manage a product recall can be critical in terms of its brand equity, corporate reputation, and overall value of the firm. As the previous section shows, a proactive strategy may actually hurt stock returns. However, it is not clear why some firms are more likely to adopt a proactive strategy under specific conditions. An answer to this question will provide useful guidelines to firms facing the task of managing product recalls.

It is, however, difficult to predict unambiguously how various antecedents may influence firms' choice of recall strategy, since competing hypotheses are possible. To help with the predictions, we distinguish between two general perspectives that firms may adopt. On one hand, firms may adopt a proactive strategy with the purpose of being socially responsible, since CSR helps to reduce potential damage to corporate and brand reputation, and maintain long-term value for the firm (e.g., Margolis, Elfenbein, and Walsh 2007; Orlitzky, Schmidt, and Rynes 2003; Siegel and Vitaliano 2007). On the other hand, firms may adopt a proactive strategy to act swiftly to reduce financial losses associated with the recall itself. This is likely to be induced by the belief that delaying the recall would create a high level of financial risk in terms of recall cost as well as litigation and payments for penalties and damages. The CSR and the financial loss perspectives generate a set of competing predictions for how several

characteristics related to the firm, brand, product, and recall might influence firms' recall strategies (see the detailed predictions and their rationale in the Appendix). These characteristics include the level of firm reputation, firm size, whether the recalled brand is an individual brand within a portfolio of different brands or is part of the family brand for all products of the firm, and the volume of the recalled product.

Model and estimation

The data used in this analysis are collected from multiple sources for each recall observation. Following the literature on firm reputation (e.g., Fombrun and Shanley 1990), we obtain the reputation data from the annual survey of "America's Most Admired Companies" conducted by *Fortune* magazine. This survey asks executives, directors, and security analysts to rate companies in their own industry. All companies are rated on eight attributes about their reputation relative to their major competitors. We were able to obtain overall reputation scores for all the companies and their ranks in respective industries from 1996 to 2007. However, given how the reputation scores are computed and the cross-sectional nature of our recall data, it is difficult to compare firms' reputation scores across industries. *Fortune* often lists companies whose overall reputation scores rank in the top half of their industry as "the most admired companies." This enabled us to categorize such companies as high-reputation firms, while other companies whose overall scores ranked in the bottom half of the respective industries were coded as low-reputation firms. A dummy variable REPUTATION was assigned to each firm in the data, and coded as 1 for high-reputation firms and 0 for low-reputation firms. Another dummy variable SIZE was used to capture firm size; it equals 1 if the recalling firm is a Fortune 500 company and 0 otherwise. The brand- and product-level variables were obtained from the CPSC recall announcements. BRAND was coded as 1 if the recalled product used the company name in its brand (i.e., family brand) and coded as 0 for individual brand

name. We use VOLUME to denote the volume of recalled products, which is provided in most CPSC announcements.⁶

Several additional variables are included to provide control for product and recall fixed effects. These variables are obtained from the CPSC announcements. They include TIME (how long the recalled products have been sold in the market until the recall announcement), PRICE (the minimum price level of the recalled product), HAZARD (the level of product hazard—most severe, less severe, and least severe),⁷ and a set of product category dummies following the CPSC categorization—TOY for the toy products, CHILD for non-toy children's products, OUTDOOR for outdoor products such as lawn mowers, and SPORTS for sporting goods. The omitted reference category includes the household and specialty products. Table 2 lists all the variables used in the analysis.

We estimated the following logit model to examine how the explanatory variables discussed in hypotheses 2 through 5 (see the Appendix) influence the probability that a proactive recall strategy is adopted by the firm:

$$\text{Prob}(PROACT_i) = \beta_0 INTERCEPT + \beta_1 REPUTATION + \beta_2 SIZE + \beta_3 BRAND + \beta_4 VOLUME + \beta_5 HAZARD + \beta_6 TIME + \beta_7 PRICE + \beta_{8-11} CATEGORIES + \varepsilon_i, \quad (3)$$

where $PROACT_i$ is a binary dependent variable denoting whether the firm adopts a proactive recall ($PROACT_i = 1$) or not ($PROACT_i = 0$). Table 3 provides the descriptive statistics and the correlation matrix among all variables.

