The Causes and Consequences of Product Recalls

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Abstract

The Causes and Consequences of Product Recalls

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For the chapter 2, I find that a CEO's characteristics will have direct impact on the occurrence of a firm's product recall. I also find that various corporate governances mechanisms can effectively mitigate/control the negative impact of CEO's characteristics on the likelihood of product recall events. For the chapter 3, I investigate the impact of PHC on firms' financial reporting policy. I find evidence that firms experiencing a product harm crisis engage in income-increasing earnings management, and the upward earning management is positively associated with the severity of the product harm crisis. Moreover, income-increasing earnings management is most prominent for crisis firms that produce durable goods, have industrial customers, and have CEOs who possess greater equity incentive and who are earlier in their tenure. Furthermore, upward earnings management helps firms retain major customers and reduces the propensity of a bonus cut and forced turnover for the CEO. For the chapter 4, I study debt market reaction to the announcements of recall firms. I find that banks charge 19% higher interest spreads on loans to recall firms after product recall announcements. In addition, banks monitor recall firms more closely by using tighter non-price terms I further find that the effects of product recall on debt contracting are more pronounced for firms with less independent board of directors, lower ex-ante ability to recover from product recalls, and with multiple product recalls. Taken as a whole, my findings suggest that banks, as informed stakeholders, generally perceive product recalls as a credit risk factor and react to this risk in debt contracting.

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Chapter 1: Introduction

A product-harm crisis (such as product recall with serious impact) is defined as a well-publicized event whereby a firm's product fails to fulfill a mandatory safety standard or is found to be defective, posing a threat to cause substantial harm, serious injury, or death to consumers (Dawar & Pillutla, 2000; Siomkos & Kurzbard,1994). When a product harm crisis occurs, it typically results in a product recall. Previous studies document that firms facing a product harm crisis incur short-term cost associated with handling product recalls (Wynne and Hoffer 1976, Crafton et al. 1981, Reilly and Hoffer 1983, Rhee and Haunschild 2006, Van Heerde et al. 2007, Zhao et al. 2011, Van Heerde et al. 2013). More importantly, product harm crises potentially impair firms' intangible assets such as brand value, reputation and customer confidence (e.g., Dawar & Lei, 2009; Dawar & Pillutla, 2000; Van Heerde, Helsen & Dekimpe, 2007), marketing effectiveness (Van Heerde et al. 2007, Cleeren et al. 2013, Rubel et al. 2011), stock market performance (Jarrell and Peltzman 1985, Hoffer et al. 1988, Thirumalai and Sinha 2011, Chen et al. 2009, Yun et al. 2014). Moreover, the advent of one crisis suggests that the future incidence of a product harm crisis is more likely (Kalaignanam et al. 2013). To respond to the damages caused by a product harm crisis, firms take actions to minimize the crisis' costs such as being more aggressive in advertisements or recall strategies (e.g., Chen, Ganesan, & Liu, 2009; Cleeren, van Heerde, & Dekimpe, 2013; Dutta & Pullig, 2011; Siomkos & Kurzbard, 1994; Lee et al 2015). In the following dissertation, I attempt to extend the literature by investigating the determinants of product harm crises from a corporate governance perspective as well as the consequences of product harm crises from earnings management and debt contracting perspectives.

While most previous studies focus on the consequence of product harm crises and the strategies firms adopt to mitigate their negative impact, very few studies investigate their determinants. Despite their worldwide occurrence, knowledge about product harm crisis events is still limited regarding why certain firms encounter such crises more often than others (Wowak et al. 2015). In order to shed light on this puzzle, I attempt to investigate the determinants of product harm crises in the first essay of my dissertation. I adopt a configurational perspective (Busenbark, Krause, Boivie, & Graffin, 2015) to analyze how chief executive officer (CEO) affects the likelihood that a firm experiences a product harm crisis (PHC).

Specifically, a configurational perspective uses three interrelated but independent domains: The Person (e.g., CEO personality and characteristics), The Position (e.g., corporate governance mechanisms), and the Environment (e.g., external markets condition and performance attribution) (Busenbark, Krause, Boivie, & Graffin, 2015). A configurational perspective generates a more comprehensive picture of the influence of CEOs on firm decisions and performance outcomes (i.e., Product Harm Crisis). Grounded in the upper echelons theory, that a CEO's psychological property in risk taking will increase a firm's PHC likelihood but such association is mitigated/nullified by the CEO's rich operational experience. Drawing upon agency theory, I then predict that corporate governance provides an effective mechanism to constrain a CEO's inappropriate risk-taking so that the PHC likelihood of an inexperienced risk-seeking CEO is attenuated when directors have related expertise to fill up the vacuum in the CEO's background. Empirical findings are consistent with the hypothesis that directors with industry expertise can alleviate the positive association between the incidence of a product harm crisis and a risk-taking CEO lacking operational experience. Further, I find that product market competition facilitates product quality improvement and the PHC likelihood of a risk-seeking CEO is lower when the market competition is high.

Regarding the consequences of a product harm crisis, prior research mainly focuses on firms' reactions regarding more aggressive marketing. Nevertheless, as a significant corporate event, product harm crises can have considerable effects on corporate accounting practices. Besides, despite the various costs associated with product harm crises, anecdotal evidence often shows that firms usually report strong financial performance in the crisis year. In the second essay of my dissertation, I endeavor to provide empirical evidence on such effects. Specifically, I try to answer the main question: Does a firm engage in more earnings management when facing a product harm crisis?

One the one hand, a product harm crisis severally damages a firm's reputation concerning its product quality and its reputation to fulfill its implicit contracts with suppliers and customers (Cornell and Shapiro 1987; Devin and Halpern 2001). Therefore, managers faced with a product harm crisis have strong incentives to manipulate earnings upward to improve customers' perception of firm's future ability to fulfill its customers' implicit claims (Bowen et al. 1995). In other words, managers have incentives to manipulate earnings to show better performance to restore its damaged reputation. Furthermore, related to the above point, since a product harm crisis influences sales and revenues, managers faced with such crisis may be pressured to manipulate earnings, as they need to make up for a decrease in operational performance (Ahmad-Zaluki, Campbell, & Goodacre, 2011), to retain or boost a firm's stock price, a key input to their compensation (Charitou, Lambertides, & Trigeorgis, 2007), and to lower the likelihood of being fired (Ali and Zhang 2015).

On the other hand, a product harm crisis can increase media coverage, which in turn increases auditors, creditors and other stakeholder's scrutiny and monitoring over the firm that experienced such crisis, resulting in fewer opportunities and higher detections risks for the managers to manage earnings (Zavyalova et al. 2012; Francis et al. 2013). Also, managers may have the incentive to manipulate earnings downward to take a big bath, or to reduce the

financial settlement of the anticipated lawsuit from customers. Thus, it is an empirical question as to whether firms increase earnings management in reaction to the product harm crisis.

Using a matched sample of U.S. manufacturing firms from 2002 to 2012, I find evidence that firms experiencing a product harm crisis engage in income-increasing earnings management, and the upward earning management is greater when the severity of the product harm crisis get more severe. Moreover, income-increasing earnings management is most prominent for crisis firms that produce durable goods, have industrial customers, and have CEOs who possess greater equity incentive and who are earlier in their tenure. Furthermore, upward earnings management helps firms retain major customers and reduces the propensity of a bonus cut and forced turnover for the CEO.

In my third essay, I study the effect of product recall events on the contracting terms for new bank loans. Unlike a product harm crisis which causes severe damage to customers, such as injuries, sickness, or even death, and then receives high levels of publicity in the press, a product recall with small-scale may receive scant attention. For example, a product recall may be caused by small glitches such as labeling errors, package errors, or design defaults. Thus, a product recall is more general and prevalent than an extreme case such as a product harm crisis. Prior studies on the consequence of product recall focus on equity investors' reaction to product recall events (i.e., Kini et al. 2016). Nevertheless, it is unknown whether banks react to the product recall event. I attempt to fill this void in the literature by investigating whether and how banks react to firm's product recalls. The question is important for two reasons: Firstly, prior studies find mixed finding regarding the market reaction to product recall announcement in aggregate. Secondly, bank loans are essential for the ongoing operations of most firms. Thus, investigating bank loan contracting can provide further evidence on the financial costs of product recalls.

There are three arguments supporting the view that banks are concerned about product recalls in aggregate, which would underlie their negative impact on firms' loan contracting. Firstly, firms experiencing a product recall incur direct costs such as short-term revenue and cash flow reductions, thus increasing their downside risk/default risk (Hendricks and Singhal 2003). Secondly, a product recall may have a negative impact on a firm's reputation, and brand value, thus influencing its cost of debt (Himme et al. 2014, Anginer 2015). Finally, a product recall reveals managers' excessive risk-taking personalities, and lack of experience, both of which increase the level of operating risk (Wowak et al. 2015B; Marucheck, Greis, Mena, and Cai 2011; Ryu 2012).

However, there are some counter arguments that banks may not be particularly concerned about product recalls in aggregate. Firstly, product recalls are increasingly frequent these days due to more stringent regulations, globalized and complicated production processes, growing consumers' awareness, and increasing product market competition. It becomes very costly for firms to completely prevent the occurrence of product recalls (Thirumalai and Sinha 2013) Bromiley and Marcus (1989) found decreases in shareholder value to be an insufficient deterrent to behavior that may lead to recalls, and that in some cases, it was profitable to produce unsafe products because new product brought speedily on the product market can generate sales. Secondly, when faced up with product recalls, firms take various actions to rescue their reputation and to minimize the negative impact of product recalls. Thirdly, consumers forget about product failure events several months later (Vassilikopoulou et al. 2009).

Using hand-collected data on product recall events from the websites of the Food and Drug Administration (FDA) and of the Consumer Product Safety Commission(CPSC), I find that recall firms pay 38 basis points (0.38%) more in cost of bank loan(otherwise known as the yield spread over the risk-free rate) than firms not subject to recalls. Using the average

bank loan facility outstanding as a benchmark, such higher yield spread translates into an increase of $1.2 million in interest costs. Also, banks monitor such recall firms more closely by using tighter non-price terms. The results are robust after correcting for possible endogeneity issues using the propensity score matching approach. I further find that the effects of the product recall on debt contracting are more pronounced for firms with a less independent board of directors, lower ex-ante ability to recover from product recalls, and with multiple product recalls. Finally, I do not find banks react to the announcements of product recalls in the medical device industry in which product recalls are considered as relatively common events. Taken as a whole, my findings suggest that banks, as informed stakeholders, generally perceive product recalls as a credit risk factor and react to this risk in debt contracting.

The rest of the dissertation is organized as follows: Chapter 2. CEO Characteristics and Product Harm Crisis. Chapter 3. Damage Control: Earnings Management in the Face of Product Harm Crises. Chapter 4. Do Bank Price the Product Failure in Debt Contracting? Evidence from Product Recalls. Chapter 5. Conclusion for my dissertation.

Chapter 2. CEO Characteristics and Product Harm Crisis

2.1 Introduction

A substantial body of research has studied the influence of CEOs on firm decisions and performance outcomes (Barnard, 1938; Lieberson & O'Connor, 1972; Jensen & Meckling, 1976; Finkelstein & Hambrick, 1987; Hoskisson, Castleton, & Withers, 2009; Boivie, Lange, McDonald, & Westphal, 2011). The concepts discussed in the literature pertain to three interrelated but independent domains: the person (e.g., CEO personality and characteristics), the position (e.g., corporate governance), and the environment (e.g., external markets condition and performance attribution) (Busenbark, Krause, Boivie, & Graffin, 2015). However, prior literature often narrowly focuses on a single domain and generates predictions in "a fragmentation" (Busenbark et al., 2015, p.235). In this study, I employ a configurational perspective proposed by Busenbark et al. (2015) to explore how CEOs influence an important firm performance outcome: incidences of product harm crises (PHCs).

PHCs are defined as publicized events whereby a firm's product is reported as being defective or failing to fulfill a mandatory safety standard, and they often result in huge losses of firm value (Dawar & Pillutla, 2000; Van Heerde, Helsen, & Dekimpe, 2007; Gao, Xie, Wang, & Wilbur, 2015). Given the ensuing media attention and public discussion on product security issues, there is a recent call for more studies on how to effectively reduce PHC incidences (Wowak & Boone, 2015). I respond to the call and study how CEOs' characteristics ("the person"), corporate governance ("the position"), and external environment ("the environment") interplay to affect the likelihood of PHCs.

I first focus on two important individual-CEO characteristics: risk-seeking personality [1] and experiences in managing operational issues. Upper echelons theory (Finkelstein & Hambrick, 1990, 1996) suggests that a CEO's psychological attributes have significant implications on firm strategic decisions (Carpenter, Geletkanycz, & Sanders, 2004;

[1] CEO risk-taking personality and CEO risk-seeking preferences are interchangeable terms in this study.

Chatterjee & Hambrick, 2007; Hoskisson, Chirico, Zyung, & Gambeta, 2017; Gamache, McNamara, Mannor, & Johnson, 2015). A CEO's risk-seeking personality might be related to a higher likelihood of PHCs due to the CEO's higher tolerance to potential risks at production. Literature also shows that what a CEO has done in the past shapes who he is and influences the decisions he makes (e.g., Daily, Certo & Dalton, 2000; Guthrie & Datta, 1997). I argue that a CEO's operational experiences will mitigate the PHC hazards associated with his risk-taking preference as CEOs who have abundant experiences in operations will be alert to product quality issues and take measures to mitigate the risks.

I next investigate how "the position" of a CEO influences the relation between CEO risk-taking personality and PHCs. Corporate governance represents an important control system that relates to "the position" of a CEO (Abernethy, Kuang & Qin, 2015). Board of directors (BOD), an essential component of corporate governance, likely affects the relation between CEO risk-taking and PHC likelihood as a principal mission of the BOD is to control unwanted managerial risk-taking (Westphal & Fredrickson, 2001; Hoskisson, et al., 2009; Cassar 2014; Kor & Sundaramurthy, 2009). I expect that the role of a BOD becomes particularly important when the CEO has a high-risk appetite but lacks operational experiences.

Concerning the influence from "the environment" in which the CEO operates, product market competition is an important external market condition that may influence the relation between CEO risk-taking personality and PHC incidents (Kranton & Minehart, 2001; Ryu, 2012). Competitions impose firms and their CEOs under direct pressure as firms providing inferior quality of products or services will suffer reputational loss and liquidation risk (Dawar & Pillutla, 2000; Kageyama, 2006; Baggs & Bettignies, 2007; Chan, Li, & Pierce, 2014). I expect that competition and market pressure will motivate a risk-seeking CEO to carefully assess the implications of his decisions on product quality, thereby alleviating the relation between the CEO's risk-taking personality and the PHC likelihood.

Using a sample of manufacturing firms in the United States from 2002 to 2012, I find that a CEO's risk-taking personality is associated with a higher PHC hazard only when he lacks operational experience. I further show that a BOD's industry experience significantly alleviates the likelihood of PHCs when the risk-seeking CEO lacks functional background in operations, supportive of the monitoring and advisory role of BODs documented in the prior literature (Berle & Means, 1932; Fama & Jensen, 1983; Abernethy et al., 2015). Finally, as predicted, risk-seeking CEOs have a lower PHC likelihood when industry competition intensifies, consistent with the view that external environment significantly affects CEOs' decision making and their firms' performance outcomes (Busenbark et al., 2015).

My findings make several contributions to the existing literature. First, I expand the research on how CEO characteristics affect firm performance (Busenbark et al., 2015). I demonstrate that factors related to a CEO's personal characteristics (e.g., risk-taking personality and functional background in operations), his position (e.g., corporate governance), and the environment (e.g., industry competition) interact, and it is their confluence that explains a firm's operational performance. My model thus facilitates a more comprehensive understanding of how strategic leaders of a firm affect firm behavior and how corporate control mechanisms and external factors influence the process.

One challenge in the literature is to capture CEOs' psychological attributes using observable data (Lawrence, 1997; Hambrick, 2007). I employ an innovative approach and infer CEOs' risk-taking personality from their off-the-job behavior. More specifically, I use a CEO's hobby of flying airplanes as an observable indicator for his values and cognitive model toward risks (Zuckerman, 1971; Zuckerman, Eysenck, & Eysenck, 1978; Cain & McKeon, 2016; Sunder, Sunder, & Zhang, 2016). My method helps infer an important CEO characteristic which is often unobservable.

I also extend the scarce literature on product-related controversies. My study relates to Wowak, Mannor, & Wowak (2015) that investigates the effects of CEO compensation on the incidences of product safety problems, as I both reveal one undesired consequence of CEOs' aggressive risk-taking; yet the two studies differ in several important ways. Firstly, while Wowak et al. (2015) focus on how compensation design functions as a powerful mechanism to guide CEOs' behavior, I examine how heterogeneity among individual CEOs in their innate values and cognitive styles implicates their actions. From this aspect, Wowak et al. (2015) study the 'wealth effect'; I, in contrast, investigate a 'risk aversion effect'[2] on CEO behavior (Cain & McKeon, 2016). To my best knowledge, my study is among the first studies to illustrate that a CEO's personality, interacting with his experiences, can influence product quality and it is the joint force of a CEO's individual characteristics, corporate governance, and market competition that has an impact on product safety issues.

2.2 Theoretical framework, related literature, and hypothesis development

Emphasizing the unique, embedded situation of CEOs, Busenbark et al. (2015) propose a configurational perspective in analyzing CEO-related issues. This perspective posits that a CEO's influence on corporate decisions can be explained by three interdependent domains: "the person", "the position", and "the environment", in which "the person" relates to personal characteristics of a CEO, such as the CEO's personality and background; "the position" refers to factors that relate to the role and structure of the CEO's job, such as corporate governance mechanisms that monitor the CEO's behavior; and "the environment" is the external environment in which the CEO operates, such as industry conditions and external pressure.[3] I adopt this configurational perspective to explore how a CEO's individual

[2] My findings suggest that a CEO's risk-seeking personality (or individual characteristics on risk aversion) has direct implications on his behavior, which stays significant after controlling for the 'wealth effects' as documented in prior literature.

[3] Busenbark et al. (2015) argue that the three domains are interdependent and jointly describe how factors

characteristics, corporate governance, and market competition interplay in explaining a firm's PHC likelihood.

2.2.1 "The Person": CEO Risk-taking Personality and Functional Background

The influence of CEOs' personal characteristics on firm performance is proposed by upper echelons theory that argues that organizational actions and performance outcomes are determined by managerial human attributes (Hambrick & Mason 1984; Chatterjee & Hambrick 2007; Hambrick 2007). Empirical evidence supports the effects of various dimensions of a CEO's attributes on firm decisions, including narcissism (Chatterjee & Hambrick, 2007), regulatory focus (Gamache et al., 2015), affection and emotions (Roth, 1995; Delgado-Garcia and La Fuente-Sabate, 2010), hubris (Tang, Qian, Chen, & Shen, 2015; Cormier, Lapointe-Antunes, & Magnan 2015), and personality (Herrmann & Nadkarni, 2014). In this study, I focus on two fundamental characteristics of a CEO: risk-taking personality and functional background (Hambrick & Mason 1984; Hambrick, 2007). A CEO's risk-taking preference represents his cognitive base, value, and perception, which ultimately influences a wide range of strategic choices made in a firm. Similarly, a CEO's functional background orients the way he tackles the current problems and significantly influences the CEO's goal selection, time range, problem definition, information processing, and strategic choices (Lawrence and Lorsch, 1967; Walsh, 1988; Slater and Dixon-Flowler, 2009). Both may have significant impacts on a firm's performance outcomes.

A higher likelihood of PHCs may be associated with a CEO's risk-taking personality as the CEO has high-risk tolerance and may ignore potential risks in the current production process and inspection system, which can grow into severe production problems at a later stage

pertaining to a CEO explain firm decisions and performance outcomes. The configurational perspective integrates various theories and represents a framework that provides new contingencies in understanding economic consequences of a CEO's individual characteristics.

(Kimes, 2010; Marucheck, Greis, Mena, & Cai, 2011; Wowak et al., 2015; Lee, 2016). I formally state in my first hypothesis that:

H1: A CEO's risk-taking personality is positively associated with the occurrence of PHCs.

However, to survive and thrive in a dynamic business environment CEOs inevitably need to take risks and their personal traits in risk-taking are potentially valuable to improve the competitive advantage of their firms (Hoskisson et al., 2017; Cain & Mckeon, 2016). I acknowledge the incremental value of a CEO's risk-taking personality and consider that it introduces a plausible tension to my first hypothesis.

While it is plausible that PHCs are more likely when a CEO is innately risk-taking, the CEO's prior experiences in operational management will help alleviate product-related issues arising from his risk-taking personality. CEOs with experiences in production and operations likely possess a clear vision on the strategic importance of achieving superior product quality at risk-taking (McGill, Slocum, & Lei, 1992; Raisch & Birkinshaw, 2008). For example, they will plan production and propose new techniques with greater prudence; they are also able to resolve potential product quality issues in an efficient way (Kalyanaram, Robinson, & Urban, 1995; Ryu, 2012; Hendricks, et al., 2014; McCann, 2014). In contrast, in the absence of operational experiences, CEOs likely pursue risk in a discretionary way and their risk-taking behavior might be merely personal interests or heuristics driven without in-depth analysis or prudent planning, leading to a higher hazard of PHCs (Shetty, 1987).

In sum, I expect that a CEO's risk-taking personality will interact with his functional background in operations to influence the occurrence of PHCs. That is, the CEO's operational experiences will mitigate the association between his risk-taking personality and the likelihood of PHCs. Hence, I hypothesize that:

H2: A CEO's operational experiences will attenuate the association between the CEO's risk-taking personality and the occurrence of PHCs.

2.2.2 "The Position": Expertise of BOD

Prior literature applying agency theory shows that a BOD, an important component of corporate governance that relates to "the position" of a CEO, represents an effective control mechanism that influences the whole process of a firm's decision making (Plöckinger, Aschaer, Hiebl, & Rohatschek, 2016; Abernethy et al., 2015; Abernethy & Wallis, 2017). BODs constrain managerial opportunism, including inappropriate risk-taking, and play a primary advisory role in making important corporate decisions. Evidence shows that directors bring external resources to the focal firm such as suppliers of inputs, knowledge of production, etc., and directors' expertise and experiences are pivotal in evaluating feasibility of the firm's strategies, detecting initial signs of risks and errors, and implementing necessary measures to prevent the occurrence of severe malpractices in the firm (Jensen & Meckling, 1976; Pfeffer & Salancik 1978; Intintoli, Kahle, & Zhao, 2016; Omer, Shelley, & Tice, 2016).

I expect that the expertise of a BOD is particularly important when the risk-taking CEO lacks experiences in operations and manufacturing. For example, directors' industry-specific experience allows them to access most relevant and accurate information so that they will provide valuable advice on how to improve production quality and ensure the effectiveness of current quality control system, especially when their CEO lacks related information or resources (Hillman, Withers, & Collins, 2009; Cassar, 2014). Prior literature indicates that directors' industry expertise helps them swiftly identify and acquire critical resources, such as global suppliers and local distributors, in the implementation of quality control (Kor & Sundaramurthy, 2009; Dalziel, Gentry, & Bowerman, 2011; Barroso, Villegas, & Pérez-Calero,

2011; Guldiken & Darendeli, 2016).[4] Therefore, I expect that a BOD's expertise is of importance to fill a void in a CEO's experience so that the negative effect of the CEO's risk-taking on product quality is mitigated. Formally stated, my hypothesis is that:

H3: BOD's expertise will attenuate the association between risk-taking personality of a CEO who lacks operational experiences and the occurrence of PHCs.

2.2.3 "The Environment": Product Market Competition

"The environment" domain in the configurational perspective relates to the contextual factors of the environment in which a firm operates. I focus on product market competition as it is a key factor that influences firm decisions and performance outcomes (Shetty 1987; Kroll, Wright, & Heiens 1999; Rust, Zahorik, & Keiningham 1995).

Product market competition imposes CEOs under pressure and introduces the threat of liquidation (Hart 1983; Hermalin 1992; Schmidt 1997). Evidence shows that firms and CEOs providing poor-quality products are subject to adverse consequences, ranging from reputational damage and financial losses to heightened litigation risk and increased bankruptcy probabilities (Dawar & Pillutla, 2000; Kageyama & Tokunaga, 2006; Baggs & Bettignies, 2007; Chan, Li, & Pierce, 2014). In contrast, by improving product quality firms are gaining market shares, financial profits, and competitive advantages compared to their rivals (Shetty, 1987; Rust, Zahorik, & Keiningham, 1995; Kroll, Wright, & Heiens, 1999). It argues that market competition has a positive effect on product quality as both firms and their CEOs who perceive the threat of market competition will value product quality with greater importance (Baggs & Bettignies 2007).[5] Evidence indeed shows that under industry competition firms are more

[4] Problems related to supplier firms' products and distribution process are a major factor of product quality failure (Marucheck et al., 2011). For example, Fords reported that 76% of the company's product quality problems stem from its first-tier suppliers (Sherefkin 2002).

[5] Compared to monopoly markets where the market structure includes a sole seller and goods of the seller faces no close substitutes, competitive markets are more likely to generate product quality close to a socially optimal level (Spence, 1975). The reason is that market competition will impose a direct pressure on firms to improve

likely to take measures, such as adopting ISO 9000, to improve the quality of production and higher product quality is often observed when the competition increases in the industry (Cotterill, 1999; Baggs, 2007; Cao & Prakash, 2011; Matsa, 2011).

Risk-taking CEOs are responsive to the dynamics of the markets (Davidson et al., 2015; Bernile et al., 2017; Cain & McKeon, 2016; Faccio et al., 2016). I expect that, bearing market competition in mind, risk-taking CEOs will become more cautious in their risk-taking initiatives when competition intensifies and hence improve their prudence in operational management to avoid providing inferior quality products. Therefore, increased product market competition will lower the likelihood of PHCs in firms led by risk-taking CEOs. My hypothesis is formally stated as follows:

H4: Industry competition will attenuate the association between a CEO's risk-taking personality and the occurrence of PHCs.

Figure 1 graphically presents my theoretical framework that explains how CEO personality, corporate governance, and market competition interact in affecting the PHC incidences.

