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Customer sentiment and firm performance

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CUSTOMER SENTIMENT AND FIRM PERFORMANCE

by

Qiang Fei

An Abstract

Of a thesis submitted in partial fulfillment
of the requirements for the Doctor of
Philosophy degree in Business Administration
in the Graduate College of
The University of Iowa

July 2011

Thesis Supervisors: Associate Professor Lopo L. Rego
Professor Thomas S. Gruca

ABSTRACT

The paper consists of two essays, both associating customer sentiment with firm performance. The first essay investigates the power of User-Generated Content (UGC) in explaining firm product and financial market performances. The second essay examines how brand equity can moderate a product recall's impact on the announcing firm and its competitors in the financial market.

In the first essay, we utilize a high involvement durable product category (i.e. automobiles) as our sampling framework, and our findings confirm UGC's predictive power and help resolve existing ambiguities in existing UGC research. We use a market share attraction model to investigate how UGC contributes to firms' success in the product market. We also investigate the impact that UGC communications exert on the firm's financial performance by inspecting its influence on firm idiosyncratic stock returns. Overall, we find that UGC communications have a direct effect on firms' success in the product and financial markets. Furthermore, we find that for both the product and financial markets, long term owner reviews influence market responses more decisively than new owners' reviews.

The second essay examines the role of customer-based brand equity in moderating the impact of product recalls on the firms' short-term abnormal stock returns. We construct a sample of all non-automobile product recalls announced between January 2001 and December 2006 by three Government agencies, *Dow Jones Newswire*, and *The Wall Street Journal* and match these product recall events with firm-level customer-based brand equity measures from the *EquiTrend*© database. Supporting previous studies we find that product recalls result in sizeable short-term negative abnormal stock returns for the recall announcing firms. More importantly the results suggest that strong brand equity attenuates the negative impact of these recalls for focal firms, while potentially benefiting their competitors. By decomposing the brand equity into brand familiarity and brand

quality, the study finds that brand quality is alleviating the focal firms from negative impact of a product recall, while brand familiarity is the driving force behind the benefits of a strong brand for competitors.

Overall, these studies advance marketing knowledge and our understanding of how customer sentiment impacts firm performances, both in the product and financial marketplaces.

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Graduate College
The University of Iowa
Iowa City, Iowa

CERTIFICATE OF APPROVAL

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PH.D. THESIS

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This is to certify that the Ph.D. thesis of

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has been approved by the Examining Committee
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INTRODUCTION

Customer sentiment, or customer perceptions of the product, has been suggested in the marketing literature to influence firm performance in the marketplace (Berthon *et al.*, 1999; Chaudhuri and Holbrook, 2001; Keller, 2003). Moreover, Billett, Jiang and Rego (2010) find that "customer sentiment in the product market spills over into investor sentiment in the stock market." We enhance the understanding of customer sentiment with two different approaches of measuring it, one through User-Generated Content (UGC), and the other through *Harris Interactive*'s *EquiTrend*. Both are great tools in the marketing dashboard for managers.

The advances in marketing and in technology have provided firms with numerous ways of assessing customer sentiment. UGC, which is free and becoming increasingly popular in people's daily life, offers firms a new and cost effective way to gage customer sentiment. The current paper fills in the gap by confirming UGC's impact on firm success in the product and financial market. By testing UGC's impact at different points of the marketing value chain in Chapter 1, we promote the understanding of this new measure of customer sentiment.

Traditionally, to evaluate customer sentiment, firms have utilized professionally administered surveys such as the one ones conducted by *Harris Interactive*'s *EquiTrend*. *EquiTrend* has measures for the overall brand equity as well as its different components such as brand familiarity and brand quality perceptions. Equipped with this knowledge of how customers perceive the brands and the firm as a whole, managers hope to predict the potential reactions from consumers in different scenarios. One of such important situations for many firms is when firms announce a product recall. Knowing what to expect and how to act when a product recall hits is vital for the success and survival of firms. Chapter 2 deals with the role of brand equity and its components in moderating product recalls' impact on announcing firms as well as well as their competitors.

CHAPTER 1

USER-GENERATED CONTENT: THE ASSOCIATION BETWEEN

USER REVIEEWS AND FIRM PERFORMANCE

<u>Introduction</u>

The number one marketing expenditure for most firms is marketing research. Firms spent $14 billion on marketing research in 2009 in hopes of understanding their customers, competitors, competing products, and the environment they compete in. At the same time, customers are more than willing to provide information regarding their purchase experiences in the form of user-generated content (UGC)[1], which can be accessed by firms as well as other consumers free of charge and in real time. The characteristics of these self-reported data, paired with the open-ended nature of user generated content, suggest an opportunity for understand customers' sentiment and highlight UGC as a potential source of marketing intelligence. However, most firms do relatively little with these increasingly and freely available, self-selected and certainly rich customer data. The primary reason indicated for this is that relatively little is known about UGC data as a marketing and managerial tool for decision making.

UGC is a form of customer voice, and forty years ago, Hirschman (1970) proposed that there are two choices consumers are facing when they are faced with deteriorating product or service quality: they can choose to exit the relationship or they can voice their dissatisfaction in an attempt to influence the organization and to improve the relationship. As explained by Hirschman, the customer voice can be in the form of direct complaining to the company or consumer to consumer communications (word-of-mouth (WOM)). Marketing research on WOM is a relatively recent development after

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[1]UGC is defined as any type of media content that is publicly available over the internet, reflects some creative effort and is created by end users (Organisation for Economic Co-operation and Development 2006).

World War II, but WOM has been acknowledged for many years as a major influence on what people know, feel and do. Britt (1966) is one of the first to point out the marketing impact of WOM on consumers. As the Internet becomes popular in the last decade, UGC, an online form of WOM, is attracting interest from an increasing number of researchers.

The primary research question this study intends to address is whether there is incremental value in UGC in explaining and predicting firm performance, both in the product marketplace and in the financial market. In particular, we have five goals to achieve. First, we identify different metrics measuring different dimensions of UGC and evaluate their explanatory power for market performance. There is no consensus in the literature of how we can measure UGC and researchers have mixed findings regarding UGC's influence on firm performance. We attempt to measure different dimensions of UGC and relate them to different performance metrics. Second, we extend UGC research to a very different product category (i.e. automobiles) from existent research. Existing literature has focused on products characterized by relatively low monetary and personal risk, such as movies, books, and TV shows (Liu, 2006; Godes and Mayzlin, 2004; Chevalier and Mayzlin, 2006). The decision making processes are significantly different between these categories and high involvement and durable product category such as automobiles to warrant further examination. Third, when examining UGC's impact on firm success in the product market, we put it in the context of a competitive market structure. By using a market share model, we are able to find how UGC and other marketing variables can affect a firm's position in a competitive marketplace. Fourth, we are interested in the role of experts in a new era of UGC becoming more and more popular. Fifth, we try to link UGC with firm performance in the financial market. Srivastava, Shervani, and Fahey (1998) presented a theoretical framework for the marketing-finance interface and advocate the linkage between marketing assets and shareholder value. As a potential valuable marketing asset to firms, UGC can enhance

firm value in unique ways. In summary, the purpose of this study is to provide a better understanding of UGC and to help assess its usage as a managerial tool.

Although UGC, especially in the form of product ratings and reviews, is a relatively novel stream of research in marketing, it has attracted the interest of many innovative marketing researchers. A number of studies have examined the dynamics and association of UGC metrics with product market performance for movie releases, book sales, and TV show viewership (Liu, 2006; Godes and Mayzlin, 2004; Chevalier and Mayzlin, 2006; Duan *et al.*, 2008; Moon, Bergey and Iacobucci, 2010).

The current study contributes to the growing literature on UGC in a number of ways. First, we use a market share model to include competition information into the study. This is extremely important for marketing, because we cannot assess the effect of a marketing action without taking into account competitors' actions. Second, this is the first study of UGC for a high involvement and durable goods category. Not only are consumer decision-making processes for such a category dramatically different from that of a frequently purchased and low value product such as books and movies, but economic implications for such categories are also enormous. For consumers, the monetary and personal risks are high, and for manufacturers, due to the high unit value, each additional customer is important. We try to fill in this knowledge gap of UGC's impact on the high involvement durable goods category. Third, this is the first study to investigate the differentiating influence of long term owners versus new owners. One of the important characteristics of durable goods is that consumers can own the product for a long period of time, and consumers who have owned the product for different lengths of time have different levels of influence on potential buyers. The minimal differentiation between different years of a model has made the current model year owners to be less influential on potential buyers than those who have owned previous model years. Fourth, we link WOM with firm value. Luo (2007) researched WOM under the marketing-finance framework by linking consumer negative voice (complaints to government agencies) with

firm idiosyncratic returns in the stock market. Our paper furthers this stream of research by directly studying the WOM communicated among consumers and how it influences firm value in the financial market.

This paper is organized as follows: First, we develop a theoretical framework for the association between different UGC metrics and firm performance. Then we conduct two separate studies for the product market and the financial market. For each of these studies, we first propose an empirical framework to test our hypotheses, and then describe our data and the empirical models. After that we report our findings and discuss managerial implications for those findings. Finally, we assess limitations of the current study and provide an agenda for future research.

<u>Theoretical Framework and Hypothesis Development</u>

UGC and WOM

UGC is in essence WOM. WOM communications are widely viewed in the marketing literature as an important outcome of firms' marketing activities (Anderson 1998; Bayus 1985; Biyalogorsky, Gerstner and Libai, 2001) as well as an important driver of consumer decision making (Laczniak, DeCarlo and Ramaswami, 2001; Villanueva, Yoo and Hanssens, 2008). Consumers view WOM as a source of information for the product or service. According to the Retail Advertising and Marketing Association/BIGresearch Study (2009), WOM is the number one influencer of consumers' choices in the electronics and apparel categories. WOM can have a significant impact on product market performance in two ways. First, WOM as customer voice (Hirschman, 1970) and as a consumer initiated communication can influence firm's behavior and other consumers' perception of the product (Laczniak, DeCarlo and Ramaswami, 2001; Villanueva, Yoo and Hanssens, 2008). Second, WOM is an indirect

indicator of customer satisfaction, which influences customers' future purchase (Yi, 1990).

UGC is no different from traditional WOM on those aspects, and at the same time UGC possesses some characteristics that make it especially interesting and relevant for firms and marketers. First, UGC is free. It is created by ordinary consumers and shared among them. Most UGC web sites are open to the public free of charge. The monetary cost to collect such data is minimal. With firms spending millions of dollars on surveying customers with poor response rates, UGC provides firms and marketers with a more economical and efficient way to collect customer data. Second, UGC is real time data. Most web sites make postings available to the public immediately after they are posted. Unlike traditional customer surveys, which usually lag in time, we can observe UGC in real time. This enables firms and marketers to respond more quickly to customers. Third, UGC is durable. By durable we refer to the fact that UGC keeps a permanent record of consumer conversations. In most cases, the content is available to the public even years after the consumer posted it. One of the problems marketers have for traditional forms of WOM is the difficulty in tracking the actual WOM activities among consumers. With self-reported data, the accuracy can be a problem. However, UGC is initiated by consumers and can be tracked and recorded accurately and unobtrusively. Fourth, UGC has become a trusted source for consumers. The credibility of the information source has always been an important factor in deciding its impact on the receiver. While there is a possibility for ill-intentioned users to manipulate UGC, its ubiquity, combined with more control and monitoring on the part of the UGC hosts, has persuaded consumers to embrace UGC as a valuable and credible source of information. According to a recent study by Nielsen (2009), 70% of online consumers trust the opinions of unknown users. In consumers' eyes, reviews and ratings by unknown users are as credible as information from the product's official web site. Fifth, with motivated and empowered consumers, UGC has become a ubiquitous phenomenon in people's daily life. Consumers engage in

online WOM (i.e. UGC): (1) to exert power, (2) to help other consumers, (3) to help the company, and (4) to establish identity in the community (Hennig-Thurau *et al.*, 2004). The Internet has ushered in "information democracy" to replace "information scarcity" (Sawhney and Kotler, 2001). Consumers are empowered with more knowledge as well as a venue to express their satisfaction or dissatisfaction and exert their influence on both peers and the firm.

UGC, in the context of product reviews and ratings, not only reflects consumers' attitudes and beliefs from past experience and perceptions, but also is a form of WOM directed at influencing peer opinion. Moreover, and as stated by some users, they expect their "voice," either positive or negative, to be heard by product or service providers. Independently, because of the ubiquity of UCG, as well as its potential reach, it is also a type of voice of consumers that companies should listen to attentively.

UGC and Product Category

As UGC integrates with consumers' decision making processes, there is evidence that it impacts product-marketplace performance. Existing research for the movie industry (Liu, 2006; Moon, Bergey and Iacobucci, 2010), where easy access to box office and ratings data exists, verifies a clear association between UGC and box office performance. Additionally, findings from the book (Godes and Mayzlin, 2004) and TV show industries (Chevalier and Mayzlin, 2006) also suggest the importance of UGC in explaining product performance.

While all UGC studies agree on the importance of UGC in influencing consumer attitudes and behavior, findings are mixed for different metrics of different UGC dimensions. The conflicting and inconsistent findings may be due to the fact that existing UGC studies have exclusively focused on low involvement experience products.

Products can be classified as search, experience or credence (Nelson, 1974). However, very few products are "pure" search, experience or credence. In fact, most

products share search, experience, and credence characteristics, usually with one dominating the other two. For example, movies have search properties (e.g., price, genre, cast), experience properties (e.g., plot, cinematography) and credence properties (e.g., critics ratings, awards). But most people would agree that for movies, experience properties dominate search and credence properties. On the other hand, more standardized products such as personal computers, most people consider search products. Medical services are usually considered a credence product because their ultimate impacts are hard for consumers to ascertain even after consumption.

Existing studies for UGC focus on experience goods such as movies and books. Consumers will not be able to fully assess the products or services until they themselves experience them. But with the availability of UGC, consumers can check other people's experience before they buy. One problem with using products such as movies and books to study UGC is that both products are low involvement and low risk products. Unlike other products with a high monetary and social risk, they may not involve an extensive decision making process, which makes UGC less relevant in this context. The risk associated with such purchases is relatively low. According to National Association of Theatre Owners, average movie ticket prices for 2009 were around $7.50, whereas for 2007, the average price for an adult trade hardcover fiction book was around $27.47, and for nonfiction hardcover books it was $25.38 (*School Library Journal*, 2008). The initial interests in a popular movies and books also tend to fade relatively quickly (more so for movies than books). Given these facts, the likelihood of consumers conducting extensive search for external information for movies and books is not comparable to a high involvement product.

Consumer buying decisions can be categorized into: extensive, limited, and routine. Extensive decision making requires a consumer to spend a large amount of time and effort to search and evaluate. Usually these products are expensive and consumers are faced with many alternatives. Routine decision making is the opposite of extensive

decision making, and limited decision making is in the middle of the two extremes. The decision making for high involvement goods is akin to extensive decision making: they are usually expensive, are "consumed" over many years, and are highly visible to others. Therefore consumers' decision making processes in this category are likely to be complex, consumers are more likely to research alternatives extensively before buying, and UGC is likely to be an important source of information. Thus, not only are the decision-making processes for this category dramatically different from already studied low-involvement and frequently purchased products, but the category characteristics are also likely to result in different dynamics between UGC metrics and product performance measures.

Studies on UGC in high involvement and high risk product categories are sparse or non-existent. Such products are significantly different from movies and books, and these are exactly the categories for which consumers tend to seek extensive advice, suggesting a potentially larger influence of UGC on consumers' decision making processes.

When we think of high involvement and high risk products that consumers tend to do an extensive search of information before purchase, the first product coming to mind is automobiles. According to *J.D. Power and Associates* (2006), about 67.5% of new vehicle buyers researched online prior to purchase. Many of the characteristics of this product make it a good candidate for study. First, spending on automobiles is the second largest expenditure most households incur in their life cycles. As such, automobile purchases are high involvement purchases, requiring significant time and commitment from consumers, suggesting a rich, complex and dramatically different decision making process than those studied in existing research. Second, automobile purchases have a relatively long inter-purchase cycle of 56months (Polk & Co study, 2009). Third, the auto industry is one of the largest industries in the US, representing more than $420B in annual sales and employing more than 1.1 million people in the US as of 2006 (Bureau of

Labor Statistics 2007). The automotive industry alone spent about 1.12 billion dollars on marketing research in 2009 (*IBIS World*, 2010), and findings from this study may suggest a valuable and cost efficient source of marketing intelligence for the automobile industry, with significant economic relevance. Fourth, the auto industry is highly scrutinized, characterized by the public availability of industry intelligence. Fifth, it is an industry for which a plethora of user-generated content exists, on publicly available popular websites such as *Edmund's* (www.edmunds.com) and *MSN Autos* (autos.msn.com).

