INSIDER TRADING AROUND AUTO RECALLS: DOES INVESTOR ATTENTION MATTER?[1]

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Abstract:

Using a comprehensive sample of customer complaints, we find that customer complaints predict future auto recalls and their financial consequences. Further, customer complaints are not contemporaneously associated with stock returns but predict large negative abnormal stock returns during the period following the recall announcement date, suggesting that stock prices reflect the information content of customer complaints with a delay. However, we find a positive relation between net insider selling and customer complaints prior to the announcement of auto recalls. Our findings suggest that insiders' informational advantage is at least in part due to investors' limited attention to publicly available information.

Keywords: Insider trading, product recalls, limited attention.

JEL Classification: G14

I. INTRODUCTION

A large stream of literature finds that insiders gain personal benefit by strategically timing their trades around important corporate events.[3] While some studies (e.g. Machan 1996, Ma and Sun 1998; Manne 1966a, b, 1985; McGee 2008, 2010; Smith and Block 2016) hold the view that insider trading is not necessarily morally wrong and may contribute to the efficiency of stock prices and enhance capital allocation, the dominant view in the literature is that insider trading is unethical, lacks morality, and, thus, should be banned (Werhane 1989, 1991; Moore 1990; Snoeyenbos and Smith 2000). Both camps in the insider literature, however, make the implicit assumption that the information insiders use in their trading decisions is not available to investors (Keown et al. 1985; Persons 1997). In this paper, we revisit this assumption by examining the differences in the timing of insiders' and investors' use of outside generated public information. Unlike prior research considering insider trading as an evidence of insiders' use of private information, our findings suggest that insiders' informational advantage can be at least in part due to investors' limited attention to publicly available information. Thus, our paper also contributes to the discussion on whether insider trading is unethical.

Our argument that insiders and investors may have a different level of attention with respect to publicly available information is motivated by the long stream of literature on limited attention (Kahneman 1973; Hirshleifer and Teoh 2003). A growing empirical literature in finance and accounting attributes the market underreaction to corporate events to the frictions in information processing caused by investors' limited attention. Specifically, prior research has shown that security prices incorporate publicly available information with a delay (Huberman

[3]For example, such events include bankruptcy filings (Ma, 2001; Seyhun and Bradley, 1997), mergers and acquisitions (Keown and Pinkerton, 1981), dividends, restatements, and earnings announcements (Sivakumar and Waymire, 1994; Ke, Huddart, and Petroni, 2003; Huddart, Ke and Shi, 2007).

and Regev 2001); investors underreact to a firm's earnings announcement when distracted by other firms' concurrent earnings announcements (Hirshleifer, Lim and Teoh 2009); and investors underreact to Friday earnings announcements consistent with weekends causing inattention (DellaVigna and Pollet 2009). We extend this stream of literature by examining whether insiders benefit from security mispricing caused by investors' limited attention to outside generated publicly available information.

We define outside generated information as the information that the management has no control over making strategic decisions regarding the timing and the amount of the information to be disclosed to the market. One source of such publicly available information that the literature suggests is customer complaints. Customer complaints are publicly available and indicate a sign of dissatisfaction with a company's products (Lapré and Tsikriktsis 2006). Consistent with this, Ittner and Larcker (1998), Johnson and Mehra (2002) and Huang (2017) show that levels of customer satisfaction is critical to a firm's long-standing financial performance.

The customer complaints and product recalls in the auto industry provide an excellent setting to examine investors' limited attention to outside generated public information and whether insiders use this information in their trading decisions. An auto recall is typically preceded by a manufacturer and/or National Highway Safety Administration (NHTSA) investigation.[4] These investigations are triggered by the severity of the customer complaints filed with the NHTSA. We conjecture that customer complaints contain information regarding both the likelihood of a recall and its financial consequences. We rely on prior evidence on market

[4] The automotive industry is regulated by NHTSA, which was created under the National Traffic and Motor Vehicle Safety Act in 1966 and aimed to reduce the number of motor vehicle-related injuries by increasing scrutiny over manufacturers' compliance with federal vehicle safety standards. Part of NHTSA's responsibilities is to oversee the process of vehicle recalls in the United States. See: http://www.nhtsa.gov/ for additional information.

inefficiencies caused by investors' limited attention and further argue that the market fails to process the information contained in customer complaints in a timely manner, presenting profitable trading opportunities to insiders. Finally, we expect insiders to discover and use the information contained in customer complaints in their trading decisions before the market fully incorporates the same information into security prices.

Using a comprehensive sample of customer complaints filed with NHTSA and 526 auto recalls during the 1996-2012 period, we find that the likelihood of an auto recall increases with customer complaints and that car manufacturers' stock prices incorporate the information content of customer complaints only after the report date of the recall, i.e., the date the recall decision has been conveyed to the NHTSA by the manufacturer. Specifically, we document a strong negative relation between customer complaints and the cumulative abnormal returns over the three month period after the manufacturer conveys the decision to initiate a recall campaign to the NHTSA. Our results suggest that these publicly available customer complaints contain value-relevant information that can be used to predict future returns. More importantly, we find that the market fails to process the information contained in customer complaints in a timely manner, presenting profitable trading opportunities to those who pay closer attention to them.

We next examine the trading behavior of the top five corporate executives of the automakers in our sample prior to the recall date and explore whether they use the information embedded in customer complaints. We find that insiders are significant net sellers prior to the recall date, particularly when there are more complaints filed with NHTSA. Thus, insiders are aware of the information content of customer complaints, while other investors fail to process this publicly available information in a timely manner. Collectively, our results suggest that insider transactions are timelier than stock prices in incorporating the implications of customer

complaints for future financial performance. The findings are consistent with our conjecture that insiders use outside generated public information to inform their trades unlike prior research considering insider trading as evidence of insiders' use of private information for personal gain.

Our results are robust to a battery of additional tests. Specifically, when a firm has two or more recalls within a 30-day window, we only use the recall with the highest severity and obtain similar results. We also repeat our analyses after eliminating recalls with moderate complaints and find either similar or stronger results. Finally, we explore whether the information in customer complaints predicts the financial severity of auto recalls. Using the potential number of cars affected in a recall as our proxy for the recall's financial severity, we find that customer complaints are indeed an important predictor of the financial burden of the auto recall.

Our findings should be of interest to investors, consumers, the NHTSA, automakers, security market regulators, and researchers. First, we explore the information content of outside generated public information, i.e., consumer complaints filed with government agencies. We find that customer complaints predict product recalls and future returns and therefore conclude that customer complaints are value-relevant in auto-recall setting.

Second, we contribute to the literature on investors' limited attention. Prior studies in this literature explore how aggregate investor attention varies from one stock to another. For example, retail investors buy into attention-grabbing stocks (Barber and Odean 2007) and stock prices underreact to earnings announcements when investors are distracted by other earnings announcements (Hirshleifer et al. 2009) or the upcoming weekend (DellaVigna and Pollet 2009). We contribute to this literature by exploring whether insiders and outsiders exhibit differential attention to publicly available information on a given firm.

Third, our findings also suggest that the timely and more effective disclosure of customer

complaints can alleviate some of the information gap between insiders and outside investors due to the investors' limited attention. For example, NHTSA may present summary information on complaints for each make-model-year on its website in a more timely fashion.[5] This will also contribute to the mission of the SEC in maintaining the integrity and fairness of the stock market.[6]

Finally, we contribute to the discussion on whether insider trading is unethical (Manne 1966a, b, 1985; Ma and Sun 1998; Engelen and Liedekerke 2007; McGee 2008, Agarwal and Cooper 2015). While the literature is divided on whether insider trading is unethical and/or illegal, the implicit assumption is that the information insiders use in their trading decisions is not available to outsiders (Moore 1990; Ma and Sun 1998; McGee, 2008; Smith and Block 2016). We depart from this literature by arguing and presenting evidence that insiders also trade on outside generated publicly available information which is not fully incorporated into the stock prices in a timely manner due to limited attention by the market. Unlike the dominant view that insider trading is unethical because insiders gain personal benefit from trading on private information, our findings suggest that insider trading can enhance the informational efficiency of stock prices caused by investors' limited attention to outside generated public information.

II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Customer Complaints and Product Recalls

Prior studies document a significantly negative stock price reaction to product recall announcements (Jarrell and Peltzman 1985; Pruitt and Peterson 1986; Davidson and Worrell

[5] Prior research shows that the presentation of information affects the extent to which investors use this information (Ettredge et al. 2002).