2.3 Empirical Measurements, Models, and Sample

2.3.1 Key Variable Measurement

Product Harm Crises. My dependent variable is the occurrence of PHCs. I create a dummy variable *PHC* that equals one if a firm has a product harm crisis in a year, and zero otherwise. I use the product concern indicator in MSCI ESG KLD STATS (KLD) database to

production quality as poor quality of products or services will be quickly identified and penalized by their customers, suppliers, and competitors (Baggs & Bettignies, 2007). The liquidation argument further suggests that under the market competition CEOs are particularly concerned about the security of their job and thus motivated to devote more efforts to quality control (Hermalin, 1992; Schmidt, 1997; Baggs & Bettignies, 2007). Then a higher level of product quality is expected with the increase of market competition. Further, evidence shows that prioritizing financial profitability at the expense of product quality (by cutting internal costs in product testing) does not represent a sustainable strategy and will eventually be penalized by the markets (Ryu, 2012; Wowak & Boone, 2015).

infer whether a firm experiences a PHC in a year, which is "designed to assess the severity of controversies related to the quality and safety of a firm's products and services" (MSCI, 2015).[6] The reliability of using the KLD product concern variable as an indicator of PHCs has been validated in prior literature (Kashmiri & Brower, 2016).[7]

CEO's Risk-taking personality. I infer a CEO's risk-taking personality (i.e., his risk-seeking preferences) from his observable characteristics, i.e., whether he obtains an airman certificate. A CEO's hobby of flying airplanes provides an observable indicator of the CEO's preferences for bearing non-pecuniary (i.e., health) risks as well as his innate desire for thrill and adventure seeking (Zuckerman, 1971; Zuckerman et al., 1978). Evidence shows that CEOs who hold airmen licenses have a high value in aggressively pursuing risky initiatives and that firms led by pilot CEOs are associated with more pronounced corporate risk-taking (Cain & McKeon, 2016; Sunder et al., 2016)[8].

I search the website of Federal Aviation Administration (FAA)[9] to identify whether a CEO has a pilot credential. For accuracy, I use both CEOs' names and dates of birth as primary filters in the search, where CEOs' names are retrieved from ExecuComp and information on CEOs' dates of birth is manually collected from Bloomberg. An indicator variable *PILOT* is created to flag whether a CEO has a pilot credential.

[6] Factors affecting this evaluation include, but are not limited to, a history of involvement in product safety-related legal cases, widespread or egregious instances of recalls or fines due to defective or unsafe products and services, resistance to improved practices, and criticism by Non-Governmental Organization (NGOs) and/or other third-party observers.

[7] Kashmiri and Brower (2016) independently code the events related to PHCs based on articles, press release, and reports on product recalls, as well as product-related litigation and compensatory damages. They find that the hand-collected data match the product concern variable in the KLD product category.

[8] Cain and McKeon (2016) has validated/tested the CEO's hobby of flying airplanes as a valid risk-taking persomality measure in a wide range of firms' policies led by the CEO. However, Sunder et al (2016) argue that CEO's hobby of flying airplanes mostly capture the sensation/innovation seeking personality. Although sensation/innovation seeking personality are highly correlated with risk-taking behaviors (Zuckerman 1971), I acknowledge the possibility of sensation seeking personality can be an alternative channel to influence the resulting product harm crisis.

[9] FAA stores and releases the names, certificate levels, and rating information for all pilots in the United States.

CEO's operational experiences. I consider a CEO knowledgeable in production and operational matters if he used to serve as a chief operating officer (COO) before the current CEO position. A COO has a full plate of responsibilities in overseeing operations, product manufacturing, procurement, and transportation, each of which has a direct implication to production and quality control (Davis, Aquilano, & Balakrishnan, 2005; Marucheck et al., 2011; Hendricks, Hora, & Singhal, 2014; Wowak & Boone, 2015). I search Bloomberg, Factiva, and companies' websites to obtain information on a CEO's employment history. Variable *CEOEXP* equals one if a CEO has prior COO experience (in the current firm or elsewhere), and zero otherwise.

BOD's expertise. Prior studies show that quality of corporate governance improves with industry-specific experiences of directors (Cassar, 2014; Kor & Sundaramurthy, 2009; Guldiken & Darendeli, 2016). I use independent directors' expertise in the industry where their firm operates as a proxy for the BOD's expertise. Directors accumulate industry knowledge and improve their supervision capability by serving multiple directorships in various firms of the same industry (Wang, Xie, & Zhu, 2015). An independent director is considered to have industry expertise if in recent four years he has served a primary position (such as an executive and director) in another firm that operates in the same industry as the focal firm. *BODEXP* captures overall industry expertise of independent directors on board, defined as the percentage of independent directors on board who have industry expertise.

Market competition. I measure market competition of an industry by Herfindahl index (Petersen & Rajan, 1995). Specifically, for each industry-year, I include all firms with non-missing sales in Compustat in calculating the Herfindahl index, where the industry is defined by the first two-digits SIC code. A smaller value of Herfindahl index indicates higher competition in the industry. I then create an indicator variable *INDCOM* that equals one for

industries with high market competition, and zero otherwise, benchmarking upon whether the Herfindahl index of the industry in a year is lower than the sample median.

Control variables. The inclusion of control variables follows prior literature. Large firms and firms with complicated organizational and operational structures might be more likely to experience PHCs (Kashmir et al., 2016; Wowak & Boone, 2015; Wowak et al., 2015). I include *SIZE* measured by the natural logarithm of total sales, and *SEG*, defined as the number of business segments. Firms in financial losses may have constrained resources to invest in improving product quality (Kini, Shenoy, & Subramaniam, 2017), but they may also have stronger incentives to provide high product quality to reduce the liquidation risk. I include *LOSS*, an indicator for a firm experiencing financial losses in the prior year. I also include market-to-book ratio (*MTB*) to control for the possibility that firms with better prospects will invest more in product-related initiatives. Further, I control for a firm's capital structure by debt ratio (*LEV*) and institutional ownership (*IO*), as debtholders and shareholders are concerned about product quality and may act on it (Lee & Park, 2009).

CEOs' characteristics, other than their risk-taking preferences, may also affect firms' production policies and product quality (Tang, Li, & Yang, 2015). A CEO's age (*AGE*) and tenure (*TENURE*) are controlled for. Older CEOs might be more conservative (Serfling, 2014; Andreou, Louca, & Petrou, 2017), potentially contributing to improved product quality; but they might also be inclined to take more risk due to limited horizon (Matta & Beamish, 2008; Galasso & Simcoe, 2011; Yim, 2013), yielding a positive effect on PHC incidences. Similarly, although longer-tenured CEOs might be entrenched (Finkelstein & Hambrick, 1989) and hence increases PHC hazards, firm-specific knowledge accrued over a CEO's tenure may facilitate his quick identification of potential issues in operations (Henderson, Miller, & Hambrick, 2006; Hambrick, 2007; Crook, Ketchen, Combs, & Todd, 2008). I also control for CEO power over the board by including a CEO-Chair indicator (*DUALITY*), board size (*BODSIZE*), and board

independence (*BODINDE*) (Abernethy et al., 2015). I further include CEO option compensation (*OPTION*) measured as the natural logarithm of the value of unexercised exercisable options to control for the risk-taking effects from CEO compensation (Wowak et al., 2015).[10] Finally, I include industry and year fixed effects. An appendix presents the definitions of all variables.

2.3.2 Sample and Data Sources

My sample is constructed by merging various data sources. PHC data are retrieved from the product quality concern indicator in the KLD database. I merge KLD with Compustat for financial information and with ExecuComp and BoardEx for information on corporate governance, director experiences, and CEO characteristics. I follow the literature and retain only manufacturing firms (i.e., two-digit SIC code 20-39) (Dawar & Pillutla, 2000; Ryu 2012; Wowak & Boone, 2015; Wowak et al., 2015). I then merge the sample with my hand-collected data on CEOs' pilot credential information and functional background in operations. My final sample consists of 3,114 firm-year observations for years 2002 to 2012.

2.3.3 Empirical Models

I employ logistic regressions as my dependent variable is a PHC indicator.[11] To test H1 concerning the relationship between a CEO's risk-taking personality and the likelihood of PHCs, I estimate the following Model (1):

$$Prob(PHC = 1) = f\ (\alpha_0 + \alpha_1 PILOT + CONTROL + \varepsilon) \qquad (1)$$

[10] Stock options granted to a CEO may be used as an effective profit- and risk-sharing method to prolong the CEO's horizon and mitigate the agency problem between shareholders and the CEO (Jensen & Murphy; 1990; Murphy, 1999; Coles, Daniel, & Naveen, 2006).

[11] Hoetker (2007) shows that extra care should be taken to interpret interaction terms in a non-linear regression, such as a logistic regression. It is recommended to provide a graphical presentation of interaction effects. I follow the recommendation in Hoetker (2007) and compare coefficients across groups in a plot. Details are discussed in empirical result section.

Where ε is an error term and *CONTROL* represents a vector of control variables. A significantly positive sign on α_1 will suggest that pilot CEOs are associated with an increased hazard of PHCs.

In H2, I expect that a CEO's experiences in operations and production will mitigate the effect of his risk-taking personality on the PHC likelihood. Model (2) is employed to examine the moderating effect:

$$Prob(PHC = 1) = f\ (\beta_0 + \beta_1 PILOT + \beta_2 CEOEXP + \beta_3 PILOT * CEOEXP + CONTROL + \varepsilon)\ (2)$$

The coefficient on the interaction term $PILOT * CEOEXP$ captures the moderating effect of *CEOEXP*. I expect that the relation between CEO risk-taking personality and PHC is mitigated by the CEO's prior operational experiences and thus β_3 will be significantly negative.

In H3, I predict that BOD's experiences will help alleviate the PHC hazard of a CEO's risk-taking when the CEO lacks operational experiences. I employ Model (3) as followings:

$$Prob(PHC = 1) = f\ (\gamma_0 + \gamma_1 PILOT + \gamma_2 BODEXP + \gamma_3 PILOT * BODEXP + CONTROL + \varepsilon)\ (3)$$

I form two subsamples based on whether a CEO has or lacks operational experiences and estimate Model (3) in the two subsamples, respectively. A significantly negative coefficient on $PILOT * BODEXP$ (γ_3) in the absence but not the presence of CEO operational experiences will be consistent with H3.

In H4, I expect that market competition will moderate the association between CEO risk-taking personality and the PHC likelihood. I estimate Model (4) to examine my expectation:

$$Prob(PHC = 1) = f\ (\theta_0 + \theta_1 PILOT + \theta_2 INDCOM + \theta_3 PILOT * INDCOM + CONTROL + \varepsilon)\ (4)$$

I expect the coefficient on $PILOT * INDCOM$ (θ_3) to be significantly negative as market competition weakens the relation between a risk-taking CEO and occurrences of PHCs. In all models, I control for industry and year fixed effects and correct standard errors for firm-level heterogeneity (Greene, 2012).

2.4 Empirical Results

2.4.1 Descriptive Statistics and Univariate Analysis

Table 1 reports the descriptive statistics of variables used in my analyses. PHCs occur in 11% of my observations. About 3% of CEOs in my sample hold an airman license.[12] There are 57% of the CEOs who have functioned as a COO before being appointed to the CEO position. On average, 17% of independent directors on board have served a major role elsewhere in the same industry during the most recent four years. An average CEO in my sample is about fifty-five years old, and his tenure is 7 years (recall that *TENURE* is measured as natural logarithm of the number of years that a CEO is in position). An average board consists of nine directors, mainly independent, and about 26% of the boards are chaired by CEOs. In addition, the mean of institutional ownership is 77% as my sample includes many large manufacturing firms.

Table 2 summarizes Pearson pairwise correlations of the variables used in my empirical analyses. The correlation between *PILOT* and *PHC* is not significant, thereby suggesting that pilot CEOs' risk-taking personality in itself does not necessarily relate to a higher PHC likelihood in the firms that they lead. I notice that *PHC* and *CEOEXP* have a significantly positive correlation, which suggests that firms subject to a greater PHC hazard tend to select CEOs who are experienced in operational management, possibly in an attempt to

[12] Cain & McKeon (2016) and Sunder et al. (2016) document that 8% of CEOs in the S&P 500 firms hold a private pilot license. If I constrain my sample to S&P 500 firms, I get a similar ratio.

control the potential risk embedded in business.[13] I also notice that several variables associated with firm size exhibit relatively high correlations (e.g., *SIZE*, *BODSIZE*, and *SEG*). I check the variance inflation factor (VIF) of the variables used in the regressions (including the interactions). The maximum VIF is 3.20 and the average VIF is 1.58, both below the cutoff threshold of 10 suggested by Kennedy (1992), suggesting that multicollinearity is less likely to be an issue in my analysis.

2.4.2 Discussion of Main Results

Table 3 reports the empirical results of Models (1) and (2). Column (1) summarizes the findings on the relationship between a CEO's risk-taking personality and PHC incidences as hypothesized in H1, and Column (2) presents the results on the moderating effect of CEOs' operational background as expected in H2. Statistics of Chi-squared show that both models exhibit significant power in explaining the variation of PHC likelihood among firms. In Column (1), the coefficient on *PILOT* is not statistically significant, suggesting that a CEO's risk-taking preference in itself does not relate to a significantly higher PHC hazard. When the interaction term *PILOT*CEOEXP* is added into the model, results in Column (2) show that the coefficient on *PILOT* becomes significantly positive (β = 1.494, p<0.10), whereas the coefficient on the interaction term *PILOT*CEOEXP* is significantly negative (β = -2.036, p < 0.05), which suggests that a CEO's risk-taking personality is significantly associated with an increased likelihood of PHCs when the CEO lacks experiences in operational management while such association is significantly mitigated in firms where the CEO has prior COO experiences. The result is in line with my prediction in H2 that a CEO's functional background in operations mitigates the PHC hazards of his risk-taking personality.

[13] In robustness tests, I examine the sensitivity of my results after controlling for plausible endogeneity at CEO selection.

The results of control variables are generally consistent with the prior literature and my predictions. Larger firms are subject to a higher PHC likelihood (Kashmir et al., 2016; Wowak & Boone, 2015; Wowak et al., 2015). Loss firms are associated with a lower PHC hazard, suggesting that these firms take measures to improve product quality in order to prevent deterioration of the liquidation risk.[14]

Figure 2 provides a graphical illustration on how the effect of a CEO's risk-taking personality on PHC likelihood varies with the CEO's operational experiences. The slope of the line representing the association between *CEOEXP* and *PHC*, is flat for *PILOT* = 0 group, while it is highly steep for *PILOT* = 1 group, which is consistent with my previous findings derived from the regression analysis. Therefore, the results of both regression analysis and graphical demonstration suggest that a CEO's operational management experiences are most valuable in reducing a firm's PHC risk when the CEO has high risk-taking personality while his experiences have marginal value when the CEO is immune to risk-seeking innately.

The results of Model (3) are presented in Table 4 where I analyze the moderating effect of a BOD's industry expertise. Chi-squared statistics suggest that the model specification has significant power in explaining the variation of the dependent variable. Recall that I expect in H3 that directors' expertise will alleviate the PHC hazards associated with a risk-taking CEO when the CEO lacks operational experiences, whereas it is less valuable in the PHC risk reduction when their CEO already has abundant experiences in operational management. My empirical findings are in line with the expectation. As shown in Table 4, the interaction term *PILOT*BODEXP* is significantly negative (β = -0.201, $p < 0.01$) only in Column (2) where the analysis is performed in a subsample of CEOs without prior COO experiences. The interaction

[14] I also find that CEO stock option compensation is associated with a lower PHC likelihood, suggesting that CEOs tend to increase their prudence over production when they own more stock options, which is consistent with prior literature that shows that CEOs' stock-based compensation will motivate the CEO to take measures to avoid product quality failure to maximize shareholders' value (Kashmir et al., 2016).

term does not show statistical significance in Columns (1) or (3) where either a full sample or a subsample of CEOs with COO background is used in the analysis.[15]

My H4 relates to the influence of product market competition. I expect that market competition will increase a risk-taking CEO's prudence over production and reduce the PHC hazards related to the CEO's risk-taking preferences. Table 5 reports the results of Model (4). The statistics of Chi-squared demonstrate the satisfactory goodness-of-fitness of my model specification. Column (1) summarizes the results using a full sample, where the coefficient on the interaction term *PILOT***INDCOM* is significant and negative (β = -2.244, $p < 0.01$), consistent with my prediction that, with the increase of market competition, CEOs will focus more on product quality and hence the influence of a CEO's risk-taking personality on PHCs is attenuated. In Column (2) and (3), I re-estimate Model (1) using a subsample of CEOs having prior COO experiences, and a subsample of CEOs without prior COO experiences, respectively. The coefficient on the interaction term *PILOT***INDCOM* remains significant and negative in both columns, suggesting that the positive effect of market competition on product quality holds for all risk-taking CEOs, regardless of their functional background in operations, as they all face the pressure of improving product quality at the markets.[16]

2.4.3 Robustness Analyses

Firms appointing risk-taking CEOs might be fundamentally different from those that choose not to do so. One concern is that firms with higher product quality may be the ones that select pilot CEOs with abundant operational management experiences. Then the observed moderating effects of CEO experiences may merely reflect the selection issue derived from CEO appointments. To mitigate this concern, I employ a propensity scoring matching (PSM)

[15] The reduction in sample size when the model is estimated in subsamples is due to the inclusion of industry fixed effects. Some industries are automatically dropped because of perfect prediction in a logistic model.

[16] Graphical analyses provide similar results as the regression analysis, supportive of the moderating effects of *BODEXP* and *INDCOM*.

method to control for observable differences between firms with *Pilot* CEOs (hereafter "treatment firms") and firms with non-pilot CEOs (hereafter "control firms"). I run a logistic regression to model the likelihood of being a treatment firm[17] and then obtain the predicted likelihood from the regression as a proxy for the propensity of one observation to become a treatment firm. I next perform a one-to-one match for each treatment firm, choosing a control firm with the closest propensity score to the treatment firm from the same industry-year combination and imposing a constraint that the difference between their propensity scores must not be larger than 0.10.[18] This procedure yields 60 pairs of treatment and control firms (120 firm-year observations in total).

Panel A in Table 6 compares covariates balance *pre-* and *post-* the PSM. I notice that before the matching firms led by pilot CEOs exhibit significant differences from multiple dimensions compared to firms of non-pilot CEOs. For example, pilot CEOs' firms are larger in size, higher in leverage and growth; further, the CEO is long-tenured, older in age, with a higher likelihood to chair the board, and compensated with more stock options. The cross-group differences generally disappear in my PSM sample, suggesting that the PSM procedure effectively eliminates the likelihood that observable differences related to my variable of interest *PILOT* may provide an alternative explanation to my findings.[19]

Pane B of Table 6 presents the results of Models (1) and (2) using the PSM sample. The coefficient on *PILOT* is not statistically significant in Column (1), consistent with my prior findings that a CEO's risk-taking personality does not necessarily increase a firm's PHC hazards. In Column (2), the coefficient on the main effect of *PILOT* becomes significantly positive whereas the coefficient on the interaction term *PILOT***CEOEXP* is significantly

[17] I include a group of variables to predict the likelihood of selecting a pilot CEO, including *SIZE*, *LEV*, *MTB*, *LOSS*, *SEG*, *IO*, *BODSIZE*, and *BODINDE*.

[18] I also impose common support by dropping treatment firms whose propensity scores are higher than the maximum or less than the minimum propensity score of control firms.

[19] The cross-group differences on *TENURE* and *AGE* remain statistically significant in the PSM sample. I follow Erkens and Bonner (2013) and include all covariates in the comparisons into next step PHC regressions.

negative, in line with my expectation that pilot CEOs experienced in production management face a lower likelihood of PHCs compared to pilot CEOs who lack such experiences.

In addition to PSM, I conduct several other robustness checks. As an alternative way to address the endogeneity related to CEO selection, I follow Kim, Wang, & Zhang (2016) and remove firms-years when a CEO's tenure is less than 3 years. To the extent that firm-CEO matching effect winds off during a CEO's tenure, excluding short-tenured CEO-years will alleviate the concern of endogeneity due to plausible CEO-firm matching effects. I replicate my prior analysis in the new sample and find that my results remain inferentially unchanged. I also follow Kini et al. (2017) and use an alternative approach to define manufacturing industries.[20] I obtain consistent results. Furthermore, to rule out the potential influence of the recent global financial crisis, I exclude years 2008 and 2009 in my sample and again my findings stay robust.

2.5 Discussion and Conclusion

This study focuses on an undesired firm performance outcome, i.e., PHC incidences, and employs a configurational perspective in analyzing how CEO personal characteristics ("the person"), interplays with corporate governance ("the position") and industry competition ("the environment") in explaining the likelihood of PHCs. My results highlight the value of CEOs' and BODs' experiences as I show that the adverse effects of a CEO's risk-taking personality on product quality can be mitigated when related knowledge has been developed inside the focal firm, from the end of either a CEO or a BOD, to control the CEO's risk-taking behavior. I further show that external pressure, such as market competition,

[20] Specifically, I include firms from industries with following two-digit SIC: 20, 23, 26, 28, 34-39, 50-54, 56-59, 73, 79, 87.

also interplays with CEO personality in the process and it is the confluence of CEO personal traits, corporate governance, and environment that affects a firm's operational performance.

My study provides timely implications to the practice. Recent years have witnessed an increasing number of firms, including high profile ones such as McDonald's, West-Ward Pharmaceuticals, etc. removing COO position from the top management team because firms believe that the COO's role largely overlaps with the CEO's and is thus redundant. My findings, however, suggest that prior experiences on operations make a good CEO and COO experiences are valuable to a CEO as well as a firm. Further, although studies argue that director interlocks undermine board independence and supervision quality (Yermack, 2004; Fich & Shivdasani, 2007; Chiu, Teoh, & Tian, 2012) and interlocking directorates represent a controversial topic in practice, I demonstrate that interlocking directorships may bring significant value to a firm, as directors' expertise from other companies will effectively conciliate the vacuum in their CEOs' background and the set of knowledge on a collective level within a firm helps improve its operational performance (Hillman et al., 2009).

Like other studies on CEO personal traits, the interpretations of my findings are subject to some limitations. First, I infer a CEO's risk-taking preferences from their observable characteristics, i.e., acquisition of an aviator license (Cain & McKeon, 2016; Sunder et al., 2016). My measure captures CEOs who tend to be extreme cases in the risk-seeking category. Future research could validate this measure and explore how other dimensions of CEO personality affect their strategic decisions and firm performance. Secondly, I assume that CEOs' operational experiences accrue through their previous COO employment. However, it is also possible that CEOs can access related information from other sources, such as their business partners, close friends, social peers, etc. Future research may investigate how CEOs obtain valuable information through multiple channels. Further, I show that BOD provides effective advisory and monitoring role in mitigating the PHC problems. Future studies could explore

whether alternative internal mechanisms are available in constraining inappropriate managerial behaviors. Besides, while I examine one possible negative consequence associated with a CEO's innate risk-taking preferences, I acknowledge the possibility that CEOs with high-risk appetite may be more capable of handling corporate adversities including production and operational crises. More research is needed to explore how my findings apply to other contexts. Finally, Internal control over financial reporting ("ICFR") is believed to be highly correlated with internal control over operation which could also affect the likelihood of occurrence of product harm crisis. As both corporate governance and top management team set the tone at the top to influence firms' performance on "ICFR" and internal control over operation, future studies could explore these mediating processes through which corporate governance and top management team affect the occurrence of product harm crisis.