Table 4 presents the results from the binary logit model. The coefficients of both firm-level antecedents REPUTATION and SIZE, β_1 and β_2 , are significantly negative. These indicate that firms with a lower reputation and smaller

Table 2
List of Variables in the Analysis

Variable	Meaning
PROACT	Whether the recall is proactive (1) or not (0)
REPUTATION	Whether the recalling company is listed in the top half of its industry in <i>Fortune</i> magazine's "America's Most Admired Companies" survey (1) or not (0)
SIZE	Whether the recalling company is a Fortune 500 company (1) or not (0)
BRAND	Whether a recalled product used its company name in its brand name (1) or not (0)
VOLUME	The number of recalled product units sold in thousands
HAZARD	The level of product hazard risk (1: high; 2: moderate; 3: low)
TIME	How long the recalled products have been sold until the recall announcement
PRICE	The (minimum) price level of the recalled product
CHILD	Whether a recalled product is in the non-toy, child product category (1) or not (0)
TOY	Whether a recalled product is in the toy product category (1) or not (0)
OUTDOOR	Whether a recalled product is in the outdoor product category (1) or not (0)
SPORTS	Whether a recalled product is in the sports and recreation product category (1) or not (0)

firm size are more likely to adopt proactive recall strategies. Following the discussion in the Appendix, these results are consistent with the predictions of firms adopting the financial losses perspective because these companies are more susceptible and sensitive to the potential financial losses from product recalls. For the brand variables, the coefficient of firm branding variable BRAND, β_3 , is significantly positive. Firms are more likely to be proactive if the recalled product uses family branding rather than individual branding.

At the product level, the coefficient of VOLUME, β_4 , is significantly negative, suggesting that firms are more likely to engage in proactive recalls if the volume of recalled product is smaller. This result is also consistent with the prediction that the major driver of the product recall strategy is to minimize the potential financial losses. Most of the covariates are nonsignificant.

In summary, proactive strategies tend to be used more often by firms that are smaller and less reputable, have a smaller volume of defective products, and are subject to the potential

spillover of the negative consequences from the recall to their other products. These findings are more consistent with the perspective of reducing financial losses than with the CSR perspective. Therefore, direct financial considerations rather than the potential benefit of corporate social responsibility appear to be the primary driver behind firms' recall strategies.

Does Proactive Recall Strategy Mediate the Effects of Antecedents on Financial Value?

In the previous sections, we have shown that various firm-, brand- and product-level antecedents affect firms' choices of different product-recall strategies. We have also shown that proactive recall strategy has a significant negative impact on a firm's financial value. An obvious question is whether the negative impact of a firm's proactive recall strategy exists after controlling for the effects of these antecedents. In other words, does proactive recall strategy mediate the effects of the antecedents on a firm's financial value (e.g., Song, Xie, and Dyer 2000)?

Table 3
Descriptive Statistics and Correlations (N = 84)

