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# The Liability of Good Reputation: A Study of Product Recalls in the U.S. Automobile Industry

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In this paper, we explore opposing theoretical claims about how organizational reputation affects market reactions to product defects. On the one hand, good reputation could be a disadvantage because expectations about product quality are more likely to be violated by defects in highly reputed products. On the other hand, a good reputation could be an advantage because of strong inertial effects on reputation orderings. We empirically test these competing hypotheses using data on product recalls in the U.S. automobile industry from 1975 to 1999. Our results support for the idea that reputation can be an organizational liability in that highly reputed firms suffer more market penalty as a result of their product recalls. We also propose that the reputational effects are moderated by two important factors: substitutability and generalism/specialism. Our results show that having few substitutes with an equivalent level of reputation, or a focused product identity stemming from specialism, buffers the negative market reactions to product recalls. We conclude with a discussion on the implications of these results for institutional, reputation, and status theories.

*Key words*: organizational reputation; product recalls; substitutability; specialism; quality

Over the past 20 years, it has become increasingly apparent from work by organizational theorists, sociologists, and information economists that the possession of good reputation provides a number of benefits to firms. These benefits include lower costs and the ability to charge higher prices (Shapiro 1983, Podolny 1993, Sullivan 1998, Benjamin and Podolny 1999), growth in sales and status (Podolny and Phillips 1996), protection against market entrants (Milgrom and Roberts 1982), increased return to actual quality (Benjamin and Podolny 1999), easier access to capital (Stuart et al. 1999), greater survival rates (Rao 1994), and superior financial performance (Roberts and Dowling 2002). A positive reputation is also important to a firm's competitive advantage because it is a positive signal to potential buyers and suppliers, increasing their willingness to contract with a firm (Fombrun and Shanley 1990, Weigelt and Camerer 1988).

Despite this extensive work in the area of reputation, there has been very little exploration of the ways organizational reputation responds to the revelation of organizational errors in the form of product defects. Is the possession of a good reputation an asset or a liability in such cases? Although there has been work investigating the reactions of various organizational constituencies to errors (e.g., Haunschild and Sullivan 2002), defects (e.g., Haunschild and Rhee 2004), and various forms of controversial organizational actions (e.g., Elsbach 1994), the role of firm reputation or status in this process has not been investigated. Therefore, in this study we investigate how an organization's reputation moderates the negative impact of defect disclosure on its subsequent market performance. Prior research on the disclosure of product defects (such as recalls and airline accidents) measures the damages caused by such defects, including losses in stock market valuation (Barber and Darrough 1996) and product sales (Reilly and Hoffer 1983). In this study we investigate how an organization's reputation might moderate the extent of these damages. In particular, while most researchers claim that good reputation serves as an organizational asset (e.g., Shapiro 1983, Fombrun and Shanley 1990, Fombrun 1996), we also explore the possibility that good reputation might be a liability in these cases, causing firms with a good reputation to suffer more market penalty than firms with a poor reputation.

Second, we also investigate the possibility that the role of reputation in the relationship between product defects and subsequent market outcomes is affected by two important factors: product uniqueness or substitutability (the number of competing products with comparable levels of reputation) and identity focus in terms of whether the firm is a generalist or specialist. Previous research has documented several mechanisms by which substitutability lowers a firm's market power (Burt 1982, White 2002). Also, the focused identity associated with specialism has been shown to facilitate the valuation and authenticity of firm products (Carroll and Swaminathan 2000, Carroll et al. 2002, Zuckerman and Kim 2003). Yet to date there has been little research investigating the role of these factors on reputational effects.

Therefore, we also explore how the effects of reputation on responses to product defects are moderated by product substitutability and generalism/specialism.

In the literature there are two general perspectives on reputation. From an economic perspective, a firm's reputation is closely tied to the value of its previous efforts (e.g., Shapiro 1983). From an organizational and sociological perspective, reputation derives not only from past performance, but also from the status of the firm's exchange partners (e.g., Podolny and Phillips 1996) and other organizational attributes, such as firm age and size (e.g., Perrow 1961, Han 1994, Fombrun 1996). Different terms for the general concept of reputation have been used in different literatures, for example, "status" or "prestige" (e.g., Blau 1964, Podolny 1993), "reputation" (Fombrun and Shanley 1990), "brand reputation," or "image" (e.g., Shapiro 1983). In much work, the concepts of status and reputation are not easily disentangled (Sine et al. 2003, Washington and Zajac 2005), and often one concept is used to define another (Washington and Zajac 2005). Organizational status, however, is essentially concerned with perceptions of an organization's standing relative to others (Sine et al. 2003) and is often defined relative to the standing of network partners (Podolny and Phillips 1996). Reputation is often discussed in terms of the perceptions of an organization's "goodness" or "badness" (Fombrun 1996, Roberts and Dowling 2002) in the eyes of a particular audience.

In this paper, however, we will not address such differences. Instead, we define and use the term reputation to mean *the consumer's subjective evaluation of the perceived quality* of the producer. While firms may bear different types of reputations, such as that of a socially concerned firm or a firm that treats employees well (cf. Fombrun 1996), we concentrate on quality reputation as our underling construct. We do this because we are interested in investigating the effects of firm reputation when product quality is at issue. We then draw on multiple literatures to understand the effects of quality reputation on market responses to defects.

Our study has important implications for theories of reputation and status. First, as noted earlier, there has been very little focus on the possibility that a good reputation may be a liability in some cases. By liability, we mean that it is possible that good-reputation firms may suffer more penalties in some situations (i.e., obtain fewer gains or suffer more losses) than poor-reputation firms. Exploring this possibility could lead to a more balanced view of the effects of firm reputation. Second, while most studies on organizational reputation have shown a unilateral effect of reputation on various outcomes, we investigate the possibility that because the efficacy of reputation is entwined with organizational identity (generalism/specialism) and uniqueness (substitutability), reputational effects may not be as simple as previously thought.

### Context

Our context is the U.S. automobile industry and the product recalls of all automakers in this industry over a 25-year period (1975–1999). We examine the role of reputation in the market response to product defects by investigating how an automaker's reputation affects market share changes in response to these recalls and how the automakers' substitutability and level of generalism/specialism moderate reputational effects. The automobile industry provides a context that allows us to use several well-established sources of information about organizational reputation. Automaker reputations carry an expectation of product quality, and good-reputation automakers are generally believed to have higher-quality products than poor-reputation automakers (Devaraj et al. 2001, Podolny and Hsu 2003). There is also, however, a degree of uncertainty about the actual underlying quality of each automaker's products, which means that consumers tend to rely on the historical results of road tests, consumer surveys, and the market analyses of prestigious institutions as sources of information about product quality. This means that consumers' use of automobile brand as a signal of quality can lead to perceptions that differ from the actual underlying quality of products. For example, "one study showed that GM-marqued cars rolling off its joint plant with Toyota in California were worth less after a few years than identical cars with Toyota badges" (*The Economist* 2002), suggesting that although actual quality was identical in this case, perceptions of quality differed.

## Reputational Disadvantage in Market Reaction to Defects

We first suggest two separate mechanisms that lead to the prediction that good-reputation firms are more likely to suffer penalties from product defects than poor-reputation firms are. The first mechanism relates to consumers' differing reactions to defects across levels of reputation. The second mechanism concerns differential media reactions.

### The Expectancy Violation Effect

The differentiating role of reputation on market penalties is predicted by the proposition that firm reputation helps create expectations about a firm's products among potential buyers (Shapiro 1983). A good reputation conferred on a firm enhances a buyer's expectation that the firm's products will be of high quality, which in turn increases the buyer's quality reliance. However, buyers do not place high expectations on a product from a firm with a low reputation. The marketing literature has long shown the existence of market segments, with some consumers focused on high quality/high price and others focused on low quality/low price (e.g., Heath and Chatterjee 1995). As long as buyers share expectations

about product quality across reputations, the order of reputation naturally translates into the ordering of quality expectations.

Furthermore, quality expectations can be viewed as an implicit promise from firms to their potential customers to produce goods with a quality level commensurate with reputation and product expectations. Given this, the better a firm's reputation, the greater the extent to which its product defects will be perceived as a breach of this implicit promise. Consequently, the negative repercussions from the disclosure of product defects will be stronger for high-reputation products. This speculation has also been interpreted as an expectancy-violation effect (Burgoon and LePoire 1993), where people react more strongly to actions that violate their previous expectations of how the other party is likely to behave.

Marketing research has shown that different market segments are likely to react differently to expectancy violations (Heath and Chatterjee 1995). There is also work suggesting that consumers of high-reputation (i.e., high-quality) firms might be more sensitive to product defects by these firms and more likely to penalize these automakers by switching to other brands. First, comfort and low maintenance costs are important predictors of luxury car ownership (and by implication, not as important to lower-end car ownership) (Sukhdial et al. 1995). A recall is a threat to low maintenance costs and might cause switching. Also, losing quality is generally quite aversive to consumers (Hardie et al. 1993) and is more likely to occur at the higher end of the quality distribution than the lower end (Simonson and Tversky 1992). Thus, consumers at the low end have lower expectations about defects, which means that the high end of the market gets hurt more than the low end in a recall situation.