2.6 References, Appendix, and Tables

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Appendix
Variable Definitions

Variable	Definition
PHC	An indicator variable equals one for firm-years with product harm crises, and zero otherwise
PILOT	An indicator variable equals one for CEOs with a pilot license, and zero otherwise
CEOEXP	An indicator variable equals one for CEOs with COO experiences, and zero otherwise
INDCOM	An indicator variable equals one for industries with high competition, and zero otherwise, where industry competition is measured by Herfindahl index
SIZE	Firm size calculated as natural logarithm of total assets
LEV	Leverage ratio calculated as total long-term debt scaled by total assets
MTB	Market-to-book ratio calculated as year-end market value scaled by book value of equity
LOSS	An indicator variable equals one if net income is negative, and zero otherwise
SEG	Firm complexity measured by the total number of business segments
IO	Percentage of shares owned by institutional shareholders
TENURE	CEO tenure measured by natural logarithm of the number of years that a CEO is in position
DUALITY	An indicator variable equals one if the CEO of a firm is also the chairman of the board of directors, and zero otherwise
OPTION	Value of stock option owned by natural logarithm of total value of unexercised exercisable stock options owned by a CEO
BODSIZE	Size of board of directors calculated as the natural logarithm of the total number of directors
BODINDE	An indicator variable equals one if the percentage of independent directors is higher than 75 percent, and zero otherwise
BODEXP	Industry expertise of independent directors calculated as the number of independent directors with industry expertise relative to the total number of independent directors, multiplied by 100
AGE	CEO age

Figure 1
Conceptual Framework of the Associations between CEO Characteristics, Corporate Governance, Market Competition and PHCs

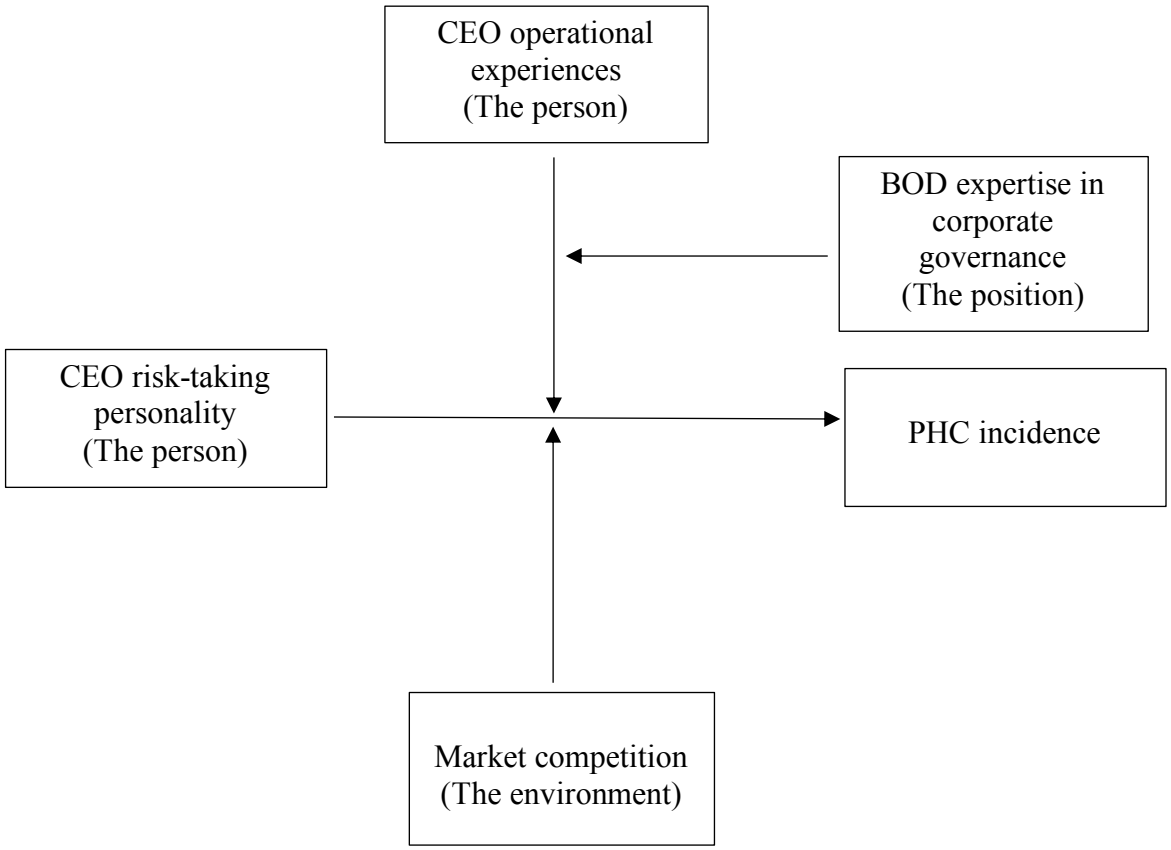

Figure 2
Plots of Interaction Effects

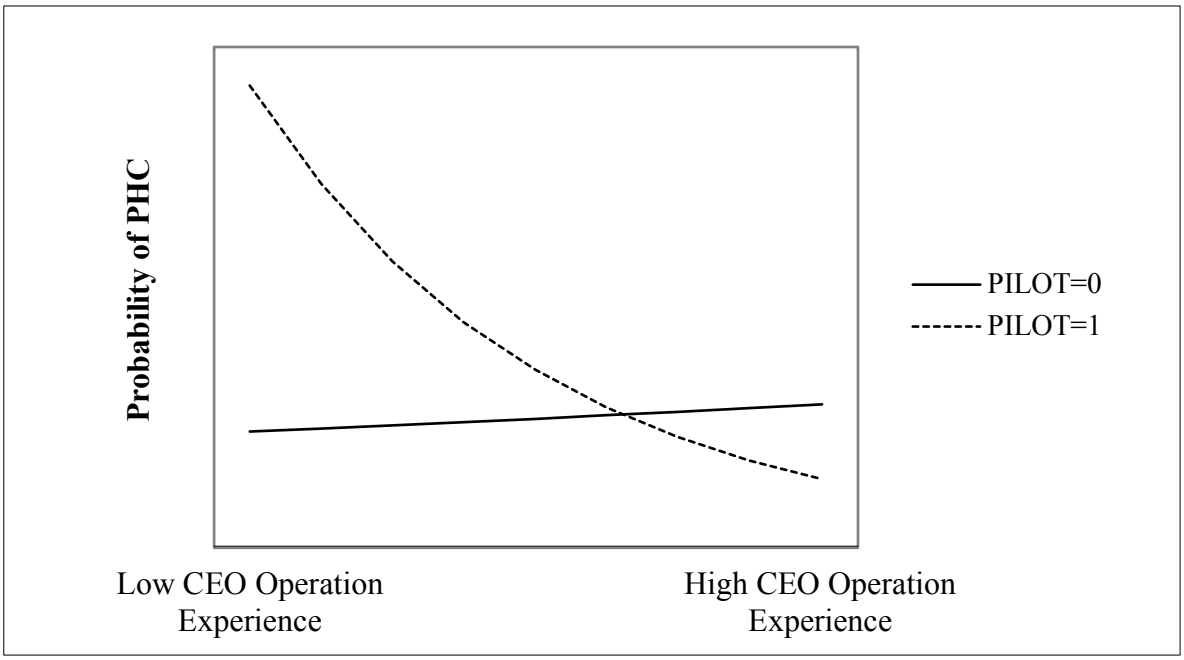

Table 1
Descriptive Statistics

Variable	N	mean	sd	median	p25	p75
PHC	3,114	0.110	0.313	0.000	0.000	0.000
PILOT	3,114	0.033	0.179	0.000	0.000	0.000
CEOEXP	3,114	0.573	0.495	1.000	0.000	1.000
SIZE	3,114	7.291	1.622	7.192	6.147	8.423
LEV	3,114	0.168	0.159	0.148	0.006	0.264
MTB	3,114	2.848	2.624	2.188	1.492	3.393
LOSS	3,114	0.180	0.384	0.000	0.000	0.000
SEG	3,114	3.411	2.325	3.000	1.000	5.000
IO	3,114	0.769	0.183	0.791	0.670	0.887
TENURE	3,114	1.788	0.843	1.792	1.099	2.398
DUALITY	3,114	0.261	0.439	0.000	0.000	1.000
OPTION	3,114	6.259	3.591	7.463	4.540	8.853
BODSIZE	3,114	2.176	0.249	2.197	1.946	2.303
BODINDE	3,114	0.738	0.440	1.000	0.000	1.000
BODEXP (in %)	3,114	17.038	21.499	11.111	0.000	25.000
AGE	3,114	55.453	7.315	55.000	51.000	60.000
INDCOM	3,114	0.547	0.498	1.000	0.000	1.000

Note: This table presents descriptive statistics of variables used in the regressions.

Table 2
Correlation Matrix

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	*PHC*																
2	*PILOT*	0.02															
3	*CEOEXP*	**0.05**	**0.05**														
4	*SIZE*	**0.29**	**0.13**	**0.14**													
5	*LEV*	**0.08**	**0.06**	**0.07**	**0.23**												
6	*MTB*	0.02	**0.01**	-0.01	**0.03**	**0.04**											
7	*LOSS*	**-0.05**	**-0.04**	**0.04**	**-0.18**	**0.13**	**-0.10**										
8	*SEG*	**0.18**	**0.10**	**0.09**	**0.46**	**0.17**	**-0.11**	**-0.05**									
9	*IO*	**-0.05**	**-0.09**	**0.08**	-0.02	**0.06**	**-0.04**	-0.02	0.00								
10	*TENURE*	**-0.12**	**0.03**	**-0.25**	**-0.16**	**-0.07**	-0.01	**-0.07**	**-0.07**	-0.01							
11	*DUALITY*	**0.03**	**0.03**	**-0.04**	**0.17**	**0.08**	0.02	**-0.05**	**0.06**	**-0.05**	**0.22**						
12	*OPTION*	0.02	**0.07**	**0.04**	**0.17**	-0.02	**0.22**	**-0.27**	0.01	**0.05**	**0.15**	**0.08**					
13	*BODSIZE*	**0.24**	**0.10**	**0.15**	**0.60**	**0.22**	**0.03**	**-0.08**	**0.35**	**-0.06**	**-0.17**	**0.13**	**0.10**				
14	*BODINDE*	**0.08**	**-0.05**	**0.11**	**0.14**	**0.10**	**0.05**	-0.03	**0.08**	**0.22**	**-0.09**	-0.01	**0.11**	**0.15**			
15	*BODEXP*	**-0.07**	-0.03	**0.05**	**-0.10**	0.00	-0.01	**0.07**	**-0.13**	**0.08**	**-0.03**	**-0.05**	0.01	**-0.10**	**0.05**		
16	*AGE*	0.00	**0.04**	**-0.06**	**0.04**	**0.03**	**-0.05**	**-0.03**	**0.08**	**-0.04**	**0.42**	**0.21**	-0.01	-0.01	**-0.07**	**-0.06**	
17	*INDCOM*	**-0.05**	**-0.05**	-0.02	**-0.14**	**-0.05**	0.01	0.02	**-0.08**	0.00	0.02	**-0.05**	0.02	**-0.08**	-0.02	0.06	**-0.03**

Note:
This table presents Pearson pairwise correlations between variables used in the regressions. Correlations significant at 5 percent level are in boldface.

Table 3
CEO Risk-taking Personality, Operational Experiences, and PHCs

	Dependent Variable = *PHC*	
Variable	(1)	(2)
PILOT	-0.096	1.494*
	(-0.197)	(1.950)
CEOEXP	0.127	0.205
	(0.511)	(0.794)
*PILOT*CEOEXP*		-2.036**
		(-1.981)
SIZE	0.600***	0.603***
	(5.113)	(5.123)
LEV	1.365	1.402
	(1.384)	(1.414)
MTB	0.014	0.015
	(0.397)	(0.412)
LOSS	-0.555**	-0.536**
	(-2.206)	(-2.126)
SEG	0.047	0.049
	(0.739)	(0.766)
OI	-0.376	-0.306
	(-0.535)	(-0.418)
TENURE	-0.519***	-0.535***
	(-3.807)	(-3.913)
DUALITY	0.049	0.082
	(0.167)	(0.284)
OPTION	-0.049*	-0.048*
	(-1.748)	(-1.712)
BODSIZE	1.644**	1.669**
	(2.531)	(2.566)
BODINDE	0.402	0.378
	(1.124)	(1.066)
BODEXP	-0.006	-0.007
	(-1.064)	(-1.163)
AGE	0.027	0.027
	(1.389)	(1.354)
Constant	-12.109***	-12.396***
	(-5.884)	(-5.962)
Year Fixed Effects	Yes	Yes
Industry Fixed Effects	Yes	Yes
Chi-squared	239.72***	243.88***
Pseudo R^2	0.32	0.33
Observations	3,114	3,114

Note:
This table presents logit regression results on the effects of CEO risk-taking personality (*PILOT*) on the likelihood of PHCs, and the moderating effect of a CEO's operational experiences (*CEOEXP*) on the relationship between CEO risk-taking personality (*PILOT*) and the likelihood of PHCs. The *z*-statistics are reported in parentheses. *, **, *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels, respectively. See Appendix for variable definitions.

Table 4
The Effects of BOD's Expertise

	Dependent Variable = *PHC*		
	(1)	(2)	(3)
Variable	Full Sample	CEO without Operational Experiences	CEO with Operational Experiences
PILOT	-0.045	4.638***	-0.507
	(-0.085)	(4.793)	(-0.865)
BODEXP	-0.006	-0.011	-0.002
	(-1.026)	(-1.030)	(-0.288)
*PILOT*BODEXP*	-0.009	-0.201***	0.019
	(-0.337)	(-2.659)	(0.697)
SIZE	0.600***	0.786***	0.656***
	(5.111)	(3.295)	(4.050)
LEV	1.354	1.353	0.262
	(1.373)	(0.850)	(0.201)
MTB	0.014	0.041	0.024
	(0.400)	(0.757)	(0.567)
LOSS	-0.552**	-0.163	-0.617**
	(-2.203)	(-0.415)	(-2.014)
SEG	0.047	0.046	0.032
	(0.739)	(0.563)	(0.420)
OI	-0.376	0.105	-1.203
	(-0.536)	(0.090)	(-1.366)
TENURE	-0.520***	-0.803***	-0.467**
	(-3.808)	(-3.695)	(-2.345)
DUALITY	0.048	0.353	0.062
	(0.161)	(0.699)	(0.165)
OPTION	-0.049*	-0.058	-0.045
	(-1.742)	(-0.822)	(-1.166)
BODSIZE	1.639**	0.883	1.839**
	(2.517)	(1.056)	(2.075)
BODINDE	0.401	-0.159	0.710
	(1.125)	(-0.299)	(1.552)
AGE	0.027	0.070***	-0.003
	(1.397)	(2.715)	(-0.119)
CEOEXP	0.125		
	(0.502)		
Constant	-12.097***	-14.838***	-10.783***
	(-5.877)	(-4.647)	(-4.086)
Year Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Chi-squared	239.9***	106.95***	219.70***
Pseudo R^2	0.32	0.40	0.35

Variable	(1) Full Sample	Dependent Variable = *PHC* (2) CEO without Operational Experiences	(3) CEO with Operational Experiences
Observations	3,114	1,254	1,784

Note:
The table presents logit regression results on the moderating effect of BOD industry experience (*BODEXP*) on the relationship between CEO risk-taking personality (*PILOT*) and the likelihood of PHCs. Results based on the full sample is presented Column (1). Results based on a subsample consisting of CEOs without operational experiences are presented in Column (2). Results based on a subsample consisting of CEOs with operational experiences are presented in Column (3). The *z*-statistics are reported in parentheses. *, **, *** indicate tow-tailed statistical significance at 10, 5, and 1 percent levels, respectively. See Appendix for variable definitions.

Table 5
The Effects of Market Competition

	Dependent Variable = *PHC*		
	(1)	(2)	(3)
Variable	Full Sample	CEO without Operational Experiences	CEO with Operational Experiences
PILOT	0.490	2.848***	0.148
	(0.924)	(3.793)	(0.226)
INDCOM	-0.244	0.106	-0.488***
	(-1.603)	(0.435)	(-2.609)
*PILOT*INDCOM*	-2.244***	-1.296**	-2.413***
	(-3.064)	(-2.191)	(-3.265)
SIZE	0.580***	0.786***	0.618***
	(4.970)	(3.251)	(3.902)
LEV	1.363	1.573	0.205
	(1.385)	(1.000)	(0.159)
MTB	0.018	0.036	0.030
	(0.497)	(0.686)	(0.679)
LOSS	-0.575**	-0.150	-0.656**
	(-2.318)	(-0.380)	(-2.185)
SEG	0.051	0.058	0.044
	(0.799)	(0.729)	(0.578)
OI	-0.386	0.203	-1.183
	(-0.555)	(0.172)	(-1.374)
TENURE	-0.543***	-0.781***	-0.518***
	(-4.065)	(-3.613)	(-2.604)
DUALITY	0.051	0.310	0.055
	(0.171)	(0.621)	(0.143)
OPTION	-0.047*	-0.064	-0.042
	(-1.652)	(-0.903)	(-1.076)
BODSIZE	1.692***	0.961	1.946**
	(2.583)	(1.166)	(2.197)
BODINDE	0.400	-0.098	0.723
	(1.126)	(-0.187)	(1.586)
BODEXP	-0.007	-0.013	-0.002
	(-1.114)	(-1.154)	(-0.318)
AGE	0.027	0.069***	-0.002
	(1.418)	(2.596)	(-0.084)
CEOEXP	0.143		
	(0.569)		
Constant	-12.004***	-14.818***	-10.585***
	(-5.885)	(-4.471)	(-4.182)
Year Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes

	Dependent Variable = *PHC*		
	(1)	(2)	(3)
Variable	Full Sample	CEO without Operational Experiences	CEO with Operational Experiences
Chi-squared	271.82***	141.87***	231.21***
Pseudo R^2	0.33	0.40	0.36
Observations	3,114	1,254	1,784

Note:
The table presents logit regression results on the moderating effect of market competition (*INDCOM*) on the relationship between CEO risk-taking personality (*PILOT*) and the likelihood of PHCs. Results based on the full sample is presented Column (1). Results based on a subsample consisting of CEOs without operational experiences are presented in Column (2). Results based on a subsample consisting of CEOs with operational experiences are presented in Column (3). The *z*-statistics are reported in parentheses. *, **, *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels, respectively. See Appendix for variable definitions.

Table 6
Results based on Propensit Score Matching (PSM)

Panel A: Checking Covariate Balance

Before PSM

	PILOT=0		PILOT=1		
Variables	N	Mean	N	Mean	Mean Difference
SIZE	3011	7.256	103	8.342	-1.086***
LEV	3011	0.166	103	0.216	-0.050***
MTB	3011	2.818	103	3.731	-0.913***
LOSS	3011	0.182	103	0.107	0.076**
SEG	3011	3.369	103	4.641	-1.272***
OI	3011	0.771	103	0.713	0.058***
CEOTENURE	3011	1.783	103	1.928	-0.145*
CEODUALITY	3011	0.256	103	0.427	-0.171***
OPTION	3011	6.191	103	8.261	-2.070***
BODSIZE	3011	2.172	103	2.304	-0.132***
BODINDE	3011	79.096	103	81.195	-2.099*
BODEXP	3011	0.737	103	0.770	-0.030
AGE	3011	55.433	103	56.039	-0.605

After PSM

	PILOT=0		PILOT=1		
Variables	N	Mean	N	Mean	Mean Difference
SIZE	60	7.714	60	7.963	-0.248
LEV	60	0.214	60	0.184	0.029
MTB	60	3.531	60	3.438	0.092
LOSS	60	0.117	60	0.100	0.017
SEG	60	3.833	60	4.367	-0.533
OI	60	0.708	60	0.745	-0.037
CEOTENURE	60	1.724	60	1.988	-0.264*
CEODUALITY	60	0.350	60	0.400	-0.050
OPTION	60	7.655	60	7.737	-0.081
BODSIZE	60	2.265	60	2.267	-0.002
BODINDE	60	0.750	60	0.750	0.000
BODEXP	60	13.143	60	15.620	-2.477
AGE	60	54.267	60	57.333	-3.067*

Panel B: Regression Results based on Matched Sample

	Dependent Variable = *PHC*	
Variable	(1)	(2)
PILOT	-0.953	2.612*
	(-1.101)	(1.667)
CEOEXP	-1.841**	-0.484
	(-2.076)	(-0.497)
*PILOT*CEOEXP*		-5.408**
		(-2.258)
SIZE	0.940	0.831
	(1.639)	(1.396)
LEV	4.340	2.769
	(0.957)	(0.594)
MTB	0.054	0.060
	(0.362)	(0.520)
LOSS	-2.809	-1.026
	(-1.180)	(-0.454)
SEG	0.444**	0.416**
	(2.220)	(2.126)
IO	1.307	2.105
	(0.457)	(0.584)
TENURE	-0.675	-1.399**
	(-1.220)	(-2.041)
DUALITY	0.487	1.197
	(0.564)	(1.090)
OPTION	-0.070	-0.063
	(-0.949)	(-0.535)
BODSIZE	1.709	3.148
	(0.546)	(0.863)
BODINDE	-0.027	0.043
	(-0.456)	(0.525)
BODEXP	0.009	-0.005
	(0.257)	(-0.135)
AGE	0.057	0.051
	(0.694)	(0.632)
Constant	-16.647*	-24.727***
	(-1.710)	(-2.786)
Chi-squared	41.64***	57.14***
Pseudo R^2	0.41	0.47
Observations	120	120

Note:
Panel A presents covariate comparisons before and after PSM. Panel B presents logit regression results on the effects of CEO risk-taking personality (*PILOT*) on the likelihood of PHCs, and the moderating effect of a CEO's operational experiences (*CEOEXP*) on the relationship between CEO risk-taking personality (*PILOT*) and the likelihood of PHCs based on the PSM sample. The *z*-statistics are reported in parentheses. *, **, *** indicate tow-tailed statistical significance at 10, 5, and 1 percent levels, respectively. See Appendix for variable definitions.

Chapter 3. Damage Control: Earnings Management in the Face of Product Harm Crises

3.1 Introduction

I investigate managers' earnings manipulation behavior in product harm crises. Product harm crises are defined as publicized events whereby a firm's product is reported as being defective or fails to fulfill a mandatory safety standard (Dawar and Pillutla 2000). Recent product harm crises that made headlines include the recalls by Samsung of its Galaxy Note 7 smartphone in 2016 and Toyota vehicle recalls in 2009 and 2010. Such crises are gaining prevalence and drawing much publicity.[21] For example, according to Advisen Insurance Intelligence (2012), 2,363 consumer products, pharmaceuticals, and medical devices were recalled in the United States in 2011, representing a 62 percent increase from 2007. Similarly, the National Highway Traffic Safety Administration (NHTSA) reported that vehicle recalls increased by 76 percent (from 339 to 599) between 1994 to 2003 and 2004 to 2013 (NHTSA 2015; Gao, Xie, Wang, and Wilbur 2015).

When a product harm crisis occurs, firms incur significant direct costs, such as expenses associated with product recalls, production halts, and remediation (Jarrell and Peltzman 1985).[22,23] But more importantly, a product harm crisis can result in significant indirect costs, particularly losses in firms' reputation, and thus a reduction in customers' trust and purchase intention (e.g., Chen, Ganesan, and Liu 2009; Dawar and Pillutla 2000; Devin and Halpern 2001; Jarrell and Peltzman 1985; Pruitt and Peterson 1986; Van, Helsen, and Dekimpe 2007). Because of the adverse impact of product harm crises, prior research documents that managers actively engage in marketing, recalling, and social media strategies to salvage their firm's

[21] Incidents that are out of the firm's control, such as product tampering, are not considered as product harm crises. To this effect, since product recalls may include such cases, I do not define product harm crisis as recall incidents. I discuss how I measure product harm crises in Section 3.1.

[22] Direct charges associated with product harm crises are recognized as special items (see the General Motors [GM] 2014 annual report), other operating expenses (see Mattel 2007 annual report) or as a reduction of net sales and an increase of Selling, General & Administrative Expense (SG&A) and Cost of Goods Sold (COGS) (see Kellogg 2010 annual report).

[23] I focus on the accrual-based earnings management and posit that managers may use such techniques to boost the total earnings. I do not claim or expect that such earnings management can entirely offset the negative impact of these direct costs on total earnings.

impaired reputation (Chen et al. 2009; Cleeren, Harald, Heerde, and Dekimpe 2013; Gao et al. 2015; Lee, Hutton, and Shu 2015; Zavyalova, Pfarrer, and Reger 2012).

In this paper, I investigate whether firms manage earnings upward as another way to restore customer confidence and attenuate CEO personal losses when faced with a product harm crisis.[24] Despite the costs associated with product harm crises, there is anecdotal evidence that firms quite often project a strong financial image in the year of a product harm crisis.[25] I aim to understand whether such a strong financial image reflects a genuine performance or earnings management. In the context of a product harm crisis, the pressures on managers to present a strong financial image and to show the firm's ability to generate earnings get intensified, as both influence customers' perception about the firm's ability to honor implicit claims in the future[26,27] (Bowen, DuCharme, and Shores 1995; Maksimovic and Titman 1991). Such implicit claims encompass the expected quality of the products, as well as the promise of timely delivery, continuing warranty service and parts supply, and future enhancements (Cornell and Shapiro 1987).

Given the various costs, especially the reputation damage, that a firm has to suffer in a product harm crisis, managers can be particularly concerned about disclosing weak financial performance for the following reasons. First, a product harm crisis can induce financial difficulties in the firm. Since customers are particularly reluctant to buy products from

[24] I do not rule out the possibility that the incentive of earnings management in the case of a product harm crisis is induced by the need to reassure shareholders. However, shareholders' biggest concern about a product harm crisis also arises from the potential loss of customers and sales. Restoring customers' confidence can eventually also please shareholders.

[25] For example, GM's annual report for 2014 (a year in which there was a major GM product recall) states that: "In 2014, I earned net income to common stockholders of $2.8 billion, including recall-related costs. Turning to Earnings Before Interest & Tax (EBIT) adjusted results, I earned $6.5 billion, which included $2.8 billion in recall-related expenses … These results are important because this is the first year since 2010 that the company met its target for core operating financial performance." Similarly, Mattel's 2007 annual report mentions that "Globally, Mattel delivered a 6 percent increase in net revenues in 2007 … I did see strong performance across many areas of my portfolio … Despite the costs associated with the product recalls, I were also able to achieve improvements in gross margin and overall profitability." In a regulatory filing in January 2017, the technical giant Samsung Electronics said its fourth-quarter operating profit jumped 50% to its highest in over three years, as a diverse business portfolio masked the negative impact of its failed Note 7 phones (Reuters, January 24, 2017).

[26] Trust-based relationships are called implicit contracts. Implicit claims have no legal standing, so they can be breached by either party. Bull (1987) argues that there are forces that prevent firms from breaching their reputation of fulfilling their implicit claims. Firms have incentives to build their reputation because the reputation determines the trade terms between firms and their stakeholders (Titman 1984; Cornell and Shapiro 1987).

[27] Following prior studies (e.g., Bowen et al. 1995; Maksimovic and Titman 1991; Hui et al. 2012), reputation and perceived ability to fulfill implicit claims are used in an interchangeable manner in this paper.

distressed firms because such firms are more likely to shirk on their product quality and will be less likely to continue to provide adequate supply in the future (Titman 1984; Maksimovic and Titman 1991), a weak financial performance in a product harm crisis is likely to create a particularly negative impact on customers' confidence. In addition, showing weak financial performance may encourage financially strong competitors to aggressively advertise or price their products with an aim to drive out the financially distressed firms that are experiencing product harm crises (e.g., Bolton and Scharfstein 1990; Opler and Titman 1994). Second, even if the product harm crisis does not cause a significant financial difficulty to the crisis firm, it can still cast doubts about product quality and safety and, hence, directly damage customers' perceptions of the firm's ability to fulfill implicit claims in the future (Devin and Halpern 2001; Cornell and Shapiro 1987). Projecting a better financial image by showing strong earnings can reassure customers that the firm has the resources to continue investing in product quality. Third, industrial customers assess suppliers' financial health to mitigate information asymmetry in their long-term supply chain relationship (Costello 2013; Hui, Klasa, and Yeung 2012). Supplier firms that experience product quality issues have incentive to manipulate earnings in order to overcome the adverse effect of product harm crises so as to maintain their long-term relationships with industrial customers.

Moreover, I also conjecture that managers manipulate earnings in the face of a product harm crisis to attenuate personal costs. Given the negative influence of the product harm crisis on a firm's stock price, managers can suffer losses if they have significant equity or option holdings (Charitou, Lambertides, and Trigeorgis 2007). Furthermore, in some extreme cases, managers bear the responsibility for the crisis by either being fired or by resigning, thus suggesting that a product harm crisis can induce managers' career concerns. Hence, self-interested managers are likely to manipulate earnings upward so as to alleviate the personal costs associated with the product harm crisis (Fudenberg and Tirole 1995).

To assess whether firms engage in earnings management during product harm crises, I examine signed discretionary accruals for a sample of U.S. manufacturing firms experiencing such crises from 2002 to 2012. I match firms experiencing product harm crises (crisis firms) with firms not experiencing product harm crises (non-crisis firms) using a propensity score matching procedure. Based on 575 pairs of crisis firms and non-crisis firms, I find that crisis firms have significantly greater signed discretionary accruals, suggesting that managers manage earnings upward in product harm crises. This upward earning management is positively associated with the severity of the product harm crisis. As an alternative measure of upward earnings management, I use downward accounting restatements (i.e., restatements caused by inflated earnings) in the subsequent periods due to accounting frauds or Generally Accepted Accounting Principles (GAAP) misapplication in the year of the product harm crisis. I find a positive relation between product harm crises and downward accounting restatements. In addition, I find that managing earnings upward appears to be effective in the short run. That is, managers of crisis firms who manipulate earnings upward in the crisis year are less likely to lose major clients in the following year after the product harm crisis, and also are less likely to experience bonus cuts in the year of product harm crisis and forced turnover in the following year.

In addition, consistent with a product harm crisis impairing a firm's reputation and thus undermining customers' perception about its ability to fulfill implicit claims, I also find that firms are more likely to manage earnings upward when reputation and implicit claims matter more to the firm and when the product harm crisis is more severe. Moreover, I observe that CEOs who bear greater personal costs from product harm crises engage in more upward earnings management. Overall, my evidence is consistent with managers having strong firm-level and personal incentives to manage earnings upward to carry them through the crisis.