UGC and Firm Performance

UGC can be theoretically linked to firm performance by borrowing from the existent research on WOM, but at the same time UGC has its own characteristics. Researchers have long deemed WOM as both a driver and an outcome of consumer behavior. One rational for WOM to have influence on people's behavior is the herding theory, which suggests that people want to be like others and thus do what everyone else is doing. Banerjee (1992) gives a simple model of herding behavior and the recent development in neural science has helped explain herding decisions (Chen, *et al* 2010). When new information, such as peer opinion, is introduced, people may change their attitudes and actions.

WOM can be decomposed into different dimensions. Harrison-Walker in his 2001 paper on the measurement of WOM verifies the three conceptual dimensions of WOM: favorableness, enthusiasm and detail. Existent research on UGC has focused on the first two dimensions and operationalized them as the valence and the volume of UGC.

Favorableness, or valence, is one of the most important measures of UGC, and almost every UGC study involves some form of valence as a predictor. Duan, Gu and Whinston (2008) argue that WOM influences product sales through awareness effect (volume) and persuasive effect (valence). This suggests that high ratings of a product help persuade potential buyers about the performance and quality of the product under

consideration. Additionally, existing research has found some evidence that customers who post high ratings are also more likely to provide additional WOM than just posting on the web site. So, a positive rating not only persuades buyers seeking information about the product's quality, but is also an indicator of additional offline WOM activities.

Interestingly, the findings about valence are mixed. Liu (2006) finds that WOM valence is not significantly associated with movie revenue. Chen *et al.* (2004) also fail to find a significant association between WOM valence and book sales, while Chevalier and Mayzlin (2006), using a similar data set, find a significant positive association between book ratings and book sales.

There are two primary reasons why customers actively seek advice and research vehicles before purchasing them. First, the personal and monetary risk of a new car is much higher than buying a book or watching a movie. The average price for a new car was around $22,651 in 2006 (U.S. Department of Energy, 2008), while the average duration of ownership was estimated at 56 months (Polk & Co study, 2009). Second, and as alluded to above, a new car is characterized by more than search and experience attributes, it is also a credence product. Credence products are also labeled post-experience products, because it is difficult for most consumers to ascertain the product quality even after they have used it. For new cars, it is difficult to assess the quality right after the purchase and for this reason, most trusty experts, such as *Consumer Reports*, only recommend a vehicle after it had been in the market long enough for accurate reliability reports to be estimated. Not surprisingly, research has indicated that potential customers of credence products tend to seek third party (i.e., experts) information to aid their decision making process.

Based on the arguments presented above, we expect the valence of user reviews for to be positively associated with cars' market performance (i.e., market share).

H1: A car's user review valence is <u>positively associated</u> with its market performance.

Enthusiasm is another dimension for WOM. One reflection of consumer enthusiasm is the frequency of WOM. While findings are mixed on WOM valence and its association with product performance (e.g., sales), most researchers agree on the influence of WOM volume on product sales. For instance, Anderson and Salisbury (2003) demonstrate that the level of WOM activities is a powerful predictor of future market performance. Several reasons justify a positive association between WOM volume and market performance. First, WOM volume is an indicator of consumers' awareness of the product. Numerous studies have shown the positive effect of brand awareness on market performance. Second, WOM volume is also an indicator of the market's interest in the product. A higher level of interest (higher UGC volume) leads to more buyers and thus superior market performance for the product. The positive association between UGC volume and product market performance has been identified in existing studies (Chevalier and Mayzlin, 2006; Duan, Gu and Whinston, 2008; Moon, Bergey and Iacobucci, 2010). However, for the movie industry, Duan and colleagues also pointed out that the positive association of WOM volume and market performance tends to diminish rather quickly. Contrary to most findings, Godes and Mayzlin (2004) fail to find any significant association between WOM volume and TV show viewership rates. Based on the above discussion, we propose:

H2: A car's user review volume is <u>positively associated</u> with its market performance.

Detail is also an important dimension of WOM. First, it shows reviewers' level of commitment. Second, by providing more details to readers, longer reviews also enhance the credibility of the message. However, it is important to question to what extent UGC users read reviews in full detail, as opposed to simply skimming and relying on the numerical ratings. In an era of information overload, customers may choose a shortcut and just read the summary ratings and a few additional reviews that catch their attention. Existing studies (Chevalier and Mayzlin, 2006) have mixed findings regarding the

association between review length and market performance. It is especially difficult to predict a directional (i.e., positive versus negative commentary) association between review length and new car sales. However, in our analyses, we are able to separate positive and negative parts of the review, therefore making it possible to examine directional association between review length and market performance. Negative WOM activities have been found to be very detrimental to the product sales and they tend to have more influence than positive UGC postings((Chevalier and Mayzlin, 2006). We propose:

H3a: The length of negative UGC comments is _negatively associated_ with the car's market performance.

H3b: The length of positive UGC comments is _positively associated_ with the car's market performance.

Besides the above mentioned three dimensions of WOM, variability of UGC is also an interesting measure. While most researchers acknowledge variability to be as an important measure (Liu 2006), few have included it in their final studies. One exception is Zhang and Dellarocas (2006), who suggest a negative association between rating variability and product market performance. They argue that variability is measuring the reliability and credibility of UGC, and consumers may use it as an indicator of the associated risks. However, the effect of UGC variability is more complex than that. There are many confounding factors. For instance, when average user ratings are high, a high degree of consensus leads readers to trust the ratings more and thus leads to more positive perceptions of the product. But when the ratings are low, a high degree of consensus on the low ratings among reviewers actually hurts the product because it will scare away potential customers when everyone is saying it is a bad product.

Besides the above four dimensions of reviews, consumers may give different weights to reviews from new owners and those from long term owners. Automobiles are characterized by a relatively even combination of all three components of search,

experience, and credence without one clearly dominating the other two. New car buyers reach out to current owners (e.g. UGC) and experts for their insights on the vehicle, to supplement their extensive research on the vehicle's search attributes. For car purchases, consumers are concerned not only with current product functionality and but also with future service quality. This has two implications. First, although new model-years may have improved functionality, consumers who are concerned about product durability and reliability may check older model-years for information. Second, consumers cannot fully assess the quality right after the purchase because long term reliability is part of the product quality.

When searching vehicles, consumers have access to both the reviews for the current model-year and reviews for the previous model-years. Current model year reviews are posted by consumers who recently bought the car, and reviews for the previous model years are written by owners who have owned the model for several years. As a marketing gimmick, manufacturers make changes to the same model every year, but the changes are usually minimal or cosmetic. Most models will remain almost the same for 5 years or more before receiving a major redesign. There are two reasons why a long term owner's review may be more relevant and more valuable to new buyers than reviews from a new owner. First, ratings of the same models after 4-5 years of use provide important information about the car's reliability, which consumers rank as one of the most important factors in their new car purchase. Although consumers may have test driven the new car, they have to rely on other users or experts for information on long term reliability and performance. The online car reviews from long term owners are not only the actual word-of-mouth in action, but they are also, to some extent, indicators of customer satisfaction in general.

It is questionable how useful new owner reviews of current model years are for new car buyers, due to their lack of other information than what the potential buyers have already known. Unlike with other products, new car buyers tend to have first-hand test-

driving experience with the cars they are considering. Reviews for new cars are usually hastily posted not long after the purchase and thus do not provide significantly more information than a test drive. Potential buyers are not gaining a lot of information from new owner reviews on the current models, which usually focus on the obvious features. For most new cars, the first three years are relatively problem free because of current manufacturing quality levels and manufacturer warranties, and it is not clear how much importance consumers attach to user reviews for current new models. However, reviews from long term owners for the same model provide valuable new information for potential buyers. Automobiles are relatively long term investments, and new car buyers may rely on ratings of long time owners to help them decide which one to purchase.

Another reason favoring older model year's user reviews is that fact that a long term owner has more credibility than a new owner. Because of the longer owning time, potential buyers assume these long term owners have more knowledge about the model and their reviews are backed with years of personal experience with the model. For these reasons, we propose that reviews from long term owners are more relevant to potential car buyers than reviews from new owners.

H4: Reviews for older model years influence the car's marketplace performance while current model year's reviews may not.

All the above discussions focus on the association between different dimensions of UGC and the product's market performance. However, since the framework paper of Srivastava, Shervani and Fahey (1998), marketers have become aware of the increasing importance of linking marketing with firm cash flows. By establishing the linkage, marketers are able to elevate marketing's role in the firms.

There are several theoretical reasons for us to expect such a linkage between UGC and firm expected cash flow. First, UGC, as a driver and an outcome of consumer behaviors, is a key part of a marketing asset such as brand equity, which has been shown to help increase firm value. Brands with high equity are familiar to consumers and enjoy

a strong, unique and favorable image association in consumers' memories. UGC, through its influence on peer consumers, enhance or harm a firm's brand equity, and at the same time, it is a reflection of the firm's brand equity in the market. Going through the value chain and the firm's product market performance, UGC ultimately shows itself in the firm's stock returns as investors derive firm value from expected cash flows. Second, UGC can directly influence investors' attitudes toward the firm because investors have direct access to all the consumer-to-consumer conversations in real time, and many individual investors are also customers. Their experience as customers and what they hear about the products directly influence their assessment of the firm. For these reasons, we expect UGC to influence firm value in the financial market. Srivastava and his colleagues (1998) argue that marketing assets can add to shareholder value through enhancing and accelerating cash flows, reducing cash flow volatility, and increasing residual value. Through its influence on consumer and investor attitudes and behavior, UGC fit under this framework. One of the commonly used measures for expected cash flows is firm-idiosyncratic stock returns (*FIR*), which is the expected cash flow in excess of the market return. This measure focuses on the return driven by firm specific strategies or characteristics. Finance literature has long established firm idiosyncratic returns as an important metric (Campbell *et al.*, 2001). In marketing, Luo (2007) find that consumer negative voice reduces *FIR*. With arguments from WOM and brand equity literature, we hypothesize:

> *H5: The UGC valence for an automotive firm is <u>positively associated</u> with its idiosyncratic returns in the stock market.*

Expert Opinions vs. User Opinions

Before the advent of the internet era, expert ratings from independent institutions such as *Consumer Reports* might have been the only source of information available to consumers. It is believed that this information influences new car purchases. Experts not

only rate the features obvious to consumers, but they also provide ratings on the car's long term performance and reliability. For example, *Consumer Repo*rts does not recommend a car until it has a track record long enough for a reliability score to be computed.

However, there has been a debate in the literature as to whether experts are indeed influencers or predictors or both. In other words, the observed association between the expert ratings and product performance may not be due to the experts' influence on consumers. Instead, it reflects experts' "expertise" in predicting the market. Eliashberg and Shugan (1997) were the first to test these two roles of experts. They propose that if experts are influencers, we should see the effect in the early stage of a movie's release but not in the late stage, and if experts are predictors, we should see the opposite. Findings from Eliashberg and Shugan (1997) and Reinstein and Snyder (2005) suggest that experts are predictors. However, using Eliashberg and Shugan's methodology, Basuroy et al (2003) find that experts are both influencers and predictors.

Our study adds to the discussion on experts' role by investigating a dramatically different industry, and by utilizing a different approach. All above mentioned papers use movie review and box office data, while mine studies the problem in the automotive industry. As we discussed previously, the auto industry possesses significantly different characteristics than the movie industry because of the high involvement and high risks on the consumers' part. Consumers may be more prudent in such purchases and thus more likely to seek external advice, from both experts and peers.

Eliashberg and Shugan (1997) propose an ingenious way of disentangling experts' roles as influencers and predictors by running weekly correlations of expert ratings and box office revenue. One assumption for this is that in the late stage of the movie release, the effect of word of mouth starts to kick in, and thus experts are less important in their role as influencers. However, with the speed of the Internet and the newly empowered consumers, UGC may start to kick in at the very early stage of a movie release. We are

adopting a different approach to test whether experts are influencers or predictors. Instead of making assumptions about word of mouth along the time line, we use the actual volume of WOM (UGC volume). If experts are predictors instead of influencers, the association between expert opinions and product success should be independent of the availability of other alternative information sources. If they are predictors it does not matter whether there are more or fewer other influencing sources. If we find a significant association between expert opinions and the product market performance and at the same time also a significant interaction between the availability of UGC and expert opinions, we are safe to conclude that experts are indeed influencers as suggested. We propose:

H6: Experts are influencers for the automobile product success.

In order to test our theoretical framework, we developed compatible empirical models for both the product market performance and financial market performance. We collected data on UGC reviews, expert reviews, monthly new cars sales, firm financial data, and additional control variables. In the following section, we divide our analysis into two studies, one for the product market and one for the financial market. In each of the study, we describe the data sources, specify the model, test the hypotheses developed, and discuss the implications of the results.

Study 1: Market Share Analysis

Data Sources

We collected data from five sources: (1) the *Edmunds'* database for automobile user reviews, (2) *MSN Autos* for car specifications, (3) the *Consumer Reports Buying Guide* for expert recommendations, (4) *Auto News'* databases for monthly new car sales, (5) *Advertising Age* for advertising data,

Edmunds.com is one of the most popular and active automobile communities, and we drew our user review data from this web site by using. Our sample covers the entire period from 2003 to 2007. Each post provides detailed ratings on performance, comfort,

fuel economy, fun-to-drive, interior design, exterior design, build quality, and reliability on a 10-point scale. Overall ratings are an average of all eight dimensions. Below the numerical ratings, reviewers have the opportunity to write detailed reviews, describe favorite features, and suggest improvements. We used the Perl program to parse the web pages and extract all required elements, including ratings and number of words in the titles, titles, car models, detailed reviews, favorite features, and suggested improvements. While edmunds.com does list car specification information, it does not provide historical list price data. For this reason, we used MSN Auto for information on list price.

The Consumer Reports Buying Guide is published by Consumers Union annually in December or January, and it is deemed to be one of the most authoritative sources for expert opinions. In each publication there is a special section for new car models, which provides category-based scores. According to the *Consumer Reports*, the scores are not comparable across categories. *Consumer Reports* classifies cars into different categories, but the classification criteria have changed over time. For this reason, the scores were difficult to use for our study. Instead, we used the recommendations from *Consumer Reports* as expert opinion. For each category, *Consumer* Reports selects several models as recommended models. While the *Consumer Reports Buying Guide* is published annually, recommendations may be based on the testing results of the previous model years if there have been no major design changes for the model. Therefore it is common for the expert ratings to remain the same for the same model across multiple years.

We got monthly car sales data from *Auto News*, a trade magazine dedicated to the auto industry. Since 2002, *Auto News* has compiled the annual market data book covering the U.S. and international markets.

Advertising data for brands were obtained from *Advertising Age*'s *Leading National Advertisers* (*LNA*), which collects annual advertising spending data for 100 elite companies from different media channels. Automobile industry spends heavily on advertising to sell to consumers, and it is not a surprise to find most of our car

manufacturers in the top 100 advertisers. For a listed company, *LNA* also provides advertising information for each major division/brand.

We processed our data in several steps. First, we merged all information from the above 5 sources. The data account for 30 models from 17 brands launched and sold from 2003 to 2008. Next, we created our data variables on a monthly basis to match the monthly sales data of each model-year automobile (e.g. Nissan Altima 2003). Then, we excluded the car models with less than cumulative 1% market share at the end of the year, and focused on the popular (main stream) models in the market. This was necessary because many niche, expensive and exotic models tend to have a very loyal following, and user reviews may not be relevant in this context. Furthermore, for some of the luxury models we do not expect buyers to look online for user reviews. Finally, we made another screening, and kept the data of the first seven months for each model-year automobile because most new models for the coming year come out after July of current year. The sales data break information down to model and month, but do not report sales of each model by model year. So the sales of any model after July can be a mix of new-model year and current-model year. Only the data for the first 6 month are free from the potential contamination. For example, *Automotive News* lists Nissan Altima sales for each month of 2006. As a normal practice, for the period of January 2006 to June 2006, the firm sold dominantly Altima 2006. Starting from August 2006, they sold both Altima 2006 and Altima 2007. Therefore, we only use the sales record for the period of January 2006 to June 2006 for the market performance of Altima 2006. Our final sample has 752 monthly observations for the period of between 2003 and 2008.