This reputational disadvantage in the social penalty associated with the disclosure of product defects can be formally modeled using a Bayesian learning model of beliefs. With Bayesian learning, consumers begin with prior beliefs of producers' product quality. They then make buying decisions based on these beliefs, and they modify their beliefs in the light of their direct and/or indirect experience using Bayes' rule (Stigler 1983). An essential notion in the Bayesian learning model is that consumers modify their beliefs on the basis of the extent to which observed quality performance differs from their prior beliefs (Cyert and DeGroot 1987). When consumers believe that a producer has a high-quality product (e.g., Lexus), they are more likely to modify their beliefs after observing a defect in that producer's products than they are with a defect in a relatively poor-quality product (e.g., Kia). This mechanism thus provides a plausible way in which the disclosure of product defects entails more market penalty for good reputation products.

### Differential Attention from the Media

A second explanation for why good-reputation firms might suffer more market penalty is that the product defects of good-reputation firms are likely to receive more attention from the mass media. Many noticeable defects in firms' products or services, such as product recalls and operational accidents/incidents, are reported and evaluated by the mass media. In the year 2000, for example, *The Wall Street Journal* included about 100 articles dealing with product recalls and about 80 articles reporting airline accidents. As there are likely to be time and energy constraints on the extent to which the media can attend to product defects (Cyert and March 1963), the media are likely to engage in paying selective, rather than exhaustive, attention to the disclosure of product defects (cf. Hayward et al. 2004, Rindova et al. 2006).

An important criterion in selecting product defects to publicize would be how much potential attention the event is likely to attract. Journalists have long insisted that prominence is an obvious attention trigger, and people are likely to pay more attention to articles that report on a prominent target or set of events (Hoffman and Ocasio 2001). Fombrun and Shanley (1990) posit that reputation is positively related to media attention (cf. Deephouse 2000). And individuals tend to pay more attention to salient information (Tversky and Kahneman 1974). These arguments suggest the product defects of high-reputation firms are more likely to be spotlighted than those of low-reputation firms, because prestigious products are widely and popularly known, and, more important, the defects of those prestigious products are an unexpected and salient event.

To examine whether this process might be occurring, we looked at the media attention paid to the recalls of a high-reputation and a low-reputation auto firm. According to *Consumer Reports*, Kia has the least customer satisfaction of any of the major car brands, and Lexus has the most (*Consumer Reports*, 1995–1999). Lexus announced six product recalls over the 1995–1999 period, and Kia announced four recalls. According to a *Lexis/Nexis* search of general interest publications, the Lexus recalls were reported 27 times in general newspapers and 18 times in *The Wall Street Journal*. The Kia recalls were mentioned six times in the general newspapers and four times in *The Wall Street Journal*. Thus, the Lexus coverage was approximately 7 newspaper reports per recall, while the Kia coverage was approximately 2.5 newspaper reports per recall. While this is obviously not conclusive evidence, it does suggest disproportionate media coverage for high-reputation firms' product defects, which seems to support the idea that product defects of high-reputation firms draw a larger reaction than those of low-reputation firms.

To summarize thus far, it may be that good-reputation firms suffer a "liability" when their products are shown to be defective, relative to poor-reputation firms. This is because of the expectancy-violation effect, combined with the fact that mass media are more likely to draw

consumer attention to the defects of good-reputation firms than poor-reputation firms.

## Reputational Advantage in Market Reaction to Defects

In contrast to the arguments for the disadvantage of reputation above, several sociological (and sociopsychological) works on prestige and status support mechanisms that lead in the opposite direction—suggesting that good reputation could be an advantage in the product-defect case.

First, an institutional perspective suggests that reputation and reputation orderings are fairly stable and thus resistant to change in the face of quality problems. Goffman's (1956) study of deference systems in society suggests that reputation orderings will acquire ritual properties and legitimacy over time. Through a sequence of institutionalization processes—e.g., habitualization, objectification, and sedimentation (Tolbert and Zucker 1996)—reputational orderings are likely to become resistant to change. Because the legitimization of reputation orderings involves connecting this ordering to wider cultural frames or rules by ascribing cognitive validity to its meanings (Berger and Luckmann 1967), organizations with good reputations will enjoy support from their audiences. The legitimacy and cultural support vested in reputation might then provide the high-reputation organizations with an institutionally based advantage that helps decrease market losses from their product defects.

The operation of legitimation processes (Scott 2001) in reputational orderings is likely to enhance the stability of these reputation structures. Legitimacy implies the support of market actors through the mechanism of authorization; consequently, a given market actor is less likely to engage in destabilizing activity. Similarly, the results of Zucker's (1977) experiment suggest that a reputation structure that has become institutionalized and legitimized is one that is taken for granted as being efficacious and necessary. This taken-for-granted status can serve as an important source of cultural persistence and stability in good reputation. Therefore, good-reputation organizations might be resilient to the revelation of product defects that could hurt their reputations, because market analysts and consumers resist changes in reputation ordering, which is collectively regarded as appropriate.

Second, social cognition processes underlying the reputational advantage in cushioning the disclosure of product defects can be derived from the tendency of industry experts to commit to their previous decision rules in evaluating each firm's product quality. In general, consumers' perceptions of product quality rely heavily on a variety of consumer audience media that cover industry experts' reports on each firm's product (Fombrun 1996; Zuckerman 1999, 2000; Podolny and Hsu 2003). These experts employ their own decision criteria and procedures, which are expected to be valid and reliable. Yet the judgments of these experts are subject to biases and influences from various factors (Vaaler and McNamara 2004). Objectively, if the firms score high by expert decision criteria, then produce defective products, the credibility of these criteria should be questioned. Yet in this case, research on escalation of commitment suggests that experts might be trapped in the "escalation phenomenon," or the tendency to adhere to a course of action even in the face of negative information concerning the viability of that course of action (Staw 1981). That is, industry experts may escalate commitment to their decision rules and criteria in judging product quality following the receipt of negative feedback on the rules, rather than reducing their commitment, as would be predicted by trial-and-error learning.

These commitment effects on prior decisions have been demonstrated in several contexts and across many populations of individuals, including those with substantial managerial experience and expertise (e.g., Staw and Ross 1987, Schoorman 1988). Research on auditors can enlighten the process behind auto industry experts because in both cases, the "expert" is supposed to be an objective outsider evaluating the quality of a given firm's product. Yet a series of studies (Messier and Quilliam 1992, Church and Schneider 1993, Tan 1995, Brody and Kaplan 1996, Moore et al. 2006) shows that auditors, whether internal or external, who have been involved in prior auditing decisions will tend to engage in escalation behavior because of fear of damage to their self-image and are thus reluctant to change their earlier decisions.

In sum, expectancy-violation effects and selective attention of the media to the defects of good-reputation firms suggest these firms will be especially penalized by the market for their defects. On the other hand, institutional processes and escalation of commitment to quality rankings by experts suggest that good-reputation firms will be buffered from market reactions to product defects. We therefore propose the following competing hypotheses:

HYPOTHESIS 1A. *The better a firm's reputation, the greater the market penalty that results from the disclosure of a product defect by that firm.*

HYPOTHESIS 1B. *The better a firm's reputation, the lower the market penalty that results from the disclosure of a product defect by that firm.*

## Boundary Conditions

As noted earlier, we are also interested in examining the boundary conditions that affect a relationship between reputation and market penalty. While most studies on organizational reputation have shown a unilateral

effect of reputation on various outcomes, we investigate the possibility that because the reputation is entwined with the situational context (substitutability) and organizational attributes (generalism/specialism), reputational effects may not be as simple as previously thought.

### Substitutability

White's socioeconomic model of production (2002) implies that substitutability between producers that share similar locations in a quality ordering serves as a root of buyer power and also puts considerable pressure on producers to lower prices. Burt's structural model (1982) suggests that structurally equivalent actors are redundant and substitutable, and thus vulnerable to potential devaluation by others. Given that similar quality reputation positions indicate structurally equivalent deference and endorsements from the market (cf. Podolny and Hsu 2003), it can be argued that the efficacy of a firm's reputation in the product defect situation is likely to be limited by its substitutability with other firms. For example, it is possible that when other firms with a comparable level of reputation exist and switching costs are low, consumers will easily withdraw their attachment to a high-reputation firm when it experiences product problems.[1]

Generalizing the work of Gould (2002) on the dynamics of status hierarchies provides more direct insight into the conditions under which attachment to a high-reputation firm is lessened. Gould's model suggests that attachments to a high-reputation firm depend not only on reputational attributes but also on the substitutability of that firm. In a market with substitutes of comparable reputation, the disclosure of product defects by a high-reputation firm is likely to shift attention to substitutes for that firm's product.