This study makes several contributions to the literature. First, given that product harm crises are becoming more prevalent in today's business, it is essential to understand the impact of such crises on firms, as well as firms' reactions. Prior studies document that firms react to product harm crises by adopting marketing, recalling, and social media communications strategies (e.g., Chen et al. 2009; Cleeren et al. 2013; Lee et al. 2015). My study complements these prior findings by showing that managers also leverage their financial reporting discretion by managing earnings upward to maintain their firm's reputation and, hence, retain customers' confidence and safeguard managers' personal interests.

Second, this study contributes to the literature investigating customers' implicit claims as an incentive for firms to manipulate earnings (Bowen et al. 1995; Burgstahler and Dichev 1997; Dou, Hope, and Thomas 2013; Matsumoto 2002; Raman and Shahrur 2008).[28] I identify a specific setting in which firms' perceived ability to fulfill implicit claims to customers is threatened by an operational problem and finds that managers use their accounting discretion to manage earnings upward to salvage their firm's reputation. Moreover, my results further corroborate the existence of implicit claims by both industrial and consumer customers, since I find the upward earnings management is present in firms dealing with both industrial and consumer customers. While industrial customers directly rely on accounting information since it is verifiable and audited, consumer customers can also learn about the company's financial outlook from news media and financial analysts, which in turn change their perceptions of the firm's financial condition and its ability to fulfill implicit claims (Matsumoto 2002; Tian and Zhou 2015).

Third, this study contributes to the literature on corporate social responsibility (CSR). Prior studies usually aggregate different dimensions of CSR and investigate the relation

[28] Generally, the implicit claims have no legal standing, so they can be breached by either party. Bull (1987) argues that there are forces that prevent firms from breaching their reputation to fulfill their implicit claims. Firms have incentives to build their reputation because the reputation determines the trade terms between firms and their stakeholders (Titman 1984; Cornell and Shapiro 1987).

between CSR performance and reporting quality under normal conditions. The common theme is that managers' business ethics lead firms to perform well on both CSR and reporting, leading to a positive association between the two (Kim, Park, and Wier 2012). In this paper, I focus on a specific dimension of CSR, namely product quality and safety crises, and show that it affects managerial incentives in financial reporting.

Lastly, this study contributes to the literature on the relationship between crises and earnings management. Prior research shows that firms typically reduce the extent of their earnings management in the face of macro-level financial crises (e.g., Kim, Chung, and Firth 2003; Filip and Raffournier 2014). In contrast, I find that firms increase earnings management in response to firm-specific product harm crises. The difference is probably due to managers having less incentive to manipulate earnings in a global financial crisis, given the higher market tolerance for poor performance (Filip and Raffournier 2014). However, firms do not have such market tolerance in firm-specific crises/wrongdoings such as product harm crises.

The rest of the paper is organized as follows: Section 2 discusses prior literature and develops the hypothesis. Section 3 discusses research design, including the sample construction. Section 4 reports the empirical results. Additional tests are provided in Section 5. Section 6 concludes the paper.

3.2 PRIOR LITERATURE AND HYPOTHESIS DEVELOPMENT

3.2.1 Prior Studies on Product Harm Crises

A product harm crisis affects a firm's short-term performance, due to direct costs associated with handling the crisis. In this respect, Jarrell and Peltzman (1985) point toward the costs of correcting/replacing the defective product, the transaction costs of the recall process, the costs

of unsold inventory, the costs of potential litigation, and the costs of changes in practices to improve quality.

While the direct costs of a product harm crisis can be threatening enough for firms' financial performance, the impairment of their reputation as a reliable manufacturer of high-quality products is of greater concern (Jarrell and Peltzman 1985). As a result, a large part of the loss of market capitalization caused by a product harm crisis is due to its negative impact on a firm's reputation and brand equity,[29] rather than its direct costs (Dawar and Pillutla 2000; Jarrell and Peltzman 1985; Pruitt and Peterson 1986).[30] For example, Van et al. (2007) indicate that crisis firms will suffer sales losses on the recalled product itself, and also from a spillover effect on non-affected but associated products. Furthermore, the sales losses undermine the financial and stock market performance of affected firms (Barber and Darrough 1996).

Managers often consider a safety-related product crisis to have the most negative impact on corporate reputation (Crisis Reputation Preparedness Study 2011). Thus, in an effort to regain customers and restore a firm's reputation, they are likely to engage in various strategies via social media platforms (e.g., Facebook), recalling actions (e.g., technical, ceremonial), and marketing (e.g., advertising, pricing) (Chen et al. 2009; Cleeren et al. 2013; Gao et al. 2015; Lee et al. 2015; Zavyalova et al. 2012). Yet, so far no studies have investigated the effect of product harm crises on managers' reporting incentives.

3.2.2 Hypothesis Development (Figure1)

[29]Brand equity, defined as the overall value of a brand, is equivalent to the customers' trust in the brand's ability to fulfill expected benefits and the customers' willingness to buy the brand's products over competing brands' products (e.g., Keller 1993; Dutta and Pulling 2011). Brand equity also leads to a spillover effect from one product to other products. For example, the recent Samsung Galaxy Note 7 explosion scandal cast doubt on the quality of other Samsung products.

[30]Jarrell and Peltzman (1985) find that shareholders' wealth losses associated with product recalls are 12 times larger than the direct costs of recalls. Cornell and Shapiro (1987) argue that the costs can be attributed to the loss of reputation to fulfill implicit claims.

Prior research documents that managers have various incentives to manipulate earnings, and that earnings management behavior is prevalent (Graham, Harvey, and Rajgopal 2005).[31] In the case of a product harm crisis, during which a firm's reputation as well as its financial performance and information environment are greatly impaired, I expect that managers will engage in income-increasing earnings management for the following reasons.

First, when selling products, a firm enters into both explicit and implicit contracts with its customers, and a large part of the ongoing relation actually remains implicit. For instance, customers usually expect a certain product quality level, as well as a commitment to continuously provide parts and services, timely delivery, warranty service, and future enhancements (Baker, Gibbons, and Murphy 2002; Cornell and Shapiro 1987). Both existing and future customers' willingness to buy from a firm is affected by their perceptions about its ability to honor its implicit commitments in the product market (Bowen et al. 1995; Maksimovic et al. 1991). Su, Zhao, and Zhou (2014) find that firms disclosing internal control weaknesses under Sarbanes-Oxley (SOX) Section 404 subsequently experience a decline in sales growth (i.e., lower customers' demands), most likely because customers question firms' sustainability and future ability to fulfill their implicit claims.[32]

A product harm crisis can bring financial hardship to a firm, as it incurs direct and indirect costs to resolve it. Reporting weak financial performance can lower customers' purchase intentions due to the concern that the firm will not honor future implicit claims, most likely by switching to poor-quality inputs, by reducing future supply, and failing to honor warranty claims in the future (Maksimovic and Titman 1991; Opler and Titman 1994; Titman 1984; Hammond 2013). For example, Kini, Shenoy, and Subramaniam (2016) find that firms

[31]For example, prior studies find that seasonal equity offering (Cohen et al. 2010), financial crises in Asia or in Europe (Chia et al. 2007; Filip and Raffournier 2014), an initial public offering (Ball et al. 2008), an acquisition financed by firms' equity (Botsari and Meeks 2008), management buyouts (Perry and Williams 1994), open-market repurchase (Gong et al. 2008), and CEO turnover or interim CEO succession (Chen et al. 2015) all incentivize managers to engage in earnings management.

[32] Similarly, Karpoff, Lee, and Martin (2008) find that firms exhibit a reduction in stock market value due to implicit claims related to a reputation loss caused by misstatement.

with higher leverage or higher distress likelihood are more likely to produce poor-quality products that result in product recalls. Financial constraints are also found to lead to product shortfalls in the supermarket industry (Matsa 2011) and worse on-time performance in the airline industry (Phillips and Sertsios 2013; Rose 1990). Besides, reporting weak performance in a product harm crisis can also attract aggressive advertising campaigns, greater production, and price low-balling from financially sound competitors, which have incentive to take the opportunity to predate the existing or potential customers from financially impaired firms (Opler and Titman 1994; Bernard 2016). Given the reason above, managers can have incentive not to reveal weak financial performance of firms[33]. To the extent that earnings are one of the most important indicators of financial status, managers of crisis firms can be particularly concerned about disclosing weak earning numbers and hence have clear incentive to manage earnings upward in a product harm crisis.

Second, even if the product harm crisis does not lead to financial difficulties, the crisis itself already severely affects the firm's reputation to fulfill implicit claims toward its customers (Cornell and Shapiro 1987; Devin and Halpern 2001; Jarrell and Peltzman 1985). First of all, experiencing a product harm crisis distorts the customers' confidence toward the firm's ability to manufacture reliable and high-quality products, and hence lowers customers' trust toward crisis firm (Dawar and Pillutla 2000). In addition, in cases of multi-product or multi-brand companies, the spillover effect of a product harm crisis suggests that customers will question firms' ability to manufacture non-affected but associated products (Van et al. 2007). Better financial performance can alleviate the negative effect of a product harm crisis on the customers' perception of the firm's future ability to fulfill implicit claims, since

[33] An anecdotal evidence also shows this point. Dun & Bradstreet (2010, 12): "One global teleconferencing company learned the hard way that suppliers are not always truthful when it comes to sharing bad news. In the middle of a new product launch, rumors flew that a sole source supplier of a critical component was in financial difficulty. When confronted, the supplier assured the team that all was well, only to file for bankruptcy shortly thereafter."

customers care about the financial image of the firm from which they purchase products/services, even when the firm is not financially distressed (Bowen et al. 1995). This is because projecting a better financial image by showing strong earnings can reassure customers that the firm has abundant financial resources and thus is competent to fulfill its implicit claims in the long term (Aaker, Vohs, and Mogilner 2010; Bowen et al. 1995; Tian and Zhou 2015)[34]. In line with this argument, prior studies document that firms use upward earnings management to avoid losses (Burgstahler and Dichev 1997), to meet analyst forecasts (Matsumoto, 2002), and to portray a rosy financial prospect (Raman and Shahrur 2008) in a bid to influence customers' assessments of firms' future abilities to fulfill their implicit claims. When surveying executives, Graham et al. (2005) also report that a majority of Chief Financial Officers (CFOs) are willing to manipulate earnings to manage the customers' perception.

Third, for industrial customers who typically enter into a long-term relationship with the supplier firm, a product harm crisis and its financial implications may lead to the severance or setback of the long-term relationship. Industrial customers are concerned the supplier may breach explicit contract terms in the long run due to the financial difficulty and reputation loss (Cen et al., 2017). For example, the customer may be concerned whether the supplier has sufficient resources to deliver products and services determined in their long-term contracts. In addition, customers in such long-term relationships may also worry that suppliers will withhold their relationship-specific investments that aim to improve product quality, delivery efficiency, and other long-term performance. Therefore, a sound financial performance can reassure long-term customers and prevent breaches of long-term contracts (Costello et al. 2013).

[34] One of the anecdotal examples used in Bowen et al. (1995) to support their argument that customers care about firms' accounting number and thus earnings is the advertisement of La Cie. La Cie advertises that "the hard drives it manufactures are backed by $400 million in assets. That means you can trust La Cie to provide a constant source of high quality machines and components. And you can be certain that we'll be around to help you with service and support. For a long, long time. (Mac User, September 1991, p. 95)". Besides, earnings matter particularly in the case of product harm crisis because the press and media usually publicize firms' earnings performance and the product recall/crisis in the news headline. For example, "Samsung earnings soar in Q4 despite unprecedented Note 7 recall" (Yahoo 2017 January). "Samsung to overtake Apple with record profits despite scandals" (Technology 2017 August). "Toyota earnings up 27% despite recalls in U.S."(USA Today 2010 August). "Despite recall woes, GM turns $2.8 billion profit" (Statesman 2015 February).

Although managers' incentives to restore reputation and attenuate personal losses imply a positive relation between experiencing a product harm crisis and income-increasing earnings management, there are counterarguments that suggest such an association may not exist or may even be negative. First, as a publicized event, a product harm crisis attracts larger media scrutiny and more negative media coverage (Rhee et al. 2006; Zavyalova et al. 2012). Knowing the occurrence of a product harm crisis, auditors, investors, creditors, customers, and suppliers are likely to increase monitoring and scrutiny over the crisis firms, thus restraining opportunities to manage earnings (Chia et al. 2007; Filip and Raffournier 2014; Francis, Hasan, and Wu 2013;). For example, DeAngelo, DeAngelo, and Skinner (1994) find that firms with consecutive losses exhibit more income-decreasing accounting choices due to increased monitoring from auditors and lenders. Studies also find that, in the recent financial crisis, firms manipulated earnings less partly because of the increased scrutiny from stakeholders (Francis et al. 2013; Filip and Raffournier 2014). Second, in anticipation of product liabilities lawsuits or securities lawsuits, firms may manage earning downward to avoid lawsuits from customers and shareholders or, alternatively, to reduce the amount of any settlement or fine. These possibilities point toward a null or a negative relation between product harm crises and earnings management.

Given the above competing arguments, it remains an empirical question whether managers engage in income-increasing earnings management when faced with a product harm crisis. Therefore, I state the following hypothesis in the null form:

Hypothesis: Product harm crises are not associated with income-increasing earnings management.

3.3 RESEARCH DESIGN

3.3.1 Sample and Identification of Firms Experiencing Product Harm Crises

Data about firms experiencing product harm crises come from MSCI ESG KLD Stats database (KLD). My sample covers the period from 2002 to 2012. I rely on the product category in KLD to identify firms that experienced product harm crises during the sample period. Specifically, regarding firms' engagements in product safety and quality, KLD reports separately the number of strengths and concerns for each firm in each year. According to MSCI (2015), the concern indicator is "designed to assess the severity of controversies related to the quality and safety of a firm's products and services. Factors affecting this evaluation include, but are not limited to, a history of involvement in product safety-related legal cases, widespread or egregious instances of recalls or fines due to defective or unsafe products and services, resistance to improved practices, and criticism by Non-Governmental Organization (NGOs) and/or other third-party observers". Kashmiri and Brower (2016) validate the product quality concern variable in KLD, confirming that the records are a reliable indicator of product harm crises.[35] I consider a firm to have a product harm crisis in a given year if the firm received a non-zero value of the product quality concern variable in KLD, and accordingly create a variable *PCRISIS* that equals one if a firm-year has a product harm crisis, and zero otherwise.

I merge KLD with Compustat, Audit Analytics, Thomson Reuters 13-F, and I/B/E/S to obtain firms' financial data, auditor data, institutional shareholding, and financial analyst coverage. 19,265 observations were left in the sample after merging different data sources. Since the focus of the paper is product harm crises, I concentrate on manufacturing firms and, hence, subsequently retain only U.S. firms in the manufacturing industry (i.e., two-digit SIC codes from 20 to 39). I further require that manufacturing industries defined by two-digit SIC codes in the sample must have at least one incidence of product harm crisis during the sample

[35] They independently code the events related to product harm crises based on articles, press release, and reports on product recalls, as well as product-related litigation and compensatory damages. They find that the hand-collected data match the product concern variable in the KLD product category.

period. After deleting firms with missing values in the regressions, 6,806 firm-years in the manufacturing industries were retained in the sample, of which 641 firm-years are identified as having had product harm crises. Panel A of Table 1 presents the sample distribution by year. The percentage of firms having product harm crises ranges from 7 to 12 percent in my sample period. Panel B of Table 1 reports the sample distribution by industry. Industries producing chemical products, fabricated metal, glass, and rubber have the highest percentage of product harm crises. On the other hand, firms in publishing and printing have the lowest percentage of product harm crisis.

[Insert Table 1]

3.3.2 Propensity Score Matching Between Crisis Firms and Non-Crisis Firms

Panel C of Table 1 compares firm characteristics across the 641 observations with product harm crises and the 6,165 observations without product harm crises. On average, compared with non-crisis firms, crisis firms are larger and exhibit higher leverage, better performance, higher sales growth, lower market-to-book ratio, greater analyst coverage, a higher ratio of PPE, a lower percentage of equity shares owned by CEOs, and a lower likelihood of having a Chief Operating Officer (COO) among the five highest-paid executives. The comparisons in Panel C of Table 1 indicate that crisis firms differ from non-crisis firms along several key firm features, suggesting potential endogeneity related to the occurrence of product harm crises. Therefore, I employ propensity score matching (PSM) to control for observable differences between crisis firms and non-crisis firms. This enhances my causal inference that product harm crises affect earnings management directly, rather than that some omitted variables affect both product harm crises and earnings management behavior.

There is no consensus regarding the determinants of product harm crises. My prediction model largely depends on Kashmiri and Brower (2016) and Wowak, Mannor, and Wowak (2015). Specifically, I model the occurrence of a product harm crisis as a function of firm size (*LogMV*), leverage (*LEV*), operating performance (*ROA*), market-to-book ratio (*MTB*), sales growth (*GROWTH*), PPE relative to total assets (*PPE*), percentage of institutional shareholding (*IO*), analyst coverage (*COVER*), presence of COO among the five highest-paid executives (*TMT*), percentage of equity shares owned by the CEO (*CEOSHARE*), industry fixed effects, and year fixed effects.

Results of the probit regression regarding the determinants of product harm crises are tabulated in Panel A of Table 2. Following the suggestions from Shipman, Swanquish, and Whited (2017), the matching is performed on a one-to-one basis without replacement and without replacement. I also impose common support by dropping crisis firms whose propensity scores are higher than the maximum or less than the minimum propensity score of non-crisis firms and set the caliper to be 0.05.[36] I find that the likelihood of experiencing product harm crises is positively associated with firm size, leverage, and PPE, and negatively associated with market-to-book ratio, sales growth, institutional shareholding, and the presence of COO among the five highest-paid executives. For each crisis firm, I choose the non-crisis firm with the closest propensity score as the control firm. This procedure yields 575 pairs of crisis firms and non-crisis firms.

To verify whether PSM alleviates the observable differences across crisis firms and non-crisis firms, I compare firm characteristics between matched crisis firms and non-crisis firms in Panel B of Table 2. On average, crisis firms in the matched sample are statistically indistinguishable from their matched non-crisis firms, except that crisis firms have a marginally lower median *ROA* and a marginally higher median *PPE* ratio. In general, the comparison

[36] As a robustness check, I vary the caliper between 0.1 and 0.03. My results remain unchanged.

suggests that my matching procedure achieves a covariate balance. The 575 pairs of crisis firms and non-crisis firms are used as my primary sample for the empirical analysis.

[Insert Table 2]

3.3.3 Measure of Earnings Management

Managers can time and engage in upward earnings management before the occurrence of product harm crisis. Prior studies document that managers can anticipate product harm crisis several months before announcing product recall publicly because managers have the opportunity to act strategically on when to cooperate with the regulatory agent to issue a recall (Chen et al 2009; Gao et al 2015; Gokalp, Keskek, Kumas, and Subasi 2016)[37]. Thus, even if a product harm crisis occurs in the fourth quarter, managers can still have ample time to engage in earnings management during the year before the fourth quarter of the year. For this reason, I focus on annual estimates rather than more granular quarterly estimates of earnings management.

Consistent with prior literature, I proxy income-increasing earnings management by signed performance-adjusted discretionary accruals (Kothari, Leone, and Wasley 2005; Mao and Renneboog 2015). Specifically, I estimate the following modified Jones model (Jones 1991) for each industry-year using all U.S. firms in Compustat with available information, where industry is defined by two-digit SIC codes:

$$\frac{TACC_{i,t}}{ASSET_{i,t-1}} = \alpha_0 + \alpha_1\left(\frac{1}{ASSET_{i,t-1}}\right) + \alpha_2\left(\frac{\Delta SALES_{i,t} - \Delta AR_{i,t}}{ASSET_{i,t-1}}\right) + \alpha_3\left(\frac{PPE_{i,t}}{ASSET_{i,t-1}}\right) + \alpha_4 ROA_{i,t} + \varepsilon_{i,t}$$

[37] For the firms initiated recalls, after the manufacturer receive information about the potential hazard of the product from its customer, the manufacturer investigates whether the defect exist through its own analysis system which can take month before announcing a product recall publicly. Even if the recall was initiated by the regulatory agencies, the investigation period can still be lengthy and the manufacturer can have opportunity/time to act strategically to decide whether and when to cooperate with the regulators agencies to announce the product recalls (Chen et al 2009; Gao et al 2015; Gokalp, Keskek, Kumas, and Subasi 2016).

where for each firm i in year t, *TACC* is total accruals defined as income before extraordinary items minus operating cash flows; *ASSET* is total assets; $\Delta SALES$ is change of sales from t-1 to t; ΔAR is change of accounts receivable from t-1 to t; *PPE* is property, plant, and equipment; and *ROA* is return on assets measured as income before extraordinary items divided by total assets.[38] Discretionary accruals (*ABADD*) are calculated as the difference between observed total accruals and predicted normal accruals based on the parameters estimated in the above regression.

To the extent that the model remains incompletely specified for the firm-year experiencing product harm crisis, I expect that abnormal accruals arising from liability reserves and other accounts related to the product failure or defects are mostly income-decreasing[39]. As such, the measurement error in the residual term used to measure earnings management is likely to be biased downward, which is against finding a positive relation, as I expect. In a robustness test I examine later, I also use downward accounting restatements that are due to accounting frauds or GAAP misapplications to measure income-increasing earnings management.

3.3.4 Empirical Model

To test whether managers of firms experiencing a product crisis tend to engage in income-increasing earnings management, I estimate the following regression using the matched sample:

$$ABADD_{i,t} = \beta_0 + \beta_1 PCRISIS_{i,t} + \sum \beta_k Control_{i,t} + IndFE + \varepsilon_{i,t}$$

[38] I specifically add *ROA* into the model because there are changes in current accruals that are closely tied to product harm crises that will reduce operating performance. For example, when a product recall happens, recalling firms may have to write off defective inventory, write off receivables against recall product, and record a current liability for expected refunds. Those income-deceasing accruals arise because of the event rather than management's intentional manipulation. If operating performance is not controlled for when estimating the normal level of accruals, accruals intrinsically associated with product harm crises will be deemed as discretionary accruals, even though those accruals are non-discretionary in a setting of product harm crises.

[39] Under US GAAP, Statement of Financial Accounting Standards SFAS#5 cover codification for product recalls (Gokalp, et al., 2016). A firm must accrue a loss contingency when the management know that the liability had been incurred before the issuance of the financial statements and when the amount of the loss can be reasonably estimated. SFAS #5 require firms specifically prohibits accruals for general or unspecified business risks such as reserves for general contingencies. Based on my browsing of financial statements, firms in the product harm crisis year do make a specific provision/reserve for the expenses associated with product recall (EX: Mattel 2007 Annual Report, General Motor Annual Report 2014).

where for each firm i in year t, *ABADD* is signed discretionary accruals; *PCRISIS* is an indicator variable for product harm crisis; and Control represents a vector of control variables. Following the recommendations in Shipman et al. (2017), I include all covariates in the propensity score matching model as control variables in the regression. In addition, I add financial distress probability measured by Altman's Z-score (*ZSCORE*), whether a firm is audited by a Big 4 auditor (*BIG4*), whether a firm experiences restructuring (*RESTR*), and whether a firm has a write-off (*WRITEOFF*). Finally, I include industry fixed effects (*IndFE*). All variable definitions are summarized in the Appendix. Given that my sample has 11 years of data, standard errors are adjusted by double clustering at both firm and year level (Petersen 2009). I expect the coefficient on *PCRISIS* to be significant and positive if firms engage in income-increasing earnings management when faced with a product harm crisis.

3.4 RESULTS

3.4.1 Main Regression Results

I first tabulate the correlations between variables used in the analysis (Table 3). *PCRISIS* appears to have a significantly positive correlation with *ABADD*. Untabulated univariate comparison suggests that the mean *ABADD* of crisis firms is -0.059, whereas the mean *ABADD* of matched non-crisis firms is -0.076, and the difference is statistically significant (t=3.111). In contrast, the mean *ABADD* of crisis firms (-0.071) is not statistically different from the mean *ABADD* of matched non-crisis firms (-0.078) when both firms are in non-crisis years (t=0.637). The correlation and comparison provide univariate evidence that crisis firms engage in income-increasing accruals management. The pair-wise correlations of *PCRISIS* and other controls, as well as those among the controls, are not large, suggesting that multicollinearity is not a serious concern in my regression model.

[Insert Table 3]

Table 4 provides the results of a multivariate regression. The coefficient on *PCRISIS* is significant and positive, indicating that having a product harm crisis is associated with significantly higher discretionary accruals. This result suggests that, compared with matched non-crisis firms, managers in crisis firms manipulate earnings upward using income-increasing discretionary accruals. In terms of economic significance, the result shows that crisis firms have an increase of 0.015 in discretionary accruals compared to matched non-crisis firms, which is equivalent to 1.5 percent of the lagged total assets. This number is economically material when compared to 5.2 percent, the mean value of ROA of the non-crisis firms.

[Insert Table 4]

3.4.2 Robustness Checks

3.4.2.1 Add Lagged Discretionary Accruals into PSM

Prior literature finds that financial reporting quality influences firms' investment and operational activities (Biddle, Hilary, and Verdi 2009; Cheng, Dhaliwal, and Zhang 2013; Feng, Li, McVay, and Skaife 2015). Hence, it is possible that firms having low-quality financial reporting are more likely to experience product harm crises. To address this concern, I re-match crisis firms with non-crisis firms using lagged discretionary accruals ($ABADD_{t-1}$) as an additional covariate in the PSM. Including $ABADD_{t-1}$ in PSM reduces the number of successful matches to 1,130 (i.e., 565 pairs of crisis firms and non-crisis firms). A covariate balance check confirms that, in the matched sample, crisis firms and non-crisis firms do not differ significantly in $ABADD_{t-1}$. When I re-estimate the regression of *ABADD* on *PCRISIS* based on

this sample of 565 pairs of crisis firms and non-crisis firms, I find that the coefficient on *PCRISIS* remains significant and positive (coefficient=0.011, t=1.661, untabulated).

3.4.2.2 Alternative Measures of Earnings Management

I also use the downward accounting restatements that are due to accounting frauds or GAAP misapplication as an alternative measure of income-increasing earnings management. I obtain data on restatement from Audit Analytics. Results are presented in Table 5, in which *RESTATE* is an indicator variable that equals one if a firm's financial statements in year *t* are subsequently restated downward, and zero otherwise. I only consider restatements caused by accounting issues and frauds that lead to overstated earnings, as my primary focus is on income-increasing earnings manipulation. I find that the tested variable *PCRISIS* has a significantly positive relation to *RESTATE*, suggesting that crisis firms are more likely to have downward accounting restatements than matched non-crisis firms. This result is consistent with firms managing earnings upward when faced with a product harm crisis.