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. PROACT	1.000											
2. REPUTATION	-.156 (.158)	1.000										
3. SIZE	-.298 (.006)	.276 (.011)	1.000									
4. BRAND	-.011 (.920)	.322 (.003)	.389 (.000)	1.000								
5. VOLUME	-.230 (.036)	-.190 (.083)	-.115 (.296)	-.051 (.644)	1.000							
6. RISK	.091 (.412)	.022 (.841)	-.077 (.487)	-.024 (.827)	.037 (.738)	1.000						
7. TIME	-.272 (.012)	-.147 (.181)	-.115 (.299)	-.083 (.452)	.278 (.011)	-.126 (.253)	1.000					
8. PRICE	.166 (.132)	.105 (.341)	.096 (.387)	.238 (.030)	-.150 (.172)	.244 (.026)	-.132 (.231)	1.000				
9. CHILD	.045 (.684)	-.047 (.672)	-.019 (.865)	-.214 (.050)	-.105 (.343)	.162 (.141)	-.133 (.228)	-.104 (.345)	1.000			
10. TOYS	.150 (.173)	-.234 (.032)	-.415 (.000)	-.414 (.000)	.198 (.071)	.235 (.031)	-.046 (.675)	-.106 (.335)	-.077 (.487)	1.000		
11. OUTDOOR	.076 (.491)	.119 (.281)	.088 (.424)	.223 (.041)	-.173 (.116)	.005 (.963)	.093 (.399)	.452 (.000)	-.165 (.133)	-.165 (.133)	1.000	
12. SPORTS	-.060 (.587)	.234 (.032)	-.019 (.865)	.086 (.438)	-.027 (.807)	.016 (.887)	-.128 (.247)	.082 (.461)	-.077 (.487)	-.077 (.487)	-.165 (.133)	1.000
Mean	.262	.583	.857	.691	275.3	2.131	920.250	1408.619	.072	.072	.262	.071
SD	.442	.496	.352	.465	629.2	.636	1147.951	3678.825	.260	.260	.442	.260

Note: p-values are in parentheses.

To address this issue, we conducted a cross-sectional analysis on abnormal returns by controlling the effects of all antecedents of proactive recall strategy and other fixed effects. Specifically, we estimate the following regression model of abnormal returns:

$$AR_{i0} = \alpha_0 INTERCEPT + \alpha_1 PROACT_i + X\Gamma + \varepsilon_i \quad (4)$$

where $PROACT_i$ is a binary variable denoting whether the firm adopts a proactive recall ($PROACT_i = 1$) or not ($PROACT_i = 0$), X and Γ are the vectors of various control variables and their coefficients. The control variables include all the antecedent variables and the covariates on the right side of Equation 3.

Table 5 presents the results. Consistent with the results of the event analysis in Table 1, the

Table 4
The Probability of Firms Adopting a Proactive Recall Strategy

	Coefficient	Standard Error	Predicted Effects	
			CSR Perspective	Financial Losses Perspective
Intercept (β_0)	3.475	2.148		NA
Firm-level antecedents				
REPUTATION (β_1)	-1.530*	.856	+	-
SIZE (β_2)	-4.236***	1.481	+	-
Brand-level antecedent				
BRAND (β_3)	3.131**	1.597	+	+
Product-level antecedent				
VOLUME (β_4)	-.017**	.008	+	-
Covariates				
TIME (β_5)	-.002**	.001		NA
PRICE (β_6)	.000	.000		NA
HAZARD (β_7)	-.170	.636		NA
Product categories				
(β_8) - (β_{11})				NA
Log likelihood	55.340			
Nagelkerke R^2	.568			
Sample size	84			

* $p < .1$, ** $p < .05$, *** $p < .01$

Note: None of the coefficients for the product category dummies is significant. NA = not applicable.

coefficient of proactive recall strategy, α_1 , is significant ($p < .01$) and negative. These results provide strong evidence that proactive recalls are associated with significantly greater negative abnormal returns than the passive recalls.

Equations 3 and 4 constitute two essential steps in mediation tests suggested by Kenny, Kashy, and Bolger (1998).⁸ By inspecting the significance of the coefficients for proactive strategy and various antecedents in both equations, we can assess the mediation effects of proactive recall strategy. As shown in tables 4 and 5, (a) the coefficient of proactive recall strategy, α_1 , is significant in Equation 4; (b) except for SIZE, the coefficients of all

other antecedent variables are significant in Equation 3 but not significant in Equation 4; and (c) the coefficients of SIZE are significant in both equations. Based on the steps outlined in Kenny, Kashy, and Bolger (1998), our results show that a firm's proactive recall strategy completely mediates the influences of REPUTATION, BRAND, and VOLUME and partially mediates the influence of SIZE on abnormal stock returns.