Variable Operationalization

Table 1.1 and Table 1.2 present the summary statistics for the primary variables of interest. Market performance is operationalized as the market share in terms of the percentage of total car units sold in the subcategory for the month. We have divided our

Table 1.1 UGC Study 1 Univariate Statistics (N=752)

Variable	Mean	Std. Dev.	Min	Median	Max
Market Share	0.10	0.06	0.02	0.08	0.31
UGC (Older Model Years)					
Valence (Average Ratings)	8.95	0.28	7.72	9.00	9.52
Variability (Rating Std. Dev.)	1.22	0.31	0.59	1.17	2.58
Positive Length (N of Words of Positive Comments)	16.19	3.34	8.81	16.02	24.22
Negative Length (N of Words of Negative Comments)	17.97	3.34	10.51	17.86	27.66
Negative/Positive (Ratio of Negative-to-Positive Length)	1.12	0.13	0.67	1.12	1.48
Volume (Num of Reviews)	172.44	122.54	13.00	141.00	731.00
UGC (Current Model Years)					
Valence (Average Ratings)	8.14	0.70	5.70	8.22	9.57
Variability (Rating Std. Dev.)	1.46	0.49	0.00	1.49	2.77
Positive Length (N of Words of Positive Comments)	13.89	3.54	3.92	13.18	32.33
Negative Length (N of Words of Negative Comments)	17.36	4.44	3.90	16.73	32.33
Negative/Positive (Ratio of Negative-to-Positive Length)	1.28	0.29	0.36	1.25	2.81
Volume (Num of Reviews)	32.36	23.94	2.00	26.00	144.00
Control					
Advertising Spending	547.50	277.94	103.10	584.90	1009.90
List Price	22322	5421	13932	21763	39800

passenger car category into two subcategories: small and midsize. For large size cars,

Ford Taurus and Toyota Avalon are the only two competing models left after data

processing. We intend to keep any subcategories with more than 3 competitors, so our

final sample consists of small cars and mid-size cars. The market share is relatively stable

throughout the year and thus the seasonal variability seen with the monthly sales data can

be avoided. The top three best selling cars in the U.S. are Toyota Camry (mid-size),

Honda Accord (mid-size), and Honda Civic (small size) in 2006. These three top models

sum up to about 14% of all passenger cars sold in 2006, and models with sales over 1%

market share add up to more than 43% of all passenger cars sold in 2006. We believe this

sample is representative of mainstream models in the market.

Table 1.2
Number of Observations by
Expert Recommendation and Car Characteristics
(N=752)

	N of Observations	Percent
Not Recommended	413	54.92
Recommended	339	45.08
Foreign	476	63.3
domestic	276	36.7
No Major Redesign	168	22.34
Major Redesign	584	77.66
Total	752	100

Regarding UGC, we collected two sets of metrics from long term owners and new

owners separately. The long term owner data include reviews posted in the last 12

months for model years that are 4-5 years old. For example, if we are examining the

Toyota Camry March 2006 market performance, the long term owner data include 12

months of reviews up to February 2006 for the 2001 and 2002 Toyota Camry. Although

every year, manufacturers release a new version of the model, the modification is usually

small. Most car models won't get a major redesign for 4-5 years. Recent reviews from owners of 2001 and 2002 Toyota Camry are valuable for potential 2006 Toyota Camry buyers because they provide information of performance and reliability after 4-5 years of use. Usually new car factory warranties expire in 3 years and after the third years consumers assume the sole responsibility for repair cost. The average owning time of a new car is about 5 years and thus we chose to use reviews posted by customers 4-5 years after they bought the car. The new owner review data include reviews for the current model year up to one month prior to the month we are studying. Again, using Toyota Camry as an example, in March 2006 the new owner review data for the 2006 Toyota Camry include new owner reviews for the current 2006 model year up to February 2006.

For both long term owners and new owners, we collected four specific UGC metrics: *valence, volume, variability,* and *length*.

The UGC *valence* is operationalized as the average ratings for the model in the defined time period. With our data, we have user ratings on a 10 point scale. The ratings were calculated by edmunds.com for each post based on the poster's ratings on eight items (performance, comfort, fuel economy, fun-to-drive, interior design, exterior design, build quality, and reliability).

The UGC *volume* is the number of reviews within the defined time period. Prior studies have used the number of reviews as a measure of WOM volume, which is an indicator of brand/product awareness. Consumers are more likely to post reviews soon after they make the purchase, and that's why we see the median number of posts for current model years is 139, while the median number of posts of a model year of 4-5 years old is merely 24. The excitement of buying a new car may lead more consumers to post reviews. But after 4-5 years of use, fewer consumers are enthusiastic enough to go online and post a review.

Users tend to give more favorable ratings for current model year than for previous model years. This is because most users do not encounter any problems in the first year;

problems are more likely to occur after 4-5 years of use. The median ratings for current

model years and previous model years are 8.95 and 8.14 respectively. Consistent with

Chevalier and Mayzlin (2006) findings for online book reviews, we find both ratings are

skewed towards the right (positive). Consumers tend to post favorable reviews about the

products.

We measure the UGC *variability* by using the standard deviation of user ratings

and we use it as an indicator of the level of user consensus on the ratings. To construct

the measures for *length*, which is an indicator of the commitment of the reviewers and

how detailed the information is, we counted the number of words in two different parts of

the review. There are two sections for a typical Edmunds.com review under the subtitle

of "Favorite Features" and "Suggested Improvements". The word count for the "Favorite

Features" part is our measure for the length of positive comments, and the count for the

"Suggested Improvements" part is our length of negative comments. The final *Length*

variable is the ratio of length of negative comments over length of positive comments.

Review length has been used in several existing studies, and most studies fail to find

associations between review length and product sales. Our variable is different from

previous studies because the Edmunds data make it possible for us to construct

directional review length variables as mentioned above. Users posted an average of about

14 words under "Favorite Features" and 17 words in the "Suggested Improvement"

section.

To measure expert opinion, we have expert recommendation as a dummy variable

from the *Consumer Reports Buying Guide*. It is 1 if recommended by the *Guide* and 0

otherwise. The *Guide* gives scores for each listed car model, but the scores are only

relevant within the defined sub-category, and thus they are not comparable across

categories. Additionally, the category classifications have changed over the years and this

makes it even more difficult to use the raw scores. Therefore, in the current study we use

recommendation as a substitute for expert opinions. Besides each listed model, the *Guide*

indicates whether the model is recommended. About half of the models in our sample were marked as recommended by the *Guide*. This is partly due to the fact that our sample consists of models with unit sales of 1% or more of the passenger car market, and it may have already excluded many models that the *Guide* did not recommend.

To test whether experts act as influencers of the market and whether the availability of user reviews mitigate expert's influence on consumer purchase decision, we create an interaction variable by multiplying the expert recommendation with the number of reviews available (both used and new).

There are five control variables in the study. *List price* is the manufacturer's suggested retail price as provided by MSN Auto. All our models are below $39,800 and above $13,000. This further confirms our argument that our sample mainly includes mainstream cars, and excludes exotic and very expensive models. *Domestic* is a dummy variable indicating whether the car is domestic (1) or foreign (0). We also control the advertising spending for the brand and whether the car model has a major redesign in the past 5 years.

Market Share Model

The dependent variable for our empirical model is market share. Cooper and Nakanishi (1988) suggest that all Market-share models should reflect the competitive structures in the market. Our model starts with Bell, Keeney and Little (1975)'s attraction models. They propose that consumer *attraction* to a brand determines the brand's market share, and it can be derived as:

$$s_i = \frac{A_i}{\sum_{j=1}^{m} A_j} \tag{1}$$

where A_i and A_j are the attraction of brand i and $j(i, j = 1,2,\ldots,m)$, $i \neq j$ and they are based on the following four axioms:

- $A \geq 0$ *and* $\sum_{j=1}^{m} A_j \geq 0.$

- $A_i = 0 => s_i = 0.$

- $A_i = A_j => s_i = s_j \ (i \neq j).$

- *When A_j changes by Δ, the corresponding change in s_i $(i \neq j)$ is independent of j.*

If defined in a multinomial logit model, *attraction* can be obtained from

$$A_i = exp(\alpha_i + \sum_{k=1}^{K} \beta_k \cdot X_{ki} + \varepsilon_i) \tag{2}$$

Where k is the number of explanatory variables; X_{ki} is the value of the kth explanatory variable X_k for brand i; α_i is a parameter for the constant influence of brand i; β_k is a parameter to be estimated; and ε_i is the error term.

By applying the log-centering transformation to the model, we obtain a linear form which is easy to estimate:

$$log\left(\frac{s_i}{\tilde{s}}\right) = (\alpha_i - \bar{\alpha}) + \sum_{k=1}^{K} \beta_k (X_{ki} - \bar{X}_k) + (\varepsilon_i - \bar{\varepsilon}) \tag{3}$$

where $\bar{\alpha}$, $\bar{X}_k$ and $\bar{\varepsilon}$ are the arithmetic means of α_i, X_{ki} and ε_i; $\tilde{s}$ is the geometric mean of s_i. See Cooper and Nakanishi (1988) for more details.

The market share model in Equation (3) incorporates the market and competitive structures by including information about competitors in the variables. Following Equation (3), we utilize the following regression to assess the association between UGC metrics and market share:

$log(A_{it}) = \beta_0 + \beta_1. \ Volume^{Old \ Model \ Years}_{i(t-1)} + \beta_2. \ Valence^{Old \ Model \ Years}_{i(t-1)} +$

$\qquad \beta_3. \ Variabilty^{Old \ Model \ Years}_{i(t-1)} + \beta_4. \ Length^{Old \ Model \ Years}_{i(t-1)} +$

$\qquad \beta_5. \ Valence^{Current \ Model \ Year}_{i(t-1)} + \beta_6. \ Volume^{Current \ Model \ Year}_{i(t-1)} +$

$\qquad \beta_7. \ Variabilty^{Current \ Model \ Year}_{i(t-1)} + \beta_8. \ Length^{Current \ Model \ Year}_{i(t-1)}$

$\qquad \beta_9. \ Expert_{it} + \beta_{10}.Expert_{it} * UGC \ Volume^{Total}_{i(t-1)}$

$\qquad \beta_{11}. \ List \ Price_{it} + \beta_{12}. \ Domestic_{it} + \beta_{15}.Redesign_{it}$

$\qquad \beta_{13}. \ Advertising \ Spending_{i(t-1)} + \varepsilon_{it} \tag{4}$

All variables have been transformed according to Equation (3) to reflect the competitive force in the marketplace. The subscript *i* indicates car models and *t* indicates month. The first four metrics of user ratings are for long time owners and the second set of four user review metrics are for new owners. Expert Recommendation remains the same for the whole year because *Consumer Reports Buying Guide* publishes annually. *List Price* is the new car list price when it first comes out and *Ad Spending* is annual advertising expenditure at the brand level. *Domestic* is a dummy variable to indicate whether the brand is domestic or foreign and it does not change over time.

Because of the potential endogeneity problem, we use a lagged version of independent variables with subscript *t-1*. These are data one month before the market share data. While the product market performance can be a consequent of user reviews and other marketing efforts of the company, the relationship can also be reversed. By using lagged independent variables, we are trying to avoid such interpretations because events in the future are not expected to have impact on the current events. The multicollinearity among independent variable is another potential problem. We tested for multicollinearity with VIF measures and none of the VIF statistics exceeds 5. To account for potential outlier influence, we use robust regression methods, which result in larger errors and more conservative estimates while correcting outliers' influence.

Our final data set is a time-series cross-sectional data set and it is susceptible to serial correlation, which can result in inefficient estimation (Kennedy, 2003). The Durbin-Watson statistics suggest that serial correlation was a problem with our data set. While our estimation remains consistent with the presence of serial correlation, the standard errors are wrong and cannot be trusted for testing hypotheses. Furthermore, we may see contemporaneous correlation and panel heteroscedasticity. To remedy these potential problems for a typical longitudinal and panel data set, we used Prais-Winsten and Panel Corrected Standard Errors as suggested by Beck and Katz (1995).

Results

Table 1.3 summarizes our estimation results. We estimated three models in the table. The first model is our base model with only control variables. Built on the first model, the second model adds expert reviews. The last model with review variables for current model year and old model years is our proposed model.

All models explain significant amount of variation in market share variable, especially the last two models with UGC information from both the current model year and the older model years. The base model explains about 14.13% of the variation in market share. Adding information of expert reviews into the model improves R^2 to 15.11%. Adding UGC information dramatically improves the explanation power of the models. As we do not have many marketing mix variables in the models, we would expect that, by including more marketing mix variables, we will be able to predict a larger proportion of variation in market share.

The models yield consistent and similar results. Overall, Table 1.3 supports the claim that UGC now has a significant influence on consumer purchase decisions for automobiles. In the following we will report the results in detail.

We find support for Hypothesis 4 that old model year reviews from long term owners have great influence on the car's market share performance while current model year reviews may not. Our hypotheses about the three UGC dimensions (valence, volume, and length) from long term owners are significantly associated with market share and are in the expected direction. But for current model year owner reviews, while volume, length and variability are significant, only the volume variable is in the expected direction, and valence, the key dimension of UGC used in almost all existing studies, is not significantly associated with the car's market share. Given the results, it seems consumers are more diagnostic about the reviews from current model year owners while they trust and get hints from old model year owners for their purchase decisions.

Table 1.3 Regression Results for UGC and Product Market Performance

Variables	Base Model	Expert	Current Model Year	Old Model Years	All Model Years	Interaction
New Model Year						
Average User Ratings			0.101		0.054	0.047
Std Dev of User Ratings			0.211***		0.130**	0.127**
N of Words Against/ N of Words in Favor (Ratio)			0.098***		0.100***	0.104***
N of Reviews			0.506***		0.415***	0.428***
Old Model Year						
Average User Ratings				0.231***	0.154***	0.161***
Std Dev of User Ratings				0.090**	0.059	0.063
N of Words Against/ N of Words in Favor (Ratio)				-0.034	-0.046*	-0.046*
N of Reviews				0.330***	0.211***	0.207***
Experts						
Recommended		0.103	0.179***	0.110*	0.163***	0.161***
Expert Recommend * N of Reviews (total)						-0.047
Controls						
List Price	0.031	0.020	-0.197***	-0.136***	-0.258***	-0.260***
Domestic	-0.208***	-0.172***	0.091	-0.070	0.108*	0.112*
Major Redesign	0.059	0.079	0.128***	0.118**	0.139***	0.137***
Advertising	0.526***	0.484***	0.226***	0.384***	0.214***	0.210***
N	752	752	752	752	752	752
R^2	14.13%	15.11%	29.67%	23.85%	35.97%	35.92%

* $p \leq .10$; ** $p \leq .05$; *** $p \leq .01$

Valence of the reviews is the one variable that attracts most attention from existent literature. Our findings support a positive association between review valence and product market share performance (Hypothesis 1).Review valence from users who have owned the car model for 4-5 years is highly significant with a coefficient estimate at 0.161. Consistent with Hypothesis 5, we do not expect a significant relationship between new owner review valence and market share. The coefficient for review valence from new owners is small and insignificant (-.047).

As an indicator of brand awareness, the number of reviews posted for both current model year and previous model years are positively associated with market share. It is not surprising to see the number of reviews from new owners is the single most important variable. The standardized coefficient is 0.428 for current model year owners vs. 0.207 for owners who have owned the car for 4-5 years. The number of reviews, especially from new owners of the current model year, indicates the amount of interests consumers have in the car model, and it also reflects the sales volume in the recent months, a lot of reviewers meaning a lot of owners. As such, the more recent data (current model year reviews) is more relevant. Our Hypothesis 2 is supported by both current model year owner reviews and old model year owner reviews.

The positive association between length and market share (Hypothesis 3) is weakly supported (p<.10) for the old model year reviews. Most previous studies find an insignificant relationship between product market performance and length of reviews. However, our variable for length is different from others in that it is a ratio between the length of the positive part and the negative part of the review. By constructing it this way, we are able to find some evidence that online users do read peers' writings in detail, instead of jumping to a quick conclusion from the numerical ratings.

The results do not support a negative relationship between rating variability and market share performance, as suggested by Zhang and Dellarocas (2007). The rating variability for old model year reviews is not significant, while for current model year

owner reviews, the coefficient for variability variable is statistically significant but with a positive sign.

Our study supports a strong association between expert opinions and product market performance. Expert recommendation is an important factor in consumer decision making processes. In fact the size of the standardized coefficient suggests that its association with the car's market share is of the same strength as UGC valence from old model years (0.161 vs. 0.169). In Hypothesis 6, we expect experts play an influencer's role in the automobile market. While the negative sign of the interaction term between expert recommendations and the number of user reviews would indicate that as more and more user reviews become available, experts' influence on new buyers weakens, the coefficient is not statistically significant (p=0.279). The predictor theory suggests that experts' impact on consumer attitudes is not subject to the availability of other influencing factors, for example, the availability of UGC. The findings fail to verify experts as influencers of consumer purchase decision making. On the other hand, it could suggest that experts are indeed predictors instead of influencers.

Discussion and Implications

Market share is one of the most important performance metrics used by managers and it has been studied by researchers extensively. One of the main purposes is to be able to predict it. The most commonly used predicting variables are price, distribution intensity, and advertising (Ghosh, Neslin and Shoemaker, 1984), but as new influencing factors emerge, it is important to incorporate them into the model. Our study demonstrates the importance of UGC in influencing and explaining market shares performance in a high involvement and durable product category. Together with the limited control variables we have, the UGC model explains more than 35% of the variance in market share.