[Insert Table 5]

To test the robustness of my results, and given different model specifications for estimating discretionary accruals (Dechow, Ge, Schrand 2010), I also use alternative measures of discretionary accruals including (1) the modified cross-sectional Jones model (Jones 1991) proposed by Dechow, Sloan, and Sweeney (1995) and used by Dechow, Richardson, and Tuna (2003); (2) the performance-matched modified Jones model (Jones 1991) proposed by Kothari et al. (2005); and (3) the cross-sectional Dechow and Dichev (2002) model as modified by McNichols (2002) and used by Ball and Shivakumar (2006). My findings remain unchanged when I use alternative measures of discretionary accruals.

3.4.2.3 Firms with Multiple Product Harm Crises

Some firms experience more than one product harm crises in the sample period. To make sure my results are not driven by the firms experiencing repeated product harm crises, I control for the number of product harm crises that a firm experienced during the sample period. Adding this variable to the regression does not change my results. In addition, I re-estimate the regression using only firms experiencing a first-year product harm crisis. A firm is defined as experiencing a first-year product harm crisis if it experiences a product harm crisis in year *t* but has not experienced any product harm crisis in year *t-1* and *t-2*. I identify 139 first-year product harm crises. As presented in Table 6, using the 139 first-year crisis firms and their matched non-crisis firms, I still find a significant positive relation between product harm crises and signed discretionary accruals.

[Insert Table 6]

3.5 ADDITIONAL ANALYSES

3.5.1 Effect of Earnings Management on Likelihood of Losing Major Clients

I argue that, when faced with a product harm crisis, firms manage earnings upward as a way to assure customers regarding the firm's financial viability and ability to honor future implicit claims. If this argument holds, it is logical to expect that income-increasing earnings management behavior should be somehow effective in retaining customers' confidence. Arguably, customers cannot easily discern earnings management done by managers, or it is too costly for them to do so. To test this prediction, I investigate whether income-increasing earnings management in the crisis year helps crisis firms retain major customers in the year following the product harm crisis.

I report the results in Table 7. The dependent variable is *LOSSCLIENT,* which equals one if a firm loses at least one major client in the following year, and zero otherwise. I use the customer database from the Segment File of Compustat to identify firms' major customers. Using matched non-crisis firms as the benchmark, I find that income-increasing earnings management significantly reduces the likelihood of losing major clients for crisis firms, which manifests itself as a significantly negative coefficient on the interaction term *ABADD*PCRISIS*. Such a result provides corroborating evidence of managers' incentives to manipulate earnings upward when a product harm crisis occurs, as doing so help the managers retain customers, at least in a short term.

[Insert Table 7]

3.5.2 Effect of Earnings Management on Likelihood of CEO's Forced Turnover and Bonus Decrease

My second argument suggests that CEOs manipulate earnings upward to alleviate the personal losses associated with product harm crises. To verify this argument, I focus on two measures of personal losses: (1) the likelihood of being forced to exit following the crisis year and (2) the likelihood of having a bonus cut in the crisis year.[40] I test whether income-increasing earnings manipulation reduces such likelihood. Earnings are shown to affect boards' decisions on CEOs' forced turnovers (Engel et al. 2003) and bonus compensation (Healy 1985) and, hence, earnings management can, in turn, affect such decisions. I do not focus on new option grants because it is less clear whether managers prefer upward earnings management, since it

[40] I focus on bonus decreases from t-1 to t because bonus is closely related to current period earnings. As a result, I expect that CEOs manipulate earnings in the crisis year t to avoid the loss in bonus due to decreased earnings caused by the product harm crisis. However, CEO turnover usually happens with a lag, and hence I focus on the CEO turnover in the year following the crisis year.

can potentially increase the exercise prices of the options, making them less in-the-money in the future.

I obtain CEOs' bonus compensation and turnover data from ExecuComp database. If a CEO's bonus decreases from year t-1 to t, given t as the crisis year, the variable *DE_BONUS* is coded as 1, and 0 otherwise. The dependent variable *CEO_FIRE* is equal to 1 if a CEO was dismissed, and zero otherwise. I consider that a CEO forced turnover occurs in year t+1, i.e., the year following the crisis year, if the CEO identification number for a company in ExecuComp changes from t+1 to t+2. Among them, I exclude cases where the turnover reason provided in ExecuComp is "deceased" or "retirement."

Regression results are tabulated in Table 8. Again, I use matched non-crisis firms as the benchmark. Columns (1) and (2) report the results for CEO bonus cut and CEO forced turnover, respectively. The variable of interest is the interaction term between *PCRISIS* and *ABADD*. In both regressions, *PCRISIS*ABADD* appears significantly negative, suggesting that the more income-increasing earnings management is conducted by a CEO in a product harm crisis, the less likely the CEO will experience a reduction in bonus in the crisis year, and the less likely the CEO will be dismissed in the year following the crisis year. The result provides further evidence supporting my arguments that CEOs are incentivized to manipulate earnings upward when faced with a product harm crisis, as doing so indeed alleviates CEOs' personal costs associated with the product harm crisis.

[Insert Table 8]

3.5.3 Cross-Sectional Variation

While I find a positive relation between product harm crises and income-increasing earnings management, I expect some cross-sectional variation in such a relation. In this section, I explore

a number of cross-sectional variations of earnings management incentives induced by the relative importance of reputation and implicit claims, as well as by CEOs' fears of personal losses occasioned by product harm crises.

3.5.3.1 Importance of Firm Reputation and Implicit Claims

Since a product harm crisis causes damages to a firm's reputation and hence customers' perception of the firm's ability to fulfill its implicit claims, when reputation and implicit claims are particularly important to the firm, managers should have stronger incentives to manipulate earnings upward to rescue the firm's reputation and customers' confidence. To test this hypothesis, I use two variables to proxy the importance of reputation and implicit claims: whether a firm has industrial customers, and whether a firm produces durable goods.

Prior studies in the marketing literature consistently show that industrial customers are different from consumer customers. Industrial customers often buy large quantities of goods/services to incorporate them as inputs into their own production processes. As a result, industrial customers need higher-quality products and longer-term supplies of parts and service after sales than consumer customers (Industrial Marketing Committee Review Board 1954). As such, firms with industrial customers are more dependent on their reputation to fulfill implicit claims than firms with consumer costumers. Industrial customers are also more likely to be in long-term relationships with their supplier firms, and are thus likely to rely on financial performance of the supplier firm to decide their explicit trade terms, as well as their relationship-specific investments (Hui et al. 2012; Costello et al. 2013). Therefore, upward earnings management incentive is expected to be higher for firms who have industrial customers.

In addition, firms producing durable goods have greater implicit claims with their customers than firms producing non-durable goods (Bowen et al. 1995). This is because

durable products have long lives, resulting in the customers purchasing durable products often requiring the long-term supply of parts and services. Bowen et al. (1995) find that firms in durable goods industries choose more income-increasing accounting methods to influence customers' perception of the firms' long-term viability and stability. Similarly, Titman and Wessels (1988) find that firms in durable goods industries opt to have a lower leverage ratio in order to signal lower bankruptcy risk to their customers.

Following Su et al. (2014), I consider that firms reporting at least one "Company" type of customer in the customer database from the Segment File of Compustat as having industrial customers. I divide the sample into subsamples with company customers and subsamples without company customers. I measure firms producing durable goods by the firms' primary industry. Similar to Bowen et al. (1995) and Su et al. (2014), I separate firms into durable goods industries (three-digit SIC codes 245, 250-259, 283, 301, and 324-399) and non-durable goods industries (all remaining SIC codes from two-digit SIC codes 20 to 39). I re-match the crisis firms and non-crisis firms within the subsamples and re-estimate the regression using subsamples. Results are tabulated in Panel A, Table 9. Columns (1) and (2) report the results when the importance of reputation and implicit claims are measured by the existence of company customers and durable goods, respectively. As shown in the table, the coefficient on *PCRISIS* is only significantly positive for firms having company customers and for firms producing durable goods, consistent with managers' earnings management incentives being stronger in a product harm crisis when reputation and implicit claims are particularly important to the firm.

[Insert Table 9]

3.5.3.2 CEO Equity Incentive and Career Concern

Product harm crises can severely affect managerial wealth through their impact on share prices. In that context, managers with significant option or equity holdings from the firm may have particular incentives to engage in earnings management following a product harm crisis. Moreover, CEOs face differential career concerns, with newly appointed CEOs being more likely than CEOs with a longer tenure to suffer greater expected loss as a result of a product harm crisis.

I use CEO equity incentive (delta) to measure the earnings management incentive induced by the CEO's equity portfolio. Following Core and Guay (2002), CEO equity incentive is calculated as the sensitivity of the value of a CEO's equity portfolio to changes in stock price, using data from ExecuComp. I separate the sample into firms with high CEO equity incentive and low CEO equity incentive, based on the sample median value of equity incentive. Following Ali and Zhang (2015), I use CEO tenure to proxy the degree of a CEO's career concern. CEOs are more concerned about their career when they are in the early years of their services and, hence, CEOs with a shorter tenure are considered as having greater career concerns. I do not include CEOs who were in the first year of their tenure, as Ali and Zhang (2015) document a strong incentive of CEOs to take a big bath after they are just appointed, which is likely to confound the results. Panel B of Table 9 reports the regression results. It shows that firms with CEOs having a higher equity incentive engage in more extensive income-increasing earnings management than firms with CEOs having a lower equity incentive. Similarly, firms with CEOs having a stronger career concern exhibit a higher level of earnings management than firms with CEOs having a weaker career concern. Collectively, the cross-sectional analyses shed further light on the relation between product harm crises and earnings management. Evidence in the cross-sectional tests supports the two major incentives for earnings management in a product harm crisis, and therefore reinforces the main results.

3.5.4 Severity of Product Harm Crisis

I also expect that, when the severity of product harm crisis is greater, which is more likely to harm customers' confidence, managers have greater incentive to engage in earnings management. I measure the severity of a crisis based on a subsample of medical device firms whose severity of product recalls are publicly available on the website of the U.S. Food and Drug Administration (FDA). I manually collect the information of the severity of product recalls and merge it with my initial crisis sample to identify 248 crisis firm-years. The FDA classifies the severity of product recalls into Class I, Class II, and Class III, with Class I recalls being the most severe and Class III being the least severe. I accordingly construct a variable *SEVERITY*, which takes the value of 3 for Class I recalls, 2 for Class II recalls, and 1 for Class III recalls. As shown in Table 10, I find a significant positive relation between *SEVERITY* and *ABADD*, consistent with managers' earnings manipulation incentives being stronger when the product harm crisis is more severe, and thus the negative influence on customers' confidence is more pronounced.

[Insert Table 10]

3.5.5 Earnings Components Used to Manage Earnings

To shed further light on the accounts that managers use to manipulate earnings upward, I break down total earnings into core earnings (measured as operating earnings after depreciation), special item, and non-operating earnings.[41] I break down earnings into these three items to reflect the ways that firms use to recognize the direct costs associated with product harm crises. Results in Table 11 show that the coefficient of *PCRISIS* is not associated, negatively associated, and positively associated with core earnings, special item, and non-operating

[41] All these components can be parts of the total accruals and, in turn, become part of the discretionary accruals.

earnings, respectively. This is consistent with my expectation and some anecdotal evidence that firms use transactions and recognition of such transactions that affect non-operating earnings in order to manage earnings.[42] For example, product harm crisis firms may recognize the gains on the sales of assets and/or investments to increase non-operating earnings. It is not surprising that special item is negatively associated with product harm crisis because many direct costs associated with product harm crisis, such as discontinuation of operation, inventory, and receivable write-offs, can be recorded as expenses in special item. Core earnings are not statistically related to product harm crises, probably because, although direct costs associated with product harm crises negatively impact core earnings, it is likely that, due to the disposal of assets and discontinuation of operations, as well as large write-offs of receivables, firms save on depreciation expenses[43] and/or bad debt expenses, which helps offset the negative impact on core earnings. These additional analyses are indicative of what accounts are used for firms to engage in earnings management in the face of product harm crises.

[Insert Table 11]

3.6 CONCLUSION

Given the increasing number of product harm crises in recent years and the severe consequences of product harm crises, a number of studies have investigated firms' strategies to protect a firm's reputation/brand equity when a product harm crisis happens. I investigate firms' reaction to product harm crises from the financial reporting perspective. I identify several incentives to manipulate earnings in a product harm crisis, and document that managers

[42] For example, the *Wall Street Journal* online reports that "Kellogg Co. said it would take a charge of up to $30 million to cover the recall of Mini-Wheats cereal in the U.S. due to possible contamination by pieces of metal mesh, but maintain its existing full-year earnings' guidance of $3.18 to $3.30 a share …. Kellogg said the performance by its recently acquired Pringles snack business *and changes in estimates for some non-operating items woul*d offset the recall expenses" (emphasis added) in 2012 (Tomson and Ziobro 2012).

[43] When I separately examine depreciation expense as the dependent variable, I do observe a negative association between product harm crisis and depreciation expense, which is consistent with my conjecture here.

manipulate earnings upward when they are faced with a product harm crisis. I also show that crisis firms are more likely to have restatements of financial statements. Consistent with firms' financial image influencing customers' perception of firms' ability to honor future implicit claims and, hence, their purchase intention, the income-increasing earnings management helps crisis firms retain large customers in the short term. It also reduces the propensity for CEOs to have bonus cuts and forced turnovers. Cross-sectional analyses are consistent with the identified incentives to manipulate earnings. That is, the incentive to manipulate earnings is greater when the implicit claims to customers are greater and when the CEOs' personal wealth and career concerns are more affected by the product harm crises. Overall, findings in this study are informative about the implications of the product harm crises on firms' financial reporting behavior and financial reporting quality.

This study has its caveat. The discretionary accrual model used in the study to measure earnings management is not without noise. Although I use the alternative measure such as accounting misstatement, the sample size in my study is also reduced. Regarding the future studies, scholars can investigate whether managers will also use voluntary disclosures to manipulate customers' perception during the product harm crisis. Unlike earnings management, voluntary disclosure can provide more timely information to the outsiders, so it is very likely firms will use voluntary disclosure along with earnings manipulating to boost the customers' confidence as well as investors' confidence.

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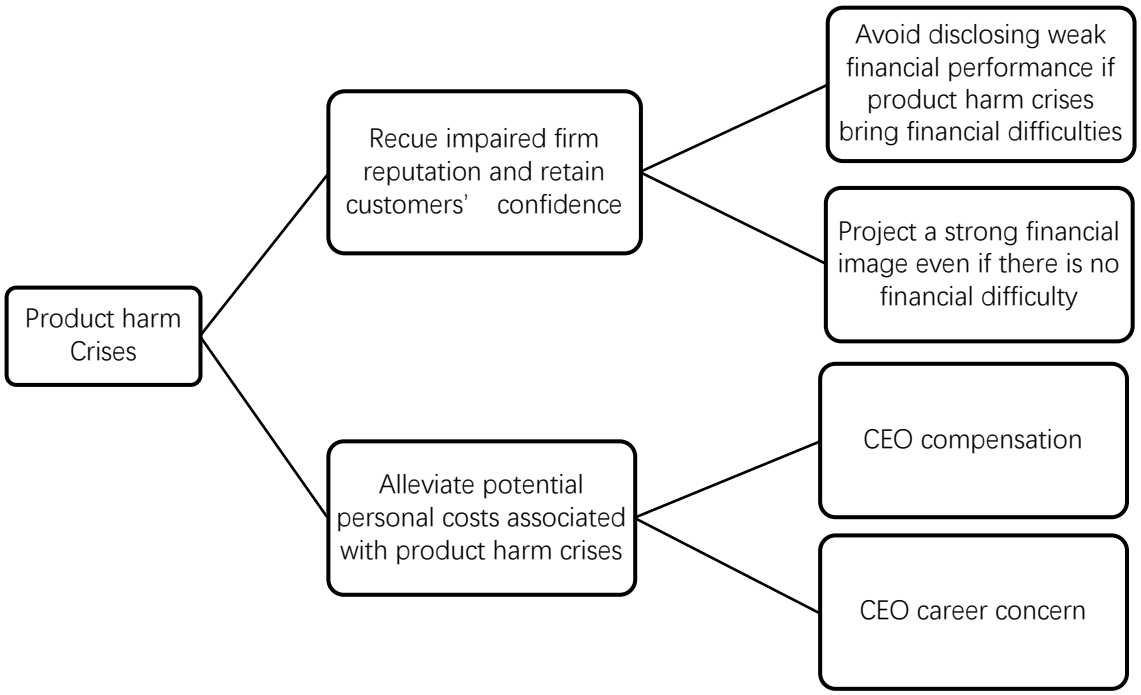
Figure 1


Product harm Crises
Recue impaired firm reputation and retain customers' confidence
Alleviate potential personal costs associated with product harm crises
Avoid disclosing weak financial performance if product harm crises bring financial difficulties
Project a strong financial image even if there is no financial difficulty
CEO compensation
CEO career concern

Appendix A
Variable Definitions

Variable	Definitions
ABADD	Discretionary accruals calculated based on performance-adjusted modified Jones model using all firms with available information in Compustat
BIG4	An indicator variable equal to 1 if a firm is audited by a Big 4 audit firm, and 0 otherwise
CASH	Cash ratio, calculated as total cash and cash equivalent to total assets
CEO_FIRE	An indicator variable is equal to 1 if a CEO was dismissed, and zero otherwise
CEOSHARE	Percentage of equity shares owned by the CEO
chgROA	Change in ROA from t-1 to t
CORE	Core earnings measured as operating incomes after depreciation
COVER	Logarithm of analyst coverage
DE_BONUS	If a CEO's bonus decreases from year t-1 to t, given t as the crisis year, the variable DE_BONUS is coded as 1, and 0 otherwise
FIRST_PCRISIS	An indicator variable for firms experiencing a product harm crisis in the first year. A firm is defined to have a first-year product harm crisis in year t if it has not had any product harm crises in year t-1 and t-2
GROWTH	Sales growth, calculated as sales in year t minus sales in year t-1 divided by sales in year t-1
IO	Percentage of shares owned by institutional shareholders
LEV	Leverage ratio calculated as total long-term debt to total assets
LogMV	Logarithm of total market value
LOSSCLIENT	An indicator variable equal to 1 if a firm lost a major client, and 0 otherwise
MTB	Market-to-book ratio, calculated as year-end market value to total common equity
NonOP	Non-operating incomes
PCRISIS	An indicator variable equal to 1 if a firm experienced product crisis in year t, and 0 otherwise
PPE	Gross property, plant, and equipment divided by total assets
RESTATE	An indicator variable equal to 1 if a firm's financial statements are restated due to accounting issues and fraud that lead to overstated earnings, and 0 otherwise
RESTR	An indicator variable equal to 1 if a firm has non-zero restructuring expenses, and equal to 0 otherwise.

ROA	Return on assets calculated as income before extraordinary items to total assets
SEVERITY	Severity of product harm crises for a subsample of medical device companies based on the product recall classification from the U.S. Food and Drug Administration (FDA)
SPECIAL	Special items
TACC	TACC is total accruals defined as income before extraordinary items minus operating cash flows
TMT	An indicator variable equal to 1 if the Chief Operating Officer (COO) is among the five highest-paid executives, and 0 otherwise
ΔAR	Change in account receivables from t-1 to t
ΔSALES	Change in sales from t-1 to t
WRITEOFF	An indicator variable equal to 1 if a firm has non-zero write-offs, and 0 otherwise
ZSCORE	Altman Z-score for probability of bankruptcy

Table 1

Sample Distribution and Descriptive Statistics of Pooled Sample

Panel A: Sample Distribution by Year

Year	No. of Observations	No. of Observations With Product Harm Crises
2002	248	28
2003	275	30
2004	653	47
2005	667	53
2006	649	56
2007	661	64
2008	687	72
2009	736	71
2010	745	91
2011	753	67
2012	732	62
Total	6,806	641

Table 1 – cont'd

Panel B: Sample Distribution by Industry

Two-digit SIC Code	Industry Name	No. of Observations	No. of Observations With Product Harm Crises
20	Food and Kindred Products	399	44
22	Textile Mill Products	32	3
25	25 Furniture and Fixtures	150	2
26	Paper and Allied Products	206	22
27	Printing, Publishing, and Allied Industries	156	1
28	Chemicals and Allied Products	1,180	231
29	Petroleum Refining and Related Industries	99	1
30	Rubber and Miscellaneous Plastics Products	138	24
32	Stone, Clay, and Glass Products	93	20
33	Primary Metal Industries	223	6
34	Fabricated Metal Products	233	39
35	Industrial Machinery and Equipment	1,049	66
36	Electronic and Other Electric Equipment	1,309	38
37	Transportation Equipment	380	37
38	Instruments and Related Products	1,005	83
39	Miscellaneous Manufacturing Industries	154	24
Total		6,806	641

Table 1 – cont'd

Panel C: Descriptive Statistics of Crisis Firms and Non-Crisis Firms in Pooled Sample

	Crisis Firm Group (No. of Obs.=641)		Non-Crisis Firm Group (No. of Obs.=6,165)			
Variables	Mean	Median	Mean	Median	Mean Difference	Median Difference
LogMV	8.765	8.514	7.119	6.969	1.646***	1.545***
LEV	0.199	0.186	0.157	0.122	0.042***	0.064***
ROA	0.059	0.062	0.024	0.052	0.035***	0.010***
GROWTH	3.212	2.747	2.922	2.122	0.290**	0.625***
MTB	0.042	0.055	0.066	0.070	-0.024***	-0.015***
IO	0.718	0.730	0.731	0.770	-0.013	-0.039***
COVER	1.759	2.234	1.326	1.540	0.432***	0.693***
TMT	0.251	0.000	0.296	0.000	-0.045**	0.000
CEOSHARE	0.733	0.021	1.447	0.038	-0.714***	-0.017***
PPE	0.514	0.446	0.488	0.406	0.027**	0.039***

*, **, *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels, respectively.
Panel A provides yearly distribution of the pooled sample of manufacturing firms (SIC codes 20-39) and firms with product harm crises in the pooled sample. A manufacturing industry is included in the pooled sample if at least one firm in the industry experienced a product harm crisis in the sample period 2002 to 2012. Panel B presents the sample distribution based on industry membership defined by two-digit SIC codes. Panel C provides descriptive statistics of 641 firm-year observations with product harm crises and 6,165 firm-years observations without product harm crises in the pooled sample. See Appendix A for variable definitions.

Table 2
Propensity Score Matching

Panel A: Determinants of Experiencing Product Harm Crises for Propensity Score Matching

	Dependent Variable = *PCRISIS*	
Variables	Coefficient	z-statistics
LogMV	0.353***	(19.036)
LEV	0.476***	(2.945)
ROA	0.223	(0.884)
MTB	-0.025***	(-3.439)
GROWTH	-0.662***	(-3.971)
IO	-0.500***	(-3.872)
COVER	-0.011	(-0.509)
TMT	-0.135**	(-2.459)
CEOSHARE	-0.005	(-0.770)
PPE	0.197**	(2.263)
CONSTANT	-4.202***	(-17.442)
Industry Fixed Effect	Yes	
Year Fixed Effect	Yes	
Observations	6,806	
Pseudo R-squared	0.222	

Table 2 – cont'd

Panel B: Test of Covariate Balance of Propensity Score Matched Sample

	Crisis Firm Group (No. of Obs.=575)		Non-Crisis Firm Group (No. of Obs.=575)			
Variables	Mean	Median	Mean	Median	Mean Difference	Median Difference
LogMV	8.467	8.261	8.468	8.339	-0.001	-0.078
LEV	0.203	0.189	0.204	0.177	-0.001	0.013
ROA	0.056	0.059	0.052	0.070	0.004	-0.010*
GROWTH	3.186	2.607	3.170	2.599	0.017	0.008
MTB	0.043	0.057	0.041	0.057	0.002	0.001
IO	0.726	0.750	0.719	0.761	0.007	-0.011
COVER	1.643	2.069	1.564	1.981	0.079	0.088
TMT	0.278	0.000	0.273	0.000	0.005	0.000
CEOSHARE	0.815	0.035	0.955	0.020	-0.140	0.015
PPE	0.519	0.452	0.524	0.422	-0.005	0.030*

*, **, *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels, respectively. Z-statistics are reported in parentheses. Panel A presents the results of probit regression of the determinants of experiencing product harm crises. The probit regression is used to perform the propensity score matching. Panel B provides the same set of descriptive statistics as in Panel C of Table 1 for 575 pairs of crisis firms and non-crisis firms that are matched on closest propensity scores. See Appendix A for variable definitions.

Table 3
Variable Correlations

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	*ABADD*															
2	*PCRISIS*	**0.10**														
3	*LogMV*	**-0.26**	0.00													
4	*LEV*	**0.10**	0.00	-0.05												
5	*ROA*	**-0.25**	0.02	**0.38**	**-0.18**											
6	*MTB*	**-0.13**	0.00	**0.24**	**-0.09**	**0.17**										
7	*GROWTH*	**-0.10**	0.01	**0.11**	**-0.06**	**0.25**	**0.10**									
8	*IO*	-0.02	0.02	-0.01	**0.11**	0.05	-0.05	0.05								
9	*COVER*	**-0.14**	0.03	**0.43**	0.00	**0.08**	**0.15**	0.05	0.04							
10	*TMT*	**0.10**	-0.01	**-0.06**	**0.12**	**0.07**	-0.01	0.04	-0.02	-0.03						
11	*CEOSHARE*	-0.12	0.01	0.04	0.01	**0.09**	0.06	0.02	0.03	0.03	0.01					
12	*PPE*	-0.04	-0.02	**-0.18**	**-0.10**	0.02	-0.03	0.05	**-0.15**	**-0.14**	-0.01	-0.03				
13	*ZSCORE*	**-0.18**	**-0.14**	0.05	**-0.50**	**0.32**	**0.24**	**0.16**	**-0.10**	**0.06**	**-0.12**	-0.02	**0.07**			
14	*BIG4*	0.03	0.01	**0.25**	0.05	**0.11**	-0.01	0.03	-0.05	**0.07**	**0.14**	0.03	**-0.07**	**-0.15**		
15	*RESTR*	**0.06**	**0.13**	0.04	**0.17**	**-0.10**	**-0.07**	**-0.14**	**0.10**	-0.01	**0.09**	0.03	-0.05	**-0.28**	**0.16**	
16	*WRITEOFF*	**-0.06**	0.03	**0.07**	0.05	**-0.10**	0.00	-0.03	0.02	**0.06**	0.01	0.00	-0.02	**-0.07**	-0.04	**0.15**

This table presents the Pearson correlation between variables used in the main regression. Correlations significant at the 5 percent level are in boldface. See Appendix A for variable definitions.