On the other hand, if potential consumers have few comparable alternatives to a high-reputation firm, they might be reluctant to retract those attachments, even if the firm experiences a product defect. Under such a low level of substitutability, the costs and risks (e.g., costs in searching alternatives with lower levels of reputation and the potential dissatisfaction after choosing among those alternatives) of deviating from a high-reputation firm are likely to be much larger than the costs and risks (e.g., potential repetition of the same product defect and subsequent repair costs) of staying with the high-reputation firm, even given the higher uncertainty from the revelation of a product defect. Thus, the low level of substitutability may counteract the Bayesian model of market learning by making consumers less sensitive to the disclosure of product defects.

The above arguments suggest that substitutability will weaken the beneficial effects of a good reputation. This means that if it is true that good-reputation firms suffer more market penalty from recalls (Hypothesis 1a), this effect should be stronger with more substitutability (i.e., they suffer more penalty). On the other hand, if it is true that good-reputation firms suffer less market penalty from recalls (Hypothesis 1b), this effect should be weaker with substitutability (i.e., they get less benefit). Applying the above arguments to the product defect situation, we hypothesize the following contingency effects on Hypotheses 1a and 1b:

Hypothesis 2a. *The negative effect of an organization's reputation on market response to its product defect is strengthened by substitutability (more competitors at a comparable level of reputation).*

Hypothesis 2b. *The positive effect of an organization's reputation on market response to its product defect is weakened by substitutability (more competitors at a comparable level of reputation).*

### Generalism/Specialism

Several recent studies have found that organizational identity is related to whether that organization is a specialist or a generalist (cf. Carroll et al. 2002). In their study of American beer brewing, for example, Carroll and Swaminathan (2000) found that small specialist breweries (microbreweries and brewpubs) remained successful even after large generalist breweries (mass production breweries and contract breweries) learned to produce beers with a comparable or higher level of quality. The authors attribute the success of specialist breweries to the appeal of specialists' identity as producers who use authentic and legitimized production methods. Due to market norms about how specialty beer should be produced, consumers believe that specialist breweries have more expertise in high-quality beers.

Carroll et al. (2002) enter into a more direct discussion on how market evaluations relate to generalism/specialism. They claim that this evaluation depends on uncertainty in production process[2] and the costs of a breakdown. When both uncertainty in the production process and the costs of a breakdown are high (e.g., investment banking and auditing), consumers evaluate generalists more favorably, as shown by Park and Podolny (2000). However, when both production process uncertainty and the costs of a breakdown are low (e.g., beer), specialist organizations will receive higher product valuations from the market. Because automotive production is likely to be a case where production process uncertainty is low and breakdowns are fairly low cost (Podolny and Hsu 2003), it is likely that specialist automakers are more likely than generalists to command higher product valuations as a result of their specialist identity.

Similarly, Zuckerman and Kim (2003) find the positive effect of a focused, clear identity on valuation in their study of the feature film market. They show that a prerequisite for a film's success in obtaining a high valuation is that the film be assigned membership in a category (independent or major) by critics. Films not

classified face an identity crisis, resulting from conflicts with the set of identities critics use. Thus, a primary strategic imperative in the film market is to pursue pure specialization. Zuckerman and Kim (2003) claim that in addition to feature films, this argument is applicable to other industries where a categorical system is firmly established, such as the auto market.

The above arguments suggest that specialization will strengthen the beneficial effects of a good reputation. This means that if it is true that good-reputation firms suffer more market penalty from recalls (Hypothesis 1a), this effect should be weaker for specialists (i.e., they suffer less penalty). On the other hand, if it is true that good-reputation firms suffer less market penalty from recalls (Hypothesis 1b), this effect should be stronger for specialists (i.e., they get more benefit). Applying the above arguments to the product defect situation, we hypothesize the following contingency effects on Hypotheses 1a and 1b:

HYPOTHESIS 3A. *The negative effect of an automaker's reputation on market response to its product defect is weaker for specialists.*

HYPOTHESIS 3B. *The positive effect of an automaker's reputation on market response to its product defect is stronger for specialists.*

## Method

As noted earlier, our research setting is the automobile industry. Our sample is all automakers that sold passenger cars in the United States during at least one year from 1975 to 1999. We chose the automaker (e.g., Buick, Lexus) rather than the auto firm (e.g., GM, Toyota) or model (e.g., Regatta, Regal) as our unit of analysis. There is research in marketing that suggests that automaker brands (e.g., Jaguar) are more important than model brands (e.g., S-type) or company brands (e.g., Ford) in market reputation (Sullivan 1998, Taran 2001). Also, to the extent that any of our proposed processes apply to the model rather than the maker level, our analyses represent a conservative test of our hypotheses.

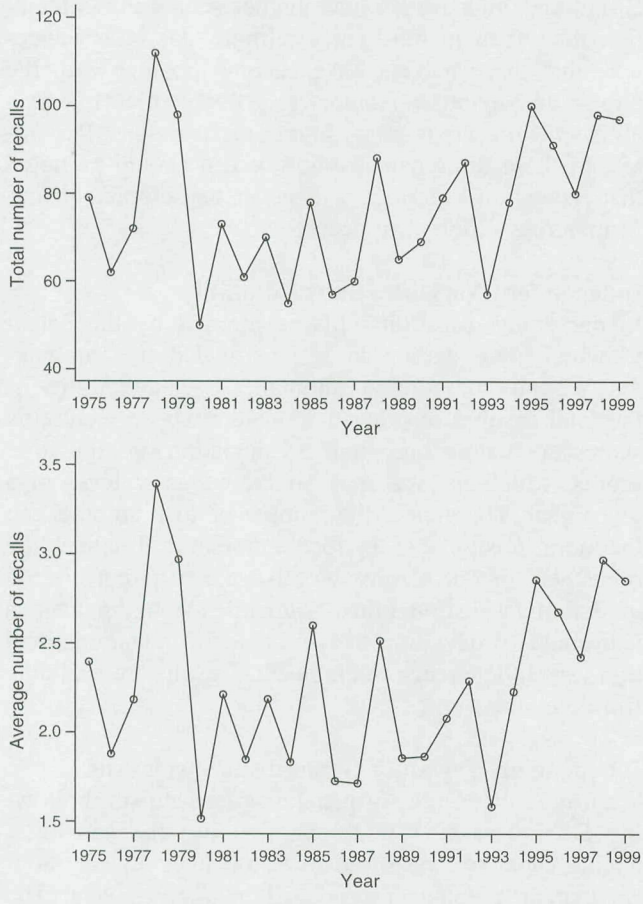
During our study period, 54 automakers sold passenger cars; 72% of these automakers were non-U.S. companies. Some automakers operated over the whole research period, while others entered or exited the U.S. auto market at certain times. We identified the sample companies using the biennial *Ward's Automotive Yearbook* and the weekly *Automotive News* between 1975 and 1999, inclusive. A few automakers that have sold a small fixed number of cars (e.g., Ferrari, Lamborghini, Maserati, Aston Martin, Austin, Lotus, and Rolls/Bentley) are excluded from the study due to limited availability of information. Moreover, because loss in market sales is included as a key variable for testing our hypotheses, it seems inappropriate to include these automakers, whose product sales are determined by the fixed numbers of cars, as demand may be higher than supply in these cases. Triumph was also excluded, as information on key variables was not available for this maker. The final sample includes 15 U.S. automakers and 31 foreign automakers.

### Independent Variable: Product Defects

We use official product recalls as our measure of product defects for these automakers. Product recall information was obtained from National Highway Traffic Safety Administration (NHTSA) reports that were provided to the U.S. Department of Transportation. Since Congress passed the National Traffic and Motor Vehicle Safety Act (NTMVSA) in 1966, which is enforced through the NHTSA, automakers have been required to produce vehicles that meet federally determined safety standards. Federal Motor Vehicle Safety Standards set minimum performance levels for those parts of the vehicle that affect safe operation (brakes, engine, steering system, tires, and lighting) and that protect drivers and passengers from death and serious injury in the event of a crash (e.g., air bags, safety belts, and child restraints). These standards are applicable to all vehicles and equipment manufactured for sale in the United States and certified for use on public roads and highways. Automakers whose vehicles are deemed not to be in compliance with standards are subject to motor vehicle or equipment recalls. Since the act was passed, approximately 225 million cars, trucks, buses, recreational vehicles, motorcycles and mopeds, as well as 25 million tires have been recalled to correct safety defects. We obtained data on all recalls and their dates for our sampled firms from the NHTSA database. The 46 automakers sampled in this study experienced a total of 1,853 recalls over the period studied, for an average of 2.26 recalls per automaker per year. Figure 1 presents both total and average numbers of recalls by year (1975–1999). Both total and average number of recalls appear to fluctuate, with no clear linear trend over the period studied. In general, however, there were more recalls during Democratic administrations than Republican ones.

Given that market responses to a product recall may be different depending on the severity of the recall (Reilly and Hoffer 1983), we present a separate analysis of severe and nonsevere recalls. The NHTSA has established several criteria to judge the severity of each recall. The NHTSA reports list the hazard level of each recall, with Type A representing significant hazard without the manufacturer's warning, Type B representing significant hazard with warning, Type C potential safety hazard, and Type D low risk of significant harm. As part of our analysis, we separate severe recalls (those involving significant hazard—A or B) from nonsevere recalls (Type C or D).