[6] The Commission is very vigorous in enforcing the laws against insider trading. For example, the Commission filed complaint against several employees and their spouses in CryoLife and charged them for insider trading prior to a product recall order issued by Food and Drug Administration (FDA).

1992; Chu et al. 2005). Therefore, information that helps predict future product recalls could be critically valuable. Since the details of manufacturing processes and the quality issues of the products are largely known to the engineers and the managers of the firm but not, to the same extent, to the investors, an information asymmetry about the true quality of a product and its deficiencies is likely to exist between insiders and outsiders (Barber and Darrough 1996; Kirmani and Rao 2000). Although firms are generally reluctant to share negative news about their products until they are required to do so, there are potential information cues that can help the public narrow the information gap. One particular source of such information is customers' complaints about the products they use.

Prior research finds that customer complaints are a sign of dissatisfaction with a company's products (Lapré and Tsikriktsis 2006).[7] Dissatisfaction may arise due to the violation of customers' ex-ante expectations regarding either the quality of the product or a design flaw which may put the customer at a discomfort and/or security risk. The latter is of particular concern due to legal ramifications, and complaints regarding such matters may be a potential product recall trigger. Moreover, the direct and indirect costs (i.e., loss of reputation and foregone future sales revenues) of dissatisfied consumers can be material and long-lasting for firms that do not effectively address these concerns (Ittner and Larcker 1998: Johnson and Mehra 2002). The significant economic impact on firms arising from customer complaints is no more salient in any line of business than in the auto industry.

The prevalent level of personal auto ownership in the U.S. and the perceived heavy cost of new autos lead to exceptional levels of interaction between products, manufacturers and the consumers. Therefore, it is not surprising that the auto industry experiences more customer

[7] See the recent research by Harris and Ogbonna (2010) and Knox and van Oest (2014).

complaints than any other line of business, and faces the costliest product recalls than any other industry (Chen and Nguyen 2013; Ni, Flynn and Jacobs 2014). Therefore, the announcement of an auto recall attracts wide media coverage and is often accompanied by a negative stock price reaction (Bromiley and Marcus 1989; Chu et al. 2005; Hoffer et al. 1987). Figure I depicts the auto industry's product recall process. The NHTSA routinely screens the complaints they receive from customers regarding automobiles and opens a safety defect investigation when it is likely that there is either an "unreasonable" safety-related defect or a non-compliance issue per federal requirements that would warrant a recall. When a manufacturer agrees with the agency's recommendation to recall a product they must notify the NHTSA of their recall decision within five days, and the agency creates a record of this issue.

<<Insert Figure I about here>>

Our first objective is to examine whether customer complaints filed with the NHTSA contain significant information concerning future car recalls. We expect that customer complaints will be associated with a higher likelihood of recalls for two reasons. First, complaints will accumulate over time if the product has a serious defect. These complaints are likely to raise flags regarding the product's true quality which in turn may trigger a safety defect investigation by the NHTSA, culminating in detection of the defect by regulators. Second, each additional complaint from a different customer potentially provides another perspective concerning the issues under screening. A security issue with a product is therefore less likely to go unnoticed with a growing number of complaints.

Although customer complaints are an important precursor to product recalls, anecdotal evidence suggests that automakers may disregard these complaints even if the underlying defect is potentially serious. For example, General Motors reportedly knew about its faulty ignition

switch issue through customer complaints months before the actual recall campaign (Bennett 2014). Honda was recently fined by the NHTSA for underreporting fatal accidents and injuries associated with its defective products (Ivory 2015). Similarly, we know that several hundred reports filed with either the NHTSA and/or the manufacturer directly were either ignored or did not conclude with a recall decision during Toyota's unintended acceleration crisis in 2009 to 2011 (Heller and Darling 2012). Nevertheless, customer complaints are likely to be noticed by regulators and eventually pave the way for a recall campaign given the significance and visibility of the products being manufactured and sold in the auto industry. Thus, we hypothesize that:

H1: The likelihood of a recall increases with customer complaints.

Customer Complaints and Stock Returns

Most existing studies find a significantly negative stock price reaction to product recall announcements (Pruitt and Peterson 1986; Marcus et al. 1987; Davidson and Worrell 1992; Barber and Darrough 1996; Chen and Nguyen 2013) while some find no such relationship (Thirumalai and Sinha 2011). Recall campaigns are associated with both direct and indirect costs; while the latter are driven mostly by a damage to brand name, questions raised regarding firm operations and quality control, as well as negative media hype (Zavyalova et al. 2012). We argue that recall announcements preceded by a large number of customer complaints likely attract greater media coverage that exacerbates the indirect costs. Customer complaints filed prior to the recall can additionally contain information concerning the direct costs (i.e., financial severity) of the recall campaign.[8] We therefore expect a negative relation between customer complaints and abnormal stock returns following the recall announcement if the market fails to pay attention to customer complaints (publicly available information) in a timely manner.

[8] We provide evidence consistent with this conjecture in additional analyses section (see Section 4.4).

An extensive body of financial economics literature suggests that the market underreacts to information in many corporate events such as earnings announcements, analyst forecast revisions (Gleason and Lee 2003), corporate fraud (Karpoff and Lott 1993), restatements (Palmrose et al. 2004), and airline crashes (Borenstein and Zimmerman 1988). One explanation often provided in the behavioral finance literature for this market underreaction to public announcements is the cognitive limitations of market agents. Market agents with limited attention will selectively attend to only certain information regarding firms due to the abundance of information pouring from all directions (Kahneman 1973). For example, Hirshleifer et al. (2009) find that the market reaction to a firm's earnings news decreases with the number of concurrent earnings announcements. Frederickson and Zolotoy (2015) show that investors pay greater attention to the earnings news of more visible firms when faced with multiple concurrent announcements. Moreover, recent research shows that investor attention as measured by Google search volumes fluctuates over time (Da et al. 2011; Vlastakis and Markellos 2012), highlighting market participants' cognitive limitations in processing all available relevant information.

We therefore argue that the automaker's stock will remain overpriced during the pre-recall period to the extent that investors' limited attention prevents them from processing the information embedded in customer complaints. In contrast, we should find no relation between customer complaints and abnormal returns following recall announcements if the market is aware of customer complaints and efficiently uses this information when assessing both the likelihood of a recall and its financial ramifications. However, even the most sophisticated institutional investors may be limited in their abilities to pay close attention to each of the hundreds of individual stocks they hold in their investment portfolios and may not be attentive to every piece of publicly available information (e.g. customer complaints) about a given stock. We

accordingly hypothesize:

H2: Customer complaints are negatively associated with abnormal stock returns during the period following a recall announcement.

Customer Complaints and Insider Trading

Our first two hypotheses predict that customer complaints contain value-relevant information and that this information is not effectively incorporated into stock prices. This clearly creates an opportunity for insiders to exploit the complaint information. Accordingly, we conjecture that due to limited attention (DellaVigna and Pollet 2009; Hirshleifer et al. 2009; Frederickson and Zolotoy 2015), if investors fail to attend to the publicly available information embedded in customer complaints then automakers' pre-recall stock prices will be higher than warranted by fundamentals so that investors will suffer large losses following the recall announcement. On the other hand, insiders are naturally more attentive to any news regarding the firm they manage. Therefore, it is expected that insiders act strategically on the value-relevant complaint information to maximize their wealth and time their trading decisions based on the severity of the complaint information.

A large stream of insider trading literature focuses on the timing of insider activism around major corporate announcements (e.g., bankruptcy filings, mergers and acquisitions (M&A), restatements, dividends and earnings announcements) to explore whether corporate insiders exploit their time-sensitive and value-relevant information to safeguard their wealth and/or profit from these transactions. For example, Seyhun and Bradley (1997) show that insiders sell their shares prior to the bankruptcy filing dates. Ma (2001) document that insiders of Chapter 11 bankruptcy firms buy significantly fewer shares before the bankruptcy announcement. In a similar fashion, Sivakumar and Waymire (1994), Sivakumar and

Vijayakumar (2001), Ke et al. (2003), and Huddart et al. (2007) document significant insider trading activity before earnings announcements while others find no such relationship (Elliot et al. 1984; Givoly and Palmon 1985). In another setting, Keown and Pinkerton (1981) and Seyhun (1990) argue that insiders engage in illegal trading activity around M&A announcements. Finally, Agrawal and Cooper (2015) document strong insider trading activity before restatements. Overall, these findings suggest that insiders can strategically time their trades around corporate events based on the content of their time-sensitive and value-relevant information to safeguard their wealth from the possible negative impacts of these events.