Table 4
Effect of Product Harm Crises on Earnings Management

	Dependent Variable = *ABADD*	
Variables	Coefficient	t-statistic
PCRISIS	0.015***	(2.624)
LogMV	-0.005	(-1.513)
LEV	0.026	(1.039)
ROA	-0.178*	(-1.947)
MTB	-0.000	(-0.330)
GROWTH	-0.010	(-0.353)
IO	-0.022	(-1.429)
COVER	-0.004	(-1.451)
PPE	0.027	(1.254)
TMT	-0.010	(-1.254)
CEOSHARE	-0.002*	(-1.803)
ZSCORE	-0.001	(-1.158)
BIG4	0.003	(0.658)
RESTR	-0.002	(-0.368)
WRITEOFF	-0.003	(-0.453)
CONSTANT	0.039	(1.066)
Industry Fixed Effect	Yes	
Firm/Year Cluster	Yes	
Observations	1,150	
Adjusted R-squared	0.350	

*, **, *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels, respectively. T-statistics are reported in parentheses.
This table presents the results of regression on the effect of experiencing product harm crises on accrual earnings management, based on propensity score matched pairs of crisis and non-crisis firms. See Appendix A for variable definitions.

Table 5
Effect of Product Harm Crises on Likelihood of Restatement

	Dependent Variable = *RESTATE*	
Variables	Coefficient	z-statistic
PCRISIS	0.260*	(1.703)
LogMV	0.012	(0.256)
LEV	0.204	(0.379)
ROA	0.424	(0.659)
MTB	-0.024	(-0.950)
GROWTH	0.265	(0.729)
IO	0.478	(1.409)
COVER	0.020	(0.388)
PPE	-0.458	(-1.336)
TMT	0.285	(1.348)
CEOSHARE	-0.004	(-0.471)
ZSCORE	-0.076**	(-2.445)
BIG4	0.029	(0.155)
RESTR	-0.000	(-0.002)
WRITEOFF	0.043	(0.351)
CONSTANT	-1.774***	(-3.073)
Industry Fixed Effects	Yes	
Firm/Year Cluster	Yes	
Observations	1,091	
Pseudo R-squared	0.117	

*, **, *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels, respectively. Z-statistics are reported in parentheses.
This table presents the results of probit regression on the effect of experiencing product harm crises on restatements due to accounting issues and fraud. Dependent variable *RESTATE* equals one if the restatement has a negative impact on earnings/assets (i.e., restatement is due to overstated earnings/assets). See Appendix A for variable definitions.

Table 6
Analysis of First-Year Product Harm Crises

	Dependent Variable = *ABADD*	
Variables	Coefficient	t-statistic
FIRST_PCRISIS	0.015*	(1.836)
LogMV	-0.002	(-0.495)
LEV	0.008	(0.137)
ROA	-0.277*	(-1.703)
MTB	-0.002	(-1.066)
GROWTH	-0.019	(-0.260)
IO	-0.003	(-0.148)
COVER	0.003	(0.539)
PPE	0.012	(0.583)
TMT	-0.025***	(-2.724)
CEOSHARE	-0.000	(-0.649)
ZSCORE	-0.001	(-0.531)
BIG4	0.008	(0.839)
RESTR	-0.004	(-0.438)
WRITEOFF	-0.019*	(-1.831)
CONSTANT	0.044	(0.913)
Industry Fixed Effect	Yes	
Firm/Year Cluster	Yes	
Observations	278	
Adjusted R-squared	0.441	

*, **, *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels, respectively. T-statistics are reported in parentheses.
This table presents the regression results based on first-year crisis firms and their matched non-crisis firms. See Appendix A for variable definitions.

Table 7
Effect of Earnings Management on Likelihood of Losing Major Clients for Crisis Firms

	Dependent Variable = $LOSSCLIENT_{t+1}$	
Variables	Coefficient	t-statistic
ABADD	-0.168	(-1.343)
PCRISIS	1.032	(1.426)
*ABADD*PCRISIS*	-2.774**	(-2.495)
LogMV	-0.067	(-1.424)
LEV	-0.275	(-0.841)
chgROA	0.980***	(2.751)
MTB	0.020	(1.562)
GROWTH	-0.114	(-0.607)
IO	-0.555*	(-1.869)
COVER	0.055	(0.939)
PPE	0.276	(1.108)
TMT	0.137	(0.861)
CEOSHARE	-0.015	(-1.253)
ZSCORE	0.001	(0.095)
BIG4	-0.329**	(-2.336)
RESTR	-0.095	(-1.001)
WRITEOFF	0.119*	(1.660)
CONSTANT	0.423	(0.813)
Industry Fixed Effect	Yes	
Firm/Year Cluster	Yes	
Observations	1,146	
Pseudo R-squared	0.081	

*, **, *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels, respectively. Z-statistics are reported in parentheses.
This table presents the results of the effect of earnings management on the likelihood of losing major clients in year t+1, given t as the crisis year. Regressions are estimated using propensity score matched crisis and non-crisis firms. See Appendix A for variable definitions.

Table 8
Effect of Earnings Management on Likelihood of CEO Bonus Decrease and CEO Dismissal

	(1) Dependent Variable = DE_BONUS_t		(2) Dependent Variable = CEO_FIRE_{t+1}	
Variables	Coefficient	t-statistic	Coefficient	t-statistic
PCRISIS	-0.008	(-0.059)	-0.103	(-0.866)
ABADD	0.647	(0.705)	0.115	(0.127)
*ABADD*PCRISIS*	-1.691**	(-2.046)	-1.724*	(-1.825)
LogMV	0.036	(0.735)	0.006	(0.094)
LEV	0.676	(1.342)	0.598	(1.034)
chgROA	0.059	(0.061)	-0.914*	(-1.673)
MTB	-0.024***	(-2.780)	-0.022*	(-1.740)
GROWTH	0.081	(0.161)	-0.245	(-0.695)
IO	-0.852**	(-2.097)	0.065	(0.106)
COVER	-0.031	(-0.813)	-0.033	(-1.066)
PPE	0.052	(0.234)	-0.100	(-0.505)
TMT	0.041	(0.460)	-0.252***	(-5.428)
CEOSHARE	0.015	(1.108)	0.020	(1.410)
ZSCORE	0.010	(0.449)	0.003	(0.196)
BIG4	-0.295*	(-1.936)	0.394**	(2.024)
RESTR	-0.157**	(-2.136)	-0.237*	(-1.818)
WRITEOFF	0.057	(0.640)	0.446***	(4.795)
CONSTANT	-0.013	(-0.024)	-1.445**	(-2.382)
Industry Fixed Effect	Yes		Yes	
Firm/Year Cluster	Yes		Yes	
Observations	1010		894	
Pseudo R-squared	0.043		0.043	

*, **, *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels, respectively. Z-statistics are reported in parentheses.
Column (1) of this table presents the results of the effect of earnings management on the likelihood of CEOs suffering a decrease in bonus from year t-1 to t, given t as the crisis year. Column (2) reports the results of the effect of earnings management on the likelihood of CEO dismissal in year t+1, given t as the crisis year. Regressions are estimated using propensity score matched crisis and non-crisis firms. See Appendix A for variable definitions.

Table 9: Cross-Sectional Variation

Panel A: Importance of Implicit Claims to Customers

	Customer Importance				Type of Goods Produced			
	(1)		(2)		(3)		(4)	
	Without Company Customer		With Company Customer		Non-Durable Goods		Durable Goods	
Variable	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
PCRISIS	0.006	(0.929)	0.024***	(3.672)	0.001	(0.122)	0.015**	(2.510)
LogMV	-0.006*	(-1.742)	-0.005	(-1.631)	-0.006*	(-1.787)	-0.011***	(-4.650)
LEV	-0.021	(-0.692)	0.061**	(1.970)	0.041*	(1.690)	0.045*	(1.858)
ROA	-0.264***	(-3.140)	-0.091	(-1.026)	0.157**	(2.378)	-0.050	(-0.768)
MTB	-0.001	(-0.889)	0.000	(0.528)	-0.001	(-1.223)	0.001	(1.414)
GROWTH	-0.026	(-0.567)	0.000	(0.009)	0.005	(0.068)	0.008	(0.361)
IO	-0.003	(-0.146)	-0.021	(-1.168)	0.020	(0.822)	-0.019	(-1.118)
COVER	-0.006*	(-1.775)	-0.002	(-0.492)	-0.005*	(-1.694)	0.001	(0.250)
PPE	0.019	(0.724)	0.024	(0.989)	0.037	(1.393)	-0.027	(-1.107)
TMT	-0.027***	(-2.987)	-0.002	(-0.172)	-0.011*	(-1.674)	-0.017**	(-2.014)
CEOSHARE	-0.003***	(-2.681)	0.000	(0.584)	-0.002	(-0.934)	-0.001	(-1.489)
ZSCORE	-0.000	(-0.184)	-0.002	(-1.196)	-0.009**	(-2.333)	-0.001	(-1.475)
BIG4	0.004	(0.800)	-0.002	(-0.300)	-0.009	(-0.752)	0.002	(0.387)
RESTR	0.004	(0.376)	-0.007	(-1.095)	-0.009	(-0.779)	0.010	(1.339)
WRITEOFF	0.009	(1.590)	-0.011	(-1.460)	0.003	(0.448)	-0.008	(-1.139)
CONSTANT	0.064*	(1.870)	0.019	(0.509)	0.064	(1.439)	0.075**	(2.305)
Industry Fixed Effect	Yes		Yes		Yes		Yes	
Firm/Year Cluster	Yes		Yes		Yes		Yes	
Observations	494		656		388		726	
R-squared	0.385		0.407		0.406		0.431	

Table 9 – cont'd

Panel B: CEO Equity Incentive and CEO Career Concern

	CEO Equity Incentive (Delta)				CEO Career Concern			
	(1)		(2)		(3)		(4)	
	Low Delta		High Delta		Low Career Concern		High Career Concern	
Variable	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
PCRISIS	0.006	(0.859)	0.015**	(2.112)	0.004	(0.736)	0.027*	(1.952)
LogMV	-0.003	(-0.331)	-0.008**	(-2.171)	-0.009***	(-2.651)	-0.014***	(-3.656)
LEV	-0.028	(-0.580)	0.057**	(2.239)	0.077**	(2.370)	-0.065	(-0.904)
ROA	0.099	(1.419)	-0.013	(-0.079)	-0.039	(-0.500)	-0.010	(-0.070)
MTB	0.003	(1.378)	-0.002**	(-2.378)	-0.001	(-0.607)	-0.001	(-1.152)
GROWTH	-0.002	(-0.085)	-0.023	(-0.983)	-0.010	(-0.252)	-0.050	(-1.620)
IO	0.016	(0.506)	0.004	(0.201)	0.019	(1.084)	-0.030	(-0.928)
COVER	0.003	(1.003)	-0.008***	(-3.319)	-0.002	(-0.792)	0.002	(0.536)
PPE	-0.012	(-0.542)	0.039*	(1.912)	0.031*	(1.796)	0.030	(1.526)
TMT	0.000	(0.025)	-0.011*	(-1.774)	-0.020***	(-2.781)	-0.008	(-0.739)
CEOSHARE	0.010	(0.919)	-0.001	(-0.839)	-0.002	(-1.175)	-0.002**	(-2.447)
ZSCORE	-0.006***	(-3.382)	-0.002	(-1.464)	-0.001	(-1.485)	-0.004	(-1.451)
BIG4	0.018	(1.639)	-0.008	(-0.810)	-0.005	(-0.666)	0.001	(0.083)
RESTR	0.011	(1.284)	0.001	(0.161)	0.016*	(1.745)	0.000	(0.020)
WRITEOFF	-0.016**	(-2.029)	-0.007	(-1.093)	0.004	(0.550)	-0.008	(-0.883)
CONSTANT	0.000	(0.004)	0.062*	(1.937)	0.046	(1.410)	0.142*	(1.850)
Industry Fixed Effect	Yes		Yes		Yes		Yes	
Firm/Year Cluster	Yes		Yes		Yes		Yes	
Observations	342		662		570		220	
R-squared	0.320		0.451		0.463		0.444	

*, **, *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels, respectively. T-statistics are reported in parentheses.
Panel A presents the regression results regarding the effect of the importance of firm reputation and implicit claims on the relationship between product harm crises and managers' incentives to manipulate earnings upward. A firm is defined as having a company customer if a company-type customer is reported for this company in the Compustat customer segment file. A firm is considered as producing durable goods if it has a three-digit SIC code of 245, 250-259, 283, 301, or 324-399. Panel B reports the regression results regarding the effect of CEOs' concerns of

personal costs on the relationship between product harm crises and managers' incentives to manipulate earnings upward. CEO compensation delta measures the sensitivity of CEO compensation to stock price. CEO tenure is used to measure CEO career concern. See Appendix A for variable definitions.

Table 10
Analysis of Severity of Product Harm Crises

	Dependent Variable = *ABADD*	
Variables	Coefficient	t-statistic
SEVERITY	0.017**	(1.978)
LogMV	-0.013**	(-2.505)
LEV	-0.018	(-0.554)
ROA	-0.199***	(-2.993)
MTB	-0.001	(-0.274)
GROWTH	0.170**	(2.245)
IO	-0.047*	(-1.943)
COVER	-0.003*	(-1.689)
PPE	-0.041	(-0.834)
TMT	-0.011*	(-1.873)
CEOSHARE	-0.001	(-0.592)
ZSCORE	-0.002*	(-1.840)
BIG4	0.013	(1.370)
RESTR	0.004	(0.575)
WRITEOFF	-0.022*	(-1.652)
CONSTANT	0.045	(0.905)
Industry Fixed Effect	Yes	
Firm/Year Cluster	Yes	
Observations	248	
Adjusted R-squared	0.382	

*, **, *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels, respectively. T-statistics are reported in parentheses.
This table presents the regression results on the severity of product harm crises. The regression is estimated based on a subsample of medical device companies whose product recall severity information is manually collected from the website of the U.S. Food and Drug Administration. See Appendix A for variable definitions.

Table 11
Analysis of Earnings Components

	Dependent Variable = *CORE*		Dependent Variable = *SPECIAL*		Dependent Variable = *NonOP*	
Variables	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
PCRISIS	-0.002	(-0.499)	-0.007***	(-3.517)	0.002**	(2.083)
LogMV	0.008***	(3.213)	-0.004***	(-4.354)	0.001**	(2.092)
LEV	0.078***	(3.116)	-0.001	(-0.118)	-0.005	(-1.398)
ROA	0.720***	(8.816)	0.211***	(4.471)	-0.003	(-0.498)
MTB	0.001*	(1.763)	0.000	(0.524)	-0.000	(-0.975)
GROWTH	0.070***	(3.184)	-0.009*	(-1.719)	0.000	(0.159)
IO	0.035*	(1.893)	-0.024***	(-3.242)	-0.007*	(-1.651)
COVER	-0.003	(-1.129)	0.001	(1.212)	-0.000	(-0.870)
PPE	0.018	(1.174)	0.002	(0.526)	0.002	(1.248)
TMT	0.010**	(2.252)	-0.006***	(-2.595)	-0.001	(-0.991)
CEOSHARE	0.001***	(3.545)	-0.000*	(-1.862)	-0.000	(-0.279)
ZSCORE	0.004***	(3.301)	-0.001*	(-1.889)	0.000	(1.400)
BIG4	-0.010**	(-2.025)	0.005**	(2.369)	-0.001	(-0.438)
RESTR	0.008**	(2.089)	-0.011***	(-3.988)	-0.003***	(-3.057)
WRITEOFF	0.006	(1.007)	-0.011***	(-2.824)	0.001	(1.444)
CONSTANT	-0.054*	(-1.667)	0.034***	(4.390)	0.007	(1.167)
Industry Fixed Effect	Yes		Yes		Yes	
Firm/Year Cluster	Yes		Yes		Yes	
Observations	1,150		1,150		1,150	

Adjusted R-squared	0.700	0.316	0.128

*, **, *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels, respectively. T-statistics are reported in parentheses.
This table presents the regression results on the relationship between product harm crises and earnings components. Earnings are broken down into core earnings (*CORE*), special items (*SPECIAL*), and non-operating incomes (*NonOP*). See Appendix A for variable definitions.

Chapter 4 Do Banks Price the Product Failure? Evidence from Product Recalls

4.1 Introduction

A product failure can manifest in many ways. The product failure can be tracked back to design flaws, manufacturing or processing defects, software problems, packaging errors or inadequate labelling, improper storage, and handling and distribution of the product, or a combination of these (Marucheck, Greis, Mena, and Cai 2011). When product failure occurs, the firm can voluntarily decide to launch a product recall to remove the product from the market. The product recall is reported to be an increasingly prevalent phenomenon in the past two decades (CPSC 2010; Advisen Insurance Intelligence 2012; NHTSA 2015). Moreover, it is reported that firms will face an even higher risk of product recalls in the future (Chen, Ganesan, and Liu 2009； Chen and Nguyen 2013; Gao, Xie, and Wang 2015).

Regarding the financial consequences of product recalls, prior literature mostly focuses on stock market reaction to product recall announcements by the firms encountering product failures (hereafter *recall firms*) (Jarrell and Peltzman 1985; Hoffer, Stephan, and Robert 1988; Chen et al. 2009; Gao et al. 2015). The majority of these studies find that the recall firm's stock price declines upon announcement of a product recall (Jarrell and Peltzman 1985; Dawar and Pillutla 2000; Hendricks and Singhal 2003; Siomkos and Shrivastava 1993). Surprisingly, no prior studies have investigated the debt market reaction to the announcement of a product recall. I endeavor to provide, from the debtholders' perspective, empirical evidence of the effect of a product recall. Specifically, I try to answer two questions:

(1) Does experiencing a product recall affect the contracting term of a new bank loan?

(2) How does the changing of a new bank's contracting term vary according to the recall firms' characteristics?

The above questions are important for at least two reasons. First, it is well established that banks are one of the most important providers of external capital to a corporation (e.g., Demirgüç-Kunt and Levine 2001; Graham, Li, and Qiu 2008; Nini, Smith, and Sufi 2009; Armstrong, Guay, and Weber 2010). Given the significance of bank loans and the growing number of product recalls, it is important to investigate whether banks react to firms' product recall announcements. Second, while most studies find that the equity market reacts negatively to the announcement of a product recall, several studies illustrate that the stock market over-reacts to the announcement of a product recall and hence rebounds later (Bromiley and Marcus 1989; Govindaraj and Jaggi 2004)[44]. In addition, Hoffer, Pruitt, and Reilly (1988) re-examine the same data and, after controlling for potential confounding events, find that those recall announcements do not significantly affect firm value. Thirumalai and Sinha (2011) do not find significant and negative stock market reaction to product recall announcements in the aggregate level in the medical device industry, where product recalls are considered a normal part of business. Debtholders are significantly different from equity holders. Debtholders have direct access to the proprietary information of the

[44] Bromiley and Marcus (1989) find that stock prices rebound 1 week after firms' product harm crises, negating the negative effect of the product harm crisis (which is the most severe case of product recall). Govindaraj and Jaggi (2004) find that the market initially overreacts negatively to the recall news, and that this reaction is generally based on the near worst-case estimates of direct and indirect costs, litigation costs, regulation compliance costs, and costs associated with future losses in sales. The firms recovered their market value as more information on actual costs became available.

firms than the dispersed stockholders do (Bharath, Sunder, and Sunder 2008)[45]. Given banks' direct access to private information and their superior information-processing abilities, investigating the banks' reaction to product recalls can complement prior study examining the financial cost of a product recall.

There are several major supporting arguments that explain why banks are concerned about product recalls, which in turn lead to a significantly negative impact on firms' loan contracting. Firstly, A direct argument is that a product recall incurs various direct costs to firms, which reduce earnings and cash flows and hence increases downside risk/default risk (Jarrell and Peltzman 1985). Secondly, a product recall has a negative impact on a firm's reputation/brand value, as well as customers' intention to purchase, which are found to influence the cost of debt (Himme and Fischer 2014; Anginer, Mansi, and Warburton 2015). Thirdly, a firm involved in a product recall has more private information, such that the information asymmetry problems are accentuated between the debtholders and the firm involved in product recall (Chen et al. 2009). Lastly, a product recall caused by a product failure may also reveal the CEO and management team's bad risk-taking appetite, lack of caution, and lack of knowledge in operation and production management, which increase the firm's operation risk (Marucheck et al. 2011; Ryu 2012; Wowak et al. 2015B).

[45] Bank loans are based on direct negotiations between firms and their lenders, and priced by informed and sophisticated loan officers. Therefore, the loan market is more informationally efficient than the bond market (Altman, Gande, and Saunders 2004).

To investigate the issue, I manually collected data on recall campaigns announced by public firms over the period from 2002 to 2013. Specifically, I manually collected data on product recalls from the US Consumer Product Safety Commission (CPSC) and food, drug, and medical device recalls from the US Food and Drug Administration (FDA). My final sample consists of 155 recall events spread over 31 different two-digit SIC industries. From there, I searched the DealScan database to ascertain whether a firm had a reported loan in a 3-year period prior to the year of the announcement of the product recall or in the 3-year period subsequent to the year of the announcement of the product recall.

In my analysis, I begin by examining the effect of a product recall on the cost of a bank loan (hereafter *interest spread*) for a sample of firms announcing product recalls. Consistent with my prediction, I find that, in the aftermath of the announcement of a product recall, banks increase the average interest spread by 38 basis points, or an increase of around a million dollars in interest expense for each facility, which is economically significant. To mitigate the concerns of the confounding factors and macroeconomic changes of debt financing, I also use difference-in-difference research design by constructing a group of no-product-recall control firms using the propensity score matching (PSM) approach. The propensity score is a firm's probability of incurring a product recall conditional on a vector of its observable characteristics. My difference-in-difference analysis yields qualitatively similar results.

Firms have different characteristics, so their risks during a product recall are perceived differently by banks. Specifically, I investigate debtholder reaction to

product recalls conditional on the information asymmetry concern and the firms' *ex-ante* ability to recover from a product recall. Firms announcing product recall experience more information asymmetry problems because of uncertainty regarding the impact of the product recalls on the firms' future cash flow (Chao et al. 2009; Gokalp, Keskek, Kumas, and Subasi 2016). Firms with more independent directors can monitor information disclosure, which mitigates information asymmetry between debtholders and firms during and after the product recalls. The firms' ability to recover from product recalls depends on whether they have ex-ante sale contracting or long-term supplier contracts (Bernard 2016). Firms with more ability to recover from product recall would be considered as having a lower risk of default by bankers. My result provides supporting evidence that firms announcing product recalls with the independent board of director and greater ex-ante ability to recover from product recalls experience lower increases in interest spreads after the announcement of a product recall.

Next, I also provide additional tests to extend my findings. I find that a firm's product recall also impacts non-pricing bank loan contracts. Specifically, based on the matched sample, I find that a loan contracted after the event of a product recall has a shorter bank loan maturity and a higher number of debt covenants. The non-price terms represent additional costs borne by recall firms. Furthermore, Bromiley and Marcus (1989) argue that, at a fundamental level, the market anticipates a normal number of product recalls per firm per period. In line with this, I also investigate whether my finding is mainly driven by firms announcing multiple product recalls over the sample-period years. My result shows that the negative relation between interest

spread and the announcement of a product recall exists for the sample of firms announcing product recalls only once during the sample period. However, debtholders more severely penalize recall firms announcing multiple product recalls over the years by charging a higher interest spread. Lastly, like the Thirumali et al. (2013) study, which doesn't find negative and significant stock reaction to product recalls in aggregate in the medical industry, I also find that debtholders do not react significantly to these firms in aggregate.

The contributions of this study are threefold. First, while prior literature examined the impact of a product recall on a firm's financing cost from an equity holders' perspective (Jarrell and Peltzman 1985; Hoffer et al. 1988; Hendricks and Singhal 2003; Chen et al. 2009; Gao et al. 2015), my study is the first to investigate this growing phenomenon from the debt market reaction. Findings in this study add to the knowledge of the nature and degree of association between financing costs and product recalls from the perspective of an important stakeholder—the bank.

Second, this study illustrates an important channel through which the product recall causes firms' losses. While prior studies find a negative security price reaction to a firm's product harm crisis announcement, my findings help explain the decline in stock price. Van Heerde et al. (2007) indicate that security price is an aggregate indicator that does not identify the underlying mechanisms through which the resulting value loss merges. Therefore, Van Heerde et al. (2007) investigate whether it is entirely due to a loss in baseline sales or whether it can be attributed to the spillover effect to other

products under the same label. In a similar spirit, this study identifies a new mechanism of loss, which is the adverse bank loan reaction to the product harm crisis.

Third, this study complements the literature on bank loan contracting. While prior studies find that bank loans can be affected by other specific firm-level events such as firms' restatements (Graham et al. 2008), weaknesses in internal control over financial reporting (Costello and Wittenberg-Moerman 2011; Kim, Song, and Zhang 2011), auditor turnover and auditor reports (Chen, He, Ma, and Stice 2016; Francis, Hunter, Robinson, Robinson, and Ma 2017), shareholder lawsuits (Deng, Willis, and Xu 2014; Yuan and Zhang 2015), and customer firms' bankruptcies (Houston, Jiang, and Lin 2015), this study identifies an event in relation to firms' product failures, which can impact bank loan contracting. Furthermore, by distinguishing the circumstances in which firms' product recalls can impact firms' bank loan contracting terms, this study illustrates that, while recall is growing prevalently and rapidly, its impact on firms' bank loan contracting is not uniform.

The rest of the paper is organized as follows: Section 2 discusses prior literature and develops the hypothesis. Section 3 discusses sample selection. Section 4 discusses research design and results. Additional tests are provided in Section 5, and Section 6 concludes the paper.

4.2 Hypothesis Development (Figure 1)

4.2.1 Product Recalls and Bank Loans

Banks, as debtholders or creditors, own fixed claims that are more senior than the residual and limited liability claims of shareholders. Nevertheless, their payoff structure has a limited upside potential that mainly exposes them to downside risks. In other words, when firms perform very well, banks' payoffs are capped by the sum of the interest and the initial amount of money borrowed by firms. However, when firms perform poorly, banks risk losing all the money borrowed by the firms. Given the asymmetric payoff, I posit that there are three reasons why the product harm crisis can have a negative impact on firms' loan contracting.

First, a firm incurs various costs when experiencing product recalls, which likely leads to lower future revenues. Jarrell and Peltzman (1985) and Hendricks and Singhal (2003) indicate various costs that a firm must bear during a product recall, including the costs of correcting/replacing the defective product, the transaction costs of the recall process, the costs of unsold inventory, the costs of potential litigation, and the costs of changes in practices to improve quality. These costs have a direct negative impact on current and future cash flow, which in turn increases the firm's downside risk/default risk.