**Figure 1 Total and Average Numbers of Recalls by Year, 1975–1999**




## Independent Variable: Reputation

The auto industry has many potentially fruitful measures of automaker reputation. However, because it is not clear exactly what specific measures of reputation would be appropriate, we used a combined approach to identify and test multiple measures. We first searched for measures that have been used in published studies. We also used an inductive approach by distributing a short questionnaire to 19 persons with extensive auto industry experience who had agreed to provide information about their opinions of automaker reputations. We asked each respondent to identify indicators that they thought might serve as a signal of an automaker's product quality and thus affect consumers' subjective evaluation of the quality. Our approach produced two broad types of indicators.

*Third-Party Ratings.* First, previous quality ratings provided by third parties is one key component affecting perceptions of quality. Levin (2000), Deveraj et al. (2001), and Podolny and Hsu (2003) discuss how third-party ratings are a key component of quality judgments on automotive products (and thus reputation/status orderings). In our questionnaire, all respondents noted previous quality ratings as a key component of consumers' collective perception of product quality. Almost all the respondents suggested *Consumer Reports: Buying Guide* and J. D. Power & Associates as the most important car-rating sources in the United States. Both of these rating services use data that is based on the experiences of actual owners of new or used vehicles. Using the experiences of actual owners is relevant for this study because those direct experiences with cars are easily expanded to a collective perception of the cars through word of mouth.

We therefore developed a measure of reputation using previous quality ratings in *Consumer Reports* and J. D. Power and Associates publications. We use the five-point scale "trouble indexes" in *Consumer Reports*. We calculate the mean of the "overall problem rate" scores of each model for the most recent three years of ownership. We choose the scores only for these three years of ownership because a survey implemented by WardsAuto Corporation revealed in 1999 that most readers (82%) of *Consumer Reports* paid attention to the scores for the most recent three years of ownership, and the mean of those scores were highly correlated with that for the older model years (corr. = 0.87 in the 1999 issues of *Consumer Reports*). We then create an overall problem rate score for an automaker in a year by averaging the overall problem rate scores of all car models with the automaker in that year. Because an automaker's reputation is assumed to derive from the prior quality ratings of the maker, an average score over the five years prior to the selected year is used.[3]

Second, we use "initial ratings," which have been published by the J. D. Power Consumer Center since 1990, as another source of previous quality ratings for an automaker. Initial ratings consist of six scores, ranging from 2 to 5, across different criteria, and are obtained by J. D. Power from consumer ratings of vehicles purchased after the first few months of ownership. We first calculate the mean of the six scores for each model and then create an automaker's score in a year by averaging those mean scores of all car models within the automaker in that year. Again, an average score over the five years prior to the selected year was measured.

We then combine these two scores (trouble index and initial ratings) into a single index of an automaker's reputation using principal components analysis (Jackson 1991). A separate factor analysis confirms that those two scores load on a single factor accounting for 86.6% of the two scores' combined variance. Following Podolny and his colleagues (e.g., Benjamin and Podolny 1999), who highlight the relativistic property of reputation, this single measure is then rescaled so that the highest reputation automaker in a given year has a reputation score of 1 and the lowest reputation automaker has a score of 0.

*Depreciation Rates.* Many questionnaire respondents also encouraged us to consider the depreciation rate of

an automaker's price over time to measure its reputation. The earlier example of the study showing the GM cars to be worth less than identical Toyota cars after a few years also suggests the value of using the depreciation rate as an indicator of quality reputation. The price of new cars is fixed by the manufacturers' objectives, cost analyses, and quality analyses. However, the price of a used car is an indication of the collective valuation of that car, because the used car price can be regarded as a car's value that results from "the implicit negotiation between sellers and buyers" (personal conversation, December 5, 2002, information manager at the Kelley Blue Book in Irvine, CA). Thus, the price of a used car weighted by its original new car price, which can be formulated as the depreciation rate, is likely to be highly correlated with collective perceptions of that car's quality (Sullivan 1998) and thus the automaker's reputation. This suggests that the lower the depreciation rate of a car's price, the higher the car's reputation.

To calculate depreciation rate, we use the *Kelley Blue Book: Used Car Guide* (Western edition) series, which was first published in 1926. We use the last issue (November–December) of each year to calculate "list prices" (the original suggested retail price) and "suggested retail values," which represent the *Kelley Blue Book*'s estimated asking price. We measure a car model's depreciation rate of price in selected year $T$ as the depreciation rate of its $T - 3$ year-model price during the three-year period. We calculate an automaker's depreciation rate of price in a year by averaging the depreciation rates of all car models' prices of that automaker in that year. The depreciation rate is then rescaled such that the automaker with the lowest depreciation rate in any given year has a score of 1 and the automaker with the highest depreciation rate has a score of 0.

*Composite Measure.* The third measure of reputation is created by combining third-party ratings and depreciation rates into a single variable using principal components analysis. A separate factor analysis confirms that those two scores load on a single factor accounting for 83.3% of the two scores' combined variance. The composite variable is then rescaled again such that the highest reputation automaker has a reputation score of 1 and the lowest 0.

The left three columns in Table 1 present the scores of our three reputation measures for the automakers in our sample in 1999. In general, Japanese and German automakers possess higher reputations than the automakers from other countries. Despite their overall high correlation (see Table 2), however, there are some discrepancies between the three indicators of reputation. For example, although Lexus, Infiniti, and Acura have the highest reputation scores measured by third-party ratings, they receive much lower reputation scores measured by depreciation rates. Some industry experts consulted for this study speculate that because those makers are newer than their sister makers (Toyota, Nissan, and Honda), they receive lower resale valuations. In contrast, BMW and Volkswagen have higher scores in depreciation rates than in third-party ratings. Our interviewees note that these makers have become popular with the public due to other features (e.g., excitement), which allows the makers to enjoy higher resale values. Regardless of these discrepancies, however, it should be noted that reputation orderings will never be completely uniform across different indicators.

### Independent Variable: Substitutability

In our study, substitutability is proxied by the extent to which a reputation level is crowded by automakers. We thus measure an automaker's substitutability as the total number of other automakers whose reputation scores are within one standard deviation of reputation scores, which is measured on the industry level in a given year. The greater the number of such automakers, the more substitutable the focal automaker. To check the robustness of our results, we also use different criteria of defining substitutability boundaries, ranging from a half standard deviation to two standard deviations, and find very little change in the results (results are available from the authors).[4]

### Independent Variable: Generalism/Specialism

We use two measures of generalism/specialism. Following Dobrev et al. (2002), we first use the spread of engine capacity (measured in liters) over all car models that an automaker produced in a given year. The choice of engine capacity reveals the range of automakers' technological offerings and their competitive market strategies, because technological space directly affects automakers' marketing and supply chain management (for a more detailed rationale for this measure, see the papers cited above). The spread of engine capacity is measured as the largest minus the smallest engine capacity. Specialists tend to produce a small number of vehicles with a narrow range of engine capacity, such as Kia. Generalists tend to produce vehicles over a large range of capacities, such as Ford, which has the Festiva (~1.5 liter), the Focus (1.5 liter–2.0 liter), the Contour (2.0 liter–3.0 liter), the Mustang (3.0 liter–4.0 liter), and the Excursion (~4.0 liter). Thus, the lower the value for the spread of engine size, the greater the level of specialism.

However, as each car model within an automaker may represent a distinctive market segment that is captured not only by engine capacity but also by price and consumer taste, we use a second, less technologically exclusive indicator of generalism/specialism: the number of car models an automaker produced in a given year, with fewer models being an indicator of specialism. We find a high correlation (=0.60) between these two components and thus combine them into a single index using