While prior studies assumed that there is an information gap between managers and the public regarding these corporate announcements, we present a case where an outside generated information (i.e. customer complaints) is publicly available and could be used by outside investors to narrow this information gap before a significant corporate announcement (i.e. product recall) occurs. The availability of complaint data that precedes the recalls limits the private information advantage of insiders. Therefore, even if managers may want to delay the disclosure of bad news to the extent possible in the hope of a turnaround or due to career concerns (Kothari et al. 2009) it may not always be possible to do so with the publicly available information that may potentially help predict upcoming recall announcements.

We argue that outside investors' limited attention to relevant information (e.g., customer complaints) coupled with insiders' selective attention to the complaints concerning their firms' products will allow insiders to better evaluate the likelihood of a recall based on the severity of customer complaints and to time their trades. Insiders will therefore likely reduce their holdings as a strategic move to safeguard their wealth from the negative impacts of the recall to the extent that customer complaints lead insiders to believe a recall campaign is probable.

On the other hand, the SEC has passed several regulations to monitor corporate insider trading activity on non-public information (Keown et al. 1985 and Persons 1997) (e.g., Rule 10b-5 of the Securities Exchange Act of 1934).[9] Lately, The Insider Trading and Securities Fraud Enforcement Act of 1988 (ITSFEA) established a program for informants, held top management accountable for their employees' illegal trading activities, and significantly increased criminal penalties. Garfinkel (1997) reports that the frequency of insider trading activity thirty days prior to earnings announcements has been less after ITSFEA.[10]

Finally, corporations enact internal policies to prevent insiders from exploiting their informational advantage at the expense of other shareholders. For example, the majority of U.S. corporations have some sort of blackout periods during which insiders are prohibited from trading in their own company's shares (Bettis, Coles, and Lemmon 2000). Therefore, any insider trading activity concentrated around these time-sensitive periods can potentially be considered as evidence of fraudulent activity. Although the interplay of the above-mentioned two opposing views is not known a priori, we argue that the magnitude of insider trading activity (i.e., net selling) prior to a recall announcement is positively associated with the customer complaints.

H3: Abnormal insider selling prior to a recall announcement is positively associated with customer complaints.

III. SAMPLE SELECTION AND DESCRIPTIVE STATISTICS

Sample Selection

We begin our sample selection process by gathering all customer complaints and recall announcements during the period from 1996 to 2012 as reported on the NHTSA's website. The

[9] The legal consequences for violating the antifraud provisions of the Securities and Exchange Act of 1934 have severely increased over time. For example, the Insider Trading Sanctions Act of 1984 imposed significant jail sentences and severe penalties equal to three times the amount of insider profits.

[10] Insider trading regulations were also introduced in other parts of the world (see Rundfelt (1986)).

complaints data contains all safety-related complaints received by NHTSA since January 1, 1995 and includes detailed information on each complaint such as the manufacturer's name, vehicle make-model-year (MMY), the date of the complaint, whether the vehicle was involved in a crash or fire and the number of persons injured or dead. During each calendar year-quarter we calculate the number of customer complaints and the number of incidents with injury, crash, fire, or death for each MMY over a one-year period. We then investigate whether these complaint measures predict the likelihood of a recall during the next quarter. We retain each MMY in our sample for a maximum of 20 years.[11] Our final sample consists of 812,290 observations (i.e., customer complaints) with 19,231 separate make-model-year configurations.

Our subsequent analyses are based on 526 recalls from four automobile companies (Chrysler, Daimler, Ford, and General Motors) involving 19 makes and 962 make-models. We obtain returns data from the CRSP and insider trading data from the Thomson Financial Insider Research Services Historical Files. We retain recalls reported on July 1, 1996 or later because insider trading information is available beginning from January 1, 1996 and we require six months of insider trading information before a recall. For each recall we obtain the US dollar value of net insider selling, *VSELL*, within three periods: *i) event period* as the three months ending before the recall date, *ii) pre-event period* as the three months ending before the beginning of the event period, and iii) *post-event period* as the three months beginning on the recall date. We then calculate abnormal net insider selling during the event period, *ABVSELL*, as net insider selling during the event period minus average net insider selling during the pre- and

[11] Problems with vehicles older than 20 years are less likely to be a concern since these vehicles are assumed to be near the end of their normal life cycles for most users. Some states waive inspections, and some insurance companies refuse to insure models that are older than 20 years. In a recent recall perception survey performed by the National Automobile Dealers Association (NADA) 61% of respondents agreed with the statement: "*Recalls of older vehicles are generally less meaningful to me than recalls of newer ones.*" (NADA 2014). Our coverage of issues concerning each auto model for its expected 20 years of life resonates therefore well with the reality in this industry.

post-event periods.[12] Following prior studies (e.g., Huddart et al. 2007; Seyhun 1988; Sivakumar and Vijayakumar 2001) we utilize only open market sales and purchases by insiders because such insider transactions are more likely to represent actions taken due to value-relevant private insider information. We focus on insider trading by the *CEO, CFO, COO, Chairman of the Board*, and *President*. To examine whether insiders trade on the information from complaints, we obtain complaint measures associated with a recall within a one-year period ending one day before the recall date. A recall may include several MMYs; if there is a previous recall on a MMY within a one-year period, then we only use the complaints on the MMY following the previous recall date. We obtain financial statement data from Compustat and require that firms have data available in order to compute their market value of equity (*MV*) and book-to-market ratio (*BM*) as of the beginning of the fiscal year. Finally, we require that firms have return data available on the CRSP in order to calculate the momentum (*MOMENTUM*).

Descriptive Statistics

Panel A of Table 1 provides descriptive statistics for the recall and complaint measures. There is a recall during approximately 1.3% of MMY-quarters. In untabulated analyses we find that 74.1% of MMYs have no recalls during our sample period, while some MMYs realized recalls during multiple quarters. The maximum number of recalls is 12 for the *Ford-F150-1997* and *Chevrolet-Silverado-2000*.

<<Insert Table 1 about here>>

Not all complaints are identical. While some complaints are associated with accidents on the roads, injuries, and sometimes even deaths, we find that others are due to trivial concerns such as mislabeled or missing placards, problems in the seat adjustment mechanisms, or a

[12] We obtain similar results when we restrict the control period to the pre-event period when measuring *ABVSELL*.

malfunctioning glovebox lock (Liu and Shankar 2015; Reilly and Hoffer 1983). We therefore construct the following five complaint measures using the NHTSA's "complaints" file: for each MMY during a calendar quarter *#INCIDENT* is the number of incidents (associated with that make-model-year), *#INJURED* is the total number of injuries, *#CRASH* is the number of incidents that involved a crash, *#FIRE* is the number of incidents that involved a fire, and *#DEATH* is the total number of deaths. We also construct a summary complaint metric, *FACTOR*, by taking the simple average of these five complaint measures. The mean (maximum) reported incident is 0.734 (455). In untabulated results, we find that there is no incident in 85% of MMY quarters. Similarly, there is no injury, crash, or fire in more than 90% of MMY quarters and percentage of MMY quarters with death is only approximately 0.35.

We use the standardized complaint measures in our regression analyses. We first winsorize complaint measures at the 99^{th} percentile for each MMY, and then standardize by dividing the number of complaints for the MMY during a quarter by the maximum number of the MMY complaint measure over the sample period. The standardized complaint measures (*#SINCIDENT, # SINJURED, # SCRASH, # SFIRE, # SDEATH,* and *SFACTOR*) accordingly vary between zero and one for each MMY. We use the standardized complaint measures in order to mitigate concerns that the relation between complaints and the likelihood of recalls could be driven by a MMY-level specific omitted factor(s) such as sales that is likely to affect both complaints and recalls.

If there is no complaint for a MMY then the complaint measure is set to zero for that MMY during all four quarters. Finally, we use the average of standardized complaint measures over four quarters in order to examine whether complaints predict the likelihood of a recall during the next quarter. We include complaints from the past four quarters in our analysis in

order to allow time for both processing complaints and any investigations that may take place between complaints and recall decisions. However, in additional analyses we obtain similar results using the standardized complaint value during the current quarter. Panel B of Table 1 shows that all five complaint measures are positively correlated with *RECALL* ($p < 0.001$). We also find that complaint measures are positively correlated with each other ($p < 0.001$) with correlation coefficients ranging from 0.13 (between *INCIDENT* and *DEATH*) and 0.72 (between *INJURED* and *CRASH*).

