ESSAYS ON PRODUCT RECALLS, NEW PRODUCT PREANNOUNCEMENTS, AND SHAREHOLDER VALUE

A Dissertation

by

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Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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August 2014

Major Subject: Marketing

ABSTRACT

Product recalls are widely recognized as a manufacturer's worst nightmare. They put the value generated by product innovation at risk. In my dissertation, I investigate the factors that determine the effects of product recalls on firm value and the contingent influence of product recalls on the effects of new product preannouncements on firm value.

In the first essay, I examine the determinants of the short- and long-term effects of product recalls on firm value. The findings offer important insights. First, while brand advertising has a significantly negative effect on short-term abnormal returns to product recall announcement, but not in the long run, especially when the recall involves a large number of vehicles. Second, advertising is positively associated with long-term shareholder value to product recall announcements. Third, diligent response to the recall (post-recall preparation) also has a positive effect on long-term shareholder value. Finally, although the voluntary recall initiation strategy has a significantly negative effect on short-term abnormal returns to product recall announcement, it has significantly positive effect on long-term firm value. Thus, the results suggest that managers should advertise judiciously, prepare post-recall response diligently, and initiate recalls to mitigate the negative impact of the product-harm crises.

In the second essay, I focus on the determinants of the effect of new product preannouncements on short-term shareholder value changes in an environment characterized by frequent product recalls. The findings indicate that product recalls

reduce the significant short-term abnormal financial returns from new product preannouncements. The results show that the product recalls can dampen the effect of new product innovativeness on the short-term abnormal returns to new product preannouncements. However, advertising spending during product recalls can attenuate the negative effects of product recall volume on short-term returns to new product preannouncements. The findings offer managers clear guidelines on when to preannounce new products and on how to manage advertising amid product recalls to realize greater financial value from new product preannouncements.

DEDICATION

To my parents Soon Kyung Choi AND Han Dae Yun.

ACKNOWLEDGEMENTS

This work would not have been possible without the guidance of my committee members and endless support of my family and friends.

I would like to give my deepest gratitude to my co-chairs, Dr. Venkatesh Shankar and Dr. Yan (Lucy) Liu, for their tremendous support and guidance throughout the whole process of writing my dissertation. Dr. Shankar has always encouraged me to engage in research by setting the example himself. Dr. Liu has always been supporting me personally and academically. I believe that if she has not joined the Department of Marketing in 2010, this dissertation work would not have been initiated.

I would also like to show my gratitude to my committee members, Dr. Alina Sorescu and Dr. Li Gan for sharing their knowledge and time. Dr. Sorescu has always provided helpful comments throughout the doctoral program and the dissertation work.

I would also like to thank everybody on the faculty of the Department of Marketing for all the support and encouragement throughout the doctoral program at Mays. Special thanks go to Dr. P. Rajan Varadarajan, Dr. Paul S. Busch, Dr. Manjit Yadav, Dr. Sanjay Jain, Dr. Ram Janakiraman, Dr. Rishika Rishika, and Dr. Haipeng Chen.

I also want to give my gratitude to the administrative staff, and my fellow doctoral students and former doctoral students from the department for making my Ph.D. experience exceptionally memorable. I especially appreciate the time that I spent together with my cohorts Min Jung Kim and Mike Lowe. Although each of us ended up

pursuing a different track in marketing, they made my time in the Ph.D. program extra special.

Nicole, a fellow doctoral student in the department, kindly proofread the whole dissertation one last time. Any error that remains is mine.

Special thanks go to my mother, father, and younger brother Jeungjoo Yun for countless encouragements. Finally, I would like to thanks my girlfriend, Minjung Kho for her endless patience and love. Now, it is my turn to support her Ph.D. endeavors.

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CHAPTER I

INTRODUCTION

Companies increasingly face crises involving harm created by their products, ranging from defective automobile recalls, lead paint in toys, faulty medical devices, and contaminated food products, which often result in product recalls. Defective products may cause fatal injuries to consumers, destroy intangible value that the firm has carefully established over many years, foster market turbulence (i.e., the rate of change in the composition of customers and their preferences), lead to revenue losses, and a decrease in the market value of the firm. Firms are greatly concerned about potential negative consequences of their organizational error and the need to employ a timely, relevant, and appropriate reaction strategy.

Unfortunately, prior research has only focused on studying the short-term effects of product recalls on firm value. However, we need a deeper understanding of the determinants of product recall announcements and asymmetries between short- and long-term effects of product recalls on firm value. Furthermore, companies invest heavily in innovation to introduce new products to the market. Although prior research suggests that the stock market reacts positively to announcements and preannouncements of new products, it is unclear if this is true in markets characterized by frequent product recalls. In this dissertation, I seek to fill this gap by examining these relationships.

In my first essay, I address the following research questions. (1) How do investors value a firm in the long-term after a product recall? (2) What are the determinants of such long-term effects? (3) How are they different from the determinants of short-term effects of product recall on firm value? (4) What are the effects of the interactions of the determinants on long-term effects? Drawing on marketing, finance, and management literature, I formulate a conceptual model of product recall determinants and relationship between product recalls and firm value. I then empirically test these relationships using both short-term abnormal returns analysis and long-term calendar-time portfolio analysis of 185 automobile product recalls during 1997-2002.

My findings offer novel and important insights on the proposed relationship and address important asymmetries between short- and long-term effects of product recalls on firm value. My results provide important contributions for both theoretical and managerial perspectives. From a theoretical stand point, the findings offer a broad understanding of factors that affect the relationship between product-harm crises and firm value. From a practitioner perspective, my results suggest that managers should advertise judiciously, prepare post-recall response diligently, and introduce new products to mitigate the long-run negative impact of the product-harm crises.

In my second essay, I focus on the determinants of the effect of new product preannouncements on short-term shareholder value in an environment of frequent product recalls. Specifically, I examine the following three research questions: (1) Do the effects of new product preannouncements on firm value differ between high and low

product recall environments? (2) What factors explain the differential effects of new product preannouncements on firm value in a high recall environment over a low recall environment? (3) What is the moderating role of product recall volume on the relationships between the determinants of new product preannouncements and firm value? I answer these research questions by using the event study methodology in the context of automobile industry. I estimate my model based on the unique dataset of 247 new product preannouncements assembled from multiple data sources during a 13-year time period. My results offer managers clear guidelines on when to preannounce new products and how to manage advertising amid product recalls to realize greater financial value from new product preannouncements.

CHAPTER II

DETERMINANTS OF THE LONG-TERM EFFECTS OF PRODUCT RECALLS ON SHAREHOLDER VALUE: AN EMPIRICAL ANALYSIS OF THE AUTOMOBILE INDUSTRY

Companies increasingly face crises involving harm created by their products, resulting in product recalls. While prior research has studied the *short-term* effects of product recalls on firm value, I develop a conceptual framework and hypotheses primarily about the determinants of the *long-term* effects of product recalls on shareholder value. I empirically test the hypotheses using both short-term abnormal returns analysis and long-term calendar-time portfolio analysis of 185 automobile product recalls during 1997-2002. My findings offer novel and important insights. My results suggest that managers should advertise judiciously, prepare post-recall response diligently, and introduce new products to mitigate the long-run negative impact of the product-harm crises.

Introduction

Companies increasingly face product harm crises, resulting in recalls of related products. Such product recalls are frequent in industries such as automobiles, pharmaceuticals and food. According to the National Highway Traffic Safety Administration (NHTSA), there was an average of 122 recalls per firm in the automotive

industry during 1997-2010. For example, during 2009-2010, Toyota announced 17 recalls (impacting 6.7 million vehicles) due to problems such as unintended acceleration, a sticky brake, and poor vehicle handling (Time 2010).

Product recalls involve extensive short- and long-term costs to the recalling firm. The short-term costs include costs related to investigation, notification, suspended production, repairs and replacement of defective products (Bromiley and Marcus 1989). Investors typically anticipate such costs and their effects on the firm's cash flow. These effects are reflected in the short-term returns to product recall announcements. For example, the market capitalization of Toyota declined by 8.8 percent on the day it announced the recall of two million vehicles (MarketWatch 2010).

Importantly, in the long-run, product recalls may damage intangible assets, such as customer equity, brand equity, corporate reputation (Rhee and Haunschild 2006), and marketing effectiveness (Liu and Shankar 2013; van Heerde, Helsen, and Dekimpe 2007). These damages can have a long-term impact on the firm's cash flow and such impact may be difficult for investors to ascertain. Furthermore, investors may not be able to anticipate other long-term costs, such as potential future liability claims from consumers, unpredictable fines from regulatory authorities, and other unexpected marketing costs to recover from the crises. Table 1 summarizes the short-and long-term costs of product recalls. For instance, over several months in 2010, Toyota had to suspend vehicle production at as many as five manufacturing plants as it encountered mounting claims. Such long-term costs have important effects on a firm's long-term shareholder value, in particular, in industries such as automobiles and pharmaceuticals

that are characterized by frequent product recalls (Cleeren, van Heerde, and Dekimpe 2013; Dawar and Pillutla 2000; Kalaignanam, Kushwaha, and Eilert 2013). For example, the market capitalization of Ford decreased by 27.9 percent one year after it announced a recall of 13 million vehicles in 2000 (*Reuters* 2001).

To mitigate potentially negative long-term effects and improve long-term shareholder value, firms can use strategic variables such as advertising, recall initiation, post-recall preparation, and new product announcement. Over time, these strategic variables provide additional information to consumers and investors about the firm's belief in its product, the seriousness of the crisis, the firm's efforts to rectify the product defect, and improvements in the quality of future products.

Firms could use different types of advertising such as brand (e.g., Toyota) advertising, promotional (e.g., zero-percent finance) advertising, recalled model (e.g., Toyota Corolla) advertising, and non-recalled model (e.g., Toyota Camry, Toyota Sienna, Toyota Tundra) advertising. By understanding the effects of these different advertising types on firm value during recall, firms can determine which type of advertising to use when they face a product recall.

Similarly, firms could voluntarily initiate a recall or perform the recall upon an order from the regulatory authority. Over the long-term, a voluntary recall might signal the firm's commitment to fix the problem but also cause some investors to overreact to potential negative financial consequences. A better understanding of the long-term effect of recall initiation strategy on firm value can help firms make an appropriate decision on this issue.

To rectify the defect(s) in the product recalled, firms engage in post-recall preparation process. Consumers and investors evaluate the firm's recovery efforts over several months after the recall announcement. By knowing how these efforts affect shareholder response in the long-run, firms can allocate their resources to post-recall preparation efforts.

Finally, to convince consumers and investors about improved product quality after recall, firms could announce the introduction of new products. A clear understanding of the effects of such announcements on the long-term returns to product recalls will enhance firms' ability to manage the recall situation.

While the short-term effects of such crises or recalls on firm value have been researched (e.g., Chen, Ganesan, and Liu 2009; Thirumalai and Sinha 2011), the long-term effects of such recalls are not well understood. An exception is Liu and Shankar (2013), who investigate the dynamic effects of product recall on brand preference and market share; however, they do not investigate the long-term impact on firm value. Furthermore, the findings from extant literature may not adequately inform managerial strategies on how to improve long-term shareholder value.

A key challenge in analyzing the effects of product recalls on long-term abnormal financial returns in industries characterized by frequent recall events is control for cross-correlations across the recall events over a long period. These cross-correlations are the most severe form of dependence in measuring abnormal returns (e.g., Kolari and Pynnonen 2010; Lyon, Barber, and Tsai 1999). Prior research has not examined the long-term effects of such correlated product recall events.

To fill this key gap in the literature, I examine the effects of product recalls on abnormal financial returns, mainly in the long-term. Important research questions in this regard are: (1) How do investors value a firm in the long-term after a product recall? (2) What are the determinants of such long-term effects? (3) How are they different from the determinants of short-term effects of product recall on firm value? (4) What are the effects of the interactions of the determinants on long-term effects?

The answers to these questions are important from both theoretical and practitioner viewpoints. From a theoretical standpoint, it is important for researchers to understand the factors that affect the relationship between product-harm crises and long-term firm value. Furthermore, indeed a better understanding of how these factors combine to enhance or diminish long-term firm value. From a practitioner perspective, managers require guidance on how to manipulate the factors under their control to minimize the negative impact of product recalls in the short- and the long-term. For example, they could benefit from knowing the conditions under which they should voluntarily initiate product recalls. Moreover, they need to decide when to undertake different types of advertising after a product recall. Furthermore, managers should know how worthwhile post-recall preparation efforts are. Finally, managers may want to know when to announce new products after a product recall.

I first develop hypotheses about the determinants of product recall effects on shareholder value changes primarily in the long-run. I then formulate models of short-term and long-term abnormal stock returns. For the long-term returns, I use the calendar-time portfolio model to account for correlated recall announcements, consistent with

prior research (e.g., Lyon, Barber, and Tsai 1999; Mitchell and Stafford 2000; Sorescu, Shankar, and Kushwaha 2007). I test these hypotheses using data from 185 product recalls in the automobile industry during 1997-2002.

My results reveal novel and important insights. First, when the recall involves a large number of vehicles, brand advertising has a significant negative effect on short-term abnormal returns to product recall announcement but has a significant positive effect on long-term abnormal returns. Second, when a firm voluntarily initiates a product recall, its brand (recalled model) advertising is negatively (positively) associated with long-term abnormal returns to product recall announcements. Third, a diligent response to the recall (post-recall preparation) together with each of brand advertising and promotional advertising also has a significant positive effect on long-term shareholder value. Finally, when the recall volume is high, the announcement of a new product has a significant positive effect on long-term firm value. My results suggest that managers should provide judicious advertising support, diligently engage in post-recall preparation, and introduce new products to mitigate the negative long-term impact of the product-harm crises.

Conceptual Development and Hypotheses

I develop hypotheses about the effects of different determinants on abnormal financial returns to product-harm crises.[1] A product-harm crisis is a negatively publicized incident involving defective or potentially dangerous products as claimed by government agencies, firms, and consumers (Dawar and Pillutla 2000; Siomkos and

[1] I provide an overview of the automobile industry's product recall process in the Appendix.

Kurzbard 1994). Product-harm crises typically result in product recalls, so I focus on product recalls.

As discussed earlier, product recalls involve short- and long-term costs. To the extent investors can immediately foresee the effects of these costs on the firm's future cash flows, these effects are reflected in the short-run abnormal financial returns (Chen, Ganesan, and Liu 2009; Davidson and Worrell 1992; Jarrell and Peltzman 1985). However, investors may not be able to anticipate some of the long-term costs of product recalls. For instance, as outlined earlier, over the many months in 2010, Toyota had to suspend vehicle production at as many as five manufacturing plants as it encountered mounting claims.

Determinants of Short-term Abnormal Returns to Product-harm Crisis

Investors will likely assess the financial consequences of a product recall based on the information they can glean from the recall announcement. In the case of corporate announcements (e.g., product recall announcement, new product announcement), stock market abnormal returns are an appropriate metric of short-term shareholder value because daily stock returns measured around the day of the announcement provide precise measurement of abnormal returns (Kothari and Warner 2007; Srinivasan and Bharadwaj 2004). Efficient market theory argues that investors, as rational economic agents, can immediately update and evaluate the current and future performance of a firm by using all publicly available information about its activities. Thus, the stock price will reflect investor expectations of performance. In the case of a product recall,

investors' perceptions of significant direct costs may diminish their expectations of future performance.

Consistent with prior studies (Chen, Ganesan, and Liu 2009; MacKinlay 1997; Sorescu, Shankar, and Kushwaha 2007; Thirumalai and Sinha 2011), I include the following key determinants of abnormal returns: recall characteristics (e.g., recall volume, recall initiation strategy, product reliability) and firm characteristics (e.g., capital structure, product scope, R&D intensity, labor intensity, sales).[2] In addition, I focus on a key strategic decision variable, namely, advertising spending.

Because different advertising types can have different effects on the short-term and long-term returns to product recall, I examine the effects of four types of advertising expenditures: brand advertising, promotional advertising, recalled model advertising, and non-recalled model advertising, consistent with Liu and Shankar (2013).