**Table 1 Sampled Scores of Reputation and Generalism, 1999**

| | Reputation: third-party ratings | | Reputation: depreciation rates | | Reputation: composite measure | | Level of generalism | |
|---|---|---|---|---|---|---|---|---|
| Order | Automaker | Score | Automaker | Score | Automaker | Score | Automaker | Score |
| 1 | Lexus | 1.000 | Porsche | 1.000 | Lexus | 1.000 | Dodge | 2.045 |
| 2 | Infiniti | 0.993 | BMW | 0.931 | BMW | 0.902 | Chevrolet | 2.040 |
| 3 | Acura | 0.859 | Lexus | 0.907 | Acura | 0.881 | Buick | 1.349 |
| 4 | BMW | 0.792 | Honda | 0.901 | Porsche | 0.856 | Ford | 1.041 |
| 5 | Toyota | 0.755 | Acura | 0.824 | Infiniti | 0.838 | Mercedes-Benz | 0.981 |
| 6 | Volvo | 0.705 | Saturn | 0.810 | Honda | 0.837 | BMW | 0.844 |
| 7 | Honda | 0.698 | Volvo | 0.803 | Volvo | 0.789 | Pontiac | 0.770 |
| 8 | Audi | 0.687 | Mercedes-Benz | 0.789 | Toyota | 0.780 | Cadillac | 0.711 |
| 9 | Mercedes-Benz | 0.682 | Toyota | 0.738 | Mercedes-Benz | 0.769 | Mercury | 0.488 |
| 10 | Subaru | 0.658 | Audi | 0.726 | Saturn | 0.753 | Lincoln | 0.375 |
| 11 | Porsche | 0.635 | Subaru | 0.623 | Audi | 0.738 | Oldsmobile | 0.299 |
| 12 | Saturn | 0.631 | Infiniti | 0.608 | Subaru | 0.669 | Toyota | 0.251 |
| 13 | Lincoln | 0.606 | Nissan | 0.546 | Nissan | 0.567 | Audi | 0.186 |
| 14 | Oldsmobile | 0.553 | Mazda | 0.544 | Mazda | 0.540 | Mitsubishi | −0.015 |
| 15 | Nissan | 0.543 | Volkswagen | 0.539 | Volkswagen | 0.484 | Honda | −0.019 |
| 16 | Mazda | 0.515 | Chrysler | 0.471 | Oldsmobile | 0.482 | Acura | −0.023 |
| 17 | Saab | 0.492 | Saab | 0.427 | Lincoln | 0.466 | Chrysler | −0.207 |
| 18 | Buick | 0.457 | Suzuki | 0.413 | Saab | 0.459 | Volkswagen | −0.273 |
| 19 | Jaguar | 0.447 | Buick | 0.386 | Buick | 0.436 | Infiniti | −0.424 |
| 20 | Mercury | 0.408 | Oldsmobile | 0.377 | Jaguar | 0.413 | Lexus | −0.440 |
| 21 | Cadillac | 0.401 | Pontiac | 0.376 | Chrysler | 0.384 | Subaru | −0.450 |
| 22 | Volkswagen | 0.396 | Jaguar | 0.353 | Cadillac | 0.370 | Mazda | −0.474 |
| 23 | Ford | 0.370 | Plymouth | 0.349 | Ford | 0.357 | Nissan | −0.504 |
| 24 | Pontiac | 0.280 | Dodge | 0.344 | Suzuki | 0.354 | Volvo | −0.590 |
| 25 | Suzuki | 0.276 | Ford | 0.324 | Mercury | 0.354 | Saturn | −0.627 |
| 26 | Chrysler | 0.273 | Cadillac | 0.316 | Pontiac | 0.337 | Plymouth | −0.668 |
| 27 | Mitsubishi | 0.259 | Mitsubishi | 0.311 | Plymouth | 0.307 | Hyundai | −0.668 |
| 28 | Plymouth | 0.250 | Lincoln | 0.293 | Dodge | 0.296 | Daewoo | −0.833 |
| 29 | Dodge | 0.244 | Mercury | 0.280 | Mitsubishi | 0.291 | Porsche | −0.842 |
| 30 | Chevrolet | 0.236 | Chevrolet | 0.267 | Chevrolet | 0.256 | Saab | −0.897 |
| 31 | Daewoo | 0.126 | Kia | 0.263 | Kia | 0.129 | Jaguar | −1.079 |
| 32 | Hyundai | 0.021 | Daewoo | 0.061 | Daewoo | 0.088 | Suzuki | −1.192 |
| 33 | Kia | 0.000 | Hyundai | 0.000 | Hyundai | 0.000 | Kia | −1.315 |

principal components analysis. A factor analysis confirms that the two scores load on a single factor, accounting for 78.7% of the two scores' combined variance. The right column in Table 1 presents the scores of generalism for the automakers in our sample in 1999. Overall, U.S. automakers are more likely to be generalists than foreign automakers are.

### Dependent Variable (Market Share Change) and Model Specification

In our hypotheses, we predict that an automaker's reputation affects the (negative) impact of its product defects (recalls in our data). We use market share as the dependent variable in this analysis because market shares, unlike sales units, are not affected by temporal fluctuations in seasonal demand. The dependent variable is therefore, the rate of change in an automaker's market share over the observation period. Consistent with prior studies of auto recalls (Crafton et al. 1981, Reilly and Hoffer 1983, Borenstein and Zimmerman 1988), we use month as the unit of time on the assumption that a longer period would make it difficult to detect the effect of a recall event because there are so many intervening events that could affect market share. For example, automakers may increase their advertising and public relations efforts after a recall in an attempt to manage the negative publicity that comes with the recall. Our interviews with industry experts suggest that this is the case. However, as noted later in this paper, we also model and test different market share lags. Data on automakers' monthly market share come from their reports to *Automotive News*.

We model the change rate of an automaker's market shares using the following power function:

$$M_{i,t} = M_{it-1}^{\alpha} \exp(\delta' SE_{it-1} + \varpi' NE_{it-1} + \gamma' R_{it-1} + \lambda' S_{it-1} + \eta' N_{it-1} + \pi' I_{it-1} + \beta' C_{it-1})\varepsilon. \quad (1)$$

Here, $M_{it-1}$ is the market share of automaker $i$ at month $t-1$; $SE_{it-1}$ refers to a dummy variables indicating whether automaker $i$ experienced a severe product recall (1) or not (0) during month $t-1$; $NE_{it-1}$ refers to a dummy indicating the event of a nonsevere product

**Table 2 Descriptive Statistics and Pearson Correlation Coefficients, 1975–1999** ($N = 9{,}290$)

| Variable | Mean | S.D. | Min. | Max. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Log (lagged market share) | 0.227 | 1.669 | −8.884 | 3.140 | | | | | | | | | | | | | | | |
| 2. Log (sales age) | 3.543 | 0.872 | −0.693 | 4.659 | 0.401 | | | | | | | | | | | | | | |
| 3. Asia origin | 0.258 | 0.437 | 0 | 1 | 0.094 | −0.549 | | | | | | | | | | | | | |
| 4. European origin | 0.351 | 0.477 | 0 | 1 | −0.668 | −0.097 | −0.433 | | | | | | | | | | | | |
| 5. Years since 1975 | 12.291 | 7.279 | 0 | 24 | 0.049 | −0.003 | 0.158 | −0.129 | | | | | | | | | | | |
| 6. Cumulative nonsevere recalls ($(t-2)$–$(t-12)$) | 0.988 | 1.130 | 0 | 10 | 0.364 | 0.355 | −0.216 | −0.227 | 0.095 | | | | | | | | | | |
| 7. Cumulative severe recalls ($(t-2)$–$(t-12)$) | 1.152 | 1.425 | 0 | 9 | 0.408 | 0.364 | −0.247 | −0.253 | −0.011 | 0.064 | | | | | | | | | |
| 8. Nonsevere recall ($t-1$) | 0.091 | 0.288 | 0 | 1 | 0.149 | 0.142 | −0.087 | −0.093 | 0.023 | 0.192 | 0.060 | | | | | | | | |
| 9. Severe recall ($t-1$) | 0.108 | 0.311 | 0 | 1 | 0.171 | 0.153 | −0.103 | −0.108 | −0.007 | 0.062 | 0.218 | −0.111 | | | | | | | |
| 10. Reputation: third-party ratings | 0.484 | 0.269 | 0 | 1 | 0.082 | −0.297 | 0.524 | −0.060 | −0.004 | −0.187 | −0.219 | −0.073 | −0.093 | | | | | | |
| 11. Reputation: depreciation rates | 0.464 | 0.272 | 0 | 1 | −0.031 | −0.459 | 0.479 | 0.102 | −0.063 | −0.274 | −0.200 | −0.108 | −0.079 | 0.782 | | | | | |
| 12. Reputation: composite measure | 0.474 | 0.255 | 0 | 1 | 0.027 | −0.401 | 0.531 | 0.022 | −0.036 | −0.245 | −0.222 | −0.096 | −0.091 | 0.943 | 0.945 | | | | |
| 13. Substitutability for third-party ratings | 8.343 | 3.585 | 0 | 21 | 0.004 | 0.337 | −0.396 | 0.005 | 0.161 | 0.258 | 0.081 | 0.101 | 0.037 | −0.236 | −0.322 | −0.296 | | | |
| 14. Substitutability for depreciation rates | 8.690 | 4.123 | 0 | 18 | 0.120 | 0.350 | −0.418 | −0.054 | 0.055 | 0.241 | 0.249 | 0.085 | 0.103 | −0.449 | −0.482 | −0.493 | 0.417 | | |
| 15. Substitutability for composite measure | 8.371 | 3.665 | 0 | 18 | 0.086 | 0.390 | −0.456 | −0.050 | 0.176 | 0.281 | 0.205 | 0.093 | 0.095 | −0.359 | −0.433 | −0.420 | 0.704 | 0.749 | |
| 16. Level of generalism | 0.056 | 1.006 | −1.550 | 4.063 | 0.648 | 0.531 | −0.309 | −0.410 | −0.018 | 0.397 | 0.502 | 0.166 | 0.212 | −0.224 | −0.308 | −0.282 | 0.153 | 0.270 | 0.241 |

*Note.* $t$ denotes the current month.