As the Internet has quickly grown to be an indispensable part of people's daily life, its impact on forming and changing consumer attitudes and behaviors has become evident. The Internet provides an efficient and convenient way for consumers to access information that is not available to them otherwise. One may not have a neighbor who drives a BMW 7 series, but he can easily find an owner in the online community. Existing literature has mixed findings on UGC's influence on marketplace success for low involvement and inexpensive products (e.g. movie tickets and book sales), but our study indicates a significant role of UGC in explaining and predicting market performance for a high involvement and expensive product. Our study utilizes marketing performance data for passenger cars and this is exactly the product category that consumers tend to actively seek external information before purchase. UGC and customer voice are more relevant for such products (Hirschman, 1970). We find that both UGC valence, an indicator of customer satisfaction, and UGC volume, an indicator of brand/product awareness and consumer interest, are powerful forces driving and explaining the market shares. Furthermore, our findings suggest that people seem to read the reviews in detail, weighing *pros* and *cons* commented by previous owners. Not only do the numerical ratings and the number of reviews matter, but also how long and how detailed the previous owners discuss their negative against positive experiences with the product seems to impact consumer reactions.

For high involvement and expensive products such as cars, consumers try to minimize their risks by obtaining knowledge about the product through extensive information search. Because of the limited and possibly biased information that manufacturers and dealers are willing to share with consumers, consumers have to rely on experts and previous owners for more facts about the product. Reviews from old model year long term owners are especially valuable for potential buyers. New owner reviews contribute to consumer knowledge, but they are not at the same level as those from long term owners. In our case of passenger cars, long term owners provide important and

valuable information on reliability and performance. These are the most important factors consumers consider when purchasing a new car. Given the nature of performance and reliability, only people who have owned the car for a relatively long time can make an assessment. Our findings indicate that consumers value and trust long term owners' opinions more than current model year owners.

Experts are another information source for consumers when they face an important purchase decision, for example, for a high involvement and expensive product. Our findings suggest that expert opinions are strongly associated with the car's market share, but it is not clear whether this is due to experts' role as influencers or predictors. The study does not find support for the role of experts as influencers.

Our findings have important implications for firms. First, as mentioned at the very beginning of this paper, UGC is an asset waiting to be tapped by firms. This study further validates UGC's usefulness in influencing and explaining market share performance. For high involvement and expensive products for which UGC are highly relevant, firms need to incorporate UGC into market research analysis and prediction. UGC is a form of WOM and also an indicator of customer satisfaction. With more and more consumers going online for firm and product related information, businesses cannot afford to ignore this important medium in developing their marketing strategies. Second, post-purchase customer services are important. firms need to invest in better servicing and pleasing customers even long after the purchase is made because customer voice has a staying power and can influence potential buyers, as is the case with new car purchases in this study. The customer relationship management is not only important for promoting customer loyalty and encouraging repeat purchases, it is also vital for acquiring new customers. Even more importantly, this study shows that customers from a long time ago can have more influence on potential buyers than more recent customers. This seemingly surprising finding can be explained by the more credibility and experience long term owners have compared to new owners. This is one more reason for firms to promote

customer loyalty. Loyal customers will make repeat purchases, and more importantly, they will help spread the word. Their description of product experience will "stay" forever on the Internet. This is a challenge for firms, but it is also an opportunity and a way to differentiate themselves from competitors.

Study 2: Stock Return Analysis

Data Sources

While Study 1 investigates the UGC's impact on the products' marketplace performance, Study 2 examines how UGC influences the firm's financial performance. In addition to the data sources described above in Study 1, we collected data from the following two additional sources: (1) *Compustat* for firm financial data, and (2) *CRSP* for stock price data.

We utilized Wharton Research Data Services *(*WRDS*)* to access the *Compustat* and the Center for Research in Security Prices (*CRSP*) databases. *Compustat* contains annual and quarterly financial data for all public traded companies, and *CRSP* has historical market information on stock prices.

We assembled the dataset for analysis, by aggregating customer reviews to the firm level, by month. We then merge this data with *Compustat* and *CRSP* data sets, deleting all firms for which no stock price and financial information was available.

The final data set has 517 firm-month observations, for the period between March 2002 and December 2008. Given that not all automakers are listed on the US stock market, these 517 observations refer to 7 automakers[2].

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[2] These automakers represent a cumulative 79% of the US auto-market as of December 2008.

Variables and Model

Following Luo (2007) we utilized firm idiosyncratic returns as the dependent variable and proxy for firm financial performance. This is aligned with both the marketing and finance literatures and similar to the studies by Campbell *et al.* (2001); Ange *et al.* (2006) and Luo (2007). Specifically, firm idiosyncratic returns (FIR) are calculated as:

$$FIR_{it} = SR_{it} - \hat{\beta}_{im}MR_{mt} \tag{5}$$

where *i* indicates firm *i*, *t* is time *t*, and $\hat{\beta}_{im}MR_{mt}$ is estimated marketwide return component of the firm's stock returns (SR_{it}). $\hat{\beta}_{im}$ is estimated from $SR_{it} = \beta_{im}MR_{mt} + FIR_{it}$ (Campbell *et al.*, 2001). We used a 36-month rolling window before the interested time point to estimate beta. Following Luo (2007), we calculated the difference between the predicted monthly firm stock return and the actual achieved return, which is the firm's monthly idiosyncratic stock return, and use it as our dependent variable.

For UGC, and as indicated above, in order to test our hypotheses, we aggregated the overall ratings from edmunds.com users to the firm level and by month. Similar to Study 1, we also obtained two UGC variables, one for new cars from new users and the other for older models from long term users who posted reviews recently. We defined the former as reviews posted in year *t* for model year *t* or model year *t+1*. For example, reviews posted on August 2nd, 2007 for a 2008 model or a 2007 model are both counted toward new car reviews. Long term owner reviews are those reviews posted in year *t* for model year *t-4* and *t-5*. Again this is consistent with the fact that Americans replace their cars after owning 4-5 years.

As controls, and aligned with existing studies from the financial, accounting and marketing literatures (Luo, 2007; Campbell *et al.*, 2001), we include firm size (total assets), firm profitability (income/assets), firm leverage (debt/assets), and firm Selling,

Table 1.4 UGC Study 2 Univariate Statistics (N=517)

Variables	Mean	Std Dev	Std Err	Min	p5	Median	p95	Max	Skewness
Firm Idiosyncratic Returns	-0.002	0.084	0.004	-0.424	-0.122	-0.006	0.139	0.375	0.294
User Review	8.945	0.346	0.015	5.7	8.5	9	9.3	10	-2.978
Long Term User Review	8.085	0.588	0.026	6.2	7.2	8	9.1	9.5	-0.051
Firm Size (Assets)	203783	114664	5043	48437	64699	200333	463664	479921	0.651
Profit (Income/Assets)	0.003	0.024	0.001	-0.261	-0.019	0.005	0.017	0.035	-8.213
Leverage (Debt/Assets)	0.502	0.133	0.006	0	0.224	0.552	0.632	0.697	-1.482
SGA/Sales	0.154	0.064	0.003	0.059	0.081	0.147	0.299	0.417	1.195

Table 1.5
Number of Observations by Firms
(N=517)

Company	gvkey	Freq.	Percent
FORD	4839	82	15.86
GM	5073	82	15.86
HONDA	5691	82	15.86
FIAT	15172	51	9.86
DAIMLER	17828	82	15.86
NISSAN	19113	60	11.61
TOYOTA	19661	78	15.09
Total		517	100%

Table 1.6 UGC Study 2 Correlations (N=517)

	Variables	1	2	3	4	5	6	7
1	Firm Idiosyncratic Returns	1.000						
2	Review (new)	0.067	1.000					
3	Review (Long Term)	0.111**	0.236***	1.000				
4	Firm Size	-0.052	-0.200***	-0.323***	1.000			
5	Profit	0.102**	0.126***	0.250***	-0.079*	1.000		
6	Leverage	-0.016	0.079*	0.167	0.004	0.320	1.000	
7	SGA/Sales	0.041	-0.070	0.219	-0.671	0.183	0.124	1.000

Note: * p≤.10; ** p≤.05; *** p≤.01

General & Administrative (SGA) expense as a ratio of over sales. All these variables are quarterly data because monthly data are not available.

Table 1.4 and 1.5 present the summary statistics for variables in our firm idiosyncratic stock return analysis, and Table 1.6 gives the correlation matrix. From Table 1.6, it seems *FIR* is correlated more with long term user reviews than with new user reviews. Also, profitability seems to correlate with individual firms' idiosyncratic returns.

The regression model is as follows:

$$FIR_{it} = \beta_0 + \beta_1\ UGC\ Ratings^{Current\ Model\ Year}_{it-1} + \beta_2\ UGC\ Ratings^{Older\ Model\ Years}_{it-1} +$$

$$\beta_3\ Size_{it-1} + \beta_4\ Profit_{it-1} + \beta_5\ Leverage_{it-1} + \beta_6\ SGA/Sales_{it-1} +$$

$$\sum \beta_k\ Quarter\ Dummies_k + \varepsilon_{it} \tag{6}$$

where *i* designates firm, *t* for a time point (month), and *k*=5,6,…,27 for quarters. The data are longitudinal panel data and face the same problems as in Study. We use the same panel corrected standard errors to correct for potential violations of OLS assumptions.

In addition to the above model, we fit a random coefficient model to allow different intercepts and slopes for different firms in our data. Because of the limited data points and the parameter identification problem, we assess a reduced form of the random coefficient model. The model specification is as follows;

$$FIR_{it} = \beta_0 + s_i + \beta_1\ UGC\ Ratings^{Current\ Model\ Year}_{it-1} + (\beta_2 + d_i)\ UGC\ Ratings^{Older\ Model\ Years}_{it-1}$$

$$+ \beta_3\ Size_{it-1} + \beta_4\ Profit_{it-1} + \beta_5\ Leverage_{it-1}$$

$$+ \sum \beta_k\ Quarter\ Dummies_k + \varepsilon_{it} \tag{7}$$

where

β_0 is fixed estimate for the population average (all firms)

β_1 - β_1 and $\sum \beta_k$ are fixed estimates for the slope of the independent variables

s_i is the random effect of individual firms on the intercept

d_i is the random effect of individual firms on the slope of long term user reviews

The random components follow Normal $(0, \sigma^2)$ where the variances are σ_s^2 for s_i and σ_d^2 for d_i. We expect $(\beta_2 + d_i)$ to be positive, which indicate a positive association between long term user review rating and FIR_{it}.

Results

Table 1.7 lists our results. The first four models are embedded fixed effect models and the last model is a random coefficient model. All reported coefficients are standardized. Our models explain more than 11% of the variation in firm idiosyncratic returns. The base model with quarterly financial variables explains 11.01% of the variation in the dependent variable and by adding user reviews, the explaining power of the model improved to 12.05% in Model 4.

Table 1.7
Regression Results for UGC and Firm's Idiosyncratic Stock Returns (N=517)

Variables	Panel Corrected Standard Error				Rand. Coeff.
	M1	M2	M3	M4	M5
Review (new)		0.073^*		0.059	0.055
Review (Long Term)			0.090^{**}	0.080^{**}	0.100^{**}
Firm Size	-0.061	-0.027	-0.032	-0.008	0.012
Profit	0.101^{**}	0.094^*	0.083	0.079	0.052
Leverage	-0.046	-0.054	-0.058	-0.063	-0.051
SGA/Sales	-0.024	0.004	-0.026	-0.004	0.003
R-squared	11.01%	11.50%	11.72%	12.05%	

Note: * p≤.10; ** p≤.05; *** p≤.01

All our models produce consistent estimates and they seem to suggest that long term owner reviews are the single most important covariate in predicting firm idiosyncratic returns, followed by profit. Our Hypothesis 5 finds support from the fact that long term user review ratings have been statistically significant ($p<0.05$) in our models. However, new user reviews are only marginally significant ($p=0.06$) in Model 2

when long term user review variable is excluded. This is consistent with what we found

in Study 1.

Table 1.8

Heterogeneous Impact of UGC on Firm's Idiosyncratic Stock Returns

Company	Company Specific Impact on Firm Excessive Return	Deviation from the Mean Slope	Std Error
FORD	0.104	0.005	0.046
GM	0.173	0.073	0.051
HONDA	0.084	-0.016	0.062
FIAT	0.083	-0.017	0.064
DAIMLER	0.044	-0.056	0.046
NISSAN	0.132	0.032	0.057
TOYOTA	0.079	-0.021	0.062

The financial impact of UGC varies across firms and Table 1.8 provides some

evidence for this heterogeneity. All slopes are positive for the long term user reviews, but

we see the most positive impact of user reviews on General Motors, Nissan and Ford,

while user reviews have a reduced impact on manufacturers such as Fiat and

Daimler/Chrysler. Figure 1.1 shows the deviations of the impact of long term user

reviews for individual firms.

Our results are robust that all models provide consistent results and all variables,

including control variables, are with the expected sign. For random coefficient model,

three firms exhibit significant positive impact from the favorable customer review

ratings.
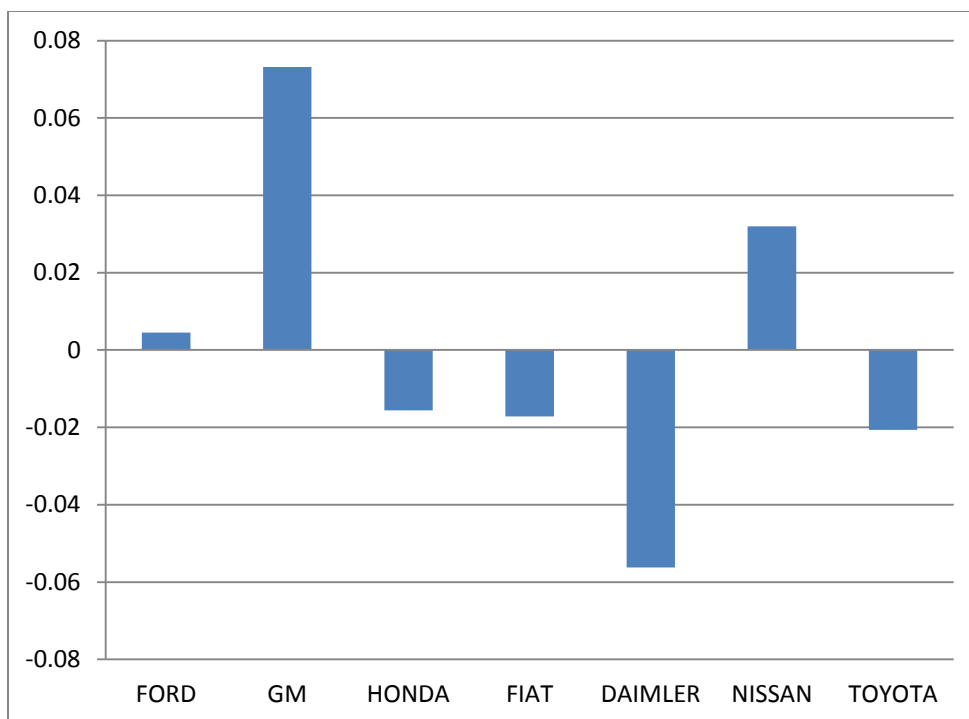
Figure 1.1 Deviation of Coefficients for Long Term User Review

Discussion and Implications

To a large extent, we are able to provide further evidence for UGC's usefulness in gaining insight into firm value creation. We are able to show that user reviews, especially those long term user reviews, can impact firm value in the financial market. The brand equity literature, with user reviews acting as an influencing force behind brand equity and as a part of it, suggests UGC play an important role in enhancing firm value. It is interesting to find that favorable user ratings for new cars did not translate into firm value for shareholders, and instead long term user ratings impact investors' valuation of the firm. There are several reasons for this. First, the long term user reviews may have worked its way through consumers who value reliability and who reward manufacturers with superior product reliability. Ultimately this marketplace success is reflected in firm stock returns. Second, the information about past product performance is an important

factor when investors make investments. A proven record and good user reviews for a 4-5 year old product is reassuring to investors about the firm's quality and credibility. Third, many individual investors are consumer-converted investors, and satisfaction after a relatively long term use increases their loyalty to the brand as well as the firm. Similar to our reasoning in the previous chapter of the market share model, new user reviews provide less valuable and credible information and while most of them are exciting reviews about the new product, they are not taken seriously by the consumers and investors.

While overall UGC has a significant impact on firm stock returns, its effect on individuals firms varies. As discussed in the results part, GM, Ford and Nissan are the three manufacturers that benefited the most from favorable long term user reviews. A 2005 reliability ranking of different car brands by consumer reports showed that Toyota and Honda were leading the list, while most brands from GM and Ford belonged to the bottom half. It seems, for weak firms, UGC can help the most. GM and Ford brands suffered from poor reliability according to consumer surveys, and it is by no accident that long term user reviews which peer consumers are reading for hints of reliability can help them regain confidence from consumers and investors. It is also understandable that Fiat and Daimler/Chrysler did not benefit a lot from favorable long term user reviews. These manufacturers are known for fun, performance and luxury, and buyers for their brands are less concerned about reliability. Actually Mercedes-Benz is among the bottom 6 brands in terms of reliability, yet it is one of the best-known luxury cars.