Brand advertising refers to advertising that features the brand and the firm and does not highlight any sub-brand or product model. Promotional advertising is informative advertising that communicates information about the brand's promotional activities that deliver customer incentives, such as annual percentage rate (APR) financing, manufacturer rebates, and extended warranty. Recalled model advertising refers to advertising spent on all the sub-brands/nameplates that were recalled during the week of the product recall announcement. In contrast, non-recalled model advertising

[2] Recall severity may also affect short-term abnormal returns to a product recall announcement. However, in the data I use in our subsequent empirical analysis, the variability in recall severity is low. Therefore, I exclude recall severity from my analysis.

captures the total sub-brand advertising spent on all sub-brands/nameplates that were not recalled.

In developing the hypotheses, I focus on key interactions among these determinants such as those between a recall characteristic and a strategic decision variable. I begin with the interaction between recall volume and brand advertising.

Recall Volume and Short-term Abnormal Returns: Moderating Role of Brand Advertising

The focus of my essay is on the long-term effect of product recalls on shareholder value. Nevertheless, I first examine the combined effect of recall volume and brand advertising on the short-term returns to product recall so that I can subsequently compare this short-term effect with the long-term effect on which I focus.

The impact of product recalls on short-term firm value may depend on the interaction between recall volume and brand advertising. Recall volume and brand advertising may individually impact brand equity and firm value in opposite directions. While recall volume negatively affects short-term shareholder value, brand advertising is a key marketing tool to arrest customer defection during the crisis (Cleeren, Dekimpe, and Helsen 2008; Cleeren, van Heerde, and Dekimpe 2013; van Heerde, Helsen, and Dekimpe 2007).

A product recall event with a high volume can damage consumer trust in the brand and negatively impact brand equity (Dawar and Pillutla 2000). Based on base-rate information (industry average), consumers and investors may attribute a high volume recall to the firm's incompetence, punishing the firm in the short-run (Lei, Dawar, and

Gurhan-Canli 2012). In contrast, brand advertising generally raises brand awareness (Aaker 1996; Srinivasan et al. 2009), differentiates from competitor brands (Krishnamurthy 2000), and builds brand equity (Liu and Shankar 2013). Thus, by itself, brand advertising allows firms to increase cash flows and firm value.

Recall volume and brand advertising may interact to affect short-term returns to a product recall. Investors may interpret brand advertising differently in the context of product harm crises. Under a product-harm crisis, the greater the negative information (or recall volume) about the brand, the more the consumers (and investors) question the credibility of brand advertising (Settle and Golden 1974). Furthermore, increased advertising will lead to greater visibility and salience of the recalled brands and firms in the marketplace, reducing advertising effectiveness (Sparkman and Locander 1980). Therefore, a heightened emphasis on brand advertising during a product harm crisis, combined with a high recall volume, will exacerbate the detrimental impact of product recalls on firm value in the short-term. Based on these arguments, I hypothesize:

> ***Hypothesis 1.*** *The negative relationship between product recall volume and short-term abnormal returns to a product recall announcement will be stronger for firms with higher levels of brand advertising than for firms with lower levels of brand advertising.*

Determinants of Long-term Abnormal Returns to Product-harm Crises

Now I examine the determinants of the long-term effects of product recalls on firm value. Much research on product recalls focuses on short-term outcomes (e.g., Chen, Ganesan, and Liu 2009; Thirumalai and Sinha 2011). It is difficult to extend this event

window over a longer horizon when automakers experience frequent recalls. Using short-term abnormal returns to assess the financial consequences of product-harm crises would only be appropriate if I assume investors can fully anticipate the incremental cash flows and the associated risks of product recalls and have full information to forecast how the strategic decisions on product recalls will affect the firm's future cash flows. However, it is unclear whether investors can anticipate the long-run costs and effects on shareholder value. Moreover, the initial negative reactions can be turned around over time with a systematic adjustment in the valuation of the impacted firm. Consequently, investors experience difficulty when correctly valuing the long-term effects of the firm's strategic decisions regarding product recalls. In the following section, I develop hypotheses on the interactions between recall characteristics (recall volume and recall initiation strategy) and the post-crisis strategies (advertising spending, post-recall preparation, and new product announcements).

Furthermore, contrary to the efficient market theory argument in the short-term, a large body of finance literature reveals that the market is slow to incorporate all available information about a firm, leading to a mispricing of the firm's stock. This literature shows that managers make strategic decisions (e.g., new product preannouncement, R&D investment) to boost firm value when the firm's stock is mispriced (Ikenberry and Ramnath 2002; Eberhart, Maxwell, and Siddique 2004; Sorescu, Shankar, and Kushwaha 2007).

Recall Volume and Long-term Firm Value: Moderating Role of Brand Advertising

In contrast to the hypothesized short-term effect of recall volume and brand advertising on firm value, I argue that in the long-run, investors will react favorably to brand advertising under a severe crisis. I posit that a steady emphasis on brand advertising over a period of time will lead to the enhancement of intangible assets (e.g., brand equity), resulting in greater shareholder value.

To assess the effect of recall volume and brand advertising on long-term shareholder value, investors will conjecture about the firm's future outlook after a crisis based in part on the firm's reaction to a major product recall. In general, brand advertising tends to have a positive long-term effect on firm performance (Joshi and Hanssens 2010). For instance, after the major recall incident in January 2010, Toyota substantially increased brand advertising to refurbish its tarnished image (*Nielsen* 2010). After months of brand advertising, Toyota's sales levels began to approach pre-crisis levels. Therefore, unlike in the short-term, it is plausible that brand advertising will serve as a positive signal of future earnings potential in the long-term.

Investors may perceive a big recall volume to be a major hit for the company. But at the same time, high levels of advertising over time increase the awareness of affected brand in the mind of consumers. If the firm continues to advertise the affected brand, investors may interpret it as a sign of firm's trust in the brand; they may believe that the brand is strong enough to be recovered. Sustained advertising also signals to the customers and investors that the firm believes in the brand and will fix any product problems. In the long-term, the combined awareness that results over time from recall and strong brand advertising grows and the initial negative perceptions dwindle.

Thus, brand advertising will likely positively moderate the relationship between recall volume and firm value in the long run. Therefore, I hypothesize:

> ***Hypothesis 2.*** *The negative relationship between product recall volume and long-term abnormal returns to a product recall announcement will be weaker for firms with higher levels of brand advertising than for firms with lower levels of brand advertising.*

Recall Initiation Strategy and Long-term Value: Moderating Role of Advertising Spending

Firms have a strategic recall initiation choice. They can either voluntarily initiate product recalls or wait for the regulatory authority to mandate the recall. On the one hand, firms responsible for the recall process may have high incentives to fulfill the product promise they made to investors and consumers, so by initiating the recall, they appear to be morally and socially responsive. Voluntary initiation also provides credible information about the firm's commitment to investors in the long run. Indeed, financial analysts track firms with more socially responsible activities more often and provide them with more favorable investment recommendations than other firms (Ioannou and Serafeim 2010).

On the other hand, investors may perceive a voluntary recall initiation as the firm's admission of guilt about its product defects and its diminished future financial prospects. Indeed, investors penalize a voluntary recall initiation strategy in the short-term (Chen, Ganesan, and Liu 2009). This negative main effect relationship may extend over a longer period (Chen, Ganesan, and Liu 2009).

I examine whether two types of advertising spending (brand advertising and recalled model advertising) after the recall announcement can alleviate or exacerbate the negative relationship between recall initiation strategy and long-term shareholder value. Attribution theory suggests that in the case of a brand voluntarily initiating the recall, consumers and investors perceive that the firm is attributing the recall to its own negligence (Settle and Golden 1974). When a firm attributes a problem with its brand to its own fault, brand advertising is less credible and less effective (Sparkman and Laconder 1980). Therefore, I argue that brand advertising will strengthen this negative relationship because it may not only make the affected brand salient, but it will also carry the negative image spillover to the brand's sub-brands (Roehm and Tybout 2006). Subsequently, investors will adjust their assessment of the firm's long-term value downward.

In contrast, advertising the recalled-model, in conjunction with a proactive recall initiation strategy, may soften the negative impact of recall because investors will likely interpret recalled-model advertising as a remedy for the affected products. Thus, investors may adjust their assessment of the negative effect of product recall announcement on the long-run abnormal returns. Therefore, recalled-model advertising spending, together with a proactive recall initiation strategy, will lead to less negative long-term shareholder value. These arguments lead to my next two hypotheses as follows:

Hypothesis 3. *The negative relationship between product recall initiation strategy and long-term abnormal returns to a product recall announcement will*

be stronger for firms with higher levels of brand advertising than for firms with lower levels of brand advertising.

Hypothesis 4. *The negative relationship between product recall initiation strategy and long-term abnormal returns to a product recall announcement will be weaker for firms with higher levels of recalled-model advertising than for firms with lower levels of recalled-model advertising.*

Effects of Interaction between Advertising Spending and Post-recall Preparation

Firms need to successfully manage and complete the post-recall processes. Not much is known about the role of post-recall preparation in minimizing the possible long-term negative impact of product recalls on firm value. A firm's post-recall preparation refers to the extent of the firm's efforts in addressing the crisis by appropriately mobilizing its resources (Shrivastava and Siomkos 1989). Addressing a product recall involves many tasks requiring considerable efforts and appropriate implementation. In the automobile product recall context, once a firm makes a recall announcement, it has to follow a process that includes several steps such as appropriately informing affected product owners, developing remedial procedures, distributing repair parts and kits, and training its dealers to repair the affected products (GAO 2011).

In most cases, there is a time lag between the recall announcement date and the date the remedy is available to consumers regardless of the type of product recalls (see Appendix for a detailed write-up on the recall process). For example, it is possible to obtain an extension from the government agency in situations when the firm may need more preparation time (NHTSA 2006). In general, a long preparation time for the recall

procedures can reduce customer and investor uncertainty associated with the quality of repairs and proper completion of the recall process.

As I argued previously, investors can update their knowledge about the completion of the recall process only during the period after the recall announcement date. As this newer information becomes available, the updated information may have a greater impact on firm value than other information. For example, if a firm responds to a recall by appropriately executing remedial procedures, the initial negative market reaction may decay over time. Post-recall preparation signals the execution ability of the recalling firm, so investors use the credible information from the post-recall processes over a period of time to make their assessment of long-term shareholder value.

Investors' assessment of the effect of a firm's post-recall preparation on its long-term shareholder value may depend on its brand advertising and promotional advertising after the recall. Brand advertising's primary roles are to create awareness and develop positive attitudes toward the brand (Keller 2010). The performance of these roles is enhanced when brand advertising occurs with post-recall preparation efforts because together they evoke greater trust in the brand than when they act separately. Promotional advertising's primary role is to improve the value of the product (Blattberg and Neslin 1990). This role also becomes more effective in the presence of post-recall preparation because promotional advertising and post-recall preparation combine to improve the attractiveness of a product's value.

Thus, I expect the firm's post-recall preparation efforts to strengthen the effects of post-recall brand advertising and promotional advertising on long-term returns to

product recall announcements. The credible information from high post-recall preparation efforts will enable investors to better forecast the firms' future cash flows from increased brand and promotional advertising spending after product recall announcements over the long-term. Consequently, investors will likely revise their expectations of long-term returns upward. Thus:

> ***Hypothesis 5a.*** *The positive relationship between brand advertising and long-term abnormal returns to a product recall announcement will be stronger for firms with higher levels of post-recall preparation than for firms with lower levels of post-recall preparation.*
>
> ***Hypothesis 5b.*** *The positive relationship between promotional advertising and long-term abnormal returns to a product recall announcement will be stronger for firms with levels of higher post-recall preparation than for firms with lower levels of post-recall preparation.*

Recall Volume and Long-term Firm Value: Moderating Role of New Product Announcements

Firms introduce new products strategically to improve their performance. Typically, firms announce or preannounce the introduction of a new product to alert consumers and investors with positive news about the firm. Indeed, new product introductions and their preannouncements have a direct positive impact on long-term firm value (Pauwels et al. 2004; Sorescu, Shankar, and Kushwaha 2007).

Importantly, positive information from new product announcements can attenuate the negative relationship between recall volume and long-term firm value.

Typically, a firm's new product announcement signals the firm's focus on a product with a superior quality and greater consumer benefits than those of its existing or recalled products. Although the announced new product may not necessarily replace the recalled product, a firm can signal the improved quality of its products through the new product announcement. In addition, in the long run, the number of new product announcements made after product recall announcements tends to provide positive news to investors and can negate the detrimental impact of recall volume on abnormal returns. Thus:

> ***Hypothesis 6.*** *The negative relationship between product recall volume and long-term abnormal returns to a product recall announcement will be weaker for firms with a greater number of new product announcements than for firms with a fewer number of new product announcements.*

Empirical Context, Data, and Variable Operationalization

I test the hypotheses in the United States (U.S.) automobile industry context. I carefully compiled the data for my empirical analysis from eight major sources: NHTSA for product recall attributes data, LexisNexis and Factiva databases for recall announcement date, Center for Research in Security Prices (CRSP) and COMPUSTAT for firm performance and firm attributes, Automotive News Market Data Book for auto vehicle sales, Ward's Automotive Yearbook for auto characteristics, Kantar Media for weekly advertising spending, and Consumer Reports for product reliability. A summary of the operationalization of key variables and their data sources appears in Table 2.

In the first step of the data collection, I identified the U.S. automobile industry's largest six manufacturers listed on the New York Stock Exchange (NYSE) – General

Motors, Ford, Chrysler, Nissan, Honda, and Toyota. These six car manufacturers represent approximately 87% of the total industry sales of passenger cars in the U.S. car market. I then collected the product recall data from the NHTSA database for these six automobile manufacturers during the period of January 1997 to December 2002, for which data were available. The NHTSA recall database is the official data source that provides information about the product defects in the automobile industry. It is the most reliable and valid data source for recent motor vehicle recall studies (e.g., Haunschild and Rhee 2004; Rhee and Haunschild 2006). During the period of my data, there were 642 product recall events involving about 95 million vehicles in the automobile industry. The six firms included in this study experienced a total of 528 recalls over the data period, which represents 82.2% of the total product recalls, for an average of 14.67 recalls per firm per year.

Providing a true measure of the financial returns of an event requires sophisticated sample selection procedures to eliminate any potential confounding effects that may arise with the data collection process. For this essay, it is critical to identify the true date when the product recall was first announced to the public, allowing us to get a clean estimation window for event studies (see MacKinlay 1997; McWilliams and Siegel 1997 for details). Although the NHTSA forms the key source of recall information on various recall characteristics, such as recall volume and recall initiation strategy, there is a time gap between the actual announcement date released to the public and the

notification date specified in the NHTSA database (e.g., Chen, Ganesan, and Liu 2009; Davidson and Worrell 1992).[3]

Following previous studies (Sood and Tellis 2007), I searched all news sources available in LexisNexis and Factiva databases for the earliest date when information about the recall became publicly available. Because I consider the earliest signal to the market as the date of the announcement, this date corresponds to the date around which the short-term stock market response to the recall announcement occurs. Often in the automobile industry, the coverage of product recalls by the press release is not complete (Barber and Darrough 1996). Vehicle recalls occur more frequently than many other types of product recalls. Furthermore, the number of cars involved in each recall event may vary from hundreds to millions. Moreover, the recall can vary in its severity level (from a non-severe light bulb malfunction to a life-threatening brake failure). News organizations may pay attention to only the product recalls that involve *both* a reasonable number of vehicles and a significant safety related consequence. As a result, only a proportion of product recalls documented by NHTSA is reported as news releases to the public (Rupp and Taylor 2002). I obtained a usable sample of 185 product recall announcements made by the big six auto firms between 1997 and 2002, for an average of 5.29 recall announcements per firm per year.

I obtained information on financial returns (daily/monthly) from the Center for Research on Security Prices (CRSP) at the University of Chicago. The short- and long-term abnormal-return metrics require the use of the four factors used in Carhart's (1997)

[3] Indeed, consistent with previous studies (e.g., Hoffer et al. 1988), I find that NHTSA's notification dates have no impact on stock prices, indicating that these dates may not be the correct announcement dates.

model. I obtained data on these factors from Ken French's Web site at Dartmouth College (see http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library.html). I collected data on key firm characteristics, such as labor intensity, R&D intensity, capital structure, market-to-book ratio, and year trend from the COMPUSTAT database. I obtained information on monthly vehicle sales from the Automotive News Market Data Book, which aggregates sales of auto brands across the manufacturers. I procured data on product reliability from Consumer Reports, on the breadth and depth of products (product scope) offered by firms, and from the annual issues of Ward's Automotive Yearbook on average car characteristics across each sub-brand, such as horsepower (HPW), size, weight, and segment. In addition, I obtained from Kantar Media (United States), weekly advertising expenditure data, which contain spending on brand advertising, model advertising, and promotional advertising.