Panel C of Table 1 reports the descriptive statistics for the variables in our recall sample. We use this sample in order to investigate whether complaints are associated with excess returns around the post-recall period (H2) and insider trading (H3) respectively. We report the US dollar value of net insider selling, *VSELL*, and the dollar value of abnormal net insider selling, *ABVSELL*, during the event period. The average *VSELL* is 0.279 ($279,000), indicating that the value of sell trades exceeds the value of buy trades. This is consistent with the insider trading literature suggesting that insiders mostly sell their holdings over the course of their ownership (e.g., Huddart et al. 2007).[13] The average abnormal net insider selling, *ABVSELL*, is -0.084 (-$84,000), indicating that insider net selling is lower during the event period than the control periods. However, we find that it is not significant. Finally, the average number of cars potentially affected in each recall (*NDEFECT*) is 226,208.

The distributions of the complaint measures for the recall sample in Panel C substantially differ from those for the complaint sample in Panel A. The mean (median) of the total number of incidents associated with the recall within a one-year period ending before the recall date,

[13] In Huddart et al. (2007) the mean dollar values of insider net trading (sell minus buy) are $84,000, $863,000, and US $67,000 during the 20 days before earnings announcements, between earnings announcement and filing dates, and 20 days after filing dates respectively.

#INCIDENT, is 171 (25), and at least one incident occurs during 84.8% of recalls (untabulated). The mean (median) number of injury complaints, *#INJURED,* is 15.8 (2), and untabulated statistics reveal that 61.2% of recalls were realized following an injury complaint. Similarly, the mean (median) number of crash complaints, *#CRASH,* is 15 (2), and there is at least one crash complaint in 64.3% of all recall announcements. We find that the mean (median) number of fire complaints, *#FIRE,* is 9 (1), and untabulated statistics indicate that 52.7% of recalls are realized following fire complaints. Finally, the mean (median) number of complaints with death, *#DEATH,* is 0.789 (0), and we find that 22.4% of recalls are realized following at least one death complaint.

We standardize complaint measures by dividing number of complaints associated with a given recall by the maximum value of the firm's complaint measure. The standardized complaint measures *(#SINCIDENT, #SINJURED, #SCRASH, #SFIRE, #SDEATH,* and *FACTOR*) accordingly vary between zero and one for each firm in our recall sample. The correlation coefficients reported in Panel D of Table 1 show that the standardized complaint variables except for *#SFIRE* and *#SDEATH* are negatively correlated with excess returns over the three months following the recall report date (*CAR[+2,+63]*). This is consistent with our argument that complaints contain information concerning the recall's financial outcome and that this information is not reflected in stock prices before the recall date. We also find that all of our complaint variables except for *#SDEATH* are positively correlated with abnormal net insider selling (*ABVSELL*). These initial univariate results therefore support our hypotheses that investors fail to react to complaint information in a timely manner (*H2*), and that insiders sell their shares in response to complaints prior to recall announcements (*H3*). We additionally find a

positive correlation between all complaint measures and recall severity (*LnNDEFECT*) which we use as a proxy for the financial severity of recalls in our additional analyses.

IV. RESULTS

Complaints and Likelihood of Recalls

We begin by examining whether customer complaints are associated with the likelihood of a recall (*H1*) by estimating the following regression model:

$$Pr\ (RECALL_{i,t+1}) = \alpha_0 + \alpha_1 COMPLAINT_{i,t} + \varepsilon \quad (1)$$

where *RECALL* is an indicator variable taking the value of one if there is a recall for a MMY during calendar quarter t+1, and zero otherwise. *COMPLAINT* is one of the six standardized complaint measures (*#SINCIDENT, # SINJURED, # SCRASH, # SFIRE, # SDEATH,* and *FACTOR*) for the MMY obtained as of calendar quarter t. We provide detailed explanations for each complaint measure in Appendix, and estimate the probit model by including indicator variables for each firm.

<<Insert Table 2 about here>>

The results presented in Table 2 support the hypothesis (*H1*) that the likelihood of a recall increases with customer complaints. We specifically find that the coefficient on each *COMPLAINT* measure is significantly positive at the 1% level, ranging between 1.484 for *#SINCIDENT* and 4.035 for *FACTOR* (the average of five complaint measures). Since complaint measures are standardized to range between zero and one, the coefficient on each complaint measure provides specific information regarding the complaint measure's effect on the likelihood of a recall relative to the effects of other complaint measures. We therefore find that customer complaints involving an injury, crash, fire, or death are on average more strongly associated with the likelihood of a recall than complaints without these qualities. Panel B of

Table 2 reports the results for the sample restricted to MMYs from four automakers with returns and insider trading information. We find that the effect of *COMPLAINTs* on the likelihood of a recall strongly persists in this restricted sample as well. The coefficient on each complaint measure in the restricted sample is comparable to the coefficient on the complaint measure from the full sample, strengthening our initial finding that complaints are significantly associated (p-value <0.01 or better) with the likelihood of a recall when incidents involve an injury, crash, fire, or death. Our findings therefore support H1, suggesting that customer complaints contain information concerning future car recalls.

Complaints and Abnormal Returns after Recall Announcements

Our findings so far provide strong support for our first hypothesis that customer complaints contain value relevant information. In this section we investigate whether the market incorporates this complaint information into stock prices in a timely manner. We conjecture that if the market fails to use the information embedded in complaints and therefore becomes aware of the recall campaign's details and financial consequences only after the recall report date, then we expect to find a negative association between complaints and excess returns following the recall report date. Specifically, we examine whether complaint measures are associated with long window excess returns (three months) following the recall report date.

We estimate the following regression model:

$$EXRET = \beta_0 + \beta_1 COMPLAINT + \beta_2 DMV + \beta_3 DBM + \beta_4 DMOMENTUM + \varepsilon \quad (2)$$

where *EXRET* is the value-weighted excess returns over the three month-window beginning two days after the recall report date, *CAR[+2,+63]*. *COMPLAINT* is one of the six standardized complaint measures (*#SINCIDENT, # SINJURED, # SCRASH, # SFIRE, # SDEATH,* and *FACTOR*) ranging between zero and one for each firm. *MV* is measured as the stock price

multiplied by the number of shares outstanding, and *BM* is calculated as the book value of common stock (CEQQ) divided by *MV* as of the most recent fiscal year before the event window. *MOMENTUM* is cumulative abnormal returns (raw return minus the CRSP value-weighted index returns) over the three-month period ending at the beginning of the event window. We sort *MV*, *BM*, and *MOMENTUM* into decile ranks separately for each firm and then standardize them to range between zero and one (i.e., *DMV, DBM,* and *DMOMENTUM).*

<<Insert Table 3 about here>>

We estimate the model by including firm fixed effects and report the results for the excess returns over the three months following the recall report date in Panel A of Table 3. We find that the coefficient on each complaint measure is significant, consistent with the market becoming aware of the recall campaign and its financial costs following the recall report date. This result is consistent with our second hypothesis, *H2,* which asserts that the market fails to incorporate fully the information content of complaints in a timely manner. Since our complaint measures are standardized to range between zero and one, the coefficients on the complaint measures can be interpreted as the excess returns following recalls with a complaint score of one. For example, when the complaint measure is *#INCIDENT,* we find that recalls with a complaint score of one experience excess returns of -9.7% over the three-month period following the recall report date.

We next examine the short window stock price reactions to recall announcements by substituting the dependent variable in Equation (2) with the value-weighted excess returns over the three day-window around the recall report date, *CAR[-1,+1]*. Results are reported in Panel B of Table 3. The coefficients on all six complaint measures are insignificant. Together with the results reported in Panel A, the results in Panel B suggest that the initial market reaction to

recalls does not reflect the information content of customer complaints and this information is incorporated only gradually into prices as more information about the financial ramifications of the recall campaign are made available to the public by the auto maker.

In untabulated analyses we also consider longer horizon (12 months) excess returns following the recall report date and find that there is both a statistically significant (at the 1% level for each complaint measure except *#DEATH*, which is significant at the 10% level) and economically large (more than 20%) relation between excess returns and complaint measures. Our results suggest that a substantial amount of the information embedded in complaints is realized gradually during the period following the recall report date.