Taken together, our findings suggest that during a recall, the stock market consolidates the impact of various firm, brand, and product characteristics and reacts mainly to a firm's product-recall strategy. In other words, during a product recall, the financial market uses a firm's strategic choice of a recall strategy as a signal to evaluate the potential consequence of the crisis. This finding underscores the impact of a firm's product-recall strategy on its financial value.

General Discussion

How does a firm's strategy in managing product recalls influence its financial value? What drives firms to act proactively in managing product recalls? In this paper, we provide answers to these research questions. One of the most interesting findings is that the use of a proactive recall strategy, which could be perceived as a socially responsible approach, actually hurts a firm's financial value more than a passive recall strategy does. In addition, our study suggests that proactive recall strategies tend to be used by firms that are smaller and less reputable, have a smaller volume of defective products to be recalled, and are subject to the spillover of negative consequences from the recalled product to the firm's other products. These results are consistent with the argument that, in choosing proactive versus passive recall strategies, firms are primarily concerned with reducing the direct financial losses associated with the recall. Social responsibility seems to be a less important concern.

Table 5
Results of Cross-sectional Regression of the Abnormal Returns

	Standardized Coefficient	t-stat
PROACT (α_1)	-.370***	-3.040
Antecedents:		
REPUTATION (α_2)	-.117	-.995
SIZE (α_3)	-.260**	-2.041
BRAND (α_4)	-.076	-.588
VOLUME (α_5)	-.083	.716
Covariates:		
TIME (α_6)	-.111	-.935
PRICE (α_7)	-.027	-.216
HAZARD (α_8)	.071	.620
CHILD (α_9)	.092	.809
TOY (α_{10})	-.227*	-1.740
OUTDOOR (α_{11})	.322**	2.568
SPORTS (α_{12})	.033	-.298
Model fit F-stat	1.971**	
R ²	.250	
Sample size	84	

* $p < .1$, ** $p < .05$, *** $p < .01$. The intercept term is insignificant.

In essence, the stock market and investors use recall strategies as a signal to estimate the financial impact of a recall. They interpret a proactive strategy as the signal of severe product hazard and significant financial losses to the firm, rather than as an indication of corporate social responsibility. This explains our results that proactive recalls are more negatively related to a firm's value than passive recalls.

An important implication of our results is that, when firms implement socially responsible corporate strategies, they need to be aware of alternative interpretations of their behavior by both consumers and investors, whose pessimistic views of a proactive strategy could undermine socially responsible strategies. The effect of a firm's proactive strategy in manag-

ing product recalls depends on whether the social responsibility signal conveyed by the strategy is credible to both consumers and investors.

When a firm recalls a product proactively and is mainly concerned with corporate social responsibility, it needs to communicate effectively to the investors about the potential product hazard and safety issues, so that the stock market will not "stereotype" the situation as just another case of severe product hazard and high financial losses.

On the flip side, investors are increasingly focusing on socially responsible investing (SRI) and incorporating responsible corporate policy into their evaluation of a firm's value (Mendonca and Oppenheim 2007). Our results suggest that many seemingly social responsible corporate policies might be driven by different motivations that are not related to CSR. From the investors' perspective, they need to be more careful when evaluating firms' strategic initiatives.

Although the marketing discipline has started to examine the linkage between corporate social responsibility and firms' financial performance (Luo and Bhattacharya 2006), the findings from the current literature have been relatively inconsistent (Orlitzky, Schmidt, and Rynes 2003). Our results suggest that the inconsistency may have occurred because a "responsible" corporate policy can be interpreted in different ways by the market. When studying corporate social responsibility, future research may need to look beyond the simple relationship between corporate social and financial performance, and investigate why firms adopt socially responsible policies and how the market might interpret such policies.