recall; $R_{it-1}$ refers to the reputation of automaker $i$; $S_{it-1}$ refers to substitutability; $N_{it-1}$ refers to level of generalism; $I_{it-1}$ represents a set of interaction terms (two-way interaction of recall and reputation, three-way interaction of recall, reputation, substitutability, and three-way interaction of recall, reputation, and generalism); $C_{it-1}$ is a vector of control variables (described below); and $\varepsilon$ is a log normally distributed error term. Because there could be cumulative effects of product recalls over a longer period, we also include the number of recalls during months $(t-1)$–$(t-12)$ in our model. By transforming Equation (1) to its natural logarithm, we obtain the linear equation with a normally distributed error term, $\mu$:

$$\log(M_{i,t}) = \alpha \log(M_{it-1}) + \delta' SE_{it-1} + \varpi' NE_{it-1} + \gamma' R_{it-1} + \lambda' S_{it-1} + \eta' N_{it-1} + \pi' I_{it-1} + \beta' C_{it-1} + \mu. \quad (2)$$

### Estimation

We estimate the parameters of Equation (2) on unbalanced, pooled, cross-section, time-series data with monthly time periods; the number of observations varies among automakers. Following recent analyses of longitudinal data (Baron et al. 2001, Dobrev et al. 2001), we use generalized estimating equations (GEE) or population-averaged (or marginal) estimators to analyze both inter- and intrafirm variation (cf. Liang and Zeger 1986). Like quasilikelihood, GEE specifies the relationship between the mean and variance of the dependent variable, rather than the full distribution of population, as is required for the cluster-specific maximum likelihood estimators, such as random effects or fixed-effects models. GEE has solutions that are consistent and asymptotically Gaussian, even when the time dependence is misspecified. We use the XTGEE procedure in STATA 7.0 by choosing the Gaussian distribution and the identity link. In addition, because repeated observations are made on each automaker, we correct for correlation in an automaker's measurements using the "exchangeable" version of the working correlation matrix. The serial correlation of the residuals is constant across time lags. Finally, we report robust standard errors using the "sandwich" estimators developed by Huber (1967) and White (1982).

### Control Variables

We control for three other factors that may affect an automaker's market share and its change. First, we expect market share to vary with an automaker's experience, which is proxied by sales age in our analysis. Findings by organizational ecologists on the relationship between age and organizational growth are not consistent (cf. Carroll and Hannan 2000). Thus, we also include squared sales age to explore a nonlinear relationship. Sales age is measured as the differences between the current month and the time the automaker entered the U.S. automobile industry. As sales age is highly skewed, we log it before entering it into the analysis.

Second, we create two dummy variables for foreign automakers (Asian automakers and European automakers), with the U.S. automakers as the reference category, because foreign automakers may face different market challenges/opportunities and governmental regulations than domestic automakers do. Finally, we include a variable measuring years elapsed from 1975 to capture any time trend effects associated with changes in market share.[5]

## Results

Table 2 presents descriptive statistics and correlations for variables used in the analysis. Mean monthly market share is 3.19%, with a standard deviation of 3.89%. Several of the control variables are fairly highly correlated. Sales age, for example, has a somewhat high correlation with generalism, and foreign automakers tend to be more specialized than U.S. automakers. Asian automakers entered the market later than U.S. makers but generally have higher reputations than U.S. makers. The high correlations among these controls may point to possible problems with multicollinearity. Following Sine and his colleagues (Sine et al. 2003, 2005), we orthogonalized highly correlated variables (cumulative recalls, level of generalism, and country of origin) using a modified Gram-Schmidt procedure (cf. Saville and Wood 1991) so that all variance-inflation factors and condition indexes become less than 2.5 and 30, respectively (cf. Belsley et al. 1980). This technique partials out the common variance and constructs an orthonormal basis for any set of linearly independent vectors.[6] We used the "orthog" command in Stata 8 to generate orthogonalized variables. We also address potential multicollinearity between main effects and interaction terms by centering variables prior to calculating interactions (cf. Cronbach 1987).

Table 3 presents the results from GEE estimates of the change in market share model shown in Equation (2). Model 1 of Table 3 is the base model, containing only the control variables. The second-order effect of sales age is positive and significant, indicating a U-shaped relationship between sales experience and market share growth. Asian automakers have greater market share growth, but European automakers have less market share growth than U.S. automakers. The significant, negative effect of time trend on market share growth might indicate increasing competition in the U.S. automotive industry over the study period.[7] The numbers of both severe and nonsevere recalls during months $(t-2)$–$(t-12)$ produce no significant effects. These nonsignificant results for older recalls are consistent with other studies (Crafton et al. 1981, Reilly and Hoffer

**Table 3 GEE Estimates of Market Share Change, 1975–1999** ($N = 9{,}290$)

| | | Third-party ratings | | | Depreciation rates | | | Composite measure | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Variable | Model 1 | Model 2-1 | Model 2-2 | Model 2-3 | Model 3-1 | Model 3-2 | Model 3-3 | Model 4-1 | Model 4-2 | Model 4-3 |
| Log (lagged market share) | 0.9257** | 0.9225** | 0.9214** | 0.9215** | 0.9215** | 0.9179** | 0.9179** | 0.9209** | 0.9198** | 0.9198** |
| | (0.0043) | (0.0044) | (0.0044) | (0.0044) | (0.0044) | (0.0045) | (0.0045) | (0.0044) | (0.0044) | (0.0044) |
| Log (sales age) | −0.0290 | −0.0434 | −0.0491 | −0.0492 | −0.0330 | −0.0340 | −0.0416 | −0.0411 | −0.0501† | −0.0517† |
| | (0.0310) | (0.0301) | (0.0305) | (0.0305) | (0.0300) | (0.0304) | (0.0304) | (0.0300) | (0.0304) | (0.0304) |
| Log (sales age)$^2$ | 0.0160** | 0.0171** | 0.0182** | 0.0182** | 0.0167** | 0.0196** | 0.0199** | 0.0177** | 0.0200** | 0.0202** |
| | (0.0065) | (0.0062) | (0.0063) | (0.0063) | (0.0062) | (0.0064) | (0.0064) | (0.0062) | (0.0063) | (0.0063) |
| Asian-origin automaker | 0.0453** | 0.0420** | 0.0441** | 0.0441** | 0.0492** | 0.0538** | 0.0540** | 0.0483** | 0.0518** | 0.0520** |
| | (0.0136) | (0.0125) | (0.0127) | (0.0127) | (0.0126) | (0.0132) | (0.0132) | (0.0126) | (0.0128) | (0.0128) |
| European-origin automaker | −0.0598** | −0.0635** | −0.0629** | −0.0629** | −0.0627** | −0.0635** | −0.0632** | −0.0627** | −0.0600** | −0.0597** |
| | (0.0138) | (0.0127) | (0.0129) | (0.0129) | (0.0127) | (0.0133) | (0.0133) | (0.0127) | (0.0129) | (0.0129) |
| Years since 1975 | −0.0020** | −0.0014** | −0.0015** | −0.0015** | −0.0016** | −0.0019** | −0.0019** | −0.0015** | −0.0016** | −0.0016** |
| | (0.0006) | (0.0006) | (0.0006) | (0.0006) | (0.0005) | (0.0006) | (0.0006) | (0.0006) | (0.0006) | (0.0006) |
| Cumulative nonsevere recalls ($(t-2)$–$(t-12)$) | 0.0003 | 0.0004 | 0.0005 | 0.0005 | 0.0001 | 0.0006 | 0.0006 | 0.0002 | 0.0005 | 0.0005 |
| | (0.0023) | (0.0005) | (0.0025) | (0.0025) | (0.0026) | (0.0025) | (0.0025) | (0.0025) | (0.0025) | (0.0025) |
| Cumulative severe recalls ($(t-2)$–$(t-12)$) | 0.0017 | 0.0015 | 0.0003 | 0.0003 | 0.0008 | 0.0007 | 0.0006 | 0.0005 | 0.0004 | 0.0004 |
| | (0.0022) | (0.0025) | (0.0025) | (0.0025) | (0.0025) | (0.0025) | (0.0025) | (0.0024) | (0.0025) | (0.0025) |
| Nonsevere recall ($t-1$) | | −0.0031 | −0.0034 | −0.0034 | −0.0030 | −0.0032 | −0.0030 | −0.0031 | −0.0032 | −0.0030 |
| | | (0.0061) | (0.0061) | (0.0061) | (0.0061) | (0.0061) | (0.0061) | (0.0061) | (0.0061) | (0.0061) |
| Severe recall ($t-1$) | | −0.0154** | −0.0119* | −0.0118† | −0.0154** | −0.0122* | −0.0120† | −0.0155** | −0.0123* | −0.0119† |
| | | (0.0058) | (0.0059) | (0.0061) | (0.0058) | (0.0061) | (0.0062) | (0.0058) | (0.0061) | (0.0062) |
| Reputation | | 0.0208** | 0.0212** | 0.0212** | 0.0201** | 0.0173** | 0.0172** | 0.0208** | 0.0230** | 0.0230** |
| | | (0.0040) | (0.0043) | (0.0043) | (0.0038) | (0.0039) | (0.0039) | (0.0040) | (0.0043) | (0.0043) |
| Substitutability | | −0.0003 | 0.0001 | 0.0001 | 0.0008 | −0.0002 | −0.0001 | 0.0006 | 0.0007 | 0.0007 |
| | | (0.0009) | (0.0010) | (0.0010) | (0.0008) | (0.0009) | (0.0009) | (0.0009) | (0.0010) | (0.0010) |
| Level of generalism | | 0.0152** | 0.0159** | 0.0159** | 0.0154** | 0.0165** | 0.0165** | 0.0162** | 0.0162** | 0.0163** |
| | | (0.0041) | (0.0041) | (0.0041) | (0.0041) | (0.0043) | (0.0043) | (0.0041) | (0.0042) | (0.0042) |
| Severe recall × reputation (Hypothesis 1) | | | **−0.0202**** | −0.0200* | | **−0.0218**** | −0.0182* | | **−0.0210**** | −0.0194* |
| | | | **(0.0066)** | (0.0079) | | **(0.0066)** | (0.0076) | | **(0.0068)** | (0.0079) |
| Severe recall × substitutability | | | −0.0010 | −0.0010 | | −0.0013 | 0.0012 | | 0.0010 | 0.0007 |
| | | | (0.0020) | (0.0020) | | (0.0015) | (0.0015) | | (0.0017) | (0.0017) |
| Severe recall × level of generalism | | | −0.0039 | −0.0039 | | −0.0038 | −0.0019 | | −0.0034 | −0.0022 |
| | | | (0.0052) | (0.0054) | | (0.0052) | (0.0057) | | (0.0052) | (0.0056) |
| Reputation × substitutability | | | −0.0018** | −0.0019** | | −0.0022** | −0.0022** | | −0.0025** | −0.0024** |
| | | | (0.0010) | (0.0010) | | (0.0007) | (0.0007) | | (0.0008) | (0.0008) |
| Reputation × level of generalism | | | −0.0078* | −0.0068† | | −0.0064† | −0.0064† | | −0.0082* | −0.0063† |
| | | | (0.0036) | (0.0036) | | (0.0033) | (0.0033) | | (0.0035) | (0.0035) |
| Substitutability × level of generalism | | | 0.0011 | 0.0011 | | −0.0003 | −0.0002 | | 0.0008 | 0.0008 |
| | | | (0.0009) | (0.0008) | | (0.0008) | (0.0008) | | (0.0008) | (0.0008) |
| Severe recall × reputation × substitutability (Hypothesis 2) | | | | **−0.0057**** | | | **−0.0042*** | | | **−0.0050*** |
| | | | | **(0.0019)** | | | **(0.0017)** | | | **(0.0020)** |
| Severe recall × reputation × level of generalism (Hypothesis 3) | | | | **−0.0131*** | | | **−0.0129†** | | | **−0.0130*** |
| | | | | **(0.0064)** | | | **(0.0068)** | | | **(0.0065)** |
| Constant | −0.0865* | −0.0524 | −0.0478 | −0.0476 | −0.0901* | −0.0952* | −0.0932* | −0.0741† | −0.0657† | −0.0637 |
| | (0.0390) | (0.0391) | (0.0390) | (0.0390) | (0.0388) | (0.0391) | (0.0391) | (0.0386) | (0.0389) | (0.0389) |
| Wald Chi-square | 62,060** | 67,189** | 69,566** | 70,398** | 67,140** | 69,330* | 70,159 | 67,431** | 69,795** | 70,602** |
| *D.f.* | 8 | 13 | 19 | 21 | 13 | 19 | 21 | 13 | 19 | 21 |