Variables, Measures and Models

Focal Independent Variables

The purpose of the study is to investigate product recall's effects on short- and long- term firm value and how firms can use recall initiation strategy, advertising spending, post-recall preparation and new product introduction announcements to alleviate the damage caused by product recalls. Thus, the key independent variables include recall attributes, advertising and new product announcements.

Recall Attributes

I include product recall volume or the volume of the defective vehicles to capture the magnitude of recall. To control for scale effects, I normalize the volume of product

recalls by the firm's number of unit sales in the previous year (Kalaignanam, Kushwaha, and Eilert 2013). I operationalize product recall initiation strategy by a binary variable that denotes whether the firm adopts a voluntary or an involuntary product recall initiation strategy. To measure the firm's post-recall preparation time after the product recall announcement, I use the time lag between the recalling firm's customer notification date from the NHTSA database and the actual recall announcement date. The longer this time is, the greater is the preparation to respond to the product recall. I measure post-recall preparation using a dummy variable that equals to 1 if the time lag is greater than or equal to the median value of time lag (33 days) and 0 if otherwise.

New Product Announcements

To account for potential information leakage of new product introductions, I use the public release of new product launch information as a proxy rather than the time of market launch (e.g., Ittner and Larcker 1997). I measure the number of new product announcements by the cumulative number of new product announcement press releases for six months after the product recall announcement. Furthermore, I include only products that were new to the firm or the market.

Control Variables

The control variables include product reliability, labor intensity, R&D intensity, sales, product scope, capital structure, market-to-book ratio, and year trend (Chen, Ganesan, and Liu 2009; Thirumalai and Sinha 2011).

I expect product reliability to positively influence abnormal returns to product recalls. I measure *product reliability* by the sales-weighted average of both the brand and

model level product reliability ratings from *Consumer Reports*, recorded as an integer on a 1-5 scale, consistent with prior research (Rhee and Haunschild 2006) (see Table 2 for details).

I expect the extent of labor use (measured by *labor intensity*) to affect the chances of a quality failure due to human causes (Thirumalai and Sinha 2011). I control for the firm's innovation (measured by *R&D intensity*) because the market's assessment of a firm's ability to overcome quality failure will be affected by the firm's innovation orientation. The level of *sales* at the time of a product recall signals to investors the firm's capabilities to fix the faulty product(s) and to recapture market share loss (Kalaignanam, Kushwaha, and Eilert 2013; Thirumalai and Sinha 2011). I measure sales at the monthly level from the *Automotive News Market Data Book*. Because *product scope* can have a positive effect on abnormal returns to recall announcements, I measure it by the breadth and depth of products, similar to how firm diversification and product scope are measured in the marketing and operation literatures (Sorescu, Chandy, and Prabhu 2003; Thirumalai and Sinha 2011), using data from the *Automotive News Market Data Book* as follows:

$$(1) \qquad E \times P = \left[\sum_{j=1}^{n} \frac{P_j}{P} \ln\left(\frac{P}{P_j} \right) \right] P = \sum_{j=1}^{n} P_j \ln\left(\frac{P}{P_j} \right),$$

where E is Entropy, the measure of firm diversification, P_j is the number of vehicle models within brand j at time t, j=1, 2… n, n is the total number of brands, and P is the firm's total number of vehicle models at time t.

Because shareholders' burden of leveraged firms is lower than that of more conservatively financed firms, capital structure reflects the information investors have about the shareholders' ability to overcome an increase in the risk posed by a product recall. I measure *capital structure* using the debt-to-equity ratio (Hendricks and Singhal 2003; Thirumalai and Sinha 2011). In addition, I include the *market-to-book ratio* to capture the firm's growth prospects, which can impact the abnormal returns to the recall announcement (Thirumalai and Sinha 2011). Finally, I include a time variable (*Yeartrend*) to capture the potential trends of the impact of product recalls on financial returns (Chen, Ganesan, and Liu 2009).

The summary statistics and the correlation matrix of key variables in the data appear in Table 3. The average cumulative abnormal return (*CAR*) of a product recall announcement is negative at .005. The average recall involves about one quarter of a vehicle's sales volume. On average, a firm initiates more than half the number of recall events. On average, firm spending on non-recalled model advertising is highest, followed by those on brand advertising, recalled model advertising, and promotional advertising, in that order. The median post-recall preparation time is 33 days.

Short-term Effects Analysis

To analyze the short-term effects of product recalls on firm value, I adopt the event study methodology. Computing short-term abnormal returns starts from defining the actual event window because I examine the abnormal returns over a relatively short period surrounding the event of interest (Brown and Warner 1985). Prior event study research has used various event windows, including a 2-day window (0, +1), a 3-day

window (-1, +1), a 6-day window (-1, +5), 11-day windows (-5, +5) (-10, +1) (-1, +10), and a 21-day window (-10, +10). I choose a relatively short event window (-1, +1) to minimize the potential confounding effects, consistent with prior research (Davidson and Worrell 1992; McWilliams and Siegel 1997).[4]

I test the effects of the determinants on short-term abnormal returns using the following specification (Chen, Ganesan, and Liu 2009; MacKinlay 1997; Thirumalai and Shinha 2011):

$$
\begin{aligned}
(2)\qquad \mathrm{CAR}_{i(-1,+1)} = {} & \beta_0 + \beta_1 RECVOL_i + \beta_2 RECSTR_i + \beta_3 PRODREL_i \\
& + \beta_4 BRDADV_i + \beta_5 RCLADV_i + \beta_6 NRCLADV_i + \beta_7 PROMADV_i \\
& + \beta_8 \left(RECVOL_i \times BRDADV_i \right) + \beta_9 \left(RECVOL_i \times RCLADV_i \right) \\
& + \beta_{10} \left(RECVOL_i \times NRCLADV_i \right) + \beta_{11} \left(RECVOL_i \times PROMADV_i \right) \\
& + \beta_{12} LABINT_i + \beta_{13} RNDINT_i + \beta_{14} SALES_i + \beta_{15} PRODSCOPE_i \\
& + \beta_{16} CAPSTR_i + \beta_{17} MTB_i + \beta_{18} YEAR_i + \beta_{19} \hat{\eta}_b + \beta_{20} \hat{\eta}_r + \beta_{21} \hat{\eta}_{nr} + \beta_{22} \hat{\eta}_p \\
& + \beta_{23} \hat{\eta}_b^B + \beta_{24} \hat{\eta}_r^M + \beta_{25} \hat{\eta}_{nr}^M + \beta_{26} \hat{\eta}_p^P + \xi_i,
\end{aligned}
$$

where $RECVOL_i$ is the volume, $RECSTR_i$ is a dummy variable representing recall initiation strategy (=1 when it is a voluntary recall and 0 otherwise), $PRODREL_i$ is product reliability, $BRDADV_i$ is brand advertising, $RCLADV_i$ is recalled model advertising, $NRCLADV_i$ is non-recalled model advertising, $PROMADV_i$ is promotional advertising, $LABINT_i$ is labor intensity, $RNDINT_i$ is R&D intensity, $SALES_i$ is sales, $PRODSCOPE_i$ is product scope, $CAPSTR_i$ is capital structure, MTB_i is market-to-book

[4] To save space, I include the detailed steps to measure short-term abnormal returns in the Appendix A.

ratio, $YEAR_i$ is year trend, all for product recall event i.[5] $\boldsymbol{\beta}$ is a parameter vector, η is a correction vector from the Control Function approach, and ξ is an error term.

Because some of the variables (e.g., advertising) are endogenous, I estimate this model by controlling for endogeneity. Two ways to control for endogeneity are the Instrument Variable (IV) and the Control Function (CF) approaches. The IV approach may be inappropriate if there is a slope endogeneity problem (Garen 1984; Luan and Sudhir 2010). The slope endogeneity problem arises when manufacturers have private information about how investors might respond to advertising spending during the product recall. The CF approach is appropriate if there are potential intercept and slope endogeneity problems, which is the case in my model. Therefore, I use the CF approach. The CF approach can be estimated with cross-sectional or panel data at the aggregate level (Garen 1984). It is also flexible enough to account for multiple endogenous variables and advertising carryover effects (Liu and Shankar 2013; Luan and Sudhir 2010). Unlike the IV approach that uses the predicted values of the endogenous variables, the CF approach uses the predicted residuals obtained from the first stage regression of the endogenous variables in the model.

Long-term Effects Analysis

The *CAR* metric is forward-looking in that it measures the firm's strategic decisions not only during the time period surrounding an event window, but also during a future time horizon. However, using this measure for long-term returns is often challenged by questioning the efficient market hypothesis (EMH). Extant research

[5] Advertising spending is measured during the week of the event.

argues that investors may have behavioral biases when correctly evaluating stock prices, and therefore, need additional information to appropriately assess the mispricing of the firm's strategic decisions made in the beginning of the recall process (e.g., Fama 1998). To account for the biases, two methods are commonly used when measuring long-term abnormal returns: the Buy-and-Hold Abnormal Returns (BHAR) and the Calendar Time Portfolio Abnormal Returns (CTAR).

The Buy-and-Hold Abnormal Returns (BHAR) has been widely used in the literature to study long-term stock returns. However, when there is considerable cross-correlation of abnormal returns (or overlap), that is, when the long-term abnormal returns for subsets of the sample firms overlap in a common calendar period, measuring the correct statistical inferences of the event portfolio's BHAR can be difficult. In particular, major corporate actions are not random events and they are clustered through time by industry. For example, in the automobile product recall context, manufacturers suffer from recurring events of product recalls instead of experiencing a one-time event, such as an initial public offering (IPO) or a seasoned equity offering (SEO). Therefore, ignoring the cross-correlation problem may lead to a serious misspecification of the model (see Lyon, Barber, and Tsai 1999; Kothari and Warner 2007 for details). The Calendar Time Portfolio Abnormal Returns (CTAR) can control for the long-term effects of such correlated product recall events (e.g., Sorescu, Shankar, and Kushwaha 2007) and is generally viewed as the most conservative method for measuring long-horizon abnormal returns. It is particularly appropriate for calculating long-term abnormal returns to events that are clustered in time, automatically accounting for cross-

sectional dependency among events such as product recalls in the U.S. automobile industry.

In this essay, I test the effects of the determinants on long-term firm value by using the calendar-time portfolio approach, controlling for risk and momentum factors (Carhart 1997) as follows:

$$(3) \qquad R_{pt} - R_{ft} = \alpha_p + \beta_p(R_{mt} - R_{ft}) + \gamma_p SMB_t + \varphi_p HML_t + \delta_p UMD_t + \varepsilon_{pt},$$

where R_{pt} is the rate of return of the calendar time portfolio *p* during month *t*, R_{ft} is the risk-free rate that is the 1-month T-bill yield in month t, R_{mt} is the average rate return on the CRSP equal-weighted index in month *t*, SMB_t is the return on a portfolio of small stocks minus the return on a portfolio of large stocks in month *t*, HML_t is the return on a portfolio of high book-to-market stocks minus the return on a portfolio of low book-to-market stocks in month *t*, UMD_t is the return on a portfolio of high prior return stocks minus the return on a portfolio of low prior return stocks in month *t*, and ε_{pt} is the residual. The intercept (α_p) reflects the average monthly abnormal returns of the portfolio.

The CTAR analysis starts from portfolio formation and categorization of firms into various portfolios based on whether (1) the firm's product recall volume was above or below the median value of the recall volume in that time period, (2) the firm's product recall initiation strategy is either voluntary or involuntary, (3) the firm's brand advertising spending is above or below the median value of eight weeks of cumulative

ad spending after the recall announcements,[6] (4) the firm's recalled model advertising spending is above or below the median value of eight weeks of cumulative ad spending, (5) the firm's promotional advertising spending is above or below the median value of eight weeks of cumulative ad spending, (6) the firm's post-recall preparation time is above or below the median value of preparation time after the product recall announcements, and (7) the firm's total number of new product announcements is above or below the median value of the cumulative number of new product announcements six months after the product recall announcement. In addition, I rebalance the portfolios each month due to the frequent product recalls and changes in advertising spending in the automobile industry.

Results

Short-term Effects

Table 4 shows the mean CAR for different event windows in the market model, the market-adjusted (three-factor) model, and the four-factor model. My results suggest that the CARs are negative and significant at the 5% significance level.

Table 5 presents the results of the short-term returns cross-sectional analysis. I focus on the result relating to H1. The coefficient of the interaction of brand advertising and product recall volume is negative and significant ($\beta = -0.0171$ and $p < .10$). This finding indicates that when recall volume is high, the recalling firm's short-term

[6] I performed additional analysis involving the negative effect of product recall on advertising effectiveness across different types of advertising. My results show that the negative impact of product recall lasts for about eight weeks for all types of advertising, suggesting that firms need at least eight weeks to recover to their original (pre-product recall) advertising effectiveness.

abnormal returns are more negative when it spends more on brand advertising, supporting H1.

In addition, control variables, product reliability, labor intensity, R&D intensity, sales, product scope, capital structure, market to book ratio, and year trend, do not have a significant ($p > .10$) effect on short-term abnormal returns, consistent with Chen, Ganesan, and Liu (2009). My finding implies that the market successfully prices the effects of these control firm and product characteristics.

Long-term Effects

I now present the results of the long-term calendar-time portfolio returns using the four-factor model. All stocks are included in the portfolios on the first trading day of the month following each event date and the compositions of portfolios vary throughout the holding period that ranges from six months to two years (see Sorescu, Shankar, and Kushwaha 2007). A summary of long-term effects results appears in Table 6. I discuss the interpretation of the results from the weighted least square (WLS) method that corrects for heteroscedasticity induced by changes in the number of firms in each calendar month. The calendar-time abnormal returns for the entire sample are significant for 6, 9, 12, 18, and 24 month holding periods, suggesting that financial returns to product recall announcements accrue over the long horizon. In fact, the alphas are fairly constant, ranging from 0.0072 to 0.0078, which implies that the monthly long-term abnormal returns are stable over the long-run in my full sample. My results indicate that the initial reaction of negative short-term abnormal returns to product recall announcements does not present a complete picture and that it takes a longer time to

reverse the initial negative, short-term valuation. These results appear in the first column of Table 6.

To test H2, the interaction effect of brand advertising and product recall volume, I first assign firms and their events into four portfolios based on (1) the firm's product recall volume and (2) the firm's brand advertising spending based on the portfolio formation criteria outlined earlier. The results appear in the second column of Table 6. Although brand advertising negatively moderates the relationship between recall volume and short-term abnormal returns, I expected the effects of brand advertising to be viewed more positively by investors in the long run. My finding is consistent with H2 but opposite from the short-term effects. I find positive and significant annual abnormal returns of about 9% for the 6 to 24 months holding period ($p < .001$). This result shows that the firm's investment on brand advertising after the product recall announcements sends favorable signals to investors in the long run.

To test H3 and H4, the moderating effects of advertising spending on the relationship between product recall initiation strategy and long-term returns to product recall, I first assign firms and their events into four portfolios for each combination based on (1) the firm's product recall initiation strategy, and (2) either the firm's brand advertising spending or the firm's recalled model advertising spending. The results appear in the third and fourth columns in Table 6. Consistent with H3, I find negative and statistically significant abnormal returns of about -2.6% across all holding periods ($p < .001$ or better). My results show that a firm's high investment in brand advertising will intensify the negative impact of a proactive recall strategy on long-term firm value. In

contrast, according to H4, the effect on long-term firm value should be positive and significant. Higher spending on recalled model advertising in conjunction with a proactive recall initiation strategy will lead to greater returns. Indeed, I find significant positive annual abnormal returns of about 4.8% for all holding periods. Firms with higher recalled model advertising support are more likely than firms with lower recalled model advertising to have higher long-term stock returns following a proactive recall initiation strategy.