There are several implications. First, UGC, especially long term user review, is important for automobile firms. Firms need to develop strategy to foster a healthy and positive environment for UGC and other WOM. This is important for the product market success and it is directly linked to shareholder value. Long term customer care again should be emphasized to create favorable user reviews from customers. Second, UGC is especially important for weaker firms as they will benefit them the most if they are

successful in generating favorable UGC to offset their weakness. This is illustrated in the case of GM and Ford. Because they were known for poor reliability, any positive trend in user reviews would help to counter this image and disproportionately boost confidence from the consumers and investors.

<div align="center">Conclusion</div>

Our study confirms that UGC plays an important role in creating value for firms in the product market place as well as in the financial market. Furthermore, the findings suggest that not all user reviews are created equal, some being more influential than the others. Our data for passenger car industry show that long term user reviews provide valuable information on product reliability and thus are more important in consumer purchase decision making process than new user reviews. This importance is also emphasized in value creating in the financial market.

Decomposing UGC into different dimensions reveals that UGC volume and valence are the two most important aspects for the product market success. They translate into superior product market performance through the awareness and the persuasive effects. Our study for the firm idiosyncratic returns further demonstrate that UGC valence can influence investor expectations about future firm cash flows. Individual firms seem to benefit differently from UGC according to their positions in the consumers' and investors' minds. In particular, UGC may counteract some prior perceptions, like in the case of GM and Ford when favorable long term customer reviews seem to benefit them the most because they are the weakest firms in terms of the reliability ranking.

Expert ratings still contribute to product success, but at the same time experts' influence is limited by UGC. As more and more UGC information becomes available, consumers give less weight to experts' opinions.

Our study has several limitations. First, all our review data are from *edmunds.com*, and consumers using *edmunds.com* may possess different characteristics

than those using other review sites (e.g. MSN Auto). The unique profiles of *edmunds.com* users bias our findings. For example, if *edmunds.com* users are more sophisticated and educated than MSN Auto users, and MSN Auto users do not actually check reviews from long time owners, we will see a different story. Chevalier and Mayzlin (2006) provide a great example of how to investigate the site differences. In their study, they compare the impact of online reviews on book sales from *amazon.com* and *bn.com*. It is possible to conduct a similar analysis for user car reviews using different web sites. Second, we have not done a content analysis of user reviews. The beauty of UGC not only exists in the ratings, but also in the actual comments users have posted. What users actually say in texts is as important as the numerical ratings they give to the car. Our study does not include a content analysis. However, with the availability of a number of content analysis software packages, we may be able to begin to look into consumers' minds. Third, we may want to investigate car subcategories to explore the heterogeneous effect of UGC and expert reviews on market shares in different product categories. UGC is more relevant in some categories than others. For example, a consumer buying a Ferrari may care more about appearance and performance than reliability, and thus may not check user reviews for previous models, while for a middle class consumer buying a Toyota Camry, reliability is very important if this is going to be the family car for the next several years. This sort of consumers may research previous owners' posts extensively before purchasing.

There are a number of interesting avenues for future research. When reflecting on his work of "Exit, Voice, and Loyalty", Hirschman (1970) proposed that instead of looking at the issue "from bottom", that is, from the point of view of consumers, it is worth reviewing this topic "from top", from the point of view of managers. While managers cannot totally control consumers' choice of exit and voice, they do have some tools at hand to intervene and influence the choice. Based on the positive associations between UGC and firm performance established by this and other studies, one future

research area for UGC is how managers can stimulate positive UGC and reduce negative UGC. One possible way to reduce negative UGC is for firms to provide a communication channel to collect consumer complaints and manage them in a timely manner to minimize future consumer to consumer complaints. In the future, researchers can empirically examine what strategies are the most effective and successful in handling UGC.

CHAPTER 2

PRODUCT RECALLS, BRAND EQUITY

AND SHAREHOLDER VALUE

Introduction

A product recall is always going to be bad for firms as well as consumers. However, when the recalls do occur, not all companies are taking the same hit. On August 24, 2006, Apple announced a recall of 1.1 million battery packs and the investors basically ignored the bad news by pushing the stock higher. But on June 19, 2007, when Gateway announced a recall of merely 14,000 notebook batteries, their stock price dropped more than 4% after the news. One possible playing factor here is the different brand equities the two companies hold. A strong brand like Apple is perceived to be more resilient and less susceptible to the negative events (Cleeren *et al.*, 2007; Dawar, 1998).

Product recall as an important phenomenon has been widely studied in finance (e.g., Ahmed *et al.*, 2002; Chu *et al.*, 2005; Pruitt and Peterson, 1985), marketing (e.g., Cleeren *et al.*, 2007; Dawar, 1998; Dawar and Pillutla, 2000; Siomkos and Kurzbard, 1994), economics (e.g., Hoffer *et al.*, 1988; Jarrell and Peltzman, 1985), and management (Bromiley and Marcus, 1989; Haunschild and Rhee, 2004; Rhee and Haunschild, 2006). A product recall is a public request to customers to return a defective product for repair, replacement, or a full refund. Product recalls can be voluntary, when initiated by the manufacturer, or mandatory, when initiated by a government agency, such as the CPSC. Mandatory product recalls usually imply a more serious situation (i.e., the government wants to protect the public) and therefore can have more serious consequences to the product maker (Davidson and Worrell, 1992). On the other hand, voluntary products recalls can be initiated by the manufacturer as a demonstration of its willingness to take responsibility for product problems and its commitment to caring for its customers' welfare. Voluntary recalls can also be initiated in hopes of limiting damage to their

brands, or as a public relations effort to maintain customers' confidence in the company's brands (Davidson and Worrell, 1992).

There are significant direct and indirect costs related to a product recall (Jarrell and Peltzman, 1985). Direct cost involves the cost to replace, repair or refund the price of defective products. For example, Mattel estimated these direct costs for their August 2007 recalls at $68M. However, indirect costs may be even more significant because they can involve loss of customer confidence and impairment to the firm's reputation, which carry the potential for significant reductions in the manufacturer's future cash flows. As a result, there can be significant shareholder value costs – particularly for public companies – via stock price movement as a response to the product recall, as stock prices tend to respond negatively to product recalls (Bromiley and Marcus, 1989; Davidson and Worrell, 1992; Hoffer *et al.*, 1988; Jarrell and Peltzman, 1985; Pruitt and Peterson, 1986). When Mattel recalled toys in August 2007, $141M of Mattel's shareholder value was erased on a single day as the consequence of a single product recall.

It is important to understand how product recalls can impact companies, consumers as well as policy makers and the research on this topic is gaining momentum over the past years not only due to its significant cost to the firm and society, but also because of increasing occurrences. According to government sources, only 43 recalls were reported in 2000, while in 2006 government announced 63 recalls. Figure 2.1 shows the increasing number of product recalls that have been reported by government agencies over the 7 year period from 2000 to 2006.

Although financial and marketing researchers have examined a variety of moderators for the impact that a product recall on the firm's stock price (e.g., Davidson and Worrell, 1992; Mizik and Jacobson, 2008), relatively little is known about whether and how companies can use market-based assets to protect themselves from the negative consequences associated with a product recall. This is of particular concern, as there have
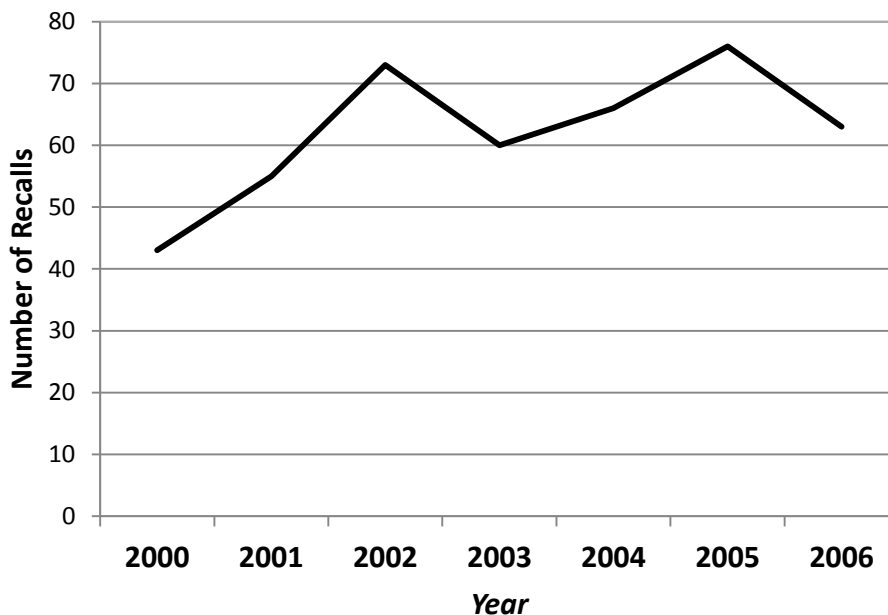
Figure 2.1 Number of Recalls Announced by Year
(Government Sources: CPSC, FDA, FSIS)

been several calls for marketers to better address the financial implications of their

marketing strategies (e.g. Mizik and Jacobson, 2008; Rust *et al.*, 2004). More

specifically, very little is known about how brand characteristics (i.e., strength of the

brand, brand associations, or brand loyalty) can help a firm mitigate the direct and

indirect costs associated with a product recall.

Among these characteristics, brand equity has received considerable attention

from marketing researchers and is usually defined as a summary measure of the

marketing effects or benefit outcomes that accrue to a product or service by being

associated with a given brand name (Ailawadi *et al.*, 2003; Keller and Lehmann, 2003;

Keller and Lehmann, 2006). Higher levels of brand equity has been linked with

competitive advantage and superior financial performance via price premiums, decreased

price sensitivity, and increased market share, easier expansion into new categories,

competitive cost structures, and higher profitability (Ailawadi *et al.*, 2003; Keller and Lehmann, 2003; Smith and Park, 1992).

However and despite the positive linkages between brand equity and firms' marketplace and financial performance, conflicting evidence exists with regards to how brand equity moderates the impact of a product recall on a firm. On one hand, most researchers (Ahluwalia *et al.* 2000; Cleeren *et al.* 2007; Dawar and Pillutla 2000; Mowen *et al.* 1981) suggest that strong brands are likely to insulate a firm from potentially devastating impacts of product recalls, via pre-recall brand familiarity, brand perceptions and brand loyalty. On the other hand, some researchers have suggested that '*the bigger they come, the harder they fall*' is likely to be the case (Rhee and Haunschild 2006). This argument is based on the notion that a strong positive brand reputation can be a liability for the firm, since customer expectations are high and these high expectations are more likely to be unmet in a product recall situation. With empirical evidence from 6 years of recall events and a new perspective using customer-based brand equity, this paper tries to shed light on the two conflicting theories – cognitive dissonance minimization vs. expectation violation.

We contribute to this stream of research by empirically examining the role that brand equity and other moderators play in explaining the impact of product recalls on firms' stock price movements. First, different from most studies on this topic, instead of studying the role of brand equity in an experimental setting, we utilize *EquiTrend*[©]'s customer-based brand equity metric and a sample of non-automotive[3] product recalls announced by a government agency (typically the CPSC), or reported in the *Wall Street Journal* for the period between January 1, 2001 and December 31, 2006. Second, by linking the impact of product recalls and the potential role of brand equity to the focal

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[3] Justifications for using non-automotive products are detailed on the research framework section.

firm's financial market performance, we are using forward looking performance metrics incorporating more and better information than product market performance metrics used in the few existing empirical studies. Third, we further decompose brand equity into brand familiarity and brand quality perception and examine them together and separately as drivers behind the overall brand equity. Fourth, we not only examine the impact of product recall on the focal/announcing firms, but also investigate its influence on competitors.

In the remaining part of the chapter, we begin by detailing a theoretical framework concerning potential moderators of the product recall and stock price association. We use this framework to develop a set of testable hypotheses. Next, we describe our research design, the dataset assembled and the methodology adopted. We then present and discuss our findings. Finally, we discuss theoretical and managerial implications of our results and consider potential limitations of our study and avenues for future research.

<p style="text-align:center">Theoretical Framework</p>

As every product recall typically involves the company, the consumer, the product, the firm's collaborators and competitors, the marketing function is an important constituent for the phenomenon. Particularly, due to its public nature, a product recall influences the public perceptions and associations with the firm's products and brands (Dawar and Pillutla, 2000). Understanding how these perceptions and associations may impact the firm's performance is critical to the business success of the firm. The brand equity's moderating role of a product recall's impact is displayed through its separate influences on consumers and investors when we use the forward-looking financial metrics to measure the firm performance. Furthermore, there are two conflicting theories about how consumers will react to a negative event differently for different brands. The cognitive dissonance minimization theory predicts a positive and protective effect from a

stronger brand as compared to a weaker brand, while expectation violation theory suggests the opposite. The product recall not only impacts the announcing firms, but also could spill over to the announcing firm's competitors. It is interesting to know how brand equity can moderate the impact from product recalls for these competing firms.

<div align="center">Brand Equity and Consumers</div>

Brand equity refers to the value added to a product or service by its association with a brand name or symbol (e.g., Aaker, 2004; Keller, 1993). In the marketing literature, brand equity has been operationalized in three main ways: as consumers' brand beliefs and attitudes that affect purchase behavior; as an observed set of product-market level revenue outcomes relative to an unbranded benchmark; and, as a financial market-based estimate of the dollar value of the firm's intangible assets that may be attributable to the firm's brands (e.g., Ailawadi, Lehmann, and Neslin, 2001; Keller and Lehmann, 2006). Here we adopt a customer-based perspective since all three approaches view the value of a brand's equity as ultimately being a function of the value that the brand delivers to consumers (Aaker, 2004). This in turn is a function of consumers' awareness of the brand and the image associations of the brand in consumers' memory (Berthon, Hulbert and Pitt, 1999; Lane and Jacobson, 1995). We utilize as our primary independent variable the construct of brand equity, defined by Keller and Lehmann (2003, 2006) as the benefits accrued by the firm from possessing strong brands at three levels – customer market, product market and financial market. This is referred to as customer-based brand equity (CBBE).

Brands with high CBBE are those that have high levels of consumer awareness and strong, positive, and unique associations in consumers' memory (Keller, 1993). Keller identified eight dimensions of brand knowledge. Furthermore, he suggests that the consumer response to brands may be decomposed into brand familiarity and brand likability.

From the consumers' perspective, the literature suggests that there are two primary reasons for brand equity to positively affect firm performance. First, the strong, favorable and unique association helps firms with great CBBE. A strong brand association and brand familiarity enables rapid product/service identification, and reduces consumer search costs, thus facilitating repeat purchasing behavior (Berthon *et al.*, 1999; Keller, 2003). This fact is particularly important for relatively low-involvement purchases such as frequently purchased consumer packaged goods (e.g., Hoyer and Brown, 1990). In addition, consumers' positive emotional connection with the brand (brand likability) may result in stronger brand loyalty (e.g., Chaudhuri and Holbrook, 2001). Loyal consumers are less susceptible to competitors' marketing efforts, reducing "churn" rate among the brand's customer (Oliver, 1997). For brands with greater CBBE, they tend to grasp a unique association in consumers' memory, which differentiates the brands from their competitors, reduce brand substitution and further protects the firm's future cash flow (McAlister *et al.*, 2007; Mela, Gupta and Lehmann, 1997).

Second, brands with greater CBBE are perceived by consumers to be of higher quality (Aaker and Jacobson, 1994; Erdem, 1998), and they are associated with lower consumer price sensitivity (e.g., Ailawadi, Neslin and Lehmann, 2003; Allenby and Rossi, 1991). This further enhances the above described behavioral loyalty since consumers will be less vulnerable to price-based appeals from rival brands. Lower price sensitivity among consumers protects cash flows from the supply and operational changes that may raise the firm's costs (e.g., Sivakumar and Raj, 1997).

Brand Equity and Investors

Several consumer-level studies indicate a negative impact of product recalls on the manufacturers but suggest that this impact may somehow be moderated by consumer-level brand-related variables as pre-recall loyalty, familiarity with the brand, prior perception of the brand, and commitment to the brand (Ahluwalia *et al.*, 2000; Cleeren *et*

al., 2007; Dawar and Pillutla, 2000; Mowen *et al.*, 1981). Ultimately the impact should be reflected in shareholder value – stock prices, which reflect the market's consensus of the firm's future cash flows and are easily measurable and obtainable. Therefore, we expect customer-based brand equity to have an important role in moderating the impact of product recalls on firm financial market performance.