Our findings generally support the argument that the public is likely to learn the details regarding a recall and begins incorporating these implications from complaint-related information into their expectations during the period following the recall report date. These findings also suggest that insiders can use complaint information in order to assess the likelihood as well as the economic cost of an upcoming recall. If so, insiders will increase their net selling activity prior to recalls accompanied by large number of customer complaints to minimize any potential loss in their wealth due to the auto recall announcement. We explore this question in the next section.

Complaints and Insider Trading

In this section we test our third hypothesis (*H3*) that customer complaints are positively associated with abnormal insider selling before the recall report date. We estimate the following model:

$$ABVSELL = \beta_0 + \beta_1 COMPLAINT + \beta_2 DMV + \beta_3 DBM + \beta_4 DMOMENTUM + \varepsilon \qquad (3)$$

where *ABVSELL* is abnormal dollar value of net insider selling over the three months ending before the recall report date. *COMPLAINT* is one of the six standardized complaint measures (*#SINCIDENT, # SINJURED, # SCRASH, # SFIRE, # SDEATH,* and *FACTOR*) ranging between zero and one for each firm. The other variables are defined as in the previous section.

<<Insert Table 4 about here>>

Table 4 presents the coefficient estimates for Equation (3). We find that the coefficients on each complaint measure (except *DEATH*) are significantly positive, indicating that insiders incorporate complaint information and significantly increase their net selling activity prior to the recall report date. For example, the first column reports the results when we measure complaints using the *#SINCIDENT*. We find that the coefficient on *#SINCIDENT* is 0.653, suggesting that abnormal net insider selling increases by approximately US $653,000 when the standardized incident measure *#SINCIDENT* increases from the minimum value of zero to the maximum value of one. In untabulated analyses we use a logarithm of *ABVSELL* and find consistent results. We accordingly find that abnormal net insider selling is positively associated with customer complaints, supporting *H3* that insiders use the information embedded in complaints in order to safeguard their wealth and minimize the forthcoming recall announcement's impact.

Robustness Tests and Additional Findings

We undertake several additional tests in order to examine the robustness of our results. In untabulated results we first find that there are some cases where we have more than one recall for a firm within a 30-day window. In these cases we use the incident with the highest recall severity, reducing our sample to 288 recalls. We repeat all analyses using the restricted sample and obtain results consistent with those reported above. Specifically, we find an even more significant association between complaints and abnormal net insider selling using the reduced

sample. Second, we standardize complaint measures by creating a dummy variable for high complaints *HIGHCOMPLAINT* that takes value of one for complaints that are in the highest quartile of the firm's complaint measure, and zero otherwise. We obtain even stronger results using this alternative standardization procedure, suggesting a non-linear association between complaints and insider selling activity. Similarly, we repeat all analyses by eliminating recalls with moderate complaints and find either similar or even more significant results.

Third, we consider the possibility that ease of access to information regarding customer complaints may have changed over time since technological advancements in accessing information changed during our sample period. We address this potential issue by comparing the very early period of our sample (1996 to 1999) when internet access to agency databases may have been either difficult or completely unavailable with the late period (2008 to 2012). We do find that our results are stronger during the late than the early study period.

Finally, we explore whether the information in complaints predict the financial severity of recalls. We measure the severity of a recall with the number of potential cars affected in the recall, *NDEFECT*. The mean (median) *NDEFECT* is 226,208 (18,748). The minimum *NDEFECT* is one for Ford-E450 in a recall reported on December 5, 2008, while the maximum *NDEFECT* is over 14 million for Ford's multiple make-models in a recall reported on August 26, 2008 (see Panel C of Table 1). In untabulated analyses we also find a negative relation (significant at the 1% level) between the logarithm of NDEFECT, *Ln(DEFECT)*, and the three-month excess returns over the post-recall date (i.e., *EXRET*). This negative relation suggests that firms experience negative excess returns, particularly following recall campaigns that involve a significant number of cars.[14] This provides support for our assumption that *NDEFECT* proxies

[14] In untabulated additional analyses we also regress the excess returns on complaint measures after controlling for

for the financial severity of recalls.[15]

We estimate the following model in order to explore whether customer complaints predict the economics cost of a recall:

$$Ln(NDEFECT)_{i,t+1} = \alpha_0 + \alpha_1 COMPLAINT_{i,t} + \varepsilon \quad (4)$$

where *Ln(NDEFECT)* is the logarithm of the number of cars potentially affected in the recall.[16] *COMPLAINT* is one of the six standardized complaint measures (*#SINCIDENT, # SINJURED, # SCRASH, #SFIRE, # SDEATH,* and *FACTOR*) as defined in Appendix. As in the previous analyses we use standardized complaint measures in order to mitigate concerns that the relation between *COMPLAINT* and recall severity could be driven by a firm-level omitted factor that affects both complaints and recall severity. We additionally include firm indicators in all regression models.

<<Insert Table 5 about here>>

The results in Table 5 suggest that complaints are positively associated with a recall's severity. The coefficients on these complaint measures range between 3.879 for *SDEATH* and 5.133 for *FACTOR*, and are statistically significant at the 1% level. For example, when we use *SINCIDENT* as our complaint measure we find that the coefficient on the standardized incidents

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the recall severity *Ln(DEFECT)*, and find that *Ln(DEFECT)* largely subsumes the relation between complaint measures and excess returns. This finding is consistent with the argument that complaints contain value-relevant information because they can be used to assess not only the likelihood but also the severity of an upcoming recall.

[15] Although we assume a positive relation between a recall's severity and the number of cars affected, we also use the explanation provided from the recall data regarding the company's corrective actions. While some recalls affect a large number of cars, the corrective action required by the company suggests that the cost of the recall may not be high. In untabulated analyses we obtain our results by either removing these recalls or setting their severity to median; as expected we find stronger results. However, we report these results using *NDEFECT* as provided by NTHSA in order to prevent any concerns regarding possible bias introduced by our identification process.

[16] In untabulated results we obtain similar results when we scale *Ln (DEFECT)* using the logarithm of the firm's market value at the beginning of the fiscal period.

is 4.983. This suggests that the number of cars affected will increase by 144% (*Exp* (4.983)) when the standardized incidents associated with a recall move from minimum value of zero to the maximum value of one.[17] This effect is lowest when the complaint measure is *SDEATH* at 47% (*Exp* (3.879)), and highest when the complaint measure is *FACTOR* at 167% (*Exp* (5.133)). We therefore find that complaints have both statistically significant and economically large effects on the severity of recalls.

V. CONCLUSIONS

In this paper we explore whether insiders use outside generated publicly available value relevant information concerning the firms that they manage that other stakeholders either ignore or fail to process in a timely manner. We first provide evidence that customer complaints contain material information that the market discovers with a delay. Specifically, we find that the likelihood of an auto recall increases with the number of customer complaints filed with the NHTSA, measured as the number of customer complaints and incidents that involve injury, crash, fire, or death. Perhaps more importantly we find that stock prices incorporate the information content of customer complaints only after the recall decision has been conveyed to the NHTSA by the automaker. Specifically, we find a strong negative relation between customer complaints and cumulative abnormal returns over the three-month period after the decision to initiate a recall campaign has been conveyed to the NHTSA by the automaker.

We next investigate whether insiders of automakers make use of the information embedded in the customer complaints filed with the NHTSA in their trading decisions. An

[17] The intercept is 9.084 when using standardized incidents as our complaint measure, indicating that the average number of cars affected is approximately 8,821 (Exp (9.084)) when the standardized incident is zero. The average number of cars affected will therefore be approximately 1,270,224 (144 x 8,821) when the standardized incident is one.

analysis of the trading behaviors of the top five corporate executives of the automakers in our sample prior to the recall date reveals that insiders are significant net sellers prior to the recall date, particularly when there are more customer complaints filed with the NHTSA. This suggests that insiders discover and utilize the information in customer complaints while other investors fail to process this outside generated publicly available information source. We interpret this finding as evidence that insiders are more attentive to news regarding their firms than other investors.

We contribute to the literature in three ways. First, our results extend the empirical literature on limited attention. Prior studies propose investors' limited attention as an explanation for why stock prices reflect information with a delay (Huberman and Regev 2001; Hirshleifer and Teoh 2003; DellaVigna and Pollet 2009; Hirshleifer et al. 2009). Recent studies find that aggregate investor attention changes over time (Da et al. 2011; Vlastakis and Markellos 2012) and that investors assign a higher priority to the processing of earnings announcements of more visible firms (Frederickson and Zolotoy 2015), consistent with attention being a scarce resource. Are stakeholders who dedicate greater attention to a given firm more likely to discover value-relevant information and trade profitably before other investors discover the same piece of information? Our study provides a first attempt to address this question by exploring the association between customer complaints and the trading behavior of corporate executives who we argue have informational advantage due to outside investors' limited attention.