To test H5a and H5b, the moderating roles of post-recall preparation on the relationships between two types of advertising support and long-term stock returns, I form four portfolios for each combination based on the firm's post-recall preparation, and the firm's brand advertising spending or the firm's promotional advertising spending. These results appear in the fifth to the sixth columns in Table 6. According to H5a and H5b, I should expect positive moderating effects of post-recall preparation. I observe positive and significant long-term abnormal returns of 3.5% (6.6%) for brand (promotional) advertising across all holding periods ($p < .001$). These results suggest that post-recall preparation has a positive moderating effect on the relationship between advertising support and long-term abnormal returns, supporting H5a and H5b.

Finally, to test H6, the interaction between new product announcements and recall volume, I create four portfolios based on the firm's total number of new product announcements and the firm's product recall volume. The results appear in the last column of Table 6. I find positive and significant annual long-term abnormal returns of 4.1% for all holding periods ($p < .001$). Consistent with H6, new product announcements

after the recall announcement positively moderates the effect of product recall volume on long-term returns.

I present a summary of the key results in Table 7. Brand advertising has a negative effect on short-term financial gains following high recall volume. However, brand advertising has a positive effect on long-term financial returns. The interaction effects of brand advertising and recalled model advertising with recall initiation strategy on long-term returns are asymmetric. Firms with higher brand advertising gain less in conjunction with voluntary product recalls. In contrast, firms with higher recalled model advertising together with a voluntary product recall strategy experience greater returns in the long run. Furthermore, post-recall preparation combined with advertising spending has a positive influence on long-term abnormal returns to product recalls. Finally, new product announcements together with high recall volume have a positive impact on long-term returns to product recall announcements.

Discussion and Implications

Theoretical Implications

This essay makes important contributions to the research on product-harm crises in several ways. First, I extend the product recall literature by examining and quantifying the long-term effects of product recalls on changes in shareholder value. I extend prior research on the determinants of the effects of product-harm crises on short-term abnormal returns (Chen, Ganesan, and Liu 2009; Thirumalai and Shinha 2011) by identifying the determinants of long-term shareholder value. My results suggest that there are important differences between the short- and long-run effects of the

determinants on firm value. In particular, brand advertising has a negative effect on short-term abnormal returns, but a positive effect on long-term abnormal returns. Second, my study contributes to the literature by proposing a contingency framework and provides post-crisis recall strategies for each type of recall situation. In doing so, it advances marketing theory by identifying the key moderators of long-term abnormal returns to product recalls. Although conventional wisdom suggests that advertising support associated with product-harm crises should lead to positive shareholder returns, my findings suggest a nuanced conclusion. Firms could realize greater firm value through post-recall brand advertising support in the long run, but not in the short-run. Finally, my study extends our knowledge of product-harm crises and shareholder value by linking product-harm crises and new product introduction research streams. Innovation and new product introduction are positively associated with shareholder wealth creation. My results are consistent with this view, suggesting that new product introduction may serve as a new signaling mechanism, resulting in a positive direct effect on long-term shareholder value. Moreover, when firms are suffering from massive product recalls, investors are likely to expect more new product introductions, resulting in higher long-term returns.

Managerial Implications

The results have important managerial implications. Due to the increasing frequency of product recalls in recent years, managers need clear guidelines for successful product-harm crisis management. The results of this essay provide more complete substantive insights than prior studies. First, there is some merit in managers

choosing a passive recall initiation strategy to realize greater shareholder value in both the short- and the long-run. My results reveal significantly negative direct effects on shareholder value from voluntary product recalls in both the short- and the long-run. This reason might explain why Chrysler was reluctant to initiate a recall regarding potential engine fires in Jeep vehicles (USA Today 2013).

Second, managers should invest in brand advertising over the long-term to create a buffer against negative incidents, especially for high volume recalls. For example, Toyota substantially increased brand advertising after the crisis to refurbish its tarnished image (Nielsen 2010). In a similar vein, managers who announce voluntary recalls are better off investing in recalled model advertising than brand advertising in the long run. However, in times of crises, they should avoid allocating marketing dollars to recalled model advertising. Therefore, over the long run, firms should have a strong focus on brand advertising in the case of mandated recalls and on recalled model advertising in the case of voluntary recalls.

Third, in conjunction with advertising support, managers should focus on post-recall preparation to remedy defects. After the recall announcement, they should expend efforts on the appropriate post-recall processes and focus on successfully eliminating the defects. Furthermore, firms with greater post-recall preparation efforts should focus more on promotional advertising than on brand advertising because promotional advertising in tandem with post-recall preparation allows managers to improve product value and induce a product purchase more than brand advertising does.

Finally, managers could use new product announcements to effectively manage a product-harm crisis situation. Firms with more new product announcements after recall announcements experience greater positive interaction effects on long-term firm value. This finding suggests that releasing new product information is critical to recovering from a crisis involving a product recall. Of course, a firm's release of such information depends on its ability to create new products, some of which may have long development cycles. However, to the extent that new and improved models of existing products can be developed, managers should release such information after product recalls. This recommendation might explain why many firms in industries marked by technological and design upgrades announce multiple new products.

Limitations, Further Research, and Conclusions

Limitations and Further Research

My research is not without limitations. First, the data are from one industry. Future research can extend the analysis to other industries to enhance the generalizability of results. Second, the focus of this essay is on abnormal returns to product recall announcements. Additional insights on the trade-off between product quality and innovation can be investigated by extending my research to study abnormal returns to new product preannouncements in the presence of product recalls.

Conclusions

Companies increasingly face product-harm crises and need to manage the long-term effects of product recalls that result from such crises. Before this essay, not much was known about the determinants of the long-term effects of product recalls on firm

value. My empirical analysis of the short- and long-term effects of 185 automobile product recalls during 1997-2002 reveals novel and important insights. First, when recall volume is high, brand advertising has a significant negative effect on short-term abnormal returns to a product recall announcement but has a significant positive effect on firm value in the long run. Second, when a firm voluntarily initiates a product recall, its brand (recalled model) advertising is negatively (positively) associated with long-term abnormal returns to product recall announcements. Third, a diligent response to the recall (post-recall preparation) together with each of brand advertising and promotional advertising also has a positive effect on long-term shareholder value. Finally, when the recall volume is high, the announcement of a new product has a significant positive effect on long-term firm value. Thus, my results suggest that managers should spend on advertising judiciously, prepare post-recall response diligently, and introduce new products to mitigate the negative impact of the product-harm crises.

CHAPTER III

NEW PRODUCT PREANNOUNCEMENT AND SHAREHOLDER VALUE IN A FREQUENT PRODUCT RECALL ENVIRONMENT

Companies invest heavily in innovation to introduce new products to the market. Although prior research suggests that the stock market reacts positively to announcements and preannouncements of new products, it is unclear if this true in markets characterized by frequent product recalls. In this essay, I focus on the determinants of the effect of new product preannouncements on short-term shareholder value in such markets. I propose a conceptual model and empirically analyze using unique data of product recalls and new product preannouncements assembled from multiple data sources. My findings offer managers clear guidelines on when to preannounce new products and on how to manage advertising amid product recalls to realize greater financial value from new product preannouncements.

Introduction

Companies spend a large amount on innovation to generate new products for the marketplace. Product innovation is the new engine of growth (Terwiesch and Ulrich 2009; Hauser, Tellis, and Griffin 2006). Innovation allows firm to raise the overall product quality and lower the cost of new products to satisfy customer needs. Moreover, strategic innovation can put a company in a sustainable leadership position. Thus, it is

assumed that most new product introductions would receive positive responses from the consumer and marketplace.

Although prior research suggests a favorable reaction from the stock market for announcements and preannouncements of new products, it is unclear if this is true in markets characterized by frequent product recalls. Moreover, the findings from the innovation literature streams do not adequately inform managers on how to enhance the short-term abnormal returns to the product preannouncement in the presence of product-harm crises. In this essay, I seek to describe situations in which new product preannouncements receive negative or non-significant market reaction. For example, the number of new product launches in the automobile industry has increased dramatically over years. While automakers are introducing new models every year, not all models receive a high level of attention from the marketplace. In addition, there are differences in the level of new product performance (Henard and Szymanski 2001). These incongruent findings make it difficult for managers and researchers to understand the success of new product preannouncements during a product-harm crisis. In light of these observations, I focus on the determinants of new product preannouncements on short-term shareholder value changes in an environment characterized by frequent product recalls.

My research fills a critical gap in the literature and addresses important research questions:

- Do the effects of new product preannouncements on firm value differ between high and low product recall environments?

- What factors explain the differential effects of new product preannouncements on firm value in a high recall environment over a low recall environment?
- What is the moderating role of product recall volume on the relationships between the determinants of new product preannouncements and firm value?

To address these questions, I build on agency and signaling theories to formulate hypotheses about the determinants of new product preannouncements on firm value changes in the presence of a product-harm crisis. Then, I propose a conceptual model and empirically analyze a sample of 247 automobile new product preannouncements during a 13-year period (1997-2009).

The answers to these questions are important from both theoretical and practitioner perspectives. From a theoretical standpoint, it is important for researchers to understand the trade-off between product quality and innovation by studying abnormal returns to new product preannouncements in the presence of product recalls. Moreover, researchers need a better understanding of how some factors strengthen or weaken short-term firm value. From a practitioner perspective, managers could benefit from knowing the conditions under which they could manipulate such unpleasant situations. For example, to mitigate potentially negative effects due to a product recall, they should know when to use strategic variables when preannouncing new products, such as the new product's innovativeness, advertising, technology specificity, recall recency, and recall initiation.

My findings offer novel and important insights. First, firms should avoid preannouncing innovative new products if they are experiencing a high recall volume.

Second, firms should invest more on advertising after the crisis or during the new product introduction to mitigate any potentially negative effects. By understanding the effect of advertising on firm value, managers can determine the optimal time for advertising in the presence of product recalls. Also, my findings suggest that managers who are preparing to preannounce their new products should avoid rushing the launch process during the recall.

This article proceeds as follows: First, I present my research hypotheses. Second, I describe the data and propose empirical models. Finally, I conclude by discussing limitations and managerial implications.

Conceptual Development and Hypotheses

In this section, I develop hypotheses about the effects of different determinants on abnormal stock returns to new product preannouncements. A new product preannouncement is a formal communication about the new product before it is officially introduced into the marketplace using strategic marketing actions (Eliashberg and Robertson 1988; Rao and Turut 2013). For example, Microsoft is famous for preannouncing their new products up to a year before the expected release date. Also, automobile firms frequently use international auto shows as an important venue to preannounce their new vehicle models about six months before the actual market release. During this time gap between the preannouncement date and the actual market introduction, a formal preannouncement made by firm may allow consumers, dealers, suppliers, and shareholders to form a positive association with the new product, which may lead to a successful market launch. Furthermore, a new product preannouncement

may influence their competitors' future behavior (Robertson, Eliashberg, and Rymon 1995; Bayus, Jain, and Rao 2001).

To the extent investors can foresee the effects of new product preannouncements on the firm's future cash flows, these effects are reflected in the short-term abnormal returns (Sorescu, Shankar, and Kushwaha 2007; Chaney, Devinney and Winer 1991, Pauwels et al. 2004; Bayus, Erickson, and Jacobson 2003). In general, firms' new product preannouncements signal their intention to launch new products that offer improved product quality and consumer benefits over their current product offerings, resulting in a positive signal from investors. However, in some cases, investors may not be able to anticipate the consequences of preannouncements due to various reasons. First, delivering information about a new product may alert competitors, leading to greater competition; competitors may rush to introduce a rival product before the firm can introduce a preannounced product (Robertson et al. 1995). Second, the increasing prevalence of strategic new product moves by firms in several industries such as in the software, computer, automobile, and motion picture industries creates uncertainty associated with new product preannouncements. Thus, investors worry about whether a firm can deliver on its preannouncement promise (e.g., the vaporware phenomenon). Finally, firms may face an unexpected and unmanageable negative event (e.g., product recalls), although they have already planned to preannounce their new product. In this essay, I am particularly interested in the latter case where a firm needs to make a preannouncement during a product-harm crisis, which cannot be directly controlled by the firm. Since product-harm crises typically result in product recalls, this will be the

research focus. The following sections present relevant theory and the impact of product recalls on short-term abnormal returns to preannouncements. Table 8 shows illustrative research on the new product preannouncements on shareholder value.

Determinants of Short-term Abnormal Returns to New Product Performance

Main Effect of Recall Volume

There is a large body of research on the effect of preannouncements on shareholder value changes, in the contexts of the innovativeness of new products, advertising support for other products, and technology specificity in the preannouncement. But not much is known about how all of these relationships coalesce in an environment of frequent product recalls.

In the case of corporate announcements (e.g., new product preannouncement, product recall announcement), stock market abnormal returns are a particularly appropriate metric of financial performance, because they use daily stock returns measured around the day of the announcement. This will lead to a more precise measurement of abnormal returns (Kothari and Warner 2007; Srinivasan and Bharadwaj 2004). The efficient market theory argues that investors as rational economic agents can immediately update and evaluate the current and future performance of a firm's activities by using all publicly available information, which, in turn, will be reflected in the stock prices.

Both agency theory (e.g., Eisenhardt 1989; Bergen, Dutta, and Walker 1992) and signaling theory (e.g., Heil and Robertson 1991; Kirmani and Rao 2000) provide a theoretical framework for exploring the impact of corporate announcements, such as

new product preannouncement and product recall announcements on investors' evaluation of firm performance. In general, the stock market's response has been measured as a metric of firm value resulting from financial information. Such financial information carries signals to key external stakeholders, which result in changes in firm value. In addition, investors (the principals) generally rely on the firm's management (the agents) to ensure that the firm maintains a sustainable competitive advantage, thereby maximizing shareholder wealth. Therefore, the principals (investors) monitor how agents (managers) perform the contract with shareholders based on information about a firm's decisions, such as new product introductions (e.g., Pauwels et al. 2004; Sorescu, Shankar, and Kushwaha 2007), brand extensions (Lane and Jacobson 1995), and announcements of product recall (e.g., Jerrell and Peltzman 1985; Chen et al. 2009; Thirumalai and Sinha 2011).

Product recalls, or the severity of product recalls, have negative performance implications for the firm (Chen et al. 2009; Jarrell and Peltzman 1985). Managers and investors are likely to speculate about the financial consequences of product recalls when releasing or obtaining recall information. In particular, investors will conjecture about the outlook of the product recall announcement based on some of the information about the recall event which can be a time-consuming task. Furthermore, product recalls are prone to last minute design changes , manufacturing process changes (i.e., suspended production), and discounted product value due to risk, which eventually leads to the delay of the new product's introduction (Brown 2004). Since investors focus on the negative impact of the firm's future cash flows and profitability, product recalls will act

as a negative signal during the true product development stage of a new product preannouncement. In line with previous studies, I also assume that investors will perceive motor vehicle defects as a negative event, therefore, this will have a negative effect on the short-term abnormal returns to new product preannouncements. Thus:

> ***Hypothesis 1.*** *The volume of product recalls prior to a new product preannouncement is negatively associated with the short-term abnormal returns to that preannouncement.*

Moderating Effects of Recall Volume

New Product Innovativeness and Short-term Abnormal Returns to NPP. The innovativeness, or relative advantage of new products, is a consistently important determinant of new product success (Montoya-Weiss and Calantone 1994; Srinivasan et al. 2009). Products with high innovativeness engender numerous advantages. Such products are typically expected to receive positive stock returns, and this holds across many industries (e.g., high tech, automobile industries) (Chaney, Devinney, and Winer 1991; Pauwels et al. 2004; Sorescu, Chandy, Prabhu 2003). Also, highly innovative products outperform mediocre products in terms of their success in the commercialization phase (Kleinschmidt and Cooper 1991).