Second, recent studies find that a firm's reputation/brand values and customer satisfaction help explain the variation in the cost of debt. The better the firm's reputation/brand value and customer's satisfaction, the lower the cost of debt (Himme et al. 2014; Anginer 2015). Consumer confidence toward firm's ability to manufacture reliable and high-quality products becomes lower due to the product recalls; thus, the firm's brand equity/reputation are impaired by its product recall (Siomkos and

Shrivastava 1993; Dawar and Pillutla 2000; Van Heerde, Helsen, & Dekimpe 2007; Rubel, Prasad, and Shuba 201; Cleeren et al. 2013).

Third, the information asymmetry is accentuated in the event of a product recall (Chen et al. 2009). Specifically, a recall firm involved a product recall possesses more private information about the severity of the product recall and its implications on the firm's future cash flow and revenue. Prior studies find that debtholders are more suspicious about accounting information provided by firms going through misconducts, and then charge higher interest spreads to these firms to compensate for higher information asymmetry (Graham et al. 2008; Yuan and Zhang 2016). As a result, debtholders also charge higher interest spreads to recall firms to compensate for higher information asymmetry.

Lastly, recent studies find that CEO risk-taking preference and carelessness can cause lack of interest or caution in investing in the maintenance and improvement of product reliability (Wowak et al. 2015A). Further, a CEO's lack of experience in production and supply chain management procedures can also result in product quality failure, which leads to product failure (Marucheck, Greis, Mena, and Cai 2011; Ryu 2012; Wowak et al. 2015B). As product recall may reveal the operational and supply chain management problems of the firm, and the lack of caution and experience of the top management team, debtholders may price a higher interest spread to compensate for higher credit risk caused by operational risk.

However, there are several counter-arguments that creditors may not be particularly concerned about the product recall. First, product recall becomes common

and costly to avoid due to the increasing globalization of production, increasing complexity of products, more stringent product-safety laws, and increasing monitoring by both firms and government agencies (Berman 1999; Chen et al. 2009). As a result, there is no certainty that debtholders will react to this frequent event. For example, Hoffer, Pruitt, and Reilly (1988) find that recall announcements do not significantly affect firm value. Kalaignanam, Kushwaha, and Eilert (2013) and Haunschild and Rhee (2004), for example, found that firms can learn from recalls and thus can modify their operations, which may lead to fewer product recalls in the future. If creditors perceive product recall as part of normal business, they may not react to the product recall announcement in aggregate. Second, based on experimental study, Vassilikopoulou et al. (2009) find that the negative effects of a firm's product recall on customers' perceptions diminish quickly after the event has occurred, because consumers tend to forget about the product recall event 3 months later. Anecdotal evidence also seems to confirm this point. Cook, formerly an executive at Ford Motor Co (F.N) for 10 years, said in an interview "You have to be proactive and I think they'll be forgiving if it's not really, really serious. People have short memories about that stuff." If debtholders also believe that product recalls, in general, have a short-lived impact on the firm's reputation and customers' purchase intention, they are unlikely to become particularly concerned about the event. Third, firms often proactively take various measures and strategies preceding and following the announcement of product recall to rescue their reputation and to minimize the negative impact of product recalls (Chen et al. 2009; Cleeren et al. 2013; Gao et al. 2015). Using case studies, some research finds that a

product recall announcement is sometimes interpreted by the stock market as indicative of the fulfilment of corporate social responsibility (CSR), and therefore has a positive impact on firm value in terms of reputational improvement, as these firms act very responsibly by removing the products promptly from market and compensating for the customers'losses (Minor & Morgan 2011). Therefore, there is no certainty that debtholders increase interest spread in response to firms' product recall in aggregate. Thus, it remains an empirical question whether banks negatively react to firms' product recalls. Accordingly, I form the hypothesis in the null form:

Hypothesis 1: The product recall announcement does not influence the cost of the bank loan (interest spread).

4.2.2 Product Recall Effect and Board of Directors Independence

The bank's negative reaction to a firm's product recall announcement can be attributed to information asymmetry caused by the firm's product recall. The information asymmetry problem between bank and firm becomes more serious after the product recall than before because there is high uncertainty regarding the negative impact of a product recall on the firm's current and future financial performance (Chao et al. 2009). Managers possess more private information about the severity of the product recall, such as the root causes of the defect, the number of units to be recalled, the cost of replacing or repairing the defective product, and so on (Chao et al. 2009; Gokalp, Keskek, Kumas, and Subasi 2016). Managers with private information

regarding a product recall can manipulate financial reporting information to minimize the investors' negative perception of the real impact of a product recall on the firm's financial performance (Jiang, Magnan, Su, and Zhang 2017). Meanwhile, lenders also become very suspicious of the financial information provided by firms during misconduct or events that cause negative publicity(Yuan and Zhang 2015). Duffie and Lando (2001) develop a theory that information risk is incremental to a firm's default risk. Empirical studies also consistently find that higher information asymmetry between banks and firms causes banks to price higher interest spread to compensate for additional risks caused by information asymmetry (Graham et al. 2008; Kim et al. 2011; etc.). For example, Hasan et al. (2012) find that earnings predictability is an important factor in bank loan contracting terms, and firms with more predictable earnings have more favourable loan terms. The independent board of directors' main responsibility consists of monitoring for fraudulent financial disclosures and disciplining managers' fraudulent behaviour (Kanagaretnam, Lobo, and Whalen 2007), and thus lessen the information symmetry problem after the announcement of a product recall. Therefore, I posit the following hypothesis:

Hypothesis 2: The relationship between product recalls and cost of debt (interest spread) is moderated by independent board of directors.

4.2.3 Product Recall Effect and Firm's Ex-Ante Ability to Recover from Product Recall

The banker's negative reaction to a firm's product recall can also be attributed to the bank's perception of the impact of the product recall on the firm's financial health or credit risk. I use the firm's ex-ante sale contracting, or long-term supply contracting, to measure the firm's ex-ante ability to recover from a product recall. When firms experience product recalls, they are faced with the risk of losing their existing customers because of the customers' loss of confidence (Dawar and Pillutla 2000). Further, using price wars and other strategies, competitor firms can engage in predation to accelerate the loss of clients to drive firms involved in product recall out of business (Bernard 2016). Furthermore, the direct cost and indirect cost associated with product recall can cause a large amount of cash payout. The long-term supply contract can be very effective in mitigating the risk of losing customers, because it is unlikely that the customer will break a long-term contract (Bernard 2016). It is also more difficult for a competitor to engage in predation because the long-term contract makes it longer and more costly for a competitor to predate the market share (Bernard 2016). Lastly, a long-term contract gives firms involved in product recall more time to raise capital.

Hypothesis 3: The relationship between product recall and cost of debt (interest spread) is less negative for firms with long-term supply contracts.

4.3 Sample Selection

I collect data on product recall campaigns following prior studies (Kini et al. 2016). Specifically, I collect data on product recall campaigns announced during the period from January 2002 to December 2012 using two US regulatory agencies that govern product quality and safety: FDA and CPSC. I collect information on food, drug, and medical device recalls from the weekly enforcement report published by FDA, and I collect information on consumer recalls from CPSC. CPSC covers a diverse range of industries, such as children's products, household appliances, heating and cooling equipment, home furnishings, toys, nursery products, workshop hardware and tools, and yard equipment, among others. For firms with multiple recalls in the sample period, I retain only the first record. Since I require firms to have loans initiated 3 years before and after product recall announcement, my loan sample covers firms with bank loans that originated between 1998 and 2015 according to the Loan Pricing Corporation's (LPC) DealScan database. The DealScan database contains both the price and non-price terms of loans. I retrieve annual financial data from Compustat and corporate governance data from Institutional Shareholder Service (BoardEx). I match firms in the DealScan database with those in the Compustat database using the link table provided by Chava and Roberts (2008). These selection criteria result in a final sample of crisis firms. These selection criteria result in a final sample containing 181 crisis firms, as reported in Table 1. To eliminate the effects of extreme observations, I winsorize all continuous variables at the 1% level in both tails. I also present the industry break-up of my sample of recalls based on two-digit SIC codes sorted by the frequency of firms that appearing in the sample. Instrument and Related Products had the most crisis firms

(25%), followed by Chemical and Allied Products (12%), and Food and Kindred Products (5%). These sub-sample results are reported in Table 2.

4.4 Research Design and Empirical Results

4.4.1 Regression Model

To investigate the effect of the announcement of the product recalls on changes in the interest spread for recall firms around the announcement dates of the product recall, I follow Graham et al. (2008) and Kim et al. (2011) by controlling for firm-specific, loan-specific, and macroeconomic factors in my regression model. The pre-crisis period is defined as the 3 years preceding the announcement date of product recall and the post-crisis period as the 3 years following the announcement date of the product recall. The sample contains all recall firms that issued a bank loan both before and after the product recalls.

The main empirical model is as follows:

$$\textit{Interest Spread} = \textit{Post} + \textit{Size} + \textit{Leverage} + \textit{MTB} + \textit{Profitability} + \textit{Tangibility} + \textit{Altman Z Score} + \textit{Cash Flow Volatility} + \textit{Credit Spread} + \textit{Term Spread} + \textit{Perform} + \textit{Pricing} + \textit{Log loan Maturity} + \textit{Log Loan Amount} + \textit{Loan Type} + \textit{Loan Purpose} + \textit{Industry Dummy} + \varepsilon \qquad \textbf{Equation (1)}$$

A loan package may comprise several facilities/loans, and each facility can have different loan terms. As the basic unit of empirical research is a loan, my regression model is conducted at the facility level, as in prior studies (e.g., Graham et al. 2008). Because the same firm can have multiple observations, I address potential

within and between firm residual correlation by clustering standard errors at both the firm and year levels, as suggested by Petersen (2009) and Gow et al. (2010). I also winsorize all continuous variables at the 1% level in both tails.

The dependent variable of interest, *Interest Spread*, is the drawn all-in spread. I follow Graham et al. (2008) and Kim et al. (2011) and measure the all-in drawn spread as the amount the borrower pays in basis points over the London Interbank Offered Rate (LIBOR) or a LIBOR equivalent for each dollar drawn down. This measure adds the borrowing spread of the loan over LIBOR to any annual fee paid to the bank group. To capture the effect of the product recalls, I define a dummy variable, *Post*, that is set equal to one if the loan initiation is after the announcement date of product recall, and zero otherwise. If banks perceive product recall as a signal of higher default risk, then the coefficient of *Post* is expected to be significantly positive. To control for firm-specific variables affecting interest spread, I include firm *size*, *leverage*, *growth opportunity*, *profitability*, *tangibility*, *Z score*, and the *cash flow volatility*. Firm size (*Size*) is measured by the natural logarithm of total assets. As larger firms are more diversified, mature, and have good reputations, meaning that they have a lower default risk (Bae and Goyal 2009), I expect that larger firms have lower interest spreads. The leverage ratio (*Leverage*) is the sum of long-term debt plus current liabilities to total assets. Firms with higher leverage borrow more, so they have higher default risk. Therefore, I expect leverage to be positively associated with interest spread. Growth opportunities (*MTB*) are the market value of equity scaled by the book value of equity at year end. On the one hand, a firm with growth potential may be subject to an

information asymmetry problem and vulnerable to financial distress. On the other hand, growth opportunities are positively associated with credit quality (Graham et al. 2008). Thus, I do not have a clear prediction regarding *MTB*. Profitability (*Profitability*) refers to earnings before interest, taxes, depreciation, and amortization (*EBITDA*). As profitable firm have lower credit risk, I expect them to have a lower cost of debt. Asset tangibility (*Tangibility*) is the ratio of net property, plant, and equipment over total assets. Debtholders can relatively easily liquidate a firm's tangible asset should the firm default, so the debtholders' loss is mitigated. Thus, I expect more tangible assets should have lower interest spread. I construct a modified *Altman Z-score* to control for firm default risk. A higher *Z-score* indicates a lower insolvency risk, so I expect it to be negatively associated with interest spread. Finally, cash flow volatility (*Cash flow volatility*) represents the standard deviation of quarterly operating cash flow over the 16 fiscal quarters before the loan initiation. Higher *cash flow volatility* implies higher risk to make a debt payment, so I expect *cash flow volatility* to be positively associated with a cost of debt. All firm-specific variables are measured as of the year prior to the loan initiation date.

I also control for loan-specific characteristics that prior literature following prior studies (Graham et al. 2008; Lin et al. 2011). I first include performance pricing (Perform pricing), an indicator variable equal to one if a loan facility uses a performance pricing clause, and zero otherwise. Performance pricing directly links the cost of debt to firms' accounting performance, which makes an incomplete contract more complete. This ex-ante repricing mechanism could affect the cost of debt (Asquith et al. 2005;

Armstrong et al. 2010). I also control for Maturity, which is the natural log of the loan's maturity in months. My model also includes the loan amount (Log loan amount). I expect the amount to be negatively associated with the cost of debt because of the economies of scale. Finally, I also control for loan contract attribute by including loan type (e.g., term loan, revolving loan) and loan purpose (e.g., debt repayment, working capital needs) indicator variables. Prior studies show that different loan types and loan purposes can affect loan prices (Graham et al. 2008).

To control for macroeconomic conditions, my model includes the macroeconomic variables Term spread and Credit spread. The variable Credit spread is the yield difference between BAA and AAA corporate bonds, which increases during economic recessions and decreases during economic expansions. Term spread is measured as the difference between 1- and 2-year Treasury bonds, increases (decreases) in good (bad) economic prospects. The debtholder requires a higher cost of debt from firms to compensate for default risk from the economic environment (Collin-Dufresne et al. 2001; Lin et al. 2011).

Table 3 presents descriptive statistics of the crisis firm. Recall firms have a mean leverage ratio of 0.248, a market-to-book ratio of 2.247, and profitability of 0.158. The average interest spread is about 164.654 basis points, and the average loan size is US $19.261 million.

Table 4 display the interest spread (in basis points) 3 years before and after the announcement of a product recall. The pre-announcement average interest spread is 149.44, and the post-announcement average interest spread is 186.77. Thus, there is

an increase of interest spread after the product recall. The difference between pre-announcement and post-announcement is 37.32, which is statistically significant.

4.4.2 Product Recall and Interest Spread: Test of H1

Table 5 reports the results of my main regression in equation (1), using *Interest Spread* as the dependent variable. I regress Interest Spread on the test variable *Post*, with the full set of control variables discussed. All reported t-values are computed based on standard errors, which are double clustered at the firm and year level (Petersen 2009; Gow et al. 2010). As the results in Column 1 of Table 5 show, the coefficient on Post (49.16) is significantly positive at the 1% level, consistent with the prediction of H1. The coefficient on *Post* indicates that, all else being equal, the interest spread increases by 38 bps after the product recall for *recall firms*. This result supports the prediction that banks penalize firms' product recall events[46]. It is worth noting that the product recall event captures the increase in risk beyond any risk factors captured by the other independent variables, such as profitability, market-to-book ratio, and Altman's Z-score. Finding a significant coefficient crisis firm indicates that the other variables cannot fully capture the incremental risk due to product recall, which provides supportive evidence for my conjecture.

Turning to control variables, I find that interest spread is positively associated with firms' leverage, credit spread, and term spread. Also, interest spread is negatively associated with firms' size, tangibility, profitability, and loan performance

[46] I also use the natural log of interest spread. The sign and significance doesn't change.

pricing. All the results of the control variables also provide evidence that is essentially consistent with prior studies.

4.4.3 Product Recall and Board of Director Independence: Test of H2s

To examine the impact of corporate governance independence on the relationship between the product recall event and the cost of bank debt, I introduce a continuous variable, *Independent Board of Directors*, to equation (1). Independent Board of Director is measured as the number of independent directors divided by the total number of directors sitting on the firm's board. The sample size drops dramatically because of the missing value to measure the independence of the board of directors. The results are presented in Table 6. I find that the coefficients of *Post*Independent Board of Director* are significant and negative, which suggests that a recall firm with an independent board of directors experiences a smaller increase in interest spreads after a product recall event. The coefficient on *Post*Independent Board of Director* indicates that, all else being equal, the recall firms with the more independent board of directors experience an 80.39 bps smaller increase in interest spread after the product recall compared to recall firms with the less independent board of directors.

4.4.4 Product Recall and Firm's Ex-Ante Ability to Recover from Product Recall: Test of H3

To examine the impact of an ex-ante contract on the relationship between product recall event and the cost of a bank loan, I measure the ex-ante contract by

following prior studies (Rauch 1999; Costello 2013). Basically, if firms work in the manufacturing industry and produce "differentiated products," then it is more likely they have longer-term supplier contracts. The rational is as follows: Prior studies find that the manufacturer firms account for the majority of the long-term supplier contracts in their sample (Costello 2013). Firms that produce products that are not homogenous but are differentiated are more likely to maintain the long-term supplier relation with their customers, as it is more difficult for customers to replace current suppliers (Rauch 1999). Thus, I code *Ex-Ante Contract* as one if the firm is a manufacturer (NAICS codes 31–33) that produces differentiated products based on the classification scheme of Rauch (1999). As shown in Table 7, I find that the coefficients of *Post*Ex Ante Contract* (-57) are significant and negative, which suggests that recall firms with ex-ante contracts will experience a smaller increase in interest spreads after product recall events. Overall, the result supports the prediction of hypothesis 2 that debtholders' reaction to the announcement of a product recall becomes less negative if the firm's ex-ante characteristics imply that it will be easier for the firm to recover from product recalls.

4.5 Robustness Tests

4.5.1 Difference-in-Difference Analysis Based on a Propensity Score-Matched Sample

My findings would be biased if certain firm characteristics caused product recall and higher cost of debt. Thus, my result could be driven by these firm

characteristics, even without product recall announcement. Further, my result could be biased if it merely captures an upward trend of increasing cost of debt financing for all firms over the years. To mitigate these concerns, I use the Propensity Scoring Matching method to construct a control sample. In the first step, I run a probit model of the probability of encountering product recall for all firms to compute the propensity score. I then match each recall firm with the control firm that has the closet propensity score of announcing a product recall, but without announcing it before initiating a new loan. I also require that the control sample firms have bank loan data both before and after the corresponding year of the product recall announcement of the matched recall firms. The matching procedure is detailed in Appendix C.

I perform multivariate analysis on the matched sample by controlling for firm characteristics, loan characteristics, and macroeconomic conditions as defined in equation 1. I label all recall firms as Recall, an indicator variable, then I include an interaction variable Recall*Post into equation (1). The regression model is as follow:

Interest Spread = Post + Recall Firm + Post*Recall Firm + Size + Leverage + MTB + Profitability + Tangibility + Altman + Cash Flow Volatility + Credit spread + Term spread + Perform pricing + Log loan maturity + Log loan amount + Loan type + Loan purpose + Industry Dummy + ε

Equation (2)

I expect that the coefficient of *Post*Recall Firm* to be positive. This is because of this coefficient capturing whether the magnitude of increase in the cost of debt differs between recall firms and control firms after the announcement date of the product recall. So, a positive coefficient shows that the announcement of the product recall increases the recall firm's cost of debt.

The regression results are shown in Table 8. The coefficient of *Post*Recall Firm* (39.25) is positive and significant. It indicates that the interest spread increases by 39.25 bps after the announcement of the product recall for recall firms relative to control firms. In sum, the result provides evidence that indicates that recall firms experience significantly higher increases in the cost of debt after the announcement of the product recall.

4.5.2 Effect of Product Recall on the Non-Price Terms of Bank Loans

In addition to interest spread, bank loans also include the various non-price terms. I also expect that product recall can influence the major non-price terms of a bank loan, such as covenant intensity, loan maturity, and collateral requirement. Regarding covenant intensity, prior studies find that debt covenant serves as a monitoring device for firms' default risks (Dichev and Skinner 2002). Further, contingent control transfer from covenant can preempt the borrower's suboptimal action (Rajan and Winton 1995; Park 2000; Christensen and Nikolaev 2012). Since product recall create uncertainty regarding the firm's credit risk, I expect that the bank may impose more covenant on a firm after a product recall is announced.

Short-term debt allows the lender to take control more quickly, so debtholder can give short-term debt to firms with high information asymmetry and poor financial conditions (Diamond 1991). On top of that, Barclay and Smith (1995) find that firms with larger information asymmetries issue more short-term debt. Since product recalls create information asymmetry and make lenders suspicious of the firms' financial reporting credibility, I expect that lenders provide loans with shorter maturity to firms announcing product recalls to mitigate concerns about information asymmetry. Collateral is another essential non-price term of bank loans that allows the lender to mitigate concerns about information asymmetry and to recover the financial loss in the event of default (Ranjan and Winton 1995). Prior studies show that debtholders require collateral for borrowers with opaque information (e.g., Berger and Udell 1990; Jimenez et al. 2006) and high default risk (Jimenez and Saurina 2004). I therefore expect that banks are more likely to require recall firms to pledge collateral on the loan after the announcement of product recall.

To assess the impact of the product recall on the non-price term of bank loans, I estimate equation (1) with non-price term as the dependent variable. Non-price terms include *Number of covenants*, *Loan maturity*, and *Collateral*. I test each non-price term separately and retain the same list of control variables as in equation (1), which includes loan- and firm-specific characteristics and economy-wide factors. I exclude the variable *Loan Maturity* from the control variables list when the dependent variable is *Loan Maturity*. The variable number of covenants is measured by the total number of general and financial covenants of a loan. Loan maturity is loan terms

measured in months, and *Collateral* is a dummy variable taking the value of one if the loan is secured by collateral, and zero otherwise. The robust standard errors are clustered at both the firm and year levels, as suggested by Petersen (2009) and Gow et al. (2010), except for the Poisson regression for *Number of covenants*, whose standard errors are clustered by firm.

The results in Table 9 show that, for the dependent variable *Loan maturity*, the coefficient of *Post* is negative and significant, so it indicates that banks reduce the loan term after the recall firms' announcement of the product recall. For the dependent variable *Number of covenants,* I also find that the coefficient of *Post* is significant and positive. It suggests that banks increase the number of the covenant after the recall firms' announcement of product recall. Taken together, it shows that banks also use the non-price terms to react to firms' announcements of product recall.

4.5.3 Product Recall Frequency Effect and Interest Spread

Some prior studies find that when firms encountering product recall very rarely, the announcement of product recalls are not perceived negatively by the stakeholders. Based on the automobile industry, Bromiley and Marcus (1989) suggest that, at a fundamental level, the market anticipates a normal number of product recalls per firm per period. Anecdotal evidence also demonstrates that a firm may not get punished by the market when the firm only rarely announces product recalls. For example, in 1998, BSX recalled one of their stent products. Rather than punishing the firm, the market reacted positively—BSX enjoyed a 5.54% positive abnormal return in

its stock price in the period immediately following the announcement. BSX had a good reputation for product safety, so the rare product recall is considered as fulfillment of good social responsibility. However, the next year, when BSX announce a new product recall, the stock market reacted very negatively to the announcement. In addition, Kalaignanam et al. (2013) argue and find that firms could gain experience and knowledge from prior product recalls to improve product reliability in the future. Thus, it is possible that my result in the equation 1 is driven by the firm that announces multiple product recalls over several years during the *post* period. To test the impact of product recall frequency on the cost of a bank loan, I first test the impact of product recall announcements on the interest spread for those firms that encounter product recall only in 1 year in the *post* period. I introduce a variable named *Single Recall*, which represents the post period for firms encountering product recall only in 1 year. Second, I also examine the impact of the total number of years in which there were occurrences of product recalls on the interest spread by introducing a variable named *Multiple Recalls*. It is measured as the number of years in which there were occurrences of product recalls. Table 10 shows that the coefficient on the variable *Single Recall* is positive and significant (51.23), meaning that banks charge higher interest spreads to firms with product recalls in only 1 year. Thus, it shows that the result from model (1) is not driven by firms having several recalls in multiple years. Next, the coefficient on the variable *Multiple Recalls* is also positive and significant (25.41). It indicates that debtholders charge higher interest spreads as the number of years in which there are

product recalls increases. Taken together, it shows that my result in model 1 is not driven by recalls firms with multiple product recalls in several years.

4.5.4 Product Recall Effect and Industry Effect

Thirumalai and Sinha (2011) find that, unlike the stock market reaction to product recall announcements in the food industry (Thomsen and McKenzie 2001) and automotive industry (Jarrell and Peltzman 1985; Bromiley and Marcus 1989), the stock market reaction to product recalls in the medical device industry is not significant. They attribute this insignificance of market reaction to three major factors: the high frequency and volume of recalls, strict regulation, and purchase relationships in the medical industry. For example, firms in the medical device industry face very stringent monitoring and regulation from FDA. Medical devices that get approved by FDA signal their firms' ability to fabricate high-quality devices. This stringent regulation and monitoring by FDA mitigates firms' liability concerns when faced with product recalls. Similarly, the negative impact of a product recall on firms' bank loan contracting may depend on industries. If bankers hold the same perception as the shareholders, they are likely to not react negatively to product harm crises in the medical device industry. However, given that banks are more risk averse because they do not have the upside gain, it is possible that banks react negatively to the announcement of a product recall. I select the recall firms operating in the medical industry and then I examine the impact of the product recall on the interest spread. As shown in Table 11, I find that debtholders

do not charge higher interest spreads to the announcement of the product recall in the medical industry. This is similar to the findings of Thirumalai and Sinha (2011).

4.6 Conclusion

This study investigates whether banks react to firms' announcements of product recalls. I find that banks charge higher interest spread and other non-price terms to firms in the period of 3 years following firms' product recalls. In order to mitigate endogenous problem, I also use strict criteria to construct my propensity scoring matching sample, and still find that banks react to firms' product recall. I also conduct a series of tests to examine the degree of impact of product recalls across firms. Overall, the results strongly support that banks react negatively to firms' product recalls.

This study has an important caveat. The study argues and finds that the independence of the board of directors can mitigate the negative impact of product recalls on banks' reactions. However, it is possible that other dimensions and measures of effectiveness of the board of directors, such as the industry expertise of the board of directors or the existence of risk committee, play more important roles during and after the announcement of product recalls. Since the measures can be manually collected, future research can be conducted to shed more light on the effectiveness of the board of directors in mitigating the damages of product recalls. Lastly, prior studies have found that disclosed ICFR weakness is associated with a higher cost of debt. Similar to the launch of product recalls, disclosing ICFR also send the signal of a poor internal control over business process and an operational management failure, future study

could examine whether banks react more strongly to firms which announce product recall and ICFR weakness concurrently.