*Note.* Robust standard errors are in parentheses; $t$ denotes the current month.
†$p < 0.10$; *$p < 0.05$; **$p < 0.01$; 2-tailed tests.

1983, Borenstein and Zimmerman 1988) and support the idea that using one month prior recalls is best because it minimizes potential noise in the data due to automaker responses to their recalls (e.g., sales promotions).[8]

Models 2-1, 2-2, and 2-3 include third-party ratings as the measure of reputation, and Models 3-1, 3-2, and 3-3 include depreciation rates. Models 4-1, 4-2, and 4-3 include the combined measure, which produces the best model fit. All results are consistent across the different measures of reputation.

Models 2-1, 3-1, and 4-1 add the main effects of all key variables in our study. As shown in these models, automakers with a severe product recall in the prior month do suffer more market penalty (i.e., decreased market share) in the following month, but nonsevere recalls produce no damage. The lack of significance for nonsevere recalls may be due to such recalls being perceived by consumers as a signal of an automaker's diligence in attending to quality control issues, as they found and fixed a potential (but minor) problem. Thus, it might be the case that such minor recalls help automakers maintain public confidence in their product.

Continuing with control variable results, Models 2-1, 3-1, and 4-1 show that all measures of automaker reputation have positive and significant effects on market share growth (cf Shapiro 1983, Podolny and Phillips 1996, Sullivan 1998, Benjamin and Podolny 1999). To illustrate the magnitude of the reputation effect in Model 4-1, a one standard deviation (=0.255) increase in an automaker's reputation score results in a 0.54% increase in the automaker's monthly market share ($=\exp[0.0208 \times 0.255] - 1 = 0.0054$). The measure of substitutability has no significant main effect on market share. Consistent with prior findings in the growth rate models (e.g., Barnett et al. 2000), however, generalists have a greater market share growth rate than specialists do.

In Models 2-2, 3-2, and 4-2, we present our test of Hypotheses 1a and 1b, whether good reputation increases (Hypothesis 1a) or decreases (Hypothesis 1b) the market penalty resulting from a product recall. Because our hypotheses concern the role of reputation on the negative effect of product recalls, we test only for the interaction of reputation with severe recalls, as only severe recalls produce this negative effect. In support of Hypothesis 1a (and not Hypothesis 1b), the coefficients of the interaction of severe recall and reputation are significant and negative. This can be interpreted as evidence that high-reputation automakers suffer more market penalty as a result of severe product recalls than low-reputation automakers do. To illustrate this effect, Model 4-2 shows that a severe recall decreases a low reputation (0.2) automaker's market share by 1.64% ($=\exp[0.0230 \times 0.2] - \exp[-0.0123 + 0.0230 \times 0.2 - 0.0210 \times 0.2] = 0.0164$) but decreases a high-reputation automaker's (0.8) market share by 2.92% ($=\exp[0.0230 \times 0.8] - \exp[-0.0123 + 0.0230 \times 0.8 - 0.0210 \times 0.8] = 0.0292$). Chi-square difference tests show that all two-way interaction term models (Models 2-2, 3-2, and 4-2) significantly increase model fit ($p < 0.01$) relative to the models with main effects alone (Models 2-1, 3-1, and 4-1).

Models 2-3, 3-3, and 4-3 show that the moderating effects of reputation in response to a severe product recall are contingent on substitutability and generalism/specialism. In these models, we add two three-way interaction terms: several recall × reputation × substitutability and severe recall × reputation × level of generalism. In Hypothesis 2a we had predicted that the negative effect of reputation on market response to a product defect would be strengthened by substitutability. In support of Hypothesis 2a, all three models show negative and significant three-way interaction effects. These results provide support for the idea that market share penalty for good-reputation automakers is greater when that automaker is more substitutable, that is, has more competitors with a comparable level of reputation. In Hypothesis 3a we had predicted that the negative effect of reputation on market response would be weaker for specialists (i.e., specialists would be buffered from the negative effects). In support of Hypothesis 3a, all three models show negative three-way interaction effects, though the effect for the depreciation reputation measure is only marginally significant using a two-tailed test (i.e., $p < 0.10$). All three models are statistically significant improvements over the prior two-way interaction models ($p < 0.05$ for Models 2-2 and 4-2; $p < 0.10$ for Model 3-2). This provides evidence that market share penalty for good-reputation automakers is weaker for specialists (and thus stronger for generalists).

## Discussion

We started this paper by noting the importance of understanding how reputation effects operate in the context of product recalls. Many theories support the idea that good reputation provides benefits: Firms with good reputations enjoy lower costs and can charge higher prices (e.g., Shapiro 1983, Podolny 1993, Sullivan 1998, Benjamin and Podolny 1999), experience greater growth in sales/status (e.g., Podolny and Phillips 1996), enjoy protection against market entrants (e.g., Milgrom and Roberts 1982), and experience greater returns relative to actual quality (e.g., Benjamin and Podolny 1999). Our contribution is in showing that, while reputation has these benefits, it is a "double-edged sword" in that it also has a significant downside. When firms make mistakes, those with good reputations suffer more market penalty than those with poor reputations do. To our knowledge, there has been little discussion in the literature of the liabilities of a good reputation on firm reputation. Responding to this gap in our understanding of reputation effects, we theorized and modeled the

effects of product defects on market responses to firms and found that high-reputation firms suffer liabilities in this case.