While the effect of innovation has a positive effect on stock market returns, , relatively less attention has been paid to the downside of innovativeness. According to Kirby (2010), investors can make an easier case for incremental innovations with major changes in the current version that are already successful than for more risky moves with long-term payoffs, because they are uncertain of demand for the preannouncements with

high innovativeness which is new to the firm. Investors interested in high margins focus on the disadvantages of increased costs and a reduced cash flow from a new market entry, rather than the prospect of growth opportunities that entirely new products possess (Benner and Ranganathan 2013). Furthermore, a new product preannouncement is made with more uncertainty (i.e., farther ahead of the market release date), whereas a new product announcement is typically made with more certainty (i.e., closer to the actual market launch) (Koku, Jagpal, and Wiswananth 1997).

The effect of new product innovativeness on short-term abnormal returns is also likely to depend on the product recalls. Product recall information conveys negative signals to investors about safety concerns on both existing and future products of the recalling firm. Since high innovativeness indicates higher uncertainty in quality and demand, investors and consumers can lose trust on the confidence of the preannouncing new product after a product recall. In the presence of product recalls, investors are likely to view the new product preannouncements with high innovativeness less favorably than preannouncements that are replacing the current model with a technological improvement. Therefore, higher innovativeness may lead to a lower return to a new product preannouncement due to a product recall. Thus, I hypothesize the following:

> ***Hypothesis 2.*** *The positive relationship between new product innovativeness and short-term abnormal returns to a new product preannouncement will be weaker for firms with high recall volume than for firms with low recall volume.*

Advertising and Short-term Abnormal Returns to NPP

The role of marketing investments (e.g., advertising) on the success of new products has been well examined in the literature on innovation (Yeoh and Roth 1999; Sorescu, Chandy, and Prabhu 2003). Advertising spending is an essential component of new product success for building greater awareness and is particularly important for accelerating the adoption rate of new products (Srinivasan et al. 2009; Chen, Chiang, and Yang 2014; Chandy and Tellis 2000). Furthermore, advertising generates greater cash flows for pioneers than for later entrants (e.g., Toyota Prius in the automobile industry) (Bowman and Gatignon 1996; Pauwels et al. 2004). Also, branding through advertising can reduce consumers' perceived risk, particularly for radical innovation (Dowling and Staelin 1994).

The effect of product recalls on short-term abnormal returns is also likely to depend on marketing investments after the product-harm crises (Yun, Liu, and Shankar 2014). Often, advertising is the most frequently used marketing activity for recovering from a product-harm crisis (Cleeren et al. 2013). Firms also heavily spend on advertising prior to the new product introduction. Therefore, investors may view higher levels of advertising investments for defective products as evidence of brand confidence and as a potential improvement in future product quality. This will be associated with higher market value. Thus:

> ***Hypothesis 3.*** *The positive relationship between advertising and short-term abnormal returns to a new product preannouncement will be stronger for firms with high recall volume than for firms with low recall volume.*

Technology Specificity and Short-term Abnormal Returns to NPP

The effect of new product preannouncements on short-term firm value vary across the types of information included in the preannouncement, such as preannouncement specificity (e.g., price, launch time), technology specificity (e.g., prototype and product demonstration, performance level), spokesperson (e.g., CEO, top executive), and financial evidence (Mishra and Bhabra 2001; Pompa, Waarts, and Wierenga 2003; Sorescu, Shankar, Kushwaha 2007). New product preannouncements present an information asymmetry problem because the preannouncing new product is not yet available in the marketplace. Therefore, investors and the market look for signals from the content of a firm's new product preannouncement. (Kirmani and Rao 2000; Sorescu, Shankar, and Kushwaha 2007).

The effect of product recall volume on short-term abnormal returns is also likely to depend on the technology specificity of the preannouncing firm. Investors can view a firm's product that has failed to meet safety standards as inferior to its rivals'. While information about a recall may convey negative signals to investors about safety concerns on the existing product line, new product preannouncements may offset this negative image by updating the current belief with the proof of an improved product quality and greater consumer benefits offered by the new product. As such, investors are likely to view the preannouncements of new products that contain technology-related information and greater improvement from the existing models more favorably than those of new products not containing technology-related information than its rivals during the product recalls. Thus, for high levels of technology specificity, I expect that the negative effect of product recall volume on short-term abnormal returns will be

attenuated by signaling technology specificity in the new product preannouncements. In summary, the greater the technology specificity, the more likely it is that product recalls of existing products will not carryover a negative signal onto the new product. Therefore, I hypothesize the following:

> ***Hypothesis 4.*** The positive relationship between technology specificity and short-term abnormal returns to a new product preannouncement will be stronger for firms with high recall volume than for firms with low recall volume.

Empirical Context, Data, and Variable Operationalization

My data comes from eight major sources: LexisNexis database (for new product preannouncement and product recall announcement data), National Highway Traffic Safety Administration (NHTSA) (for product recall attributes data), Center for Research in Security Prices (CRSP) and COMPUSTAT (for firm performance and firm attributes), Automotive News Market Data Book (for auto vehicle sales), Ward's Automotive Yearbook (for auto vehicle characteristics), Kantar Media (for weekly advertising spending), and Consumer Report (for product reliability and technology specificity for new products).

To empirically test the hypotheses, I compiled a unique dataset by collecting data on a number of key variables related to the new product preannouncement and product recall in the U.S. automobile industry. In order to avoid potential confounding effects, I searched all news sources available in the LexisNexis database for the earliest date when information about the new product preannouncement and product recall announcement became publicly available (see MacKinlay 1997; McWilliams and Siegel 1997 for

details). Because I consider the earliest signal to the market as the date of the announcement, this date corresponds to the date around which the short-term stock market response to the new product preannouncement occurs. After these careful data collection steps, my final sample for this essay consists of 247 new product preannouncements from publically traded U.S. automobile manufacturers listed on the New York Stock Exchange (NYSE) – General Motors, Ford, Chrysler, Nissan, Honda, and Toyota between January 1997 and December 2009. Table 9 shows examples of new product preannouncements.

Data about product recall attributes came from the NHTSA database which provides information about product defects for automobile manufacturers. NHTSA recall data is the official data source, and is viewed as the most reliable and valid data source for recent motor vehicle recall studies (e.g., Haunschild and Rhee 2004; Rhee and Haunschild 2006). I obtained recall characteristics from both the NHTSA database and the firm's product recall announcements from the LexisNexis database. These include information on the recalled vehicle make and models, the firm's recall initiation strategy, the volume of vehicle units to be recalled, recall severity, recall recency, and the filed date.

I obtained information on financial returns (daily) from the Center for Research on Security Prices (CRSP) at the University of Chicago. Short-term abnormal-stock return metrics require the use of three risk factors proposed by Fama and French (1993), augmented with Carhart's (1997) momentum factor. I obtained data on these four-factors from Ken French's Web site at Dartmouth College (see

http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library.html). I collected information on preannouncement characteristics, such as technology specificity, spokesperson, preannouncement specificity, and targeting evidence from the actual preannouncement. I obtained key firm characteristics, such as R&D intensity, labor intensity, and firm size from the COMPUSTAT database. I obtained information on the monthly sales from the annual issues of the Automotive News Market Data Book, which aggregates sales of auto brands across manufacturers. I procured data on product reliability from the Consumer Report. I obtained vehicle segment information for new products, whether it is sport sedan, SUV/truck/van/wagon, hybrid, or luxury vehicle from the annual issues of Ward's Automotive Yearbook. In addition, Kantar Media (United States) provided the weekly advertising expenditure data. Next, I present the method used to measure the short-term abnormal returns. Table 10 summarizes the operationalization of the dependent, key independent, and control variables, along with the data sources and references for each variable.

Variables, Measures and Models

Dependent Variable: Short-term Abnormal Stock Returns

In examining the effects of new product preannouncements on short-term firm value, I adopt an event study methodology. The short-term horizon consists of a relatively short period around an event. Computing short-term abnormal returns starts with defining the actual event window, because the abnormal stock returns are examined over a relatively short period surrounding the event of interest (Brown and Warner 1985). Prior event study research has used various event windows, including a 1-day, 2-day, 3-

day, and 6-day windows. In this essay, I present results using various event windows to measure the differences among the results of event windows. Among various event windows, I chose a relatively short event window (2-day window (-1; 0)) to minimize potential confounding effects or information leakage (McWilliams and Siegel 1997; Davidson and Worrell 1992). During each day in the event window, I compute abnormal returns as the difference between the realized (actual) stock returns and the expected stock return for the firm around the event date:

$$AR_{it} = R_{it} - E\left[R_{it} \mid \Omega_{t-1}\right], \tag{1}$$

where R_{it} is the daily stock return of firm i at time t and $E[R_{it}|\Omega_{t-1}]$ is the expected stock returns of firm *i* at time *t* given the information set Ω available on day *t*-1. There are multiple options in the choice of a model for expected returns, such as the market model, the market-adjusted model, and the four-factor model. In the case of the market model, the expected return is given by

$$E\left[R_{it} \mid \Omega_{t-1}\right] = \hat{\alpha}_i + \hat{\beta}_i R_{mt}, \tag{2}$$

where R_{mt} is the average market returns based on a market index such as the S&P 500 at time *t* and α_i and β_i are firm specific factors that need to be estimated from an ordinary least squares regression of R_{it} on R_{mt} during the 120 trading days ending 31 days before the product recall announcement. In the case of the market-adjusted model, the expected return is given by

$$E\left[R_{it} \mid \Omega_{t-1}\right] = R_{mt}, \tag{3}$$

where R_{mt} is the average return of the entire stock market. Finally, in the case of the four-factor model, I follow the finance literature (e.g., Ang et al. 2006) using the Fama-French (FF) three-factor model augmented with the momentum factor (Carhart 1997). The Carhart four-factor model is specified below (Fama and French 1993; 2006):

$$(4) \qquad R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + \gamma_i SMB_t + \varphi_i HML_t + \delta_i UMD_t + \varepsilon_{it},$$

where R_{ft} is the risk-free rate, R_{mt} is the market return, SMB_t is the difference in returns between small and large firms, HML_t is the difference in returns between high- and low-value firms, UMD_t ¬is the Carhart (1997) momentum factor that reflects the difference in the returns of firms with high and low prior stock performance ("up" minus "down"), and ε_{it} is the residual. Then, the mean abnormal returns on day *t* for the entire sample is estimated as

$$(5) \qquad \overline{AR}_{it} = \frac{1}{N}\sum_{i=1}^{N} AR_{it}.$$

Abnormal returns are then estimated over a short period surrounding the event and are cumulated over the specified event window (time $t = t_1$ to t_2), resulting in one measure of cumulative abnormal returns (CAR) for each event, given by

$$(6) \qquad CAR_{i(t_1,t_2)} = \sum_{t=t_1}^{t_2} \overline{AR}_{it}.$$

Key Independent Variables

The innovativeness of a preannouncing new product could influence the financial returns to investors and shareholders (Pauwels et al. 2004; Srinivasan et al. 2009; Sorescu, Shankar, and Kushwaha 2007). It is conceivable that a higher level of

innovation would yield greater stock returns than preannounced products with a lower level of innovation (Sorescu, Chandy, and Prabhu 2003). To measure the innovativeness of preannounced new products, I follow the criteria from the JDPA's expert rating on an automobile vehicle's innovativeness. The innovativeness of a new vehicle model can be classified into a single item measure using a 0 to 5 scale, where 0 implies no visible vehicle change, 3 implies major changes that affect the exterior sheet metal and a considerable change to the interior, and 5 implies a new marketplace offering (e.g., 2001 Acura MDX). Generally, minor changes in a model are not preannounced by firms, and the stock returns of these preannouncements are relatively low or have no impact on firm value. I only retain new product preannouncements that are equal or higher than level 3 since this includes vehicles that are either significantly redesigned or are new introductions.

I include the firm's advertising efforts to capture firms' efforts to facilitate the demand of the new or existing products, and at the same time to mitigate the negative effects of product recalls. The *advertising* variable is measured as the log of weekly advertising expenditure of the preannouncing automaker in thousands of dollars. I also include the *product recall volume* (i.e., the number of defective vehicles), to capture the extent of the recall volume and product adoption in the market. In order to account for scale effects, I normalize the volume of product recalls by the firm's number of unit sales in the previous year (Kalaignanam et al. 2013).

The content of a preannouncement can influence both investors and the market response. I operationalize *technology specificity* as a binary variable that takes the value

of 1 if the new product preannouncement contains information on the detailed technological improvement of the new product and 0 if otherwise.

Additional Independent Variables

In this essay, I follow how recent new product preannouncement and product recall studies operationalize the control variables in their study as a measure of product, firm, and industry characteristics, including recall recency, recall severity, recall initiation strategy, product reliability, sales, vehicle characteristics, and preannouncement characteristics, as preannouncement specificity, spokesperson, targeting evidence (Sorescu, Shankar, and Kushwaha 2007; Chen et al. 2009; Thirumalai and Sinha 2011). I control for these variables to alleviate potential confounding effects on abnormal returns when examining the impact of new product preannouncements on short-term financial returns.

I measure *recall recency* as the time lag between the firm's product recall announcement date and the firm's new product preannouncement date following the product recall announcement. It is conceivable that the abnormal returns for the new product preannouncement would be reduced when the preannouncement date is close to the product recall announcement date. *Recall severity* is a dummy variable denoting the recall type that increases the chance of a vehicle crash or consumer injury (Liu and Shankar 2014). I measure *recall initiation strategy* as a binary variable that denotes whether the firm adopts a voluntary product recall strategy or an involuntary product recall strategy. In addition, I also want to examine the impact of product reliability on short-term abnormal returns. For objective measures, I assess *product reliability* as a

variable using the average predicted reliability ratings from *Consumer Reports*, recorded as an integer on a scale of 1 to 5. To account for the impact of a preannouncing brand's overall product reliability, I assess the product reliability as the sales-weighted average of the respective reliability ratings of the firm's preannouncing brands. Since a well-known brand is typically associated with better product quality, it can be presumed that the extent of perceived product quality will positively influence the abnormal returns for the new product preannouncements even in the presence of a product recall.

Preannouncement specificity is defined as a binary variable that takes a value of 1 if the preannouncement contains information on the price or time of the introduction of the new product and 0 if otherwise. *Spokesperson* is a dummy variable that takes a value of 1 if the new product preannouncement was made by the chief executive officer or top management executive and 0 if otherwise (Sorescu, Shankar, and Kushwaha 2007). Finally, *target evidence* is a dummy variable that takes a value of 1 if the preannouncement contains information on the potential target consumer or target market of the new product and 0 if otherwise.

I also control for vehicle characteristics. I classify the new motor vehicles into several types based on the segment information. I classify *sport sedan* as a binary variable that takes a value of 1 if the preannouncing new product is a sport or two-door sedan and 0 if otherwise (Balachander, Liu, and Stock 2009); *SUV/Truck/Van/Wagon* is a dummy variable and takes a value of 1 if the preannouncing new product is a SUV, truck, van, or wagon model vehicle and 0 if otherwise; *hybrid vehicle* is a binary variable that takes a value of 1 if preannouncing new product is a hybrid vehicle and 0 if

otherwise; finally, *luxury vehicle* is a dummy variable that takes a value of 1 if the preannouncing new product is luxury vehicle and 0 if otherwise (Balachander, Liu, and Stock 2009).

The level of sales at the time of new product preannouncements signals to investors the firm's competitive standpoint in the marketplace (Thirumalai and Sinha 2011). *Sales* are measured as the log of monthly unit sales of the preannouncing automaker from the *Automotive News Market Data Book*. I include *firm size* to reflect the relative financial returns as a proportion of firm value. In line with previous literature, this is measured as the log of total asset from the COMPUSTAT database (Sorescu, Shankar, and Kushwaha 2007). Finally, I include *year fixed dummies* to capture potential trends of the impact of new product preannouncements on firm value. Table 11 provides the descriptive statistics and the correlation matrix.