4.7 References and Tables References, Appendix, Figure, and Tables

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Appendix A Variable Definitions

Variable names	Variable definitions
Product recall variables	
Post	A dummy variable that equal one if the date of loan initiation is after the announcement of product recall, zero otherwise.
Multiple recalls	A dummy variable that equal one if firm is involved in product recall, and zero otherwise.
Number of prior recalls	A continuous variable counting the total number of years in which there is a product recall
Firm characteristics	
Leverage	(Long-term debt + debt in current liabilities)/total assets.
Size	Natural log of total assets at year-end.
Market-to-book	(Market value of equity plus book value of liabilities and preferred stock)/Total Assets
Profitability	EBITDA/total assets
Tangibility	Net property, plant and equipment/total assets.
Altman	calculated as (1.2 * working capital +1.4 * retained earnings + 3.3 * EBIT + 1.0 * sales)/total assets.
Cash Flow Volatility	Standard deviation of quarterly cash flows from operations over the fiscal years before the loan initiation year scaled by total debt.
Independent Board of Director	is measure as the number of independent directors divided by the total number of directors sitting on firm's board
Loan characteristics	
Interest Spread	Interest spread is measured as all-in spread drawn in the Dealscan database. All-in spread drawn is defined as the amount the borrower pays in basis points over LIBOR or LIBOR equivalent for each dollar drawn down. (For loans not based on LIBOR, LPC converts the spread into LIBOR terms by adding or subtracting a differential which is adjusted

	periodically.) This measure adds the borrowing spread of the loan over LIBOR with any annual fee paid to the bank group.
Loan Maturity	Natural log of the loan term. Loan term is measured in months.
Security Dummy	A dummy variable that equals one if a collateral is pledged on a facility, and zero otherwise.
Loan Amount	Natural log of the loan facility amount. Loan amount is measured in millions of dollars.
Performance pricing dummy	A dummy variable that equals 1 if the loan facility uses performance pricing, and 0 otherwise.
Number of covenants	A total number of financial and general covenants of a loan facility.
Loan type dummies	A dummy variable for loan type, including term loans, revolvers greater than one year, revolvers less than 1 year, and 364-day facilities.
Loan purpose dummies	A dummy variable for loan purposes, including corporate purposes, debt repayment, working capital, and takeovers.
Macroeconomic factors	
Credit spread	The difference between BAA and AAA corporate bond yields (data source: Federal Reserve Board of Governors).
Term spread	The difference between the 10-year Treasury yield and the 2-year Treasury yield (data source: Federal Reserve Board of Governors).

Appendix B

Propensity scoring matching method

Certain firms' characteristics are associated with the propensity of encountering product recall such as financial leverage, Zscore, size, and R&D (Kini et al., 2016). Therefore, I first use these firm's characteristics to estimate a probit model that computes the probability of encountering product recall, using all available information between the period 1996 to 2015. My probit regression model is as follows:

$$\textit{Prob (product recall = 1)} = \textit{Size} + \textit{Leverage} + \textit{Zscore} + \textit{R\&D} + \textit{Industry} + \varepsilon$$

Where product recall is an indicator variable taking the value of 1 if there is the announcement of product recall during a fiscal year, and 0 otherwise.

Second, I use the obtained coefficients to compute the propensity score for each firm in each year. Then I merge the propensity score with all sample firms which have the necessary information for bank loan and other control variables. For each recall firm that have bank loan information not only in the three years preceding the announcement of product recall but also in the three years following the announcement of product recall, I require the control firm is : 1) from the same industry based on two-digit SIC code, 2) the control firm have bank loan information not only in the three years preceding the announcement of product recall but also in the three years following the announcement of product recall, 3) the absolute difference in propensity score between recall firms and control firms in the year prior

to the announcement of product recall is the smallest, 4) a firm can be only used once as control firm.

Figure 1:

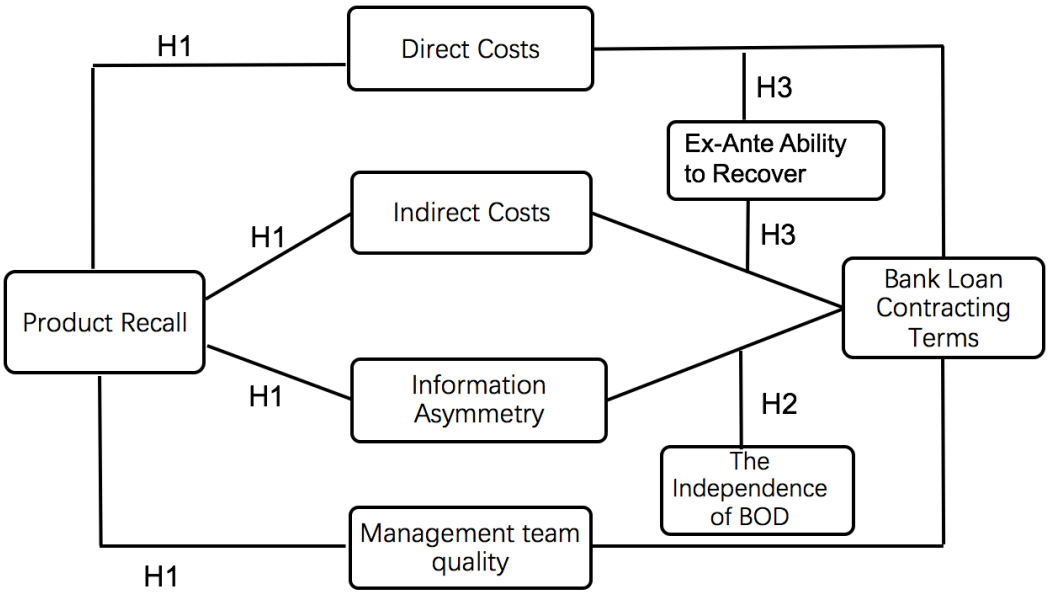
H1
Direct Costs
H3
Ex-Ante Ability to Recover
Indirect Costs
H1
H3
Product Recall
Bank Loan Contracting Terms
H1
Information Asymmetry
H2
The Independence of BOD
Management team quality
H1

Table 1

Recall-Starting Year	No. of Recall Firms
2003	25
2004	27
2005	15
2006	17
2007	16
2008	7
2009	9
2010	4
2011	7
2012	21
2013	6
2014	9
2015	2
Total	155

Table 2

Two-digit SIC	Description of industry	Percent
13	Oil and Gas	0.73
20	Food and Kindred Products	5.19
22	Textile Mills Product	0.42
23	Apparel & Other Textile Product	2.18
24	Lumber & Wood Products	0.42
25	Furniture & Fixtures	2.49
26	Paper & Allied Products	2.49
28	Chemical & Allied Products	12.36
30	Rubber & Miscellaneous Plastics Products	1.14
31	Leather & Leather Prdocuts	0.42
32	Stone, Clay, & Glass Products	0.52
34	Fabricated Metal Products	1.04
35	Industrial Machinery & Equipment	2.8
36	Electronic & Other Electric Equipment	5.4
38	Instruments & Related Products	25.13
39	Micellaneous Manufacturing Industries	5.5
50	Wholesale Trade - Durable Goods	1.87
51	wholesale Trade - Nondurable Goods	4.88
52	Building Materials & Gardening Supplies	1.66
53	General Merchandize Stores	4.67
54	Food Stores	1.35
55	Automative Dealers & Service Stations	2.6
56	Apparel & Accessory Stores	3.74
57	Furniture & Homefurnishing Store	1.45
58	Eating & Drinking Places	0.52
59	Miscellaneous Retail	5.09
62	Security & Commodity Brokers	0.83
72	Personal Services	1.66
73	Business Services	0.52
78	Motion Pictures	0.31
80	Amusement & Recreation Services	0.42
Total		100

Table 3 Descriptive Statistics

Variable	*N. of. Obs.*	*Mean*	*Std*	*Median*	*p25*	*p75*
Interest Spread	463	164.654	142.318	150.000	55.000	225.000
Post	463	0.378	0.485	0.000	0.000	1.000
$Leverage_{t-1}$	463	0.248	0.230	0.215	0.089	0.343
$Logassets_{t-1}$	463	7.519	1.815	7.477	6.373	8.548
$Tangibility_{t-1}$	463	0.208	0.147	0.157	0.098	0.273
$Profitabily_{t-1}$	463	0.158	0.097	0.146	0.112	0.208
MTB_{t-1}	463	2.247	1.306	1.845	1.343	2.774
$Zscore_{t-1}$	463	2.140	1.158	1.962	1.503	2.891
$Cashflow_t$ $Volatility_{t-1}$	463	0.058	0.030	0.054	0.039	0.070
Log $Maturity_t$	463	3.627	0.735	4.078	3.258	4.094
$LogFacility_t$ $Amount_t$	463	19.261	1.700	19.432	18.421	20.330
$Performance_t$ $Pricing_t$	463	0.518	0.500	1.000	0.000	1.000
Credit $Spread_t$	463	1.032	0.370	0.920	0.830	1.160
Term $Spread_t$	463	1.417	0.989	1.760	0.360	2.270

Table 4 Effect of product recall on the Cost of Debt Financing

Panel A: Univariate Analysis on the Cost of Debt Financing Changes Around announcement of product recall										
Years around announcement of product recall	-3	-2	-1	0	1	2	3	*Pre - recall*	*Post recall*	*Difference (Post - Pre)*
All indrawn(bps)	134.599	173.08	135.192	136.439	189.837	162.36	173.34	149.44	186.77	-37.32***

This table reports the bank interest spread response to the announcement of product recalls for firms involved in product recalls. It reports the univariate analysis of interest spreads 3 years before through 3 years after product recalls for recall firms.

Table 5
Multivariate Analysis on the Effect of Product Recall on the Cost of Debt Financing

VARIABLES	Coefficient	T-Stat
Post	37.649***	(3.09)
Firm Characteristics		
$Leverage_{t-1}$	210.648***	(3.289)
$Size_{t-1}$	-21.271***	(-2.657)
$Tangibility_{t-1}$	-12.275	(0.198)
$Profitability_{t-1}$	-356.404***	(-4.298)
MTB_{t-1}	-3.056	(-0.828)
$Altman_{t-1}$	-19.604**	(-0.329)
Cash Flow $Volatility_{t-1}$	269.068	(0.71)
Loan Characteristics		
Log Loan $Maturity_t$	21.4932	(-1.166)
Log Loan $Amount_t$	-8.2212	(-0.622)
Performance $Pricing_t$	-25.435**	(-2.301)
Macroeconomic Characteristics		
Credit $Spread_t$	47.0334***	(6.009)
Term $Spread_t$	27.3955***	(4.045)
Control for		
Loan $Type_t$	Yes	
Loan $Purpose_t$	Yes	
Industry Dummy	Yes	
Constant	293.1007***	(1.637)
No of Observations	472	
Adjusted R-squared	0.622	

*** p<0.01, ** p<0.05, * p<0.1

Note: This table reports the bank interest spread response to the announcement of product recall for firms involved in product recalls. The dependent variable is interest spread. The independent variable Post is set equal to one if the loan initiation is after the product recall date, and zero otherwise. All the right-hand side variables are measured at the end of the fiscal year preceding the initiation of each loan facility. The variable definitions for all the variables can be found in Appendix A. All the continuous variables are winsorised at the 1% level in both tails. Robust t-statistics are reported in parentheses, based on robust standard errors clustered at both the firm and year levels. The superscripts *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Table 6
Effects of Product Recall on the Cost of Debt Financing and Corporate Governance

Variables	Coefficient	T-Stat
Post	197.78**	(2.246)
Independence of BOD	13.631	(0.018)
Post*Independence of BOD	-80.395*	(-1.903)
Firm Characteristics		
$Leverage_{t-1}$	170.473**	(2.116)
$Size_{t-1}$	1.379	(0.112)
$Tangibility_{t-1}$	6.126	(0.075)
$Profitability_{t-1}$	-438.51***	(-4.1)
MTB_{t-1}	-10.079	(-1.239)
$Altman_{t-1}$	1.775	(-0.114)
Cash Flow $Volatility_{t-1}$	-247.984	(-0.693)
Loan Characteristics		
Log Loan $Maturity_t$	7.205	(0.389)
Log Loan $Amount_t$	-30.513	(-1.47)
Performance $Pricing_t$	-39.509**	(-2.054)
Macroeconomic Characteristics		
Credit $Spread_t$	5.731	(0.154)
Term $Spread_t$	38.325***	(3.716)
Control for		
Loan $Type_t$	Yes	
Loan $Purpose_t$	Yes	
Industry Dummy	Yes	
Constant	657.185	(1.626)
No of Observations	170	
Adjusted R-squared	0.695	

*** p<0.01, ** p<0.05, * p<0.1

Note: This table reports the bank interest spread response to lawsuit filings conditional on the quality of firm-level corporate governance. The dependent variable is *interest spread*. The independent variable *Post* is set equal to one if the loan initiation is after the product recall date, and zero otherwise. The quality of corporate governance is measured at the end of the year prior to lawsuit filing. The variable *independence of BOD* is a dummy variable that is set to one if the *Board Independence* is higher than average. All right-hand-side variables are measured at the end of the fiscal year preceding the initiation of each loan facility. The variable definitions for all the variables can be found in Appendix a. All continuous variables are winsorised at the 1% level in both tails. Robust *t*-statistics

(*F*-statistics for *F*-tests) are reported in parentheses, based on robust standard errors clustered at both the firm and year levels. The superscripts *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Table 7
Panel A Effects of Product Recall on the Cost of Debt Financing and Ex Ante Contract

VARIABLES	Coefficient	T-Stat
Post	49.941***	(4.076)
Ex ante contract	63.009	(0.852)
Post*Ex ante contract	-57.0273***	(-2.654)
Firm Characteristics		
$Leverage_{t-1}$	216.495***	(3.269)
$Size_{t-1}$	-20.687***	(-2.758)
$Tangibility_{t-1}$	-0.54	(-0.001)
$Profitability_{t-1}$	-332.435***	(-4.096)
MTB_{t-1}	-4.401	(-1.156)
$Altman_{t-1}$	-19.721**	(-2.119)
Cash Flow $Volatility_{t-1}$	252.639	(0.849)
Loan Characteristics		
Log Loan $Maturity_t$	7.966	(0.595)
Log Loan $Amount_t$	-7.924	(-0.897)
$Performance\ Pricing_t$	-24.5521***	(-2.178)
Macroeconomic Characteristics		
$Credit\ Spread_t$	43.551***	(5.411)
$Term\ Spread_t$	24.419***	(3.551)
Control for		
$Loan\ Type_t$	Yes	
$Loan\ Purpose_t$	Yes	
$Industry\ Dummy_t$	Yes	
Constant	350.77	(1.947)
No of Observations	472	
Adjusted R-squared	0.626	

*** p<0.01, ** p<0.05, * p<0.1

This table reports the bank interest spread response to firm's product recalls conditional on firms' ex-ante ability to recover from product recall. The dependent variable is *interest spread*. The independent variable *Post* is set equal to one if the loan initiation is after the product recall date, and zero otherwise. The firm's ex-ante ability to recover from product recall is measured by the variable *Ex-Ante Contract.* The variable *Ex-Ante Contract is* equal to one if firms are a manufacturer (NAICS codes31–33) that produce differentiated products based on the classification scheme of Rauch (1999), and 0 otherwise. All the other variables are defined in Appendix A. All the

continuous variables are winsorised at the 1% level in both tails. Robust *t*-statistics (*F*-statistics for *F*-tests) are reported in parentheses, based on robust standard errors clustered at both the firm and year levels. The superscripts *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Table 8
Effect of Product Recall on the Cost of Debt Financing: Propensity Scoring Matching Sample

VARIABLES	Coefficient	T-Stat
Post	-1.806	(-0.173)
Recall Firm	-12.38	(-1.116)
Post* Recall Firm	38.250**	(2.54)
Firm Characteristics		
$Leverage_{t-1}$	88.048***	(2.217)
$Size_{t-1}$	-17.473***	(-3.319)
$Tangibility_{t-1}$	64.615	(-0.899)
$Profitability_{t-1}$	-283.029***	(-2.862)
MTB_{t-1}	-1.202	(-0.265)
$Altman_{t-1}$	-20.363***	(-2.861)
Cash Flow $Volatility_{t-1}$	122.485	(-0.436)
Loan Characteristics		
Log Loan $Maturity_t$	16.055	(-1.44)
Log Loan $Amount_t$	-17.477***	(-2.644)
Performance $Pricing_t$	-22.164*	(-1.666)
Macroeconomic Characteristics		
Credit $Spread_t$	34.511***	(2.928)
Term $Spread_t$	17.893***	(3.185)
Control for		
Loan $Type_t$	Yes	
Loan $Purpose_t$	Yes	
Industry Dummy	Yes	
Constant	443***	-2.97
No of Observations	778	
Adjusted R-squared	0.682	

*** p<0.01, ** p<0.05, * p<0.1

This table reports the bank interest spread response to the announcement of product recalls for the sample of recall firms and their corresponding control firms based on the PSM approach documented in Appendix A. The definitions for variables can be found in Appendix A. The dependent variable is *interest spread*. The independent variable *Post* is set equal to one if the loan initiation is after the product recall date, and zero otherwise. The

independent variable *Recall Firms* is equal to one if firm is involved in a product recall during the sample period, 0 otherwise. All right-hand-side variables are measured at the end of the fiscal year preceding the initiation of each loan facility. The variable definitions for all the variables can be found in Appendix A. All continuous variables are winsorised at the 1% level in both tails. Robust *t*-statistics are reported in parentheses based on robust standard errors clustered at both the firm and year levels. The superscripts *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Table 9
Effect of Product Recall on the Non-Price Term based on Matching Sample

Independent Variable	Dependent Variable= Collateral	Dependent Variable= Log Loan Maturity	Dependent Variable= Covenant Number
Post	-1.413**	0.1666**	-0.476***
	(-2.279)	(2.48)	(-3.434)
Recall Firm	-2.01***	0.02	0.145
	(-3.038)	(0.33)	(0.914)
Post*Recall Firm	1.414*	-0.15*	0.261*
	1.664	(-1.83)	(1.668)
Firm Characteristics			
$Leverage_{t-1}$	8.600***	0.0029	0.209
	(2.966)	(0.02)	(0.579)
$Size_{t-1}$	-1.159***	-0.006	-0.416***
	(-4.183)	(-0.22)	(-6.707)
$Tangibility_{t-1}$	-2.509	-0.18	-1.271**
	(-1.6031)	(-0.73)	(-2.134)
$Profitability_{t-1}$	-13.862***	1.1***	-0.716*
	(-3.148)	(2.59)	(-1.826)
MTB_{t-1}	-0.115	0.018	-0.156**
	(-0.329)	(0.65)	(-2.455)
$Altman_{t-1}$	-0.2788	-0.04	0.008
	(-0.946)	(-1.33)	(0.104)
CashFlow $Volatility_{t-1}$	26.661***	-1.412	-5.645**
	(2.993)	(-1.31)	(-2.379)
Loan Characteristics			
Log Loan $Maturity_t$	0.9897***		-0.097
	2.74		(-0.99)
Log Deal $Amount_t$	-0.7005***	0.0582***	0.31***
	(-2.602)	(2.26)	(5.508)
Performance $Pricing_t$	-1.8647***	0.028	1.094***
	(-2.602)	(0.505)	(11.407)
Macroeconomic Characteristics			
Credit $Spread_t$	0.4127	-0.0668	-0.079
	(-0.931)	(-1.08)	(-0.646)
Term $Spread_t$	0.1412	-0.037*	0.013
	(-0.617)	(-1.9)	(0.299)
Control for			
Loan $Type_t$	Yes	Yes	Yes

Loan Purpose$_t$	Yes	Yes	Yes
Industry Dummy	Yes	Yes	Yes
Constant	19.917***	-29.69	-1.196
	4.207	(-1.617)	(-1.094)
No of Observations	234	652	510
Adjusted R-squared		0.706	0.371

*** p<0.01, ** p<0.05, * p<0.1

This table shows the logit regression/ ordinary least squares (OLS)/Poisson results for the non-pricing terms of bank loans on the announcement of product recall using the propensity score-matched sample. All the variables are defined in Appendix A. All continuous variables are winsorised at the 1% level in both tails. All the variables are defined in Appendix A. The dependent variable *Collateral* is a dummy variable taking the value of one if the loan is secured by collateral, and zero otherwise. The dependent variable *Number of Covenants* is measured by the total number of general and financial covenants of a loan. The dependent variable *Log Loan maturity* is the log value of loan terms measured in months. The robust standard errors are clustered at both the firm and year levels, as suggested by Petersen (2009) and Gow et al. (2010), except for the Poisson regression for Number of covenants, whose standard errors are clustered by firm.

Table 10 Effect of Frequency on the Interest Spread

VARIABLES	Coefficient	T-Stat	Coefficient	T-Stat
Single Recall	51.236***	-3.128		
Mutiple Recalls			25.411**	-2.442
Firm Characteristics				
$Leverage_{t-1}$	344.790***	(-3.336)	302.273***	(-2.913)
$Size_{t-1}$	-23.218*	(-1.915)	-22.994**	(-2.071)
$Tangibility_{t-1}$	-36.392	(-0.438)	-36.23	(-0.468)
$Profitability_{t-1}$	-439.837***	(-3.030)	-499.056***	(-5.114)
MTB_{t-1}	-1.768	(-0.276)	5.443	(-0.943)
$Altman_{t-1}$	-8.465	(-0.410)	-9.854	(-0.652)
Cash Flow $Volatility_{t-1}$	237.812	(-0.599)	424.797	(-1.57)
Loan Characteristics				
Log Loan $Maturity_t$	10.261	-0.487	7.3038	(-0.428)
Log Loan $Amount_t$	-9.68	(-0.614)	-8.605	(-0.585)
Performance $Pricing_t$	-32.1*	(-1.9168)	-33.0453**	(-2.108)
Macroeconomic Characteristics				
Credit $Spread_t$	30.476	(-1.573)	35.151**	(-2.554)
Term $Spread_t$	16.813	(-1.621)	22.720***	(-2.843)
Control for				
Loan $Type_t$	Yes		Yes	
Loan $Purpose_t$	Yes		Yes	
Industry $Dummy_t$	Yes		Yes	
Constant	507.894*	(-1.937)	465.838*	(-1.948)
No of Observations	313		392	
Adjusted R-squared	0.6483		0.6434	

*** p<0.01, ** p<0.05, * p<0.1

This table reports the bank interest spread response to the announcement of firm's product recalls. The dependent variable is *interest spread*. The independent variable *Single Recall* which represents the post period for firms encountering product recall only once. The independent variable *Multiple recalls* is measured as the number of years in which there were occurrence of product recalls. All the other variables are defined in Appendix A. All the continuous variables are winsorised at the 1% level in both tails. Robust *t*-statistics (*F*-statistics for *F*-tests) are reported in parentheses, based on robust standard errors clustered at both the firm and year levels. The superscripts *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Table 11 Effect of Product Recall and Interest Spread in Medical Industry

VARIABLES	Coefficient	T-Stat
Post	-14.873	(-0.652)
Firm Characteristics		
$Leverage_{t-1}$	128.930**	(-2.089)
$Size_{t-1}$	-27.976***	(-2.582)
$Tangibility_{t-1}$	-76.464	(-0.646)
$Profitability_{t-1}$	-221.649	(-1.039)
MTB_{t-1}	-5.881	(-0.677)
$Altman_{t-1}$	-26.337	(-1.5102)
Cash Flow $Volatility_{t-1}$	673.569	(-0.940)
Loan Characteristics		
Log Loan $Maturity_t$	25.544	(-0.828)
Log $Loan\ Amount_t$	-4.23	(-1.053)
$Performance\ Pricing_t$	-23.533	(-1.006)
Macroeconomic Characteristics		
$Credit\ Spread_t$	3.469	(-0.198)
$Term\ Spread_t$	14.144	(-0.985)
Control for		
$Loan\ Type_t$	Yes	
$Loan\ Purpose_t$	Yes	
Industry Dummy	No	
Constant	340.777***	(-6.385)
No of Observations	83	
Adjusted R-squared	0.799	

*** p<0.01, ** p<0.05, * p<0.1

This table reports the bank interest spread response to the announcement of product recall for firms involved in product recalls in the medical industry. The dependent variable is *interest spread*. The independent variable *Post* is set equal to one if the loan initiation is after the product recall date, and zero otherwise. All the right-hand side variables are measured at the end of the fiscal year preceding the initiation of each loan facility. The variable definitions for all the variables can be found in Appendix A. All the continuous variables are winsorised at the 1% level in both tails. Robust *t*-statistics are reported in parentheses, based on robust standard errors clustered at both the firm and year levels. The superscripts *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Chapter 5. Conclusion

Product harm crises have emerged as a major societal and economic issue, with some arising from the death of several people and leading to the bankruptcy of the firm at the center of the controversy. The recent bankruptcy announcement of Japanese airbag manufacturer Takata Corporation illustrates the potential implications of such crises. However, most prior studies on product harm crises focus on their marketing implications. In contrast, my studies examine this important business phenomenon from the angles of accounting, corporate governance, and debt contracting. Several contributions and implications arise from the three essays.

First, results suggest that CEOs' risk-taking preferences, combined with their lack of experience in production and operation management, are significantly associated with product safety issues. Board of directors may, therefore, consider increasing the proportion of directors with expertise in the industry to fill the void of managers' experience, so that the board of directors can better monitor and advise the CEO in the area of production, to align the CEO's incentive with shareholders, and to encourage investment in product quality.

Second, findings contained in the dissertation inform investors, auditors, creditors, and other stakeholders of the implication of product harm crises on a firm's financial reporting activities. Prior studies illustrate the various marketing strategies a firm can take to rescue its reputation and regain customer confidence. The studies contained in the dissertation complement such work by informing managers that firms projecting a strong financial performance in the crisis year can also reduce the likelihood of losing customers, especially business customers, and mitigate negative personal consequences such as reduced bonus and forced turnover.

Thirdly, the dissertation findings are informative about the financial costs induced by product recalls. Although a product recall can cause significant adverse costs to firms, some studies argue and find that investors may consider product recalls as a part of the normal cost of conducting business. Focusing on new bank loans in the period following the product recall event, my dissertation also reports that product recalls can cause financial losses in terms of higher interest spreads.

The studies presented in this dissertation are subject to some limitations. First, I restrict my sample to US-listed firms. Further research is needed to confirm the generalizability of my findings to private firms and non-US firms. Secondly, my sample focuses on the manufacturing industries which are largely regulated by CPSC and FDA. Future research can extend my study by investigating other important industry areas, such as service sectors. Thirdly, while my dissertation finds that CEO characteristics can influence product harm crises, future research can provide more insights by investigating the mechanism through which CEOs affect the product quality. There are several possibilities, such as cutting down process controls, quality standards, and employee bonuses. Exploring these mediating processes could be a promising avenue for future research. Fourthly, while my dissertation documents that managers use upward earnings management to rescue reputation and alleviate personal costs involved in the product harm crises, future researchers can examine whether managers also use optimistic management earnings forecast during the crisis year along with the upward earnings management to attain the same objective. Anecdotal evidence often shows that firms often announce very optimistic earnings forecasts in the year of a product harm crisis.