Second, while an extensive body of research examines the effects of recall announcements on outcomes such as firm value (Barber and Darrough 1996; Pruitt and Peterson 1986), future purchase intention (Lin et al. 2011) sales performance (Rhee and Haunschild 2006), and future recall likelihood (Haunschild and Rhee 2004), to our knowledge, this is the

first study examining an outside generated public information channel as an antecedent for product recalls. We show that customer complaints, which are publicly available, contain useful information that can predict both the likelihood and financial severity of recalls. Future studies can explore whether the information in customer complaints moderates the effects of recall announcements on different firm outcomes.

Finally, we contribute to the disclosure literature by suggesting timely and more effective presentation of the customer complaints information. Specifically, we suggest NHTSA may consider presenting summary information on complaints for each make-model-year on its website in a more timely fashion. This would improve the market efficiency by mitigating the limited attention of investors and highlighting materially relevant information about companies to all investors. The implications of our findings could go beyond the auto industry since such policy improvements could also be employed in industries where similar regulatory processes are observed such as food, pharmaceutical and medical device industries (regulated by FDA), and consumer products (regulated by CPSC).

In conclusion, we show that insiders' trading activity may be –at least partly– based on publicly available information about their firms that the investment community may tend to overlook. The cognitive limitations of market participants coupled with the differential attentiveness of insiders to the outside-generated information concerning their firms create possibilities for such important information to be used profitably by insiders. While further research in different settings is warranted to explore the generalizability of our findings, our perspective in this paper presents a response to recent calls in the literature on insider trading to investigate insider's use of different types of information for their trades.

REFERENCES

Agrawal, A., & Cooper, T. (2015). Insider trading before accounting scandals. *Journal of Corporate Finance*, 34*:* 169-190.

Barber, B. M., & Darrough, M. N. (1996). Product reliability and firm value: The experience of American and Japanese automakers, 1973-1992. *Journal of Political Economy*, 104(5): 1084-1099.

Barber, B. M., & Odean, T. (2007). All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies*, 21(2): 785-818.

Bennett, J. (2014). "GM Ordered New Switches Long before Recall." Wall Street Journal (Online) November 10. http://www.wsj.com/articles/gm-ordered-new-switches-long-before-recall-1415584224

Bettis, C., J. Coles, and M. Lemmon. (2000). Corporate policies restricting trading by insiders. *Journal of Financial Economics* 57: 191–220.

Borenstein, S., & Zimmerman, M. B. (1988). Market incentives for safe commercial airline operation. *American Economic Review*, 78: 913-935.

Bromiley, P., & Marcus, A. (1989). The deterrent to dubious corporate behavior: Profitability, probability and safety recalls. *Strategic Management Journal*, 10(3): 233-50

Chen, Y., & Nguyen, N. (2013). Stock price and analyst earnings forecast around product recall announcements. *International Journal of Economics and Finance*, 5: 1–10.

Chu, T. H., Lin, C. C., & Prather, L. J. (2005). An extension of security price reactions around product recall announcements. *Quarterly Journal of Business and Economics*, 4: 33-48

Da, Z., Engelberg, J., & Gao, P. (2011). In search of attention. *Journal of Finance*, 66(5): 1461-1499.

Davidson, W. N., & Worrell, D. L. (1992). The effect of product recall announcements on shareholder wealth. *Strategic Management Journal*, 13(6): 467-473.

DellaVigna, S., & Pollet, J. M. (2009). Investor inattention and Friday earnings announcements. *Journal of Finance*, 64(2): 709-749.

Elliott, J., Morse, D., & Richardson, G. (1984). The association between insider trading and information announcements. *The RAND Journal of Economics*, 15(4): 521-536.

Engelen, P. J., & Van Liedekerke, L. (2007). The ethics of insider trading revisited. *Journal of Business Ethics*, 74(4): 497-507.

Frederickson, J. R., & Zolotoy, L. (2015). Competing Earnings Announcements: Which Announcement Do Investors Process First?. *The Accounting Review*, 91(2): 441-462.

Garfinkel, J. A., (1997). New evidence on the effects of federal regulations on insider trading: The Insider Trading and Securities Fraud Enforcement Act (ITSFEA). *Journal of Corporate Finance*, 3: 89–111.

Givoly, D., & Palmon, D. (1985). Insider trading and the exploitation of inside information: Some empirical evidence. *Journal of Business*, 58(1): 69-87.

Gleason, C. A., & Lee, C. M. (2003). Analyst forecast revisions and market price discovery. *The Accounting Review*, 78(1), 193-225.

Harris, L. C., and E. Ogbonna. (2010). Hiding customer complaints: Studying the motivations and forms of service employees' complaint concealment behaviours. *British Journal of Management* 21(2): 262-279.

Haunschild, P. R., & Rhee, M. (2004). The role of volition in organizational learning: The case of automotive product recalls. *Management Science*, 50(11): 1545-1560.

Heller, V. L., & Darling, J. R. (2012). Anatomy of crisis management: lessons from the infamous Toyota Case. *European Business Review*, 24(2): 151-168.

Hirshleifer, D., Lim, S. S., & Teoh, S. H. (2009). Driven to distraction: Extraneous events and underreaction to earnings news. *The Journal of Finance*, 64(5): 2289-2325.

Hirshleifer D., & Teoh, S. H. (2003). Limited attention, information disclosure, and financial reporting. *Journal of Accounting and Economics*, 36(1): 337-386.

Hoffer, G. E., Pruitt, S. W., & Reilly, R. J. (1987). Automotive recalls and informational efficiency. *The Financial Review*, 22(4), 433-442.

Huang, J. (2017) The customer knows best: The investment value of consumer opinions, *Journal of Financial Economics*, 128(1): 164-182.

Huberman, G., & Regev, T. (2001). Contagious speculation and a cure for cancer: A nonevent that made stock prices soar. *The Journal of Finance*, 56(1): 387-396.

Huddart, S., Ke, B., & Shi, C. (2007). Jeopardy, non-public information, and insider trading around SEC 10-K and 10-Q filings. *Journal of Accounting and Economics*, 43(1): 3-36.

Ittner, C. D., & D. F. Larcker. (1998). Are non-financial measures leading indicators of financial performance? An analysis of customer satisfaction. *Journal of Accounting Research* 36 (3): 1-35.

Ivory, D. (2015). New York Times. http://www.nytimes.com/2015/01/09/business/honda-fined-70-million-in-underreporting-safety-issues-to-government.html?_r=0

Jarrell, G., & Peltzman, S. (1985). The impact of product recalls on the wealth of sellers. *Journal of Political Economy* 93: 512–536.

Johnson, R., & S. Mehra. (2002). Best-practice complaint management. *Academy of Management Executive* 16 (4): 145-154.

Kahneman, D. (1973). Attention and Effort. Englewood Cliffs, NJ: Prentice-Hall.

Karpoff, J. M., & Lott, Jr. J. R. (1993). Reputational penalty firms bear from committing criminal fraud, the. *Journal of Law and Economics*, 36(2): 757-802.

Ke, B., Huddart, S., & Petroni, K. (2003). What insiders know about future earnings and how they use it: Evidence from insider trades. *Journal of Accounting and Economics*, 35(3): 315-346.

Keown, A. J., & Pinkerton, J. M. (1981). Merger announcements and insider trading activity: An empirical investigation. *Journal of Finance*, 36(4): 855-869.

Keown, A. J., Pinkerton, J. M. , Young, L. & Hansen, R. (1985). "Recent SEC Prosecution and

Insider Trading on Forthcoming Merger Announcements." *Journal of Business Research* 13(4): 329–338

Kirmani, A., & Rao, A. R. (2000). No pain, no gain: A critical review of the literature on signaling unobservable product quality. *Journal of Marketing* 64: 66–79.

Knox, G., & R. van Oest. (2014). Customer complaints and recovery effectiveness: A customer base approach. *Journal of Marketing* 78 (4): 42 –57.

Kothari, S. P., Shu, S., & Wysocki, P. D. (2009). Do managers withhold bad news?. *Journal of Accounting Research,* 47(1): 241-276.