Following prior research (Sorescu, Shankar, and Kushwaha 2007; MacKinlay 1997), I test the effects of the determinants on short-term abnormal returns by using cross-sectional analyses around the new product preannouncement date. I test the effects of the determinants on short-term abnormal returns using the following specification:

$$
\begin{aligned}
(7) \qquad CAR_{it(-1,0)} = {} & \beta_0 + \beta_1 VOLUME_{it} + \beta_2 INNV_{it} + \beta_3 ADV_{i(t-1)} + \beta_4 TECH_{it} \\
& + \beta_5 \left(INNV_{it} \times VOLUME_{it} \right) + \beta_6 \left(ADV_{it} \times VOLUME_{it} \right) \\
& + \beta_7 \left(TECH_{it} \times VOLUME_{it} \right) \\
& + \beta_8 INIT_{it} + \beta_9 SEVERITY_{it} + \beta_{10} RECENCY_{it} + \beta_{11} RELIAB_{it} \\
& + \beta_{12} NPPSPEC_{it} + \beta_{13} TARGET_{it} + \beta_{14} CEO_{it} \\
& + \beta_{15} 2DR_{it} + \beta_{16} SUV_{it} + \beta_{17} HYBRID_{it} + \beta_{18} LUXURY_{it} \\
& + \beta_{19} SALES_{it} + \beta_{20} SIZE_{it} + \sum_{k=1}^{K-1} \beta_{21k} YEAR_{ki} + \xi_{it}, \\
& \text{where } \xi_{it} \sim N(0, \sigma^2_{\xi_{it}})
\end{aligned}
$$

Where *CAR* is the short-term abnormal return, $VOLUME_{it}$ is the product recall volume prior to the new product preannouncement, $INNV_{it}$ is the innovativeness of the new product, $ADV_{it(t-1)}$ is the previous week's total advertising spending, $TECH_{it}$ is technology specificity, $INITIATION_{i(t-1)}$ is a dummy variable representing the recall initiation strategy (=1 when it is a voluntary recall and 0 otherwise), $SEVERITY_{it}$ is the severity of product recall, $RECENCY_{it}$ is the lag between the new product preannouncement date and the recall announcement date, $RELIAB_{it}$ is product reliability, $NPPSPEC_{it}$ is preannouncement specificity, $TARGET_{it}$ is targeting evidence, CEO_{it} is spokesperson, $2DR_{it}$ is sport sedan, SUV_{it} is SUV, truck, van, or wagon vehicle type, $HYBRID_{it}$ is hybrid vehicle type, $LUXURY_{it}$ is luxury vehicle type, $SALES_{it}$ is sales, $SIZE_{it}$ is firm size, and $YEAR_i$ is a vector of (k-1) year dummies, for the new product preannouncement event *i*. $\boldsymbol{\beta}$ is a parameter vector, and ξ is an error term.

Because the advertising variable is endogenous, I estimate the model by controlling for endogeneity. To correct for this potential problem, I test my hypotheses by using the Instrument Variable (IV) approach. This ensures that my results from the

cross-sectional analyses provide a clear relationship between the determinants and firm financial performance of new product preannouncements.

Results

Main Results

I conducted tests to assess the significance of the positive CARs for the new product preannouncements. Table 12 shows the mean CAR for different event windows in the market model, market-adjusted (three-factor) model, and four-factor model. Also, Table 12 presents the tests of significance of positive abnormal returns. Based on the results of the four-factor model, preannouncing firms realize about + 0.52 % returns in the [-1, 0] event window. My results show that the CARs are positive and highly significant ($p < .01$) for the new product preannouncements, consistent with previous research.

Determinants of Short-term Effects

Table 13 presents the results of the cross-sectional analysis that examines the determinants of short-term abnormal returns. This method supplements the previous event study results (MacKinlay 1997). As I presumed, the coefficient of the product recall is negative and significant ($\beta = -.0012$ $p < .10$). This indicates that, ceteris paribus, as the preannouncing firm experience a high volume of product recall, its short-term abnormal returns will be more negative, supporting H1. In other words, investors will interpret this as a negative signal for preannounced products with high recall volume. The coefficient of the interaction of innovativeness and product recall volume is negative and significant ($\beta = -.0109$ and $p < .01$). My result shows that the product recall

volume negatively moderates the relationship between the innovativeness of the new products and short-term abnormal returns for the new product preannouncements, supporting H2. Finally, the coefficient of the interaction of advertising and product recall volume is positive and statistically significant ($\beta = .060$ and $p < .01$). The result indicates that when recall volume is high, the preannouncing firm's short-term abnormal returns are more positive when it spends more on advertising before the firm preannounces the new product, supporting H3. The result shows that the main effect of technology specificity significantly affect short-term firm value ($\beta = .0134$ and $p < .01$). However, the coefficient of the interaction of technology specificity and product recall volume is positive but not significant ($\beta = .0041$ and $p > .10$). However, its effect is in the positive direction as I presumed.

In addition, among control variables, recall recency, recall initiation strategy, and spokesperson do have a significant ($p < .05$) effect on short-term abnormal returns, and the direction of coefficients were the same as I expected, except for the spokesperson. Other vehicle, preannouncement, and firm characteristics, such as product reliability, preannouncement specificity, targeting evidence, sales, firm size and vehicle segment information do not have a significant impact on short-term abnormal returns. I examined further checks to ensure that potential multicollinearity is not a concern from the last column of the cross-sectional analysis. The estimated variance inflation factor (VIF) scores were all less than 6, indicating no serious multicollinearity. Also, given that firms in the automotive industry experience multiple product recalls, I corrected for a possible clustered error structure and potential heteroskedasticity. In summary, my findings

suggest that the market reactions are less positive for firms with greater recall volume. Low innovativeness and high advertising expenditures under conditions of high recall volume, suspended preannouncement timing, and presence of technology specificity influence short-term abnormal returns for the new product preannouncement more positively.

Discussion and Implications

My study makes important contributions to the literature on innovation for theory and practice. I extend the existing knowledge on innovation and shareholder value by linking the new product preannouncement and product-harm crises research streams. In so doing, the results of this study can provide more substantive insights than prior studies. This essay suggests that product recalls have a negative effect on short-term abnormal returns. A few reasons could underlie this result. First, negative publicity due to product recalls may lower the market response of a preannounced new product. Second, investors have a negative view regarding recalled products offered by the firm. This negative view may carry over to a preannounced product, making investors question the quality of new product.

The results also have some important managerial implications. Due to the increasing frequency of new product introductions and product recalls in recent years, managers need clear guidelines for strategic product management. Product-harm crises can have detrimental effects on a firm's performance and on its very survival. When firms are experiencing a high volume of recalls, managers should avoid preannouncing their innovative new products. Furthermore, managers should invest more on advertising

before the preannouncement because this positively moderates the relationship between product recalls and short-term abnormal returns. Literature on product-harm crises has shown that advertising can help a firm overcome the crisis. Moreover, advertising can enhance the awareness and positive attitude toward the preannounced products. Managers should also emphasize the technological improvement in greater details in the new product preannouncement, but this should not delivered by an executive member of the firm. Managers should avoid preannouncing a new product right after the product recall incident. Finally, a proactive recall strategy can help firms realize greater short-term abnormal returns.

The goal of this essay is to present a more comprehensive picture showing how new product preannouncements in conjunction with product recalls negatively impact firm value. Furthermore, I make a methodological contribution; I proposed model demonstrates a way to incorporate preannouncements with new product recalls in a tumultuous recall environment.

Limitations, Further Research, and Conclusions

Limitations and Further Research

While my study contributes to the current knowledge of the benefits and consequences of firms' innovation and new product preannouncements, it also suggests additional areas for future research. First, the analyses can be extended to examine the determinants of long-term shareholder value. Second, while I study the relationship from one industry, which enables us to develop a tight and robust set of results, it would also

be interesting to study the drivers of returns to preannouncements in the presence of product-harm crises in other industries to improve the generalizability of the results.

Conclusions

Companies are under increasing levels of pressure to generate innovative products. As a result, managers need to successfully manage their new product introduction strategies. However, firms increasingly face product-harm crises, resulting in recalls of existing products. Such devastating costs have important effects on a firm's shareholder value, in particular, in industries characterized by frequent new product launch and product recalls such as automobiles, food, and pharmaceuticals. Managers seek to maximize firm value when preannouncing their new product. Also, they seek to minimize the impact of a product-harm crisis. Ideally, they want to prevent negative spillover effects from a product-harm crisis from affecting their new product announcements. Before this study, little was known about the link between new product preannouncements and product-harm crises, and its impact on firm value. The empirical analysis of the short-term effects of 247 automobile preannouncements during 1997-2009, reveals novel and important implications. First, when firms experience a large volume of product recalls, this has a significant negative effect on short-term abnormal returns to a new product preannouncement. Second, when the recall volume is high, preannouncing less innovative products can alleviate the negative effect on firm value. Third, when the recall volume is high, investing on advertising prior to the preannouncement can help attenuate the negative effect on firm value. Fourth, including technology related information of new products has a positive effect on the short-term

firm value to the new product preannouncements. Finally, delaying preannouncement from the recall incident also has a positive effect on short-term firm value. Thus, my study suggests that firms using appropriate responses to the crises may help accrue greater stock returns out of their new product preannouncements. The results of this study will enable managers and marketers to make better strategic product introduction decisions in a turbulent market environment.

CHAPTER IV

CONCLUSIONS

Product recalls are the worst nightmare for many companies. In this dissertation, I provide insights by examining both determinants of product recalls and new product preannouncements in the presence of product recalls. My findings provide both academics and managers with a better understanding of product recalls in various situations.

In my fist essay, I find that there are significant asymmetries between short-term and long-term effects of product recalls on firm value. I find that brand advertising has a significant negative effect on short-term abnormal returns to product recall announcement but has a significant positive effect on long-term abnormal returns. Furthermore, I find that a diligent response to the recall together with brand advertising and promotional advertising has a significant positive effect on long-term firm value. Finally, I find that the announcement of a new product increases long-term firm value when the recall volume is high. I expect that these findings will help managers of recalling firms to make better informed decisions when it comes to announcing a product recall.

In my second essay, I study the effects of new product preannouncements on firm value in the presence of product recalls, which are overlooked by managers and academics. My findings extend the existing knowledge by linking the new product

preannouncement and product-harm crises. I find that product recalls have negative effects on short-term firm value of new product preannouncements. I also find that investing on advertising before the preannouncement positively moderates the relationship between product recalls and short-term firm value. Furthermore, I provide evidence that emphasizing the technological improvement of new product in the preannouncement will help preannouncing firms mitigate the negative impact of product recalls on short-term firm value. Finally, I find that preannouncing the new product right after the product recall incident decreases firm value. These findings are particularly important for mangers who seek clear guidelines for strategic product management when they are about to make new product preannouncements in the presence of product recalls. I suggest that product recalls have a negative effect on short-term abnormal returns of new product preannouncements.

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APPENDIX A

The Recall Process in the Automobile Industry

The automobile industry in the United States (U.S.) is one of the most highly regulated industries with regard to product safety. Given the important role of motor vehicles as a means of transportation in our daily life, the National Highway Traffic Safety Administration (NHTSA) is responsible for requiring manufacturers to make certified products, monitoring the vehicles and equipment that consumers use on roads, and tracking the recall processes. NHTSA defines motor vehicle safety as, "the performance of a motor vehicle or equipment in a way that protects the public against unreasonable risk of accidents occurring because of the design, construction, or performance of a motor vehicle, and against unreasonable risk of death or injury in an accident, and includes non-operational safety of a motor vehicle (NHTSA 2006)." It is triggered by quality failures including all possible cases of causing potential loss of vehicle control (e.g., sticky pedals, break flaws) or injury to people inside or outside of the vehicle (e.g., airbags malfunction, child safety seats).

The product recall process starts with either the NHTSA or the firm receiving complaints or information from customers or dealers about suspected safety defects. If the NHTSA receives similar reports from a group of people about the same product, based on the number of reported complaints and the severity of the consequences, it might open an investigation on suspicious products for more a detailed analysis of the problem. Once an investigation is opened, it can be conducted in two phases-- the

preliminary evaluation phase and the engineering analysis phase (NHTSA 2006). In both phases, the office of defects investigation (ODI) obtains from consumers, manufacturers, and suppliers data on crashes, injuries, warranty claims, and parts sales to decide if further analysis needs to be conducted. A case under investigation can be closed either if the agency does not conclude a safety-related defect or if the manufacturer decides to initiate a voluntary product recall. Once the recall is initiated, the NHTSA records all safety recalls and monitors the process of recall execution until its completion. According to NHTSA reports, more than 390 million cars, trucks, buses, and motorcycles have been recalled to correct safety defects since 1966 (NHTSA 2006).

During the recall process, the NHTSA is responsible for reviewing the planning and implementation of safety defect recalls provided by auto manufacturer. The NHTSA approves or requests changes to recall campaign plan based on information, such as: (1) a description of vehicles containing the safety defects (e.g., make, model year, date manufactured), (2) the number of unit affected, and (3) a description of manufacturer's plan to remedy the defect through a recall campaign (e.g., recall notification letter, notifications to dealers, estimated time to be available to consumers). According to NHTSA's report, NHTSA is pursuing a 60-day notification policy on all recall campaigns. However, the NHTSA tries to approve recall plan within a week (NHTSA 2013).

The NHTSA evaluates the effectiveness of safety defect recalls based on the recall campaign's completion rate. It uses the data submitted by the manufacturers for each recall campaign case. The recalling automakers are required to report completion

rate data to NHTSA every quarter for six consecutive quarters (18 months, which is beyond our long-term window of 12 months) after the start of a recall campaign. However, recall completion rate for the first six months is only around (20-30) %. Importantly, it does not release these data to the public.

According to GAO (2011), the average completion rate across all years and firms during 2000-2008 is about 65 %. This completion rate varies substantially by other factors, such as: (1) the owners' perception of a safety defect, (2) the age and type of vehicle (old cars tend to have lower completion rates), and (3) the component recalled (e.g., brakes, fuel systems, cruise control). As such, these factors affecting completion rates are outside the NHTSA or the firm's control. For example, when vehicle owners read recall notices, they form their perceptions of the severity of a defect. According to GAO (2011), some manufacturers do not notify some dealerships even after recall notifications are sent to owners in a timely manner (e.g., within one week). In some cases, the recalled parts were not readily available when manufacturers notify owners of the recalls.

In summary, given the recall process in the U.S. automobile industry, our measure of post-recall preparation is reasonable. Therefore, owners and investors can assess the firm's efforts on the remedial procedures based on the time difference between recall announcement and notification date.

Measurement of Short-term Abnormal Returns

During each day in the event window, we compute abnormal returns as the difference between the realized (actual) stock return and the expected stock return for the firm around the event date:

(A1) $$AR_{it} = R_{it} - E\left[R_{it} \mid \Omega_{t-1}\right],$$

where R_{it} is the daily stock return of firm *i* at time *t* and $E[R_{it}|\Omega_{t-1}]$ is the expected stock return of firm *i* at time *t* given the information set Ω available on day *t-1*. There are different models for expected returns: the market model, the market-adjusted model, and the four-factor model. In the case of the market model, the expected return is given by:

(A2) $$E\left[R_{it} \mid \Omega_{t-1}\right] = \hat{\alpha}_i + \hat{\beta}_i R_{mt},$$

where R_{mt} is the average market returns based on a market index such as the S&P 500 at time *t* and α_i and β_i are firm-specific factors that need to be estimated from an ordinary least squares regression of R_{it} on R_{mt} during the 120 trading days ending 31 days before the product recall announcement. In the case of the market-adjusted model, the expected return is given by

(A3) $$E\left[R_{it} \mid \Omega_{t-1}\right] = R_{mt},$$

where R_{mt} is the average return of the entire stock market. Finally, in the case of the four-factor model, we follow the finance literature (e.g., Ang et al. 2006) and use the Fama-French (FF) three-factor model augmented with the momentum factor (Carhart 1997). The Carhart four-factor model is specified below (Fama and French 1993; 2006):

(A4) $$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + \gamma_i SMB_t + \varphi_i HML_t + \delta_i UMD_t + \varepsilon_{it},$$

where R_{ft} is the risk-free rate, R_{mt} is the market return, SMB_t is the difference in returns between small and large firms, HML_t is the difference in returns between high- and low-value firms, UMD_t is the Carhart (1997) momentum factor that reflects the difference in the returns of firms with high and low prior stock performance ("up" minus "down"), and ε_{it} is the residual. Then, the mean abnormal returns on day *t* for the entire sample is estimated as:

$$\overline{\mathrm{AR}}_{it} = \frac{1}{N}\sum_{i=1}^{N} \mathrm{AR}_{it}. \quad \text{(A5)}$$

Then, the abnormal returns over a short period surrounding the event are estimated and cumulated over the specified event window (time $t = t_1$ to t_2), resulting in one measure of cumulative abnormal returns (CAR) for each event, given by:

$$\mathrm{CAR}_{i(t_1,t_2)} = \sum_{t=t_1}^{t_2} \overline{\mathrm{AR}}_{it}. \quad \text{(A6)}$$

Measurement of Long-term Abnormal Returns

The BHAR is defined as, "the average multiyear return from a strategy of investing in all firms that complete an event and selling at the end of a pre-specified holding period versus a comparable strategy using otherwise similar nonevent firms" (Mitchell and Stafford 2000, p. 296). Accordingly, the BHAR is computed by comparing the difference between the cumulative abnormal returns of a firm's stock over a certain period of window (e.g., one year or more) and the cumulative abnormal returns of a benchmark of stocks whose risk adjustment factors are closely matched to those of the testing firm over the same period, such as stocks with similar size, book-to-market, and momentum (Dionysiou 2013; Kothari and Warner 2007). Although it has been widely

used in the literature, the method has some limitations that need to be accommodated. Measuring the correct statistical inferences of the event portfolio's BHAR has been difficult because of considerable cross-correlation of abnormal returns (or overlap). This is mainly because the long-term abnormal returns for subsets of the sample firms are likely to overlap a common calendar period. In particular, major corporate actions are not random events, and those events cluster through time by industry. For example, in the automobile product recall context, manufacturers are more likely to suffer from recurring events of product recalls instead of experiencing a one-time event, such as an initial public offering (IPO) or a seasoned equity offering (SEO). Therefore, ignoring the cross-correlation problem may lead to a serious misspecification of the test (See Dionysiou 2013; Kothari and Warner 2007 for details).