One might think that a good reputation would buffer firms from the vagaries of the market because of the inertial properties of such reputations. Indeed, as noted earlier, several status and institutional theories suggest exactly this: Reputation orderings are inertial, and success breeds success (and failure breeds failure) (e.g., Podolny 1993). If that is true, then the moderating effect of reputation would be nonsignificant or perhaps even positive. As we find negative effects, our results highlight the fact that the inertial effects of reputation are limited in the case of product defects. This demonstrates an important boundary condition on inertial effects. The durability of reputation orderings does not seem to necessarily mean that there are no counteractive forces, and a product recall is one such force.

Why are these inertial effects not present in our study? One possibility is that a serious product recall presents consumers with information about quality that is relatively unambiguous. The inertial properties of reputation orderings depend on uncertainty about the underlying quality of that firm's products (White 2002, Podolny and Hsu 2003). While there is some degree of uncertainty surrounding an automotive firm's quality, the level of uncertainty is likely to be less than in some other contexts, such as the arts or other industries where professionalization is more important (Podolny and Hsu 2003). In addition, the presence of a regulatory agency (NHTSA) helps consumers resolve uncertainty, and regulatory agencies are important in other industries as well (e.g., pharmaceuticals). Thus, the level of uncertainty surrounding the quality of a firm's product, and the presence of regulatory agencies designed to help resolve uncertainty, may be a limiting condition on the inertial properties of reputation.

It could also be that the escalation of commitment tendencies on the part of raters, which we hypothesized earlier, just does not apply in a situation where there are no penalties for the expert raters changing their ratings. Unlike the earlier-mentioned situation where auditors did not change their endorsements of firms' accounting procedures, the automotive analysts do not stand to personally benefit from retaining their earlier endorsements, nor are there any potential penalties in terms of losing clients (e.g., readers of auto-rating magazines) by changing ratings. Thus, the reward structure surrounding the situation is likely to affect experts' escalation of commitment.

Our study also offers evidence to confirm the relatively unstudied ideas that substitutability and generalism will influence the effect of reputation on market penalty. Our results demonstrate that nonsubstitutability signals uniqueness within quality reputation categories and helps buffer good-reputation organizations from market penalties. In contrast, high levels of substitutability cause greater market penalties for good-reputation organizations by facilitating the detachment of potential consumers from their products. The paper also demonstrates that specialism has a synergistic relationship with organizational reputation, increasing the inertial effects of reputation. Good-reputation specialists are more protected from market penalties than good-reputation generalists are. This leads us to suspect that in an industry where most firms are specialists, we might still find an inertial effect of reputation. In short, whether reputation is sensitive (Hypothesis 1a) or not (Hypothesis 1b) to product defects seems to be contingent on substitutability and generalism/specialism. While sociological research has theorized and evidenced the effect of substitutability and specialism on the valuation of products themselves (e.g., Burt 1982, Carroll and Swaminathan 2000, Carroll et al. 2002, White 2002, Zuckerman and Kim 2003), our study demonstrates that these factors can also condition reputational (dis-)advantages.

Our study also suggests the importance of investigating boundary conditions on status/reputation effects. We have focused on the two organizational characteristics, substitutability and generalism, which are closely related to organizational uniqueness and identity, respectively. However, there are likely to be many additional characteristics that accelerate or decelerate the reputational effects. As we discussed above, uncertainty about the actual quality of products may increase reputational effects, leading consumers to be more like to rely on reputation as a signal (cf. Podolny 1994). The extent to which organizational reputation is dimensionalized could provide another condition. One limitation of our study is our exclusive focus on the quality dimension of reputation. There are many other dimensions underlying organizational reputation, including financial performance, social responsiveness, and institutional ownership (Fombrun and Shanley 1990). Thus, it would be of great value to examine how a firm's reputation measured by the quality dimension affects reputation measured by other dimensions. For example, studies could investigate whether an automaker's social responsibility reputation increases or decreases the negative effect of its quality reputation when a recall occurs (cf. Zyglidopoulos 2001).

In addition, our results showing that the market penalty only applies to severe recalls suggest that the liability effect may be sensitive to how a recall is perceived by the market. In our study, we suggest that the nonnegative market response to nonsevere recalls may be due to the fact that mass media and other audiences are less likely to focus attention on minor recalls. For example, among the 98 recalls announced by the automakers in our sample in 1998, all major recalls (63) were reported by *The Wall Street Journal*, while only 60% of the minor recalls were reported. However, this differential effect

may only apply to situations where companies have relatively frequent problems (like recalls) and/or situations where some events are minor and others are not, as the minor events then provide a comparison with the major events. Situations where the problems are less frequent and/or all events are major, such as airline accidents or other types of disasters, are likely to have more uniform market penalties.

## Conclusion

Our results have implications for both institutional theories and work on organizational reputation. Our study suggests that the institutional context surrounding reputational orderings is subject to change, as consumers do seem to penalize automakers that violate expectations and norms. Cultural support is withheld from these firms. This is consistent with recent arguments about changes in institutions and the need for more research on these changes (e.g., Dacin et al. 2002, Strang and Sine 2002). In addition, the idea that the press is involved in disseminating more information about the defects of good-reputation firms (relative to poor-reputation firms) suggests that these institutional logics for the meaning of good reputation means might be reflected in the press, and thus the press serves as a mediating structure for the dissemination of reputation standards/norms. As our results cannot distinguish between individual expectancy-violation effects and the effects of the business press on the relationship between reputation and penalty for recalls, future research attempting to disentangle these explanations would be useful.

Our findings about the role of reputation and market response by automotive firms suggest important features of the interaction of firm errors and reputation. Beyond automotive firms, the research presented here points to the importance of studying reputation in other areas. Other important product recalls like drugs and children's toys might be similarly affected by reputation and moderated by substitutability and generalism. For example, good-reputation drug firms may suffer more market penalty for having to withdraw a drug from the market, especially if there are other similar substitutes available. Our results suggest this is especially likely for generalist drug firms.

Other error situations, such as airline accidents and corporate malfeasance, might also be affected by reputation. As noted earlier, these errors are both less frequent and less easily segmented into those that are minor and those that are severe. For example, good-reputation airlines (which might be those with few prior accidents) might lose more customers after an accident than poorer-reputation airlines would. The effects of reputation, market responses, and firm characteristics in these error situations are clearly important and deserving of further study.

And finally, the implication that firm reputation does not provide protection in an error situation (e.g., a recall) suggests that managers of good-reputation firms need to be especially vigilant in their learning processes—detecting and correcting errors. While there are many benefits from a good reputation, such a reputation cannot be relied on as a buffer from negative reactions in all situations.

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### Endnotes

[1]The resource-based view of the firm (e.g., Barney 1997) suggests similar argument by showing that firms lose competitive advantages when followers attain substitutable capabilities and knowledge.

[2]Uncertainty in production process, which is defined as uncertainty in the stages and parts of manufacturing and services provided, should be distinguished from uncertainty in product quality. For example, although there is a low level of uncertainty in the production process of wine (i.e., the manufacturing stages are routine and predictable), uncertainty surrounding wine product quality is fairly high (Benjamin and Podolny 1999). In contrast, there is a relatively high level of uncertainty in the service processes of flight attendants, although their service quality can be judged with little uncertainty.

[3]We also attempted to include a set of weighted averages of previous quality ratings (e.g., heavier weight in the current period) and found similar results. We use the unweighted scores because they produced better model fit.

[4]In this paper we measure only functional substitutability because prior research suggests that the substitutability of products can be conceptualized by their proximity on one attribute important to the product category (e.g., quality reputation), even when they differ on other attributes (Sujan 1985, White 2002). Given the multidimensional nature of the substitutability construct (cf. Ding 2004), however, future studies incorporating measures of nonfunctional substitutability stemming from other product attributes such as social prestige and style of cars would be valuable.

[5]We also modeled time effects using other specifications (e.g., pre-1979 vs. post-1979; dummies for presidential administration; and dummy variables for major changes in safety standards) and found no changes in the significance of our hypothesized variables. We do not include these variables in our model because they decrease model fit.

[6]See Golub and Van Loan (1996) to understand how the modified Gram-Schmidt procedure generates a better conditioned set of vectors than the traditional Gram-Schmidt procedure.

[7]In a separate analysis, we found a significant, positive interaction effect of Asian automakers and time trend, which supports the idea that Asian automakers have been increasing their market share over time. We also found that U.S. automakers

showed significantly higher market share growth during the Reagan administration than during the Clinton administration. Results are available on request from the authors.

[8]We have also done some robustness checks for changes in the time window, which produced some interesting findings. First, we found that the number of severe recalls during months $(t-13)$–$(t-60)$ has significant ($p < 0.05$) and negative effect on market share, after controlling for the number of recalls during months $(t-2)$–$(t-12)$. Nonsevere recalls had no such effect. Second, this negative effect is greater for good-reputation automakers ($p < 0.05$). This implies, therefore, that our findings on the liability of good reputation represent both short-term and long-term phenomena (but not medium term). The longer-term penalty may be due to a decline in the effectiveness of sales promotions undertaken in response to a recall. This interpretation is necessarily speculative, which means that more research examining timing effects is needed.

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