Lapré, M. A., & Tsikriktsis, N. (2006). Organizational learning curves for customer dissatisfaction: Heterogeneity across airlines. *Management Science*, 52(3): 352-366.

Lin, C. P., Chen, S. C., Chiu, C. K., & Lee, W. Y. (2011). Understanding purchase intention during product-harm crises: Moderating effects of perceived corporate ability and corporate social responsibility. *Journal of Business Ethics*, 102(3): 455-471.

Liu, Y., & Shankar, V. (2015). The dynamic impact of product-harm crises on brand preference and advertising effectiveness: An empirical analysis of the automobile industry. *Management Science,* 61(10): 2514-2535.

Ma, Y. (2001). Insider trading behavior prior to Chapter 11 bankruptcy announcements. *Journal of Business Research*, 54(1): 63–70.

Ma, Y., & Sun, H. L. (1998). Where should the line be drawn on insider trading ethics? *Journal of Business Ethics*, 17(1): 67-75.

Machan, T. R. (1996). What is morally right with insider trading. *Public Affairs Quarterly*, 10(2): 135-142.

Manne, H. G. (1966a). Insider trading and the stock market. Free Press.

Manne, H. G. (1966b). Defense of insider trading. *Harvard Business Review*, 44(6): 113-122.

Manne, H. G. (1985). Insider trading and property rights in new information. *Cato Journal* 4(3): 933–943.

Marcus, R. D., Swidler, S., & Zivney, T. L. (1987). An explanation of why shareholders' losses are so large after drug recalls. *Managerial and Decision Economics*, 8(4): 295-300.

McGee, R. W. (2008). Applying ethics to insider trading. Journal of Business Ethics, 77(2): 205-217.

McGee, R. W. (2010). Analyzing insider trading from the perspectives of utilitarian ethics and rights theory. *Journal of Business Ethics*, 91(1): 65-82.

Moore, J. (1990). What is really unethical about insider trading? *Journal of Business Ethics*, 9(3): 171-182.

NADA (2014). The Impact of Vehicle Recalls on the Automotive Market. Accessed on 9/14/2016: http://automotivedigest.com/wp-content/uploads/2014/09/NADA-report-The-Impact-of-Vehicle-Recalls-on-the-Automotive-Market.pdf

Ni, J. Z, B.B. Flynn, & F.R. Jacobs. (2014). Impact of product recall announcements on retailers' financial value. *International Journal of Production Economics* 153: 309-322.

Palmrose, Z. V., Richardson, V. J., & Scholz, S. (2004). Determinants of market reactions to restatement announcements. *Journal of Accounting and Economics*, 37(1): 59-89.

Persons, O. (1997). SEC's insider trading enforcements and target firms' stock values. *Journal of Business Research* 39(3): 187–194.

Pruitt, S. W. & Peterson, D. R. (1986). Security price reactions around product recall announcements. Journal of Financial Research, 9: 113–122.

Rhee, M., & Haunschild, P. R. (2006). The liability of good reputation: A study of recalls in the U.S. automobile industry. *Organization Science*, 17: 101–117.

Reilly, R. J., & Hoffer, G. E. (1983). Will retarding the information flow on automobile recalls affect consumer demand? *Economic Inquiry*, 21(3): 444-447.

Rundfelt, R. (1986). Insider Trading: Regulation in Europe. *Journal of Accounting, Auditing & Finance*, 1(2): 125-130.

Seyhun, H. N. (1988). The information content of aggregate insider trading. *Journal of Business* 61: 1–24.

Seyhun, H. N. (1990). Do bidder managers knowingly pay too much for target firms?. *Journal of Business*, 63: 439-464.

Seyhun, H. N., & Bradley, M. (1997). Corporate bankruptcy and insider trading. *Journal of Business*, 70(2): 189-216.

Sivakumar, K., & Waymire, G. (1994). Insider trading following material news events: Evidence from earnings. *Financial Management*, 23(1): 23-32.

Sivakumar, K. & Vijayakumar, J. (2001). Insider Trading, Analysts' Forecast Revision, and Earnings Changes. *Journal of Accounting, Auditing & Finance*, vol. 16, 2: pp. 167-187.

Smith, T., & Block, W. E. (2016). The Economics of Insider Trading: A Free Market Perspective. *Journal of Business Ethics*, *139*(1): 47-53.

Snoeyenbos, M., & Smith, K. (2000). Ma and Sun on insider trading ethics. *Journal of Business Ethics*, 28(4): 361-363.

Thirumalai, S., & Sinha, K. K. (2011). Product recalls in the medical device industry: an empirical exploration of the sources and financial consequences. *Management Science*, 57(2): 376-392.

Vlastakis, N., & Markellos, R. N. (2012). Information demand and stock market volatility. *Journal of Banking & Finance*, 36(6): 1808-1821.

Werhane, P. H. (1989). The ethics of insider trading. *Journal of Business Ethics*, 8(11): 841-845.

Werhane, P. H. (1991). The indefensibility of insider trading. *Journal of Business Ethics*, 10(9): 729-731.

Zavyalova, A., Pfarrer, M. D., Reger, R. K., & Shapiro, D. L. (2012). Managing the message: The effects of firm actions and industry spillovers on media coverage following wrongdoing. *Academy of Management Journal*, 55(5): 1079-1101.

APPENDIX

Variable Definition

Variable Name	Complaint Sample (Model 1)
RECALL	An indicator variable taking value of one if there is a recall for a MMY during calendar quarter t+1, and zero otherwise.
MMY	Make-model-year
#INCIDENT	The number of incidents for a MMY during a calendar quarter.
#INJURED	The number of injured for a MMY during a calendar quarter.
#CRASH	The number of incidents that involved a crash for a MMY during a calendar quarter.
#FIRE	The number of incidents that involved a fire for a MMY during a calendar quarter.
#DEATH	The number of dead for a MMY during a calendar quarter.
#SINCIDENT	The standardized *#INCIDENT* obtained by dividing number of incidents for the MMY during a quarter by the maximum number of the incident measure for the MMY over the sample period.
#SINJURED	The standardized *#INJURED* obtained by dividing number of injuries for the MMY during a quarter by the maximum number of the injury measure for the MMY over the sample period.
#SCRASH	The standardized *#CRASH* obtained by dividing number of crashes for the MMY during a quarter by the maximum number of the crash measure for the MMY over the sample period.
#SFIRE	The standardized *#FIRE* obtained by dividing number of fires for the MMY during a quarter by the maximum number of the fire measure for the MMY over the sample period.
#SDEATH	The standardized *#DEATH* obtained by dividing number of deaths for the MMY during a quarter by the maximum number of the death measure for the MMY over the sample period.
FACTOR	The average of the five standardized complaint measures.
COMPLAINT	One of the six standardized complaint measures for the MMY obtained as of calendar quarter t.
	Recall Sample (Models 2, 3, and 4)
EXRET	Either the value-weighted excess returns over three days around the recall report or the value-weighted excess returns over three months beginning two days after the recall report date.
VSELL	The value of sell transactions (in million dollars) minus value of buy transactions (in million dollars) in the event period, 3 months ending before the recall report date.
ABVSELL	Abnormal dollar value of net insider selling in the event period, measured as the net insider selling in the event period minus the average net insider selling pre-event period, 3 months ending before the beginning of the event period, and post-event period, 3 months beginning on the recall date.
RDATE	The date report received by NHTSA.
NDEFECT	The number of potential cars affected in the recall.
#INCIDENT	The total number of incidents associated with the recall within one year period ending before the recall date.
#INJURED	The total number of injuries associated with the recall within one year period ending before the recall date.
#CRASH	The total number of crashes associated with the recall within one year period ending before the recall date.
#FIRE	The total number of fires associated with the recall within one year period ending before the recall date.
#DEATH	The total number of deaths associated with the recall within one year period ending before the recall date.
#SINCIDENT	The standardized *#INCIDENT* obtained by dividing number of incidents associated with a recall by the maximum number of incidents across all recalls for the firm in the sample period.
#SINJURED	The standardized *#INJURED* obtained by dividing number of injuries associated with a recall by the maximum number of injuries across all recalls for the firm in the sample period.
#SCRASH	The standardized *#CRASH* obtained by dividing number of crashes associated with a recall by the maximum number of crashes across all recalls for the firm in the sample period.
#SFIRE	The standardized *#FIRE* obtained by dividing number of fires associated with a recall by the maximum number of fires across all recalls for the firm in the sample period.
#SDEATH	The standardized *#DEATH* obtained by dividing number of deaths associated with a recall by the maximum number of deaths across all recalls for the firm in the sample period.
FACTOR	The average of the five standardized complaint measures.
COMPLAINT	One of the six standardized complaint measures.
LMV	The natural logarithm of market value of equity (MV) at the beginning of the year where MV is measured as stock price multiplied by number of shares outstanding at the beginning of fiscal year t end.
BM	The book-to-market ratio at the beginning of the year, measured as the book value of equity divided by the market value of equity.
MOMENTUM	The cumulative market-adjusted returns over three months ending one day prior to the beginning of a given period.