One remedy to the cross-correlation issue is the Calendar Time Portfolio Abnormal Returns (CTAR) approach (see Fama 1998; Mitchell and Stafford 2000; Sorescu, Shankar, and Kushwaha 2007 for details). This approach is viewed as the most conservative method for measuring long-horizon abnormal returns. It is particularly appropriate for calculating long-term abnormal returns to events that are clustered in time, automatically accounting for cross-sectional dependency among events such as product recalls in the U.S. automobile industry. In the marketing literature, the CTAR has been used to assess the long-term stock market valuation of new product preannouncements (Sorescu, Shankar, and Kushwaha 2007), customer satisfaction (Aksoy et al. 2008) and corporate branding strategies (Mizik, Knowles, and Dinner 2011). Computing the CTAR starts with the creation of multiple portfolios of securities

based on common characteristics such as common events or corporate strategies. We can estimate the monthly returns of the resulting portfolios by the market model, the market-adjusted model, or the model with risk adjustment factors. Finally, we can test for the significance of the intercept – or "alpha" – in the specified model for various time periods ranging from several months to years. Using the Fama-French (FF) three-factor model augmented with the Carhart's (1997) momentum factor, the four-factor model is:

$$(A7) \qquad R_{pt} - R_{ft} = \alpha_p + \beta_p (R_{mt} - R_{ft}) + \gamma_p SMB_t + \varphi_p HML_t + \delta_p UMD_t + \varepsilon_{pt}$$

However, the CTAR is not without limitations. Unlike the BHAR metric, it does not provide separate measures of abnormal returns for each event or firm. Instead, it can only be calculated at a portfolio level, which is a single measure of abnormal returns for each subsample (or portfolio). As such, researchers need to measure a separate abnormal return for each portfolio based on the common characteristics of events or corporate strategies. Furthermore, it is impractical to use more than three independent variables due to the increasing number of sub-portfolios that result from reducing the number of observations in each group (Sorescu, Shankar, and Kushwaha 2007). To test statistical inferences of the independent variable of interest, researchers can determine the effect of the independent variable on the long-term abnormal returns by comparing the intercepts (or alphas) from various portfolios.

APPENDIX B

TABLE 1. Product-harm Crisis Related Costs

Short-term	Long-term
Investigation costs	Unanticipated consumer liability claims
Labor costs	Unpredictable regulatory fines
Suspended production and idle plant costs	Unexpected marketing recovery costs
Notification costs	Uncertain decrease in marketing effectiveness
Repair costs	Unpredictable loss due to corporate reputation dilution
Replacement costs	

TABLE 2. Variables, Operationalization, and Data Sources

Variable	Reference	Operationalization	Data Source
Dependent Variables			
Financial returns	Chen, Ganesan, and Liu (2009); Thirumalai and Shinha (2011)	Short-term abnormal returns one day before and one day after the product recall announcement date	Center for Research in Security Prices (CRSP)
	Sorescu, Shankar, and Kushwaha (2007)	Long-term calendar-time portfolio-level returns (after the announcement)	Center for Research in Security Prices (CRSP)
	Fama and French (1993); Carhart (1997)	Fama and French's (1993) and Carhart's (1997) momentum factors	Ken French's Web site
Focal Independent Variables			
Product recall volume	Chen, Ganesan, and Liu (2009); Thirumalai and Shinha (2011)	The number of units recalled normalized for the number of unit sales by the firm in the previous year	NHTSA, LexisNexis, Automotive News Market Data Book
Product recall initiation strategy	Chen, Ganesan, and Liu (2009)	1 if firms initiate voluntary product recall and 0 if the recall was mandated by the government agency	NHTSA, LexisNexis
Brand advertising	Liu and Shankar (2013)	Log of weekly expenditures on brand level advertising	Kantar Media
Recalled model advertising	Liu and Shankar (2013)	Log of weekly expenditures on recalled model level advertising	Kantar Media
Non-recalled model advertising	Liu and Shankar (2013)	Log of weekly expenditures on non-recalled model level advertising	Kantar Media
Promotional advertising	Liu and Shankar (2013)	Log of weekly expenditures on promotional advertising	Kantar Media
Post-recall preparation	This study	1 if the time lag between the firm's notification date to customers and actual recall announcement date is greater than or equal to the median value of time lag in the sample, 0 if otherwise	NHTSA, LexisNexis
New product announcements	This study	Cumulative number of new product announcements made by firm in the six months after the product recall announcement	LexisNexis, Factiva, Automotive News Market Data Book
Control Variables			
Product reliability	Kalaignanam, Kushwaha, and Eilert (2013); Liu and Shankar (2013)	Unit sales-weighted average of brand reliability ratings + unit sales-weighted average of reliability ratings of the recalled-models	Consumer Reports, Automotive News Market Data Book
Labor intensity	Thirumalai and Sinha (2011)	Number of employees / sales revenues	COMPUSTAT
R&D intensity	Thirumalai and Sinha (2011)	R&D expenditures / sales revenues	COMPUSTAT
Sales	Thirumalai and Sinha (2011); Kalaignanam et al. (2013)	Log of unit sales	Automotive News Market Data Book
Product scope	Sorescu et al. (2003); Thirumalai and Sinha (2011)	$\left[\sum_{j=1}^{n}\frac{P_j}{P}\ln\left(\frac{P}{P_j}\right)\right]P = \sum_{j=1}^{n}P_j\ln\left(\frac{P}{P_j}\right)$, where P*j* is the number of vehicle models within brand j, j=1, 2… n, and P is the firm's total number of vehicle models	Ward's Automotive Yearbook
Capital structure	Thirumalai and Sinha (2011)	Debt-to-equity ratio: Long-term debt / shareholder equity	COMPUSTAT
Market to book ratio	Thirumalai and Sinha (2011)	Total number of shares outstanding times the stock price at quarter-end / common equity	COMPUSTAT
Year trend	Chen, Ganesan, and Liu (2009)	The number of years between 1997 and the year when the recall occurred	COMPUSTAT

TABLE 3. Summary Statistics and Correlation Matrix

Variable	M	SD	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. CAR (-1; 1)	-0.005	0.034	-0.159	0.106	1															
2. Product recall volume	0.272	0.385	0.00001	2.092	-0.11	1														
3. Product recall initiation strategy	0.584	0.494	0	1	-0.13	-0.33	1													
4. Brand advertising	8.422	1.14	4.424	10.442	0.12	-0.06	-0.15	1												
5. Recalled model advertising	5.842	1.141	3.212	8.228	-0.17	-0.22	0.37	-0.21	1											
6. Non-recalled model advertising	9.755	0.774	6.679	11.125	0.08	-0.09	-0.12	0.45	-0.1	1										
7. Promotional advertising	5.484	2.385	0	9.19	0.1	-0.06	-0.11	0.22	-0.28	0.4	1									
8. Post-recall preparation	0.514	0.501	0	1	-0.01	0.06	-0.25	0.11	-0.09	0.04	-0.07	1								
9. Product reliability	2.997	0.932	1.333	5	-0.01	-0.02	0.24	-0.51	0.42	-0.56	-0.34	-0.23	1							
10. Labor intensity	0.272	0.084	0.076	0.551	0.08	0.09	-0.2	0.002	-0.36	0.11	0.28	0.06	-0.34	1						
11. R&D intensity	0.284	0.134	0.13	0.827	-0.09	0.2	0.03	-0.52	0.22	-0.48	-0.15	-0.05	0.59	-0.15	1					
12. Sales	14.018	0.59	12.906	14.767	0.15	-0.22	-0.13	0.42	-0.47	0.63	0.46	0.08	-0.54	0.23	-0.56	1				
13. Product scope	26.12	17.873	4.159	64.128	0.13	-0.19	-0.17	0.45	-0.51	0.62	0.35	0.16	-0.57	0.34	-0.5	0.9	1			
14. Capital structure	0.266	0.062	0.052	0.56	0.03	0.001	-0.07	0.38	-0.28	0.43	0.12	0.08	-0.48	0.05	-0.37	0.45	0.5	1		
15. Market to book ratio	1.195	0.309	0.847	3.138	0.06	0.23	-0.09	-0.28	0.03	-0.22	0.11	-0.16	0.51	-0.15	0.45	-0.24	-0.3	-0.37	1	
16. Year trend	2.611	1.751	0	5	-0.08	-0.1	0.15	0.38	0.27	0.03	-0.08	-0.09	-0.13	-0.24	-0.27	-0.03	-0.09	0.05	-0.26	1

Notes: *p*-values are in parentheses.

TABLE 4. Results of Short-Term Abnormal Returns Model

	Cumulative Abnormal Returns (CAR)		
	(1)	(2)	(3)
	Market Model	**Market-adjusted Model**	**Four-factor Model**
Holding Period	**(n=185)**	**(n=185)**	**(n=185)**
[0; 1] Window	**-0.0056**	**-0.0068**	**-0.0042**
Positive: Negative	77:108	72:113	83:102
CDA t	-2.233**	-2.648***	-1.821**
Generalized Z	-1.531*	-2.246**	-0.852
[-1; 1] Window	**-0.0077**	**-0.0094**	**-0.0063**
Positive: Negative	78:107	78:107	79:106
CDA t	-2.526***	-2.695***	-2.248**
Generalized Z	-1.236	-1.360*	-1.442*
[-1; 5] Window	**-0.0085**	**-0.0126**	**-0.0076**
Positive: Negative	80:105	80:105	87:98
CDA t	-1.809**	-2.617***	-1.771**
Generalized Z	-0.941	-1.065	-0.262
[-10; 1] Window	-0.0089	**-0.0140**	-0.0062
Positive: Negative	88:97	85:100	87:98
CDA t	-1.452*	-2.213**	-1.108
Generalized Z	-0.203	-0.327	-0.262
[-1; 10] Window	**-0.0099**	**-0.0167**	**-0.0084**
Positive: Negative	82:103	76:109	83:102
CDA t	-1.622*	-2.641***	-1.502*
Generalized Z	-0.646	-1.655**	-0.852
[-10; 10] Window	-0.0111	**-0.0213**	-0.0084
Positive: Negative	85:100	76:109	83:102
CDA t	-1.368*	-2.549***	-1.124
Generalized Z	-0.056	-1.655**	-0.852

Notes: This table shows the average cumulative returns and test statistics for various windows around the product recall announcement. The sample consists of 185 product recall announcements of six firms from 1997 to 2002.

*** Denotes one-tail t-test significance at the 1% level;

** Denotes one-tail t-test significance at the 5% level;

* Denotes one-tail t-test significance at 10% level.

TABLE 5. Cross-Sectional Short-Term Abnormal Returns Around Product Recall Announcement Date

	Final Model (Control Function Approach)	
Independent Variables	**Coefficient**	**Robust Standard Error**
Intercept	-0.0497	(0.222)
Main effects		
Product recall volume	0.0686	(0.069)
Product recall initiation strategy	-0.0078	(0.006)
Brand advertising	0.0018	(0.005)
Recalled model advertising	-0.0129***	(0.004)
Non-recalled model advertising	0.0051	(0.009)
Promotional advertising	0.0011	(0.002)
Moderating effects		
Product recall volume x Brand advertising (H_1)	-0.0171*	(0.010)
Product recall volume x Recalled model advertising	0.0035	(0.006)
Product recall volume x Non-recalled model advertising	0.0065	(0.008)
Product recall volume x Promotional advertising	-0.0063*	(0.003)
Control variables		
Product reliability	0.0076	(0.005)
Labor intensity	0.0158	(0.037)
R&D intensity	0.0053	(0.026)
Sales	0.0025	(0.013)
Product scope	-0.0003	(0.0004)
Capital structure	0.0120	(0.048)
Market to book ratio	0.0011	(0.010)
Year trend	0.0008	(0.002)
Endogeneity correction terms included	Four correction terms significant	
R-squared	0.2305***	
Sample Size:	185	
Dependent Variable:	*CAR*(-1; 1)	

$^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$

Notes: Robust standard-Errors corrected for clusterwise heteroscedasticity. The *CAR* is computed from the four-factor model.

TABLE 6. Results from Long-Term Calendar-Time Portfolio Analysis of Abnormal Returns

	Main Effect	**Moderating Effect**					
		(H_2)	(H_3)	(H_4)	(H_{5a})	(H_{5b})	(H_6)
Holding Period	**All Firms**	**Advertising Support Recall Volume x Brand Advertising**	**Advertising Support Recall Initiation Strategy x Brand Advertising**	**Advertising Support Recall Initiation Strategy x Recalled Model Advertising**	**Post-Recall Preparation Preparation x Brand Advertising**	**Post-recall Preparation Preparation x Promotional Advertising**	**No. of New Product Announcements Volume x No. of New Product Announcements**
6 Months Alpha (%)							
OLS	0.0071***	0.0080***	-0.0008	0.0026	0.0026	0.0044**	0.0052***
WLS	0.0077***	0.0100***	-0.0012*	0.0027**	0.0022***	0.0047***	0.0054***
9 Months Alpha (%)							
OLS	0.0065***	0.0070***	-0.0012	0.0039**	0.0031***	0.0053***	0.0040**
WLS	0.0072***	0.0081***	-0.0017***	0.0039***	0.0028***	0.0049***	0.0044***
12 Months Alpha (%)							
OLS	0.0066***	0.0059***	-0.0011	0.0043**	0.0035***	0.0059***	0.0029**
WLS	0.0075***	0.0068***	-0.0022***	0.0040***	0.0029***	0.0055***	0.0034***
18 Months Alpha (%)							
OLS	0.0066***	0.0058***	-0.0019	0.0038**	0.0039***	0.0062***	0.0028***
WLS	0.0078***	0.0067***	-0.0029***	0.0031***	0.0030***	0.0055***	0.0037***
24 Months Alpha (%)							
OLS	0.0059***	0.0051***	-0.0014	0.0047***	0.0043***	0.0071***	0.0021**
WLS	0.0073***	0.0061***	-0.0028***	0.0034***	0.0029***	0.0059***	0.0034***

Notes: This table shows the results of long-term abnormal returns using the calendar-time portfolio approach and test statistics for various periods after the product recall announcement. The data are presented as monthly abnormal returns estimated using the four-factor model.