Product market action can be transferred to financial market reaction through the expected cash flow as well as through the fact that a large audience of firms' marketing activities are themselves investors. Firms with strong CBBE tend to be well known companies with familiar brand names. Several studies have found that advertising, by driving awareness among consumers and investors and by reducing information asymmetry, can promote broader ownership (Grullon, Kanatas and Weston, 2004) and reduce the chance of underpricing (Similarly, Chemmanur and Yan, 2009). Peter Lynch's famous mantra is "buy what you know." This is exactly what many individual investors or even institutional investors are doing - they are sticking with familiar brand names. Keloharju, Knüpfer, and Linnainmaa (2010) find that people who are customers of a company are more likely to own the company's stock. This inclination to buy what you know also applies to institutional investors. There is a home bias for US portfolio fund managers to prefer investing in locally headquartered firms (Coval and Moskowitz, 1999).

Investor sentiment can also be a key factor in forming the market reaction. The investor sentiment hypothesis suggests that because of investors' sentiment and misperceived future cash flows, firms are susceptible to volatility and mispricing. When investors have positive sentiment about a firm and like a firm, they tend to overvalue the firm, which is the so called glamour effect in the finance literature. Firms with strong CBBE tend to have brands that are perceived to possess superior quality and are more favorably perceived by the general public. With this positive perception, these "glamour" firms may be overvalued in times of a strong market sentiment. These stocks have overly

enthusiastic investors which lead to overvalued stocks (Lakonishok, Shleifer and Vishny, 1994).

Cognitive Dissonance vs. Contrast

There are two competing theories when consumers face a violation of their prior expectation. Festinger's theory of cognitive dissonance (1953) posits that consumers will try to reduce the "psychological discomfort" or the dissonance by distorting the incoming information. On the contrary, Contrast theory predicts that consumers will magnify the disparity between the reality and their expectations, thus may shift more than warranted away from their prior expectations (Hovland, Harvey and Sherif, 1957). These two competing theories give different predictions when firms are caught up in a product recall crisis.

In consistence with the cognitive dissonance theory, Dawar and Pillutla (2000) find that in a product-harm crisis situation, customers who have strong prior expectations may minimize cognitive dissonance by selectively processing available information and thus think more positively about a firm towards which they have prior positive attitudes. Pre-existing levels of customer loyalty, customers' familiarity with the brand, and prior perceptions of and commitment to the brand have all posited to moderate the impact of product recalls (Cleeren *et al.*, 2007; Ahluwalia *et al.*, 2000; Dawar and Pillutla, 2000; Mowen *et al.*, 1981). This body of research suggests that such market-based assets provide companies with a goodwill "buffer" among consumers against negative events like product recalls. More broadly, the literature suggests that strong customer relationships indicated by high levels of satisfaction and attitudinal loyalty serve as "insurance" against external shocks and changes (Fornell, 1992).

However, Rhee and Haunschild (2006) provide a different argument, which is more in line with the Contrast theory. They purport that because consumers tend to have higher expectations for reputed brands or the companies possessing the strong brands,

when these expectations are violated in a crisis situation such as a product recall, the consumers are more likely to be shocked and feel betrayed that they will act more negatively and thus penalize the firms more. In a study of automobile recalls, these authors find that a brand's good reputation can be a liability and the market share of the more reputed manufacturers suffered more than their less reputed counterparts.

Competitive and Contagious Effects

Product recalls not only impact the announcing firm, but also have significant consequence for its competing firms in the market. Information transfer theory suggests that an action by one firm conveys information about other firms, and this subsequently affects their performance in the market. The logic behind this is that "firms in the same industry face the same or similar states of the world, so each firm's announcement says something about state-of-the-world uncertainty for its competitors" (Schipper, 1990: 99). Previous literature in marketing, finance and accounting has well documented such phenomena. The types of events studied include layoffs (Goins and Gruca, 2008), new product introductions (Zantout and Chaganti, 1996), drug withdrawals (Ahmed *et al.*, 2002) and earning reports (Lang and Stulz, 1992). In marketing, researchers have long been interested in finding how marketing events or actions of the focal firm can affect its competitive advantages against other players in the market and how competitors are influenced by these events and actions. For example, Simon and Sullivan (1993) studied major marketing events of Coca Cola and how they impact the market performance of Coca Cola and its main rivalry, Pepsi.

While the consensus has been that the action of one firm will impact its competitors as well as itself, it is hard to determine the consequence of such events. There are two effects from such events, and the competitive and contagious effects work against each other. The competitive effect suggests that because the firms are competing in the market for the limited resources and customers, one firm's curse is another firm's

blessing. It is especially true for firms selling similar products and serving the same market (Simon and Sullivan, 1993). Equally possible and important is the contagious effect. Firms of the same product category are subjected to the same external environment and resource constraints. One firm's failure may indicate the same problem for other firms (Schipper, 1990). Depending on different situation, event attributes, firm specific characteristics, and the market structure, either of the competitive and contagious effects can take a dominating role. The similarity between the event firm and its competitors can also explain the strength of the competitive and contagious effects (Goins and Gruca, 2008).

Hypotheses

Overall, because of the negative implications from a product recall and the empirical evidence from previous research on this topic, we expect to be able to replicate previous findings regarding the overall short-term negative influence the product recalls have on the announcing firm's stock prices:

H1a: When faced with a product recall, the announcing firm will exhibit short-term negative financial market returns.

Among the announcing firm's competitors, we have to distinguish two types of competitors. There are competitors who share the most similar product portfolio as the announcing firm, and there are firms which are in the same industry as the announcing firm but are not in direct competition with the focal firm. We call the former direct competitors and the latter indirect competitors. The competitive effect may dominate the contagious effect for those direct competitors who share the greatest similarity with the recall firms (Goins and Gruca, 2008), while the two effects may offset each other for indirect competitors. Thus we expect:

H1b: When faced with a product recall, the announcing firm's direct competitors will exhibit short-term negative financial market returns.

H1c: When faced with a product recall, the announcing firm's indirect competitors will not exhibit short-term negative financial market returns.

One of our key objectives is to find how brand equity can moderate product recalls' impact on firm performance. While there are two competing theories for how expectations about the firms can influence the negative impact from product recalls, brand equity is more than just expectations and a strong brand equity has dimensions such as familiarity and strong and unique associations that will may help firms in the product recall. Given the many above mentioned positive impact of overall brand equity on firms, we expect:

H2a: When faced with a product recall, the firm that own higher equity brands will experience less negative (or more positive) cumulative abnormal returns (CAR).

H2b: When faced with a product recall, the announcing firm's direct and indirect competitors that own higher equity brands will experience less negative (or more positive) cumulative abnormal returns (CAR).

However, given the many constructs of the brand equity, it is interesting to know which constructs are the driver for the proposed phenomenon. As suggested by Keller (2003), a future direction for research is to decompose brand equity into brand familiarity and brand likability and investigate the differentiating effect of these two aspects of brand equity. Familiarity refers to how familiar the consumers are with the brand and brand likability indicates how favorable consumers feel about the brand. If a brand is perceived to be of high quality, it tends to be liked and viewed favorably by consumers.

All theories and evidence about brand familiarity point to a positive and protective role in a product recall situation. Familiar brands are easy and quicker to access from consumers' memory and thus are more likely than unfamiliar brand to be in the consumer's consideration set. Since consumers may think they know the familiar brands better than unfamiliar one, they are more confident in choosing those brands. For brand quality, most theories and studies also suggest a positive role. Higher quality

perception encourages loyal customers and reduces price sensitivity. Thus when we decompose brand equity into brand familiarity and brand quality perception, we hypothesize the following:

H3a: When faced with a product recall, the announcing firm that owns more familiar brands will experience less negative (or more positive) cumulative abnormal returns (CAR) than those owning less familiar brands.

H3b: When faced with a product recall, the announcing firm's competitors (direct and indirect) that own more familiar brands will experience less negative (or more positive) cumulative abnormal returns (CAR) than those owning less familiar brands.

H4a: When faced with a product recall, the announcing firm that owns higher quality brands will experience less negative (or more positive) cumulative abnormal returns (CAR).

H4b: When faced with a product recall, the announcing firm's competitors (direct and indirect) that own higher quality brands will experience less negative (or more positive) cumulative abnormal returns (CAR).

Research Design

Data

The data used in the study are based on product recall announcements and reports from U.S. Department of Agriculture (USDA), U.S. Food and Drug Administration (FDA), Consumer Product Safety Commission (CPSC), the *Wall Street Journal* and *Dow Jones News Service*. All product recalls occurred within the 6 year period between January 1st 2001 and December 31st 2006. Following previous event studies (e.g., Pruitt and Peterson, 1986), product recalls related to automobiles are excluded from our data set for several reasons. First, automobiles are complex products and as a result have so many associated product recalls that the stock market reaction tends to be non-existent (Pruitt and Peterson, 1986). Second, if we were to include automotive product recalls in our

dataset, the large number of automotive recalls compared to other types of recalls may bias the combined result. Third, automotive recalls are so frequent (e.g., daily or weekly events) that they are less likely to have as a dramatic impact as more rarely observed recalls. Fourth, most automotive recalls are not severe and for the vast majority involve small accessories, thus unlikely to generate significant abnormal stock price movements.

Our dataset also excludes product recalls from retailers because in such cases it is often not clear whether it is the retailer or the manufacturer that bears the burden of product recalls (Pruitt and Peterson, 1986). For example, on Jan 13th 2005, the Consumer Product Safety Commission, jointly with Wal-Mart, announced the voluntary recall of 600,000 slow cookers because of defective handles. The slow cookers were manufactured by Hamilton Beach/Proctor-Silex Inc., but Wal-Mart was the sole distributor. In this example, the direct cost of the recall was probably assumed by Hamilton Beach/Proctor-Silex Inc. and Wal-Mart was not affected.

Finally, following standard data selection procedures outlined for event studies (e.g., Hoffer *et al.*, 1988), we also eliminated from our dataset multiple product recalls for a single date, as well as contaminated event windows i.e. if one or several other significant events occurred within the time window of abnormal returns we are testing, we delete the recall observation. We utilized the time window of [0, 2], which is a three day window including the product recall announcement day and the day after. In summary, each observation (i.e., product recall) in our dataset is a unique combination of recall date and company. An inspection of Figure 2.2 reveals that most negative impacts on the firms occur within our three-day window [0,2].
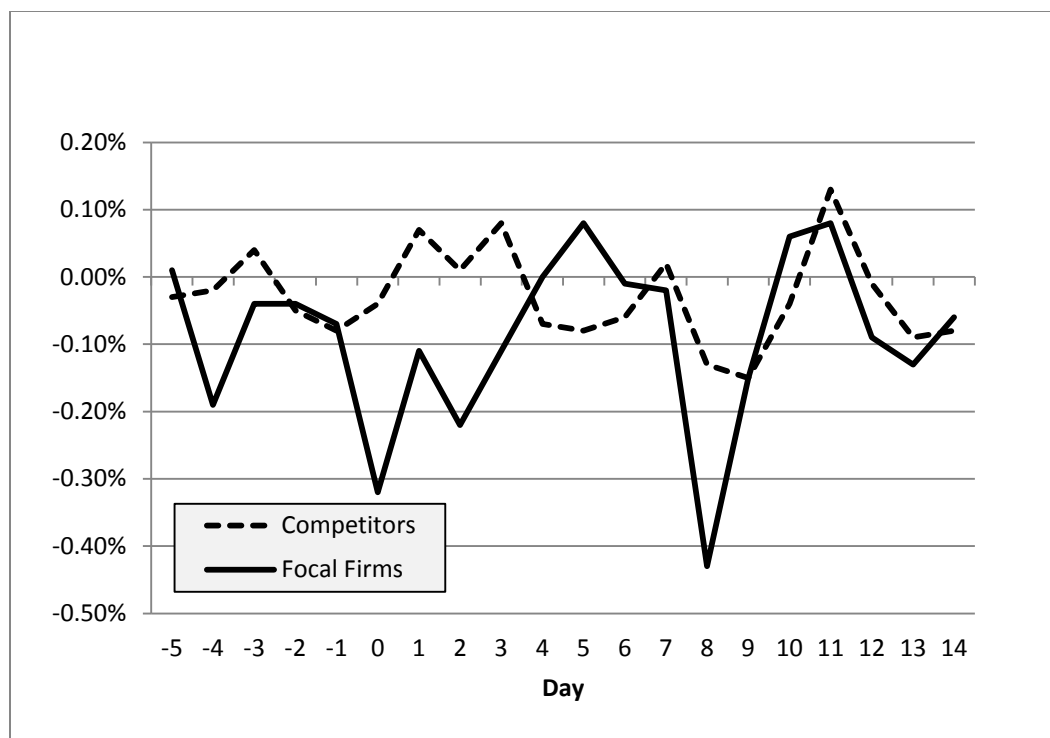
Figure 2.2 Abnormal Stock Returns by Day for Focal Firms and Competitors

For each of these recall events we content analyzed and code for event characteristics (i.e. announcement source, severity, industry, etc.). Using a framework by Siomkos and Kurzbard (1994) and Chen, Ganesan and Liu (2009), we coded each event as proactive or passive according to whether there were incidents before the announcement. We also attempted to examine whether the product recall was mandatory or voluntary. However, for almost every single product recall announcement, the government site release always used language such as "…in cooperation with (Government Agent Name), (Company Name) voluntarily …" making it impossible to unequivocally state whether the recall was mandatory or voluntary.

We then matched this sample of product recalls to the *Harris Interactive*'s *EquiTrend*© database for the same period. The *EquiTrend*© database is collected annually from more than 20,000 US consumers of more than 1,000 large brands across 35

categories to measure consumers' evaluations of their brand perceptions and experiences. The consumer sample is designed to be representative of the adult US population. The *EquiTrend*[©] brand equity variable is based on the brand's scores in familiarity, quality and purchase intent.

In order to replicate event studies as they are analyzed in the financial literature, our empirical model also include a pre-event window of abnormal stock returns[4], prior year return of assets (ROA) and a measure of firm size. We utilize the *Compustat* database to computed return-on-assets and firm size as measured by total firm assets.

After the above procedures, we obtain 162 recall events with focal firms which overlap with our *EquiTrend*[©] data set. Among them, 143 events were announced by government sources, and 27 were reported in the *Wall Street Journal*.

Then we augment this data set with competitors in the same *EquiTrend*[©] categories. The rationale is to increase the power of our analysis with more data points. At the same time, because we will code a variable indicating whether the firm is the event announcing firm (focal firm), we will be able to investigate whether some variables work differently for focal firms and their competitors. It is important for marketers to investigate competitors alongside the focal firms to capture the dynamics in the market place. Simon and Sullivan (1993) give an example of doing this when studying the effect of key marketing events on the two rivals (Coca Cola vs. Pepsi) in the beverage industry. Besides these competitors, we checked the company and industry information from *Hoover's Online*, and recorded major competitors of the announcing firm as defined by *Hoover's*. After supplementing the data with competitors, we have 2005 observations. The following table lists the *EquiTrend*[©] Categories.

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[4] Please see Appendix 1 for how we operationalize abnormal stock returns.

Table 2.1
Number of Observations by EquiTrend[©] Categories

Category	Obs.	Percent
Apparel/Accessories	75	3.74
Appliances	124	6.18
Beverages	36	1.80
Computer-Related Products	229	11.42
Consumer Electronics	210	10.47
Foods	592	29.53
Health and Beauty Products	168	8.38
Hotels/Restaurants	44	2.19
Household Products	82	4.09
Media Other	14	0.70
Motorcycles	20	1.00
E-Commerce	32	1.60
Drug: OTC	73	3.64
Drug: Rx	154	7.68
Telecommunications	8	0.40
Tools	44	2.19
Toys	100	4.99
Total	2,005	100%

We use the *EVENTUS* software package provided by Wharton Research Data Services (WRDS) to compute abnormal stock returns for each observation (firm level events) in our data set. Please see Appendix for full information about the abnormal stock returns we use in the study. Following default abnormal stock returns calculation procedures; we use a minimum of 3 and a maximum of 255 trading days ending 46 days before the event and for several different time windows around the recall announcement date. To account for stock price momentum before the recall announcement, we compute a pre-event window between 30 days and 2 days prior to the product recall date (Acharya, 1993; Fama, 1998) using the *EVENTUS* database.

Tables 2.2, 2.3 and 2.4 detail descriptive statistics for all variables used in our analyses. For those who recalled products in our sample period, the average number of

recalls by them is 4.85, and it seems that when we include competitors into the data, we do not see significant abnormal return for the [0,2] window, which may be due to the fact that for competitors competitive and contagious effects offset each other.

We also report the correlations among the variables for the recall announcing firms and their competitors in Tables 2.5 and 2.6. The tables show that for the recall announcing firms, brand equity and brand quality is correlated with $CAR_{[0,2]}$ more than brand familiarity, while for competitors, brand familiarity is correlated with the abnormal returns more than brand equity and brand quality.