Directions for future research

Our study could be a harbinger of several new issues that link marketing strategies to a firm's performance. For instance, based on the previous literature, we have classified product

harm–crisis management strategies along the proactive versus passive dimension. Because of the greater frequency of product recalls in recent years, firms need clear guidance on the different strategies that are available and the effectiveness of these strategies under different market and product conditions. Thus, a comprehensive study of recall strategies could offer a useful typology as well as an assessment of the effectiveness of various strategies. Furthermore, it will be interesting to examine the role of the news media in a recall event. It is quite

likely that certain types of product recalls, such as those for toys, might garner greater attention or bias from the media. Finally, we suggest that the stock market might give firms' proactive recall strategy an interpretation that is different from the responsible signal suggested in the literature. Future studies may examine whether consumers also perceive this strategy differently, and how product-recall strategies influence consumer purchase decisions and product sales.

Appendix: Theory and Hypotheses on the Antecedents of Product-Recall Strategies

Firm-level antecedents

A firm's market reputation and its overall size are potential drivers of recall strategies. Research has shown that for a high-reputation firm, society has a greater expectation that the firm should behave in a socially responsible manner (Margolis, Elfenbein, and Walsh 2007). The expectation-disconfirmation theory suggests that, if a firm does not adopt a more socially responsible strategy to handle product recalls, the amount of negative repercussions will be greater for a high-reputation firm than for a low-reputation firm (Rhee and Haunschild 2006). Therefore, under the CSR perspective, a firm with higher reputation will be more likely to adopt a proactive strategy than a low-reputation firm.

However, with a perspective of reducing financial losses, the role of firm reputation could be different. It is well known that firm reputation is strongly correlated with product quality (Waddock and Graves 1997), and that firms with a good reputation are typically those that compare favorably with competitors on products and services (Fombrun and Shanley 1990). Due to the perception of high quality, when high-reputation firms (e.g., Toyota compared with Ford) are involved in product recalls, their product recalls may be perceived as an occasional error or considered to be a temporary aberration. Thus, reputation can be a useful asset for high-reputation firms in buffering the negative impact of recalls, and the negative impact of product recalls is lower for a firm with a high reputation (Ahluwalia, Burnkrant, and Unnava 2000; Dawar and Pillutla 2000; Siomkos and Kurzbard 1994). From the perspective of reducing financial losses, a proactive strategy will be more useful for a low-reputation firm than for a high-reputation one, and high-reputation firms will be less likely to engage in proactive recalls.

H2a (CSR perspective): High-reputation firms are more likely to adopt a proactive recall strategy than low-reputation firms.

H2b (Financial losses perspective): High-reputation firms are less likely to adopt a proactive recall strategy than low-reputation firms.

In addition to reputation, firm size may also have opposing impact on the choice of a proactive strategy. Quite often, the initially identified product safety problems do not result in recalls (Mullan 2004). This indicates that adopting a proactive strategy by moving early may lead to unnecessary losses for a firm. Moreover, larger firms have more resources and a larger asset base over which to spread the costs of adopting a socially responsible strategy (McWilliams and Siegel 2001). Thus from the CSR perspective, larger firms are more capable and more likely to initiate proactive recalls, even though eventually some recalls might not be necessary.

From the perspective of reducing financial losses, smaller firms will be more sensitive to potential losses because they have fewer resources and do not have as large a financial cushion as larger firms do. They are more likely to take preventive measures by initiating proactive recalls in order to reduce recall costs and lessen the risk of potential litigation and liability payments.

H3a (CSR perspective): Larger firms are more likely to adopt a proactive recall strategy than smaller firms.

H3b (Financial losses perspective): Smaller firms are more likely to adopt a proactive recall strategy than larger firms.

Brand-level antecedents

At the brand level, product-recall strategy may be influenced by whether the recalled brand is an individual brand within a portfolio of different brands (e.g., P&G's individual brands such as Tide and Folgers), or is part of the family or umbrella brand that is applicable to all products of the firm (e.g., Sony laptops and Sony TV sets). Branding

strategy directly influences the degree of potential spillover from the recalled product to other products of the firm. Because products that use a family brand name are perceived to be more closely associated with each other than those that use different brand names (e.g., Aaker and Keller 1990), the associations of a product are more likely to transfer to another product if the two products share the same family brand name.