FIGURE I.

Timeline of Motor Vehicle Recall Process in the U.S.

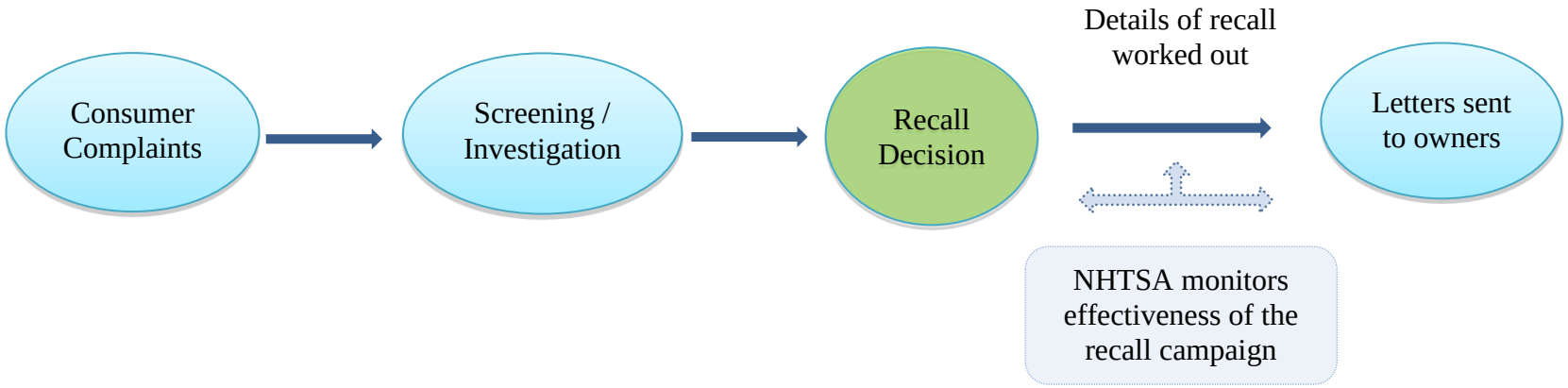

Figure I shows the timeline of the recall process in the U.S. automotive industry. NHTSA is the National Highway Traffic Safety Administration that oversees the safety recall process. When the manufacturer makes a recall decision, NHTSA concludes their investigation and they continue monitoring the effectiveness of the recall campaign. [i]

[i] Summarized from the information provided on the NHTSA official website, and the report to Congress by the U.S. Government Accountability Office. Please read the full report at: http://www.gao.gov/products/GAO-11-603

Table 1: Descriptive Statistics and Correlations

Panel A reports descriptive statistics on the customer complaints sample (N=812,290). The sample includes all Make-Model-Year observations (MMYs) with customer complain data between January 1, 1996 and December 31, 2012. Panel B reports Pearson correlations between the measures of customer complaints. Panel C reports descriptive statistics on the measures of insider trading and recall severity from the auto recall sample. The sample includes all recall announcements (N=526) with a defect report date between January 1, 1996 and December 31, 2012. Panel D reports Pearson correlations between the measures of insider trading and recall severity from the auto recall sample. *p-values* are reported under correlation coefficients.

Panel A: Descriptive Statistics for the Customer Complaints Sample

Variable	N	Mean	Q25	Median	Q75	Q90	Q99	Max
RECALL	812,290	0.013	0	0	0	0	1	1
#INCIDENT	812,290	0.734	0	0	0	1	15	455
#INJURED	812,290	0.052	0	0	0	0	2	396
#CRASH	812,290	0.053	0	0	0	0	2	99
#FIRE	812,290	0.029	0	0	0	0	1	76
#DEATH	812,290	0.004	0	0	0	0	0	120
#SINCIDENT	812,290	0.063	0	0	0.062	0.250	0.558	1
#SINJURED	812,290	0.013	0	0	0	0	0.25	1
#SCRASH	812,290	0.017	0	0	0	0	0.333	1
#SFIRE	812,290	0.011	0	0	0	0	0.25	1
#SDEATH	812,290	0.001	0	0	0	0	0	0.511

Panel B: Pearson Correlations for the Complaints Sample

	#SINCIDENT	*#SINJURED*	*#SCRASH*	*#SFIRE*	*#SDEATH*
RECALL	0.0905	0.0998	0.1022	0.0781	0.0392
	<.0001	<.0001	<.0001	<.0001	<.0001
#SINCIDENT		0.4522	0.4944	0.3760	0.1330
		<.0001	<.0001	<.0001	<.0001
#SINJURED			0.7272	0.3366	0.2201
			<.0001	<.0001	<.0001
#SCRASH				0.3244	0.2253
				<.0001	<.0001
#SFIRE					0.1425
					<.0001

Panel C: Descriptive Statistics for the Auto Recall Sample

Variable	N	Mean	Min	Q25	Median	Q75	Max
CAR[-1,+1]	526	-0.001	-0.299	-0.019	0.001	0.022	0.237
CAR[+2,+63]	526	0.029	-0.587	-0.103	-0.008	0.114	2.039
VSELL	526	0.279	-0.494	0	0	0	15.229
ABVSELL	526	-0.084	-7.614	-0.244	0	0	15.229
#TINCIDENT	526	171	0	3	25	156	1335
#TINJURED	526	16	0	0	2	15	140
#TCRASH	526	15	0	0	2	14	123
#TFIRE	526	9	0	0	1	5	112
#TDEATH	526	0.789	0	0	0	0	9
NDEFECT	526	226,208	1	1300	18,748	148,000	14,400,000
MVE ($Million)	526	34,240	1954	20658	30011	45024	70,953
BTM	526	-0.008	-44.101	0.330	0.428	0.526	1.329
MOMENTUM	526	0.002	-0.450	-0.115	-0.022	0.0937753	1.657

Panel D: Spearman Correlations for the Auto Recall Sample

	CAR[2,63]	*ABVSELL*	*#SINCIDENT*	*#SINJURED*	*#SCRASH*	*#SFIRE*	*#SDEATH*	*FACTOR*	*LnDEFECT*
CAR[-1,1]	0.046	0.037	0.018	0.016	0.013	0.016	-0.037	0.018	-0.012
	0.292	0.393	0.677	0.719	0.760	0.717	0.398	0.676	0.779
CAR[2,63]		0.001	-0.092	-0.108	-0.077	-0.060	-0.025	-0.095	-0.131
		0.976	0.035	0.013	0.076	0.172	0.570	0.029	0.003
ABVSELL			0.091	0.106	0.095	0.071	0.046	0.099	0.027
			0.036	0.015	0.029	0.101	0.296	0.023	0.545
#SINCIDENT				0.919	0.934	0.861	0.623	0.980	0.674
				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
#SINJURED					0.951	0.848	0.666	0.951	0.626
					<0.001	<0.001	<0.001	<0.001	<0.001
#SCRASH						0.833	0.654	0.957	0.647
						<0.001	<0.001	<0.001	<0.001
#SFIRE							0.617	0.878	0.582
							<0.001	<0.001	<0.001
#SDEATH								0.679	0.403
								<0.001	<0.001
FACTOR									0.663
									<0.001

Table 2: Customer Complaints and Product Recalls

Table 2 reports coefficients estimates for all MMYs from the following regression model:

$$Pr\ (RECALL_{i,t+1}) = \alpha_0 + \alpha_1 COMPLAINT_{i,t} + \varepsilon \qquad (1)$$

where *RECALL* is an indicator variable which equals one if there is a recall for a Make-Model-Year (MMY) in calendar quarter t+1, and zero otherwise. *COMPLAINT* is one of the six standardized complaint measures (*#SINCIDENT, # SINJURED, # SCRASH, # SFIRE, # SDEATH, and FACTOR*) for the MMY obtained as of calendar quarter t. Panel A reports the results for all MMYs while Panel B reports the results for the