Event Study

Event studies have been widely used in both the finance and marketing literatures to examine the effect of an economic event on stock prices (Agrawal and Kamakura, 1995; MacKinlay, 1997). Product recalls are clearly important economic events as they can have significant impact on a firm's product-market and financial performance (Jarrell and Peltzman, 1985). In order to assess the timing and magnitude of the impact of the product recall on the related firm's stock price, existing research has traditionally relied on regression models, using abnormal stock returns[5] as the dependent variable, and a number of moderating event characteristics as predictors (e.g., Davidson and Worrell, 1992; Hoffer *et al.*, 1988; Jarrell and Peltzman, 1985; Pruitt and Peterson, 1986). The event characteristics explored frequently concern details of the product recall, such as: (1) the amount of publicity generated by the recall; (2) whether the recall is mandatory or voluntary; (3) the reasons dictating the recall (i.e., reported illness, death, whether or not children were involved, etc.); (4) whether the recall involves repair or withdrawal of the product from the marketplace; and, (5) the total associated direct costs to the firm (e.g.,

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[5] Abnormal stock returns are usually computed using a relatively narrow window of trading days around the product recall date. These abnormal returns are assumed to measure the financial markets reaction to the product recall event.

Table 2.2 Univariate Statistics for Recall Announcing Firms (N=162)

Variable	Mean	Std Dev	Std Error	Min	p5	Median	p95	Max	Skewness
$CAR_{[0,2]}$	-0.006	0.022	0.002	-0.069	-0.052	-0.004	0.024	0.052	-0.675
$CAR_{[-30,-2]}$	0.002	0.094	0.007	-0.298	-0.154	0.002	0.142	0.331	-0.218
ROA (return-to-assets)	0.064	0.058	0.005	-0.118	-0.028	0.057	0.160	0.223	-0.118
Firm Size (total assets)	49804	120457	9464	1588	3416	14222	96484	750507	4.568
Leverage (debt-to-assets)	0.517	0.144	0.011	0.162	0.288	0.553	0.731	0.905	-0.147
N of Recalls	4.85	3.98	0.31	1	1	4	13	19	1.366
N of Bus. Segments	4.96	2.08	0.16	1	1	5	8	11	-0.461
Advertising-to-Sales	0.050	0.036	0.003	0.007	0.009	0.035	0.121	0.143	1.062
R&D-to-Sales	0.120	0.342	0.027	0.004	0.005	0.022	1.198	1.593	3.856
Brand Equity	63.94	5.31	0.42	50.66	54.37	64.28	70.47	77.16	-0.305
Brand Familiarity	0.75	0.13	0.01	0.20	0.45	0.76	0.92	0.96	-1.429
Brand Quality	6.86	0.56	0.04	5.02	5.96	6.91	7.61	8.33	-0.416

Table 2.3 Univariate Statistics for Recall Announcing Firms' Competitors (N=162)

Variable	Mean	Std Dev	Std Error	Min	p5	Median	p95	Max	Skewness
$CAR_{[0,2]}$	0.000	0.026	0.001	-0.188	-0.041	0.000	0.040	0.134	-0.274
$CAR_{[-30,-2]}$	0.003	0.106	0.002	-0.701	-0.159	0.004	0.155	0.796	-0.147
ROA (return-to-assets)	0.062	0.114	0.003	-0.987	-0.080	0.067	0.188	0.482	-4.372
Firm Size (total assets)	30842	82355	1918	82	542	10706	85301	750507	6.763
Leverage (debt-to-assets)	0.525	0.240	0.006	0.066	0.242	0.508	0.802	2.597	3.671
N of Recalls	3.11	2.76	0.06	1	1	2	9	19	1.943
N of Bus. Segments	4.03	2.34	0.05	1	1	4	8	11	0.160
Advertising-to-Sales	0.050	0.036	0.001	0.007	0.007	0.039	0.138	0.143	1.181
R&D-to-Sales	0.104	0.275	0.006	0.004	0.004	0.022	0.215	1.593	4.910
Brand Equity	60.50	7.55	0.18	35.16	44.01	61.65	71.50	79.98	-0.646
Brand Familiarity	0.66	0.20	0.00	0.06	0.21	0.72	0.94	0.98	-0.957
Brand Quality	6.50	0.82	0.02	3.41	4.54	6.64	7.59	8.33	-1.114

Table 2.4 Firm Types, Recall Characteristics and Announcement Source

Firm	Freq.	Percent
Focal Firms	162	9.27
Direct Competitors	257	12.82
Indirect Competitors	1,586	79.10
Total	2,005	100.00
Recall Characteristics		
Involved Customer Fatality	3	1.85
Food/Beverage/Drug Industry	56	34.57
Incidents Recalled Prior to Recall	86	53.09
Recall Announcement Source		
Government	143	88.27
Wall Street Journal	27	16.67
Dow Jones News Wire	48	29.63
Gov. & WSJ	15	9.26

Table 2.5 Correlation for Recall Announcing Firms (N=162)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 CAR$_{[0,2]}$	1.000																
2 CAR$_{[-30,-2]}$	0.047	1.000															
3 ROA (return-to-assets)	0.061	0.004	1.000														
4 Firm Size (total assets)	-0.029	0.040	-0.091	1.000													
5 Leverage (debt-to-assets)	0.037	-0.086	-0.184	-0.261	1.000												
6 Government Source	-0.051	0.030	-0.238	-0.092	0.234	1.000											
7 Wall Street Journal Source	-0.038	-0.070	0.025	0.045	-0.111	-0.455	1.000										
8 Food/Beverage/Drug Industry	0.030	-0.011	0.276	0.001	0.194	-0.138	0.023	1.000									
9 Involved Customer Fatality	0.166	0.037	-0.028	-0.138	0.005	0.050	0.061	-0.100	1.000								
10 Incidents Prior to Recall	0.033	-0.023	-0.216	-0.138	0.048	0.311	-0.077	-0.487	0.129	1.000							
11 N of Recalls	0.127	-0.051	-0.001	-0.216	0.303	0.300	-0.275	-0.084	0.153	0.174	1.000						
12 N of Bus. Segments	-0.054	-0.037	-0.128	0.335	-0.071	-0.017	-0.079	-0.110	0.047	0.010	0.020	1.000					
13 Advertising-to-Sales	0.100	-0.041	0.041	-0.239	-0.059	-0.040	0.061	0.049	0.186	-0.013	0.196	0.164	1.000				
14 R&D-to-Sales	-0.162	0.092	-0.111	0.133	-0.277	-0.031	-0.020	-0.125	-0.036	-0.113	-0.295	-0.044	0.099	1.000			
15 Brand Equity	0.204	0.020	0.049	-0.269	0.208	0.158	-0.123	-0.250	0.095	0.146	0.330	0.027	0.155	-0.240	1.000		
16 Brand Familiarity	0.080	0.001	0.125	-0.180	0.240	0.177	-0.028	-0.079	0.093	0.117	0.343	-0.013	0.112	-0.194	0.648	1.000	
17 Brand Quality	0.161	-0.010	0.013	-0.298	0.204	0.152	-0.069	-0.344	0.106	0.220	0.321	0.085	0.176	-0.235	0.911	0.693	1.000

Table 2.6 Correlations for Recall Announcing Firms' Competitors (N=1843)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 $CAR_{[0,2]}$	1.000																
2 $CAR_{[-30,-2]}$	0.069	1.000															
3 ROA (return-to-assets)	0.082	-0.022	1.000														
4 Firm Size (total assets)	0.017	-0.044	0.256	1.000													
5 Leverage (debt-to-assets)	0.022	-0.021	-0.336	-0.274	1.000												
6 Government Source	-0.047	0.065	-0.117	-0.037	0.011	1.000											
7 Wall Street Journal Source	0.017	-0.022	-0.026	0.028	-0.009	-0.335	1.000										
8 Food/Beverage/Drug Industry	0.031	-0.017	0.170	0.151	0.114	-0.196	-0.002	1.000									
9 Involved Customer Fatality	0.014	-0.008	0.074	0.051	-0.055	-0.130	0.106	0.103	1.000								
10 Incidents Prior to Recall	0.001	0.007	-0.076	0.027	-0.019	0.186	-0.039	-0.402	0.099	1.000							
11 N of Recalls	-0.005	-0.015	0.011	-0.026	0.091	0.140	-0.072	0.206	-0.051	-0.040	1.000						
12 N of Bus. Segments	0.031	-0.004	-0.064	0.394	-0.043	0.123	-0.001	-0.137	-0.107	0.057	0.016	1.000					
13 Advertising-to-Sales	0.040	-0.028	-0.111	-0.293	0.182	-0.029	0.007	-0.038	0.001	-0.046	0.012	-0.070	1.000				
14 R&D-to-Sales	-0.066	-0.006	-0.048	-0.109	-0.172	-0.022	0.057	-0.153	0.021	-0.029	-0.157	-0.091	0.039	1.000			
15 Brand Equity	0.024	-0.035	-0.012	-0.087	0.162	0.140	-0.087	0.034	-0.116	0.002	0.101	0.186	0.074	-0.230	1.000		
16 Brand Familiarity	0.056	-0.009	0.015	0.010	0.244	0.128	-0.051	0.056	-0.150	-0.047	0.152	0.221	0.083	-0.261	0.724	1.000	
17 Brand Quality	0.030	-0.039	-0.010	-0.100	0.171	0.153	-0.077	-0.032	-0.156	0.016	0.108	0.195	0.115	-0.232	0.947	0.782	1.000

Davidson and Worrell, 1992; Bromiley and Marcus, 1989; Hoffer *et al.*, 1988; Pruitt and Peterson, 1986; Jarrell and Peltzman, 1985).

Most event studies focus on relatively short time windows because by efficient market theory, these "abnormal" returns cannot be persistent. In our study, we decide to utilize the two-day window, which includes the announcement day and the day after that.

Empirical Model

To empirically explore the association between product recalls and abnormal stock price returns we utilize linear regression analyses (Srinivasan and Bharadwaj, 2004). Given the standard data cleaning procedures followed, each product recall is actually an independent observation (Hoffer *et al.*, 1988), thus making linear regression an appropriate methodology to examine the impact of product recalls on abnormal stock price returns, as well as examining the moderating role that marketing strategies and actions might have on this association. From an estimation point of view, the only additional concerns were non-normality, multicollinearity and endogeneity. With regards to non-normality, since many of the variables exhibit skewed distributions, we performed a natural log transformation to them. Following this transformation, all variables are deemed close to normally distributed, as tested via a White's statistic. Close inspection of Tables 2.5 and 2.6 suggests that multicollinearity is not a significant issue in our data. For all regressions estimated, the variance inflation statistics and condition indices confirmed that multicollinearity is not of concern. Finally, with regards to endogeneity, we utilize a one year lag structure, thus alleviating and avoiding the issue of endogeneity. Some firms have multiple recall events or they appear in multiple recalls events as competitors in the same category, and to control for the correlation within these clusters, we use the robust standard error estimates to test our hypothesis.

Therefore, the empirical model estimated is:

$$CAR_{(0,2)it} = \alpha_{it} +$$

$$\beta_1 \, CAR_{(-30,-2)it} + \beta_2 \, ROA_{\,i(t-1)} + \beta_3 \, Firm \, Size_{\,i(t-1)} + \beta_4 \, Leverage_{\,i(t-1)} +$$

$$\beta_5 \, Government_{\,it} + \beta_6 \, WSJ_{\,it} + \beta_7 \, Severity_{\,it} + \beta_8 \, Incidents_{\,it} +$$

$$\beta_9 \, N \, of \, Segments_{\,i(t-1)} + \beta_{10} \, N \, of \, Recalls_{\,it} + \beta_{11} \, Food/Beverage/Drug_{\,it} +$$

$$\beta_{12} \, Advertising/Sales_{\,i(t-1)} + \beta_{13} \, R\&D/Sales_{\,i(t-1)} +$$

$$\beta_{14} \, Brand \, Equity_{\,i(t-1)} +$$

$$[\beta_{14} \, Brand \, Familiarity_{\,i(t-1)} + \beta_{15} \, Quality \, Perception_{\,i(t-1)}] +$$

$$\sum_s \beta_s \, Year \, Dummies + \varepsilon_{it} \qquad\qquad (8)$$

where i indicates firms and t indicate the time points (year). $CAR_{(0,2)}$ is the cumulative abnormal stock return for the two-day window including the recall announcement day and the day after it. $CAR_{(-30,-2)}$ is the pre-event window. *Firm Size* is the natural log of firm's total assets; *ROA* is the natural log of the firm's return-on-assets. *Leverage* is calculated as dividing the sum of current liabilities and long term debts by total assets. The next three dummies represent whether the recall was announced by a government source (e.g. CSPC, FDA, FSIS), reported in the *Wall Street Journal*, and whether it involved fatalities. *Number of Business Segments* represents the number of business segments in which the firm operates in as provided by *Compustat* data base. *Number of Recalls* is the number of recalls by the same company in the sample period. *Food/Beverage/Drug dummies* captures whether the recall is related to a food, beverage or drug product. *Advertising/Sales* and *R&D/Sales* controls for the impact of company spending on its financial market performance. *Brand Equity* is the consumer-based brand equity measure provided by *EquiTrend*©. *EquiTrend*© further provides different constructs of the overall brand equity, and we use the *Brand Familiarity* and *Quality Perception* dimensions. Finally, we include dummies for years.

We estimate Equation (8) separately for three groups: recall announcing firms, their direct competitors, and their indirect competitors.

<u>Results and Discussion</u>

Table 2.7 presents the mean abnormal stock returns for the days around the recall announcement. It suggests that the announcing firms suffer the most for the first three days on and after the announcement date. On average, the announcing firms in our sample have a sizable negative abnormal stock return at -0.32%, and it is statistically significant. The abnormal stock returns for the announcing firms remain negative for the next 3 days (-0.11%, -0.22%, and -0.11%). This seems to support our Hypothesis 1a that the announcement firm will be negatively impacted by the product recall. Table 2.7 also reports abnormal returns for competitors. The negative impact of product recalls on the announcing firm's direct competitors is minimal and statistically insignificant at the .05 level. However our Hypothesis 1b that direct competitors benefiting from the competitive effect in a product recall is not supported. Hypothesis 1c seems to find support that we do not see a pattern of statistically significant movement of indirect competitors.

Table 2.8 details the results obtained for different regression models when using $CAR_{[0,2]}$. Overall, our results suggest that possession of strong brands significantly contributes to shielding the announcing firms from the negative abnormal stock price returns associate with a product recall. The coefficient for Brand Equity is 0.195 ($p \leq 0.05$). The results support Hypothesis 2a that the strong brands (brand equity) provides a buffer zone for the focal firms in a product recall crisis. For competitors, the brand equity does not improve firms' performance in the stock market and Hypothesis 2b is not supported. Figure 2.2 demonstrates that firms with higher brand equity suffer less than those with lower brand equity.

To further investigate the mechanism at work behind the brand equity's moderating role for firm financial performance in a product recall situation, we decomposed the overall brand equity into familiarity and quality perception. Table 2.8 does not support Hypothesis 3a that brand familiarity is protecting the product recall

Table 2.7 Mean Abnormal Returns Around Recall Day

Day	Recall Announcing Firms (N=162)			Direct Competitors (N=257)			Indirect Competitors N=(1586)		
	Abnormal Return	Positive: Negative	p-value	Abnormal Return	Positive: Negative	p-value	Abnormal Return	Positive: Negative	p-value
-5	0.01%	74:88	0.3590	-0.04%	131:126	0.3671	-0.03%	722:864	0.1522
-4	-0.19%	73:89	0.0428	-0.10%	121:136	0.2954	0.00%	779:807	0.3115
-3	-0.04%	73:89	0.3352	0.11%	130:127	0.2444	0.02%	788:798	0.1244
-2	-0.04%	68:94	0.2212	0.02%	129:128	0.2345	-0.06%	746:840	0.1016
-1	-0.07%	68:94	0.2425	0.15%	137:120	0.0341	-0.12%	719:867	0.0010
0	-0.32%	71:91	0.0063	-0.13%	115:142	0.0959	-0.02%	775:811	0.2069
1	-0.11%	73:89	0.1941	-0.01%	122:135	0.4717	0.08%	796:790	0.1228
2	-0.22%	71:91	0.0391	0.02%	129:128	0.3454	0.01%	790:796	0.3563
3	-0.11%	67:95	0.2597	0.14%	138:119	0.1214	0.07%	775:811	0.0362
4	0.00%	68:94	0.3292	-0.16%	106:151	0.0104	-0.05%	733:853	0.2842
5	0.08%	81:81	0.3173	-0.05%	113:143	0.1113	-0.09%	736:850	0.0532

Table 2.8 Regression Results for Product Recalls and Firm Cumulative Abnormal Stock Returns

Variable	Brand Equity			Brand Familiarity & Quality		
	Focal Firms	Direct Competitors	Indirect Competitors	Focal Firms	Direct Competitors	Indirect Competitors
$CAR_{[-30,-2]}$	0.043	0.136*	0.072*	0.050	0.145**	0.070*
ROA (return-to-assets)	-0.010	0.112	0.100***	0.008	0.107	0.093***
Firm Size (total assets)	0.132	-0.070	0.002	0.150*	-0.048	-0.005
Leverage (debt-to-assets)	-0.012	-0.126*	0.054	-0.002	-0.103	0.038
Government Source	-0.143	0.064	-0.051*	-0.128	0.070	-0.054*
Wall Street Journal Source	-0.102	0.061	0.005	-0.101	0.061	0.002
Food/Beverage/Drug Industry	0.076	0.005	0.011	0.099	0.007	0.009
Involved Customer Fatality	0.156***	-0.023	0.007	0.161***	-0.042	0.009
Incidents Prior to Recall	0.059	0.029	0.018	0.054	0.037	0.024
N of Recalls	0.028	0.035	-0.016	0.051	0.033	-0.022
N of Bus. Segments	-0.136	0.037	0.051*	-0.155*	0.047	0.044
Advertising-to-Sales	0.101	0.045	0.045*	0.101	0.051	0.043
R&D-to-Sales	-0.133	-0.056	-0.055*	-0.132	-0.067**	-0.049*
Brand Equity	0.195**	-0.010	0.009			
Brand Familiarity				-0.121	-0.171	0.109**
Brand Quality				0.256*	0.071	-0.065
N	162	257	1586	162	257	1586
Adj. R^2	12.05%	5.14%	2.57%	11.80%	7.05%	2.97%

Note: * $p \le .10$; ** $p \le .05$; *** $p \le .01$

announcing firms. Hypothesis 3b is partially supported and for indirect competitors, it seems those with familiar brand names benefit the most from other firms' product recalls. While brand familiarity does not seem to protect the focal firms, brand quality does show the positive moderating effect. The results support Hypothesis 4a and suggest brand quality is more important than brand familiarity in providing focal firms with a buffer zone in a product recall. But brand quality is not delivering for competitors in the short term.