From the CSR perspective, the attribution of responsibility that is implied by a passive recall strategy is likely to affect products beyond the defective products and decrease sales if the firm uses the family brand name. In supporting this view, Sullivan (1990) finds that the negative publicity on how Audi refused to recall its allegedly defective Audi 5000 resulted in negative spillover and lower sales losses for various Audi models but not for its Volkswagen models.

On the other hand, if a firm does not act quickly to initiate recalls, incidents due to product hazard are more likely to occur, which can trigger greater public attention and scrutiny of the firm's other products that share a family brand name. This may lead to more recalls of the firm's other products and higher litigation and liability costs. Therefore, a firm with family branding is more likely to adopt a proactive recall strategy in order to reduce financial losses.

Therefore, the predictions under both perspectives are the same; firms that use the family branding strategy are more likely to be proactive in recalls than firms that use an individual branding strategy.

H4: Firms will be more (less) likely to adopt a proactive recall strategy if their recalled product uses the company name (an individual brand name).

Product-level antecedents

At the product level, the volume of recalled products may affect recall strategies. A large volume of recalled products makes it more likely that consumers are exposed to the recall and how the firm handles the crisis. From the CSR perspective, the firm is more likely to behave proactively when the recall volume is larger, since it helps convey a responsible image to the public. However, if a firm is trying to reduce financial losses, it will be less likely to initiate a proactive recall when the volume of recalled products is large because many product hazard investigations do not result in a recall. Compared with a proactive strategy that makes it unavoidable for the firm to pay the costs of recalling a large volume of products, delaying the potential recall might be financially worthwhile if a recall eventually does not have to be issued. In contrast, if the volume of the recalled product is small, the direct recall cost is lower relative to the high costs that could result from litigation and damage payments. As a result, firms have a strong incentive to act quickly and issue proactive recalls.

H5a (CSR perspective): Firms are more likely to adopt a proactive recall strategy when the volume of the recalled products is larger.

H5b (Financial losses perspective): Firms are more likely to adopt a proactive recall strategy when the volume of the recalled products is smaller.

Notes

1. There could be other ways to categorize the product-recall strategies adopted by firms. We focus on the most commonly used typology, i.e., proactive and passive strategies.

2. All phrases within quotes reflect the terminology used by CPSC in their recall procedures.

3. Focal firm(s) refers to the firm that is involved in a product-harm crisis or product recall.

4. The complete list and the reference to Mattel can be found at the following website: <http://money.cnn.com/magazines/fortune/bestcompanies/2008/snapshots/70.html>.

5. To reduce the concern related to potential information leakage, it is important that we specify an estimation period that ends several days prior to the event period. We follow this accepted practice but note that our results remain unchanged for alternative specifications of the estimation period.

6. Among the 89 recall observations, CPSC did not provide the volume information for five recalls. We thus have 84 observations for the analysis on antecedents.

7. In coding the hazard level of each recall, we followed the CPSC guideline of categorizing hazard into three classes: Class A hazard, Class B hazard, and Class C hazard. The risk of death or grievous injury or illness ranges from likely or very likely for Class A hazard to not likely but possible for Class C hazard. A variable HAZARD is used to denote three different levels of potential hazard. HAZARD equals 1 for the most severe or risky hazards and 3 for the least severe or risky.

8. Some studies suggest a third step in the mediation test and run a regression of the abnormal returns on all control variables (e.g., Baron and Kenny 1986). However, the mediation literature has shown that this step is not required because it excludes many inconsistent mediation cases where opposing indirect effects may cancel out the direct effects (e.g., Kenny, Kashy, and Bolger 1998; MacKinnon, Krull, and Lockwood 2000; MacKinnon,

Fairchild, and Fritz 2007). An alternative way to test mediation effects is to use structural equation models (SEM). However, due to the categorical nature of proac-

tive recall variable (which violates the normality assumption of SEM) and small sample size, we decided not to pursue this approach.

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