***, **, * denote one-tail significance at the 1%, 5%, and 10% level, respectively.

TABLE 7. Summary of Results

Determinants	Short-term Returns		Long-term Returns	
	Predicted effects	**Actual results**	**Predicted effects**	**Actual results**
Moderating effects				
Advertising x Product recall volume				
Product recall volume x Brand advertising	− (H_1)	−	+ (H_2)	+
Advertising x Product recall initiation strategy				
Product recall initiation strategy x Brand advertising	N.A.	N.A.	− (H_3)	−
Product recall initiation strategy x Recalled model advertising	N.A.	N.A.	+ (H_4)	+
Post-recall preparation x Advertising				
Post-recall preparation x Brand advertising	N.A.	N.A.	+ (H_{5a})	+
Post-recall preparation x Promotional advertising	N.A.	N.A.	+ (H_{5b})	+
New product announcement x Product recall volume	N.A.	N.A.	+ (H_6)	+

Notes: N.A., not applicable;

Hypotheses numbers are shown in parentheses. The effects of other variables are not shown to save space.

TABLE 8. Illustrative Research on the New Product Preannouncements on Shareholder Value

Illustrative Studies	Industry	Sign of Innovation Effect	Short-term Postevent Return	Dependent Variable	Product Recall Presence
Chaney, Devinney, and Winer (1991)	Multiple industries	+	0.75%	*CAR*(-1; 1)	—
Zantout and Chaganti (1996)	Multiple industries	+	0.15%	*CAR*(-1; 0)	—
Hendricks and Singhal (1997)	Multiple industries	-	-5.25%	*CAR*(-1; 0)	—
Lee at al. (2000)	Multiple industries	+	2.71%	*CAR*(-1; 1)	—
Mishra and Bhabra (2001)	Multiple industries	+	0.44%	*CAR*(-1; 0)	—
Sorescu, Chandy, and Prabhu (2003)	Pharmaceuticals	+	—	NPV	—
Bayus et al. (2003)	Personal Computer	+	—	ROA, Asset Growth	—
Pauwels et al. (2004)	Automobile	+	0.02%	M-to-B Ratio	—
Sorescu, Shankar, and Kushwaha (2007)	Software/Hardware	+	Non-significant	*CAR*(-2; 2)	—
Srinivasan et al. (2009)	Automobile	+	0.07%	Stock returns	—
Sood & Tellis (2009)	Technology	+	0.50%	*CAR*(-1; 1), Total Return	—
This study	**Automobile**	**Yes (+)**	**Yes (0.52%)**	**Yes: *CAR*(-1; 0)**	**Yes**

Notes: "—" denotes that the effect is not investigated

TABLE 9. Example of New Product Preannouncement in the Presence of Product Recalls

Automaker	Announcement Date	Excerpt from the Announcement	Innovation Type	Product recall presence (Volume)	*CAR*[-1, 0] (%)	Source
Chrysler, PT Cruiser	1999-01-03	The 2001 Chrysler PT Cruiser adds a new dimension to the Chrysler brand around the world by breaking the barriers of conventional automotive design and function. "Chrysler PT Cruiser dramatically changes the profile of the Chrysler brand by expanding the breadth of its product line and the presence of the brand around the world," said Robert J. Eaton, Chairman, DaimlerChrysler (NYSE: DCX)....Internationally, Chrysler PT Cruiser will reflect the individualism of consumers who are looking for a vehicle that is efficient for their daily transportation, while offering flexibility for their weekend and holiday travel requirements.	New entry into the market	Yes (170,000)	-9.70%	PR Newswire
Acura, MDX	2000-01-11	Acura introduced its vision for the next generation of sport utility vehicle with the MD-X concept SUV at the 2000 North American International Auto Show. Featuring advanced technology and luxury amenities, the multi-dimensional MD-X concept offers performance and handling with off-road capability and utility. "The MD-X concept is our interpretation of a no-compromise vehicle with sports sedan performance and SUV functionality," said Dick Colliver, executive vice president, Acura division. "The MD-X closely reflects the direction and focus of our new SUV which goes on sale this fall."	New entry into the market	Yes (213,736)	0.65%	PR Newswire
Lincoln, Aviator	2001-08-21	Lincoln confirmed today in a meeting of its top dealers that the next all-new product in the transformation of the brand will be the 2003 Lincoln Aviator. "The Lincoln Aviator will bring together all of the elements we believe define American Luxury: Balance and composure on the road, indulgent comfort and distinctive design," says Lincoln Mercury President Mark Hutchins. The 2003 Lincoln Aviator, which will go into production in the summer of 2002, will be a sport utility vehicle built on a 113.7-inch wheelbase, and it will have an advanced dual overhead cam, four-valve V-8 engine, a sophisticated four-wheel independent suspension and available all-wheel drive. It also will be an ultra-low emissions (ULEV) vehicle....Additional information on the 2003 Lincoln Aviator, including photography, features and options, technical specifications and pricing will be released closer to the introduction of the vehicle.	New entry into the market	Yes (1,400,000)	-7.27%	PR Newswire
Honda, Ridgeline	2004-11-02	Honda's all-new 4-door, 4WD truck will be named the "Ridgeline" when it goes on-sale at Honda dealerships nationwide in Spring 2005 as a 2006 model…."The growing market for aftermarket truck parts and accessories makes SEMA the perfect place to announce the Ridgeline name," said Dan Bonawitz, vice president in charge of corporate planning for American Honda.....The Ridgeline takes advantage of the industry's first fully integrated, closed-box frame with unibody construction to deliver superior ride, handling and packaging efficiency along with half-ton payload capacity and significantly stronger body rigidity versus traditional body-on-frame trucks....Complete details on the Ridgeline's innovative new approach to the truck market will be available at the 2005 North American International Auto Show in January.	New entry into the market	No (0)	1.28%	PR Newswire
Dodge, Challenger	2007-02-14	DaimlerChrysler announced today that the all-new 2008 Dodge Challenger will be built at its Brampton Assembly Plant near Toronto. "It's good news that the Dodge Challenger will be added to the Canadian production line-up," said Reid Bigland, President and CEO - DaimlerChrysler Canada. "Quickly bringing desirable new products such as the Dodge Challenger to market is critical to keeping our plants humming and our dealerships busy."..... The 2008 Dodge Challenger would be going into production in 2008.	New entry into the market	No (0)	7.40%	PR Newswire

TABLE 10. Variables, Operationalization, and Data Sources

Variable	Reference	Operationalization	Data Source
Dependent Variables			
Financial returns	Chen, Ganesan, and Liu (2009); Thirumalai and Shinha (2011)	Short-term abnormal returns two days around the new product preannouncement date	Center for Research in Security Prices (CRSP), LexisNexis, Factiva
	Fama and French (1993); Carhart (1997)	Fama and French's (1993) and Carhart's (1997) momentum factors	Ken French's Web site
Focal Independent Variables			
Product recall volume	Chen, Ganesan, and Liu (2009); Thirumalai and Shinha (2011)	Sales revenue-weighted average of vehicles recalled by the preannouncing firm in the previous month	NHTSA, LexisNexis, Automotive News Market Data Book
Innovativeness	Pauwels et al. (2004), Srinivasan et al. (2009)	Single item measure on using a 0 to 5 scale, where 0 implies no visible vehicle change, 3 implies major changes that affect exterior sheet metal and considerable change to interior, 5 implies new entry into the market (e.g., 2001 Acura MDX). We only retain new product preannouncements that are equal or higher than level 3 in order to examine the impact of innovation level of each vehich that are significantly redesigned or new introduction.	JDPA's Expert Rating Criteria, Consumer Report, Automotive News Market Data Book
Advertising	Kalaignanam, Kushwaha, and Eilert (2013); Liu and Shankar (2013)	Log of monthly advertising expenditures on the preannouncing make (in thousand of dollars)	Kantar Media
Technology specificity	Mishra and Bhabra (2001)	1 if preannouncement contains information on the detailed technological improvement of the new product, 0 if otherwise	LexisNexis, Factiva
Recall initiation strategy	Chen, Ganesan, and Liu (2009)	1 if firms initiate voluntary product recall and 0 if the recall was mandated by the government agency	NHTSA, LexisNexis
Recency of product recall	This study	The time lag between the firm's product recall announcement date and the firm's new product preannouncement date following the product recall announcement.	LexisNexis, Factiva
Product reliability	Kalaignanam, Kushwaha, and Eilert (2013); Liu and Shankar (2013)	Reliability ratings of the preannouncing model if the new product is already in the market, average of firm reliability ratings if otherwise	Consumer Report, Automotive News Market Data Book
Spokesperson	Sorescu, Shankar, and Kushwaha (2007)	1 if preannouncement was made by the chief executive officer or top menagement executive, 0 if otherwise	LexisNexis, Factiva
Preannouncement specificity	Sorescu, Shankar, and Kushwaha (2007)	1 if preannouncement contains information on the price or time of introduction of the new product, 0 if otherwise	LexisNexis, Factiva
Targeting evidence	This study	1 if preannouncement contains information on the potential target consumer or target market of the new product, 0 if otherwise	LexisNexis, Factiva
Control Variables			
Sport sedan	Balachander, Liu, and Stock (2009)	1 if preannouncing new product is sport or two-door sedan, 0 if otherwise	Ward's Automotive Yearbook
SUV/Truck/Van/Wagon	This study	1 if preannouncing new product is SUV, Truck, Van, or Wagon, 0 if otherwise	Ward's Automotive Yearbook
Hybrid vehicle	This study	1 if preannouncing new product is hybrid vehicle, 0 if otherwise	Ward's Automotive Yearbook
Luxury vehicle	Balachander, Liu, and Stock (2009)	1 if preannouncing new product is luxury vehicle, 0 if otherwise	Ward's Automotive Yearbook
Sales	Thirumalai and Sinha (2011); Kalaignanam et al. (2013)	Log of monthly unit sales of the preannouncing make	Automotive News Market Data Book
Firm size	Sorescu, Shankar, and Kushwaha (2007)	Log of total asset (in millions of dollars)	COMPUSTAT

Table 11. Summary Statistics and Correlation Matrix

	Variable	M	SD	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	*CAR(-1;0)*	0.01	0.03	-0.1	0.16	1																	
2	*Innovation*	4.26	0.75	3	5	0.05	1																
3	*Advertising*	8.78	1.66	0	11	0.02	-0.04	1															
4	*Product recall volume*	0.64	0.9	0	4.5	-0.12	-0.05	-0.02	1														
5	*Recall recency*	34.9	20.6	0	75	-0.11	-0.07	-0.1	0.17	1													
6	*Recall initiation strategy*	0.52	0.5	0	1	0.03	0.05	-0.03	0.16	0.19	1												
7	*Recall severity*	0.21	0.41	0	1	-0.04	0.04	-0.07	0.31	0.14	0.21	1											
8	*Product reliability*	2.67	0.88	1	5	0.02	0.04	-0.19	0.05	0.01	0.06	0.03	1										
9	*Technology specificity*	0.33	0.47	0	1	0.15	0.05	-0.03	-0.05	-0.01	-0.11	-0.04	-0.08	1									
10	*Spokesperson*	0.46	0.5	0	1	-0.05	0.02	0.04	-0.05	-0.04	0.04	0.04	-0.07	0.15	1								
11	*Preannouncement specificity*	0.65	0.48	0	1	0.01	0.07	-0.01	-0.06	0.08	0.06	0.06	0	0.12	0.04	1							
12	*Targeting evidence*	0.09	0.28	0	1	-0.1	0.08	0.01	-0.02	-0.06	0.05	0.09	-0.09	0.33	0.34	0.15	1						
13	*Sport sedan*	0.1	0.3	0	1	0.06	0	-0.08	-0.09	0.01	0.04	0	0.03	0	-0.1	-0.05	0	1					
14	*SUV/Truck/Van/Wagon*	0.47	0.5	0	1	-0.06	0.07	0.08	0.12	0	0	-0.04	0	-0.04	0.01	-0.05	0.02	-0.28	1				
15	*Hybrid vehicle*	0.04	0.21	0	1	-0.02	0.03	0.12	-0.04	-0.17	-0.07	-0.06	-0.25	-0.03	0.08	-0.07	-0.04	-0.07	-0.12	1			
16	*Luxury vehicle*	0.34	0.48	0	1	0.04	-0.02	-0.35	-0.07	0	0.07	0.07	-0.07	0.18	0.06	0.02	0	-0.09	-0.15	-0.03	1		
17	*Sales*	10.4	1.17	6.18	12.5	0.09	0.15	0.27	0.01	-0.11	-0.04	-0.21	-0.03	-0.01	0.04	0.08	-0.17	0	-0.08	-0.03	-0.35	1	
18	*Firm size*	12.1	0.66	10.2	13.1	-0.06	0.09	0.04	0.01	0.2	0.31	0.17	-0.01	-0.06	-0.01	0.09	0.11	-0.01	0.08	0.08	0.05	-0.1	1

Note: N=247.

TABLE 12. Cumulative Average Abnormal Returns of New Product Preannouncement Across Different Event Windows

Window	1. Market Model				2. Market-Adjusted Model				3. Fama-French Four-factor Model			
	Mean abnormal return (%)	% Positive	Patell *t*-statistic[a]	*p*-value	Mean abnormal return (%)	% Positive	Patell *t*-statistic[a]	*p*-value	Mean abnormal return (%)	% Positive	CDA *t*-statistic[a]	*p*-value
[-1, 0]	**0.47*****	**55.51%**	**3.228**	**0.0012**	**0.47*****	**55.13%**	**2.987**	**0.0028**	**0.52*****	**56.92%**	**2.683**	**0.0073**
[0, +1]	0.23	56.27%	2.255	0.0242	0.17	55.13%	1.759	0.0785	0.30	55.73%	1.546	0.1222
[-1, +1]	0.26	53.61%	1.900	0.0574	0.19	51.71%	1.351	0.1767	0.34	52.57%	1.432	0.1521
[-1, +2]	0.22	49.81%	1.401	0.1613	0.16	51.71%	0.994	0.3203	0.24	49.01%	0.885	0.3764
[-2, +1]	0.24	53.99%	1.808	0.0706	0.17	49.05%	1.358	0.1746	0.29	52.57%	1.034	0.3009
[-2, +2]	0.20	48.67%	1.398	0.1621	0.15	48.67%	1.057	0.2906	0.19	50.20%	0.607	0.5438

Notes: The *p*-values are two-tailed.

[a]Patell *t*-statistic is adjusted for cross-sectional variance.

TABLE 13. Cross-Sectional Abnormal Returns Around New Product Preannouncement Date

Dependent variables: *CAR*[-1; 0]	Hypothesized Effect	Coefficient M1: *Main*	Coefficient M2: *Uncorrected*	Coefficient M3: *With 2SLS*
Intercept		-0.0355	-0.0402	-0.0586*
Main effects				
Innovativeness		0.0013	0.0016	0.0009
Advertising$_{(t-1)}$		0.0004	0.0004	-0.0042
Product recall volume	***H1:*** θ_1**<0**	-0.0091**	-0.0008*	-0.0012*
Recall recency		-0.0002***	-0.0002***	-0.0002***
Recall initiation strategy		0.008	0.0086*	0.0093***
Recall severity		0.002	0.0033	0.0038
Product reliability		0.0008	0.0008	-0.0005
Technology specificity		0.0143**	0.0135**	0.0134***
Preannouncement specificity		-0.0014	-0.0016	-0.0014
Targeting evidence		0.0014	0.0016	0.0015
Spokesperson		-0.0103*	-0.0101*	-0.0099**
Moderating effects				
*Product recall volume*Innovativeness*	***H2:*** θ_2**<0**		-0.0100**	-0.0109***
*Product recall volume*Advertising*$_{(t-1)}$	***H3:*** θ_3**>0**		0.0062**	0.0060***
*Product recall volume*Technology*	***H4:*** θ_4**>0**		0.0037*	0.0041
Control variables				
Sport sedan		0.0049	0.0043	0.0016
SUV/Truck/Van/Wagon vehicle		-0.0007	-0.0008	-0.0003
Hybrid vehicle		-0.0032	-0.0024	-0.0005
Luxury vehicle		0.0051	0.0061	0.0018
Sales		0.0035	0.0042	0.0059*
Firm size		-0.0023	-0.0027	-0.0022
Year fixed effects		Two year dummies significant	Three year dummies significant	Nine year dummies significant
R-squared		**0.136*** **	**0.156*** **	**0.168*** **

Notes: *N*=247. Robust standard errors are in parentheses.

$^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$