Chen, Ganesan and Liu (2009) suggest that companies practicing a more proactive strategy when involved in a product recall crisis received more negative market reaction than those using a more passive strategy. Our findings do not support their claims. While the estimates for whether there is an incident (passive) are always in the direction as predicted by Chen, Ganesan, and Liu, they are not statistically significant for the focal firms.

Advertising and R&D spending does not seem to moderate a product recall's influence on the recall announcing firms. While advertising may improve brand familiarity and R&D may promote innovation, they do not have direct impact on the focal firm's abnormal stock returns in the short time window we are examining.

Somewhat surprisingly, we find that diversification in different business segments do not necessarily alleviate the impact a product recall has on a firm's negative abnormal stock price returns. We also find that the prior 30 days abnormal returns (i.e., $CAR_{(-30,-2)}$) and return on assets (ROA) do not have significant influence on abnormal stock price returns for the focal firms, but they do impact competitors in a positive way. Firm size is not statistically significant in most of the models and larger firms do not necessarily fare better than smaller firms in the event of a product recall.

Further, we find that if the product recall is announced by a government agency, the associated abnormal stock returns tend to be more negative for indirect competitors.

Surprisingly, we find no significant estimates for the *Wall Street Journal* sources, which is the primary source for a large number of studies on this topic.

Conclusions

Product recalls have been widely studied in finance, management and marketing. Marketing researchers have historically examined the influence that these events have on customer's perceptions and how these perceptions can then be mapped into future financial performance. While this is a valid approach, we propose a more direct way to examine the impact that these perceptions – specifically, customer based brand equity perceptions – have on abnormal stock price returns, following closely the empirical framework utilized by financial researchers.

Our study supports claims made by marketing researchers (e.g., Ahluwalia *et al.*, 2000; Cleeren *et al.*, 2007; Dawar and Pillutla, 2000; Mowen *et al.*, 1981) that strong brands are assets and can protect companies from negative events such as product recalls. This provides some justification for the millions of dollars (and even billions) that companies spend in creating, promoting and defending their brands. These strong brands, not only increase present cash flows, guarantee future cash flows, but can also create a "goodwill buffer" to protect those cash flows from negative events such as a product recall. This confirms that brand equity is a long term asset (Keller 2006).

We also find that by decomposing the brand equity into brand familiarity and brand quality perception, the results seem to suggest that brand quality is the driving force behind the protecting effect of strong brands for the recall announcing firms, but brand familiarity is the driving the benefits a strong brand can give to competitors. This indicates that quality (perception) is not only the long term driver for firm performance (Philips, Chang, and Buzzell 1983), but also a great asset to reduce risks in the very short term in a product recall crisis. Furthermore, for competitors with more familiar brand names, they may benefit from other firm's crisis. This important to firms because now

they are aware of the differentiating impact of the different constructs of the marketing assets (brand equity) they are building, and they should be better prepared for any risk and opportunity in a product recall situation given the status and composition of their brand equity.

While our results have not reversed the disturbing findings by Chen, Ganesan and Liu (2009) about the benefit of firms being passive in product recalls, we do not find support for their claim. And we believe that for some industries, investors do reward firms for being proactive. In addition, the incident variable may not be a very good measure for proactive vs. passive strategy because it may be more reflective of the leakage. When there is an incident, some investors may guess about the possibility of defective products and subsequently product recalls.

We contribute to the current literature on product recalls in several ways. First, we contribute to a better understanding on how marketing actions impact financial performance, by assembling a unique dataset, that merges unique financial (i.e., product recalls) and marketing data (*EquiTrend*©). Second, we provide a more direct way to examine how marketing actions (i.e., customer based brand equity perceptions) moderate the impact of a product recalls on abnormal stock price returns. Third, we find supporting evidence that strong brands are significant assets, which can contribute not only to enhance financial performance, but to protect the firm from negative events. Fourth, by examining the different constructs of brand equity and their impact on the firm performance in the product recall crisis, we promote the understanding of the different driving forces behind overall brand equity. Furthermore, this study also contributes to marketing practice, as it confirms the importance of brand equity as a long term assets that can contribute to create and sustain present cash flows, but can also protect and secure those cash flows in the future.

Limitations and Future Research

As mentioned previously, there is room for improvement on how to code the severity associated with a product recall. Currently, we coded whether a product recall involves death or not. Optimally speaking, we would like to assess the degree of financial losses associated with the product recall. Although the current available data does not allow us to measure this, we would like to further examine how we could correctly proxy this metric. Additionally, we can expand our data by complementing our study with a survey for those firms not in the *EquiTrend*[©] database and thus derive brand equity scores from those surveys. In this way, we have a more representative sample.

Now that we have a better understanding of the product recall events and how marketing assets such as brand equity can help firms, it is even more interesting and urgent for us to find a marketing strategy in dealing with the product recalls. While Chen, Ganesan and Liu (2009) made a major step in this direction, we may require a better approach of defining the marketing strategy. In the future, more studies should be conducted toward this goal.

CHAPTER 3

CONCLUSION

Discussion of Findings

In the paper, we investigate how different measures of customer sentiment can contribute to firm success in the product and financial markets. Both UGC communications and brand equity are important measures of customer sentiment that firms should use to help them understand their customers, enhance their performance in the product market and create value for shareholders in the financial market.

Our study confirms the important role of UGC communications in influencing consumer attitudes and behavior in the product market place. Furthermore, we show that UGC communications, in the form of user reviews, have a direct impact on firm value in the financial market. However, in the example of user reviews for automobiles, not all reviews are the same, with some being more influential than others. We find that reviews from long term owners offer valuable information on product reliability and thus are valued more by consumers than reviews from new buyers. The same pattern shows in analyses for both the product and the financial market.

UGC communications can be measured in different ways for its different dimensions. Our study reveals that volume and valence are the two most important aspects for UGC in the product market. Through the awareness and the persuasive effects, these two aspects of UGC contribute to the success of the product. The analysis of firm idiosyncratic returns further demonstrates that UGC valence is associated with investor assessment of future firm cash flows, and for different firms, UGC communications' impact varies. It seems UGC communications can counteract consumer prior perceptions, like in the case of GM and Ford when favorable long term customer reviews seem to benefit the two firms the most because they are the weakest firms in terms of the reliability ranking.

Alongside UGC communications, the traditional wisdom is that experts play an important role in influencing consumer purchase decisions. We find that expert recommendations are highly associated with the product success, but at the same time it is not clear whether this is because experts are good predictors or are powerful influencers. Our results do not support the influencer hypothesis.

While UGC, as a new way of assessing customer sentiment, shows its credibility as an important factor in influencing firm performance in the financial and product markets, it does not fully substitute other forms of traditional marketing tools such as brand equity measures obtained by professional consulting firms through scientific customer surveys. Our second essay uses a traditional way of assessing customer sentiment and demonstrates the importance of customer-based brand equity in helping firms understand and react to product recalls.

We use brand equity metrics from *EquiTrend*© data set of *Harris Interactive* and investigate how the customer-based brand equity can protect firms in the event of a product recall. Our results confirm findings from other marketing researchers (e.g., Ahluwalia *et al.*, 2000; Cleeren *et al.*, 2007; Dawar and Pillutla, 2000; Mowen *et al.*, 1981) that strong brands insulate companies from product recalls. So brand equity is a long term asset (Keller, 2006) that firms should invest in as insurance against a negative event such as a product recall.

While researchers have long argued for the benefits of owning a strong brand, little has been done to investigate the different dimensions of a brand. By decomposing the overall brand equity into brand familiarity and brand quality perception, we are able to show that for the recall announcing firm, quality drives the protection effect for a firm with high brand equity, and at the same time brand familiarity benefit the firm's competitors, in the marketplace. Brand quality (perception) can be the long term driver for firm performance (Philips, Chang and Buzzell, 1983; Billett, Jiang and Rego, 2009), but in the very short term, we do not find it to contribute to benefiting competitors in a

product recall as much as brand familiarity. By understanding the different roles of brand quality and familiarity, by accurately assessing its status in the marketplace, a firm can make better managerial decisions to not only alleviate the negative impact from a crisis such as a product recall, but also take advantage of the opportunity when its competitors are in a crisis.

Overall our two studies confirm the importance of having a good assessment of customer sentiment in the marketplace. By using different ways to assess customer sentiment (UGC and customer-based brand equity), and investigating their association with firm performance in the financial market as well as the product market, we attest to the fact that marketing assets are driving firm success.

Directions for Future Research

While we have successfully demonstrated the importance of UGC and brand equity in creating and enhancing firm value, our studies have several limitations and leave room for future research on this topic.

For the UGC study, we have identified the following limitations. First, although we believe high involvement durable goods categories are the most relevant for investigating UGC communications, our results may not generalize to product categories other than automobiles because of the peculiar characteristics of these products. For example, the model-year phenomenon is mostly only restricted to automobile manufacturers, who make minimum changes over the 4-5 year period to the same model. For other standardized products, the model will remain the exactly the same for all its market life. Second, our results may be biased by our data source. All our review data are from edmunds.com, edmunds.com users may be different from users from other review sites. For example, if edmunds.com users are more sophisticated and educated than MSN Auto users, and MSN Auto users do not actually check reviews from long time owners, we will find different results. Chevalier and Mayzlin demonstrate in their 2006 paper how

to investigate the site differences. In their study, they compare the impact of online reviews on book sales from *amazon.com* and *bn.com*. If data are available, it is also possible to do a similar analysis for user car reviews using different web sites. Third, a full content analysis of user reviews may reveal more about the working mechanism behind UGC's association with firm performance. The actual texts users post on the web provide important information about consumers, products, and dynamics in this process. Our study does not include a full content analysis and we have only summarized numerical ratings and counted the number of words in the reviews. Use of qualitative content analysis could provide a more in-depth analysis of the actual content of user reviews.

Another interesting avenue for future research is to focus on what firms can "do" to UGC. It is not ethical for managers to control and manipulate UGC, but certainly they have tools to intervene and influence consumers. Now that we have found the positive associations between UGC and firm performance, the next step is to investigate how managers can stimulate positive UGC and reduce negative UGC. One way to reduce negative customer voice may be for firms to provide an outlet and communication channel for consumer complaints. Most people would agree that it is better for the firms if their customers complain to them instead of to other consumers and government agents. In the future, researchers can empirically examine what strategies are the most effective and successful in handling UGC.

For our study on brand equity and product recalls, there is also room for future research. First, the differentiating roles of brand quality and brand familiarity in different situations may be worth further investigation. These constructs have been studied extensively in marketing, but very few studies have examined how they are going to differently impact different firms in different situations. Second, we believe researchers should examine with great care the strategies firms are adopting for product recalls. It is quite disturbing that Chen, Ganesan and Liu (2009) find companies are better off for

being passive rather than proactive. Our results do not seem to support this claim. Furthermore, we believe that the way the measure is constructed is more reflective of an information leakage than a marketing strategy adopted by the firm. More studies are required to probe the success of different strategies for firms in the product recall crisis.

Overall our studies advance marketing knowledge and understanding of how customer sentiment impacts firm performances, both in the product and financial marketplaces. By utilizing a novel form of evaluating the customer sentiment through UGC and a more traditional form of assessing it through proprietary survey data, we are able to demonstrate the importance of gaining insight of customers and their brand perceptions. Our studies are only the first step in investigating the association between customer sentiment and firm performances, and we hope to stimulate more studies on this topic in the future.

APPENDIX A

ABNORMAL RETURNS

We utilized the *EVENTUS* software package available through WRDS to compute
market model abnormal returns (Cowan 2007) defined as follows:

$$R_{jt} = \alpha + \beta R_{mt} + \varepsilon_{jt} \tag{A1}$$

Where R_{jt} is the return of stock j at time t, and R_{mt} is the return of market (our
benchmark) at time t. ε_{jt} is an error term. For our benchmark, we used the return of Center
for Research in Security Prices (*CRSP*) value weighted index. By regressing R_{jt} on R_{mt} for
the estimation period, which *EVENTUS* defaults to be a minimum of 3 days and a
maximum of 255 days ending 46 days prior to the event date, we obtain estimates for α
and β. These estimates allow us to calculate the abnormal return as follows:

$$A_{jt} = R_{jt} - (\alpha_{hatj} + \beta_{hatj} R_{mt}) \tag{A2}$$

A_{jt} is the abnormal return, R_{jt} is the return of stock j at time t, α_{hatj} is estimated α
and β_{hatj} is the estimated β for stock j from equation (1). R_{mt} is the market return, which is
the return of *CRSP* value weighted index for the same period. Basically this views the
abnormal return for a stock as the difference between its current return minus its
predicted (i.e., expected) return according to the historic relationship between the stock
return and the market returns.

Then it is relatively simple to derive the cumulative abnormal return as follows:

$$CAR(T1, T2) = \sum_{t=T1}^{T2} A_{jt} \tag{A3}$$

The cumulative abnormal return is summation of daily abnormal return from time
T1 to time T2. In our study, we will focus on CAR for different time windows. As stated
above, most financial research indicates that abnormal stock price returns tend to be
relatively short lived phenomena. Following traditional event studies procedures, we
examined a combination of time windows (e.g., T1 through T2) ranging from 1 day prior
to the event all the way up to 10 days (approximately 2 trading weeks) past the event.

Closer inspection of these results suggests that a large percentage of the stock price reaction occurred on the one or two days following the event. However, a few studies find stock prices are affected by product recalls not only during the short period after the event but also even two months after the event (e.g., Chu *et al.* 2005; Pruitt and Peterson 1986). Although there is no general agreement as to the exact time frame of the impact of product recalls, the literature suggests that the window to be utilized, should be short, yet include the vast majority of the abnormal returns associated with the recall. In our study, we focus on the two-day window including the day of the recall announcement and the day after. We also look at windows expanding 1 and 2 days before or after the announcement, and they provide substantially similar results.

APPENDIX B

VARIABLE DEFINITIONS FOR THE PRODUCT RECALL STUDY

Variables	Definition
$CAR_{[0,2]}$	Cumulative Abnormal Returns for Day 0 to Day 2. Sum of market adjusted abnormal returns for the announcement date and two days after it
$CAR_{[-30,-2]}$	Cumulative Abnormal Returns from 30 days prior to the recall announcement date to 2 days prior
ROA (return-to-assets)	Ratio of return to total assets
Firm Size (total assets)	Total assets
Leverage (debt-to-assets)	Ratio of debt to total assets
Government Source	1 if the recall was announced by government sources, and 0 otherwise
Wall Street Journal Source	1 if the recall was reported by the Wall Street Journal, and 0 otherwise
Food/Beverage/Drug Industry	1 if the recalled product belongs to the food, beverage and drug category, 0 otherwise
Involved Customer Fatality	1 if the recall involved customer fatality, and 0 otherwise
Incidents Prior to Recall	1 if incidents were reported prior to the recall announcement, and 0 otherwise
N of Recalls	Number of recalls before the current recall by the firm
N of Bus. Segments	Number of business segments of the firm
Advertising-to-Sales	Ratio of advertising to sales
R&D-to-Sales	Ratio of research and development spending to sales
Brand Equity	Brand Equity measures from *EquiTrend* data set
Brand Familiarity	Brand Familiarity measures from *EquiTrend* data set
Brand Quality	Brand Quality measures from *EquiTrend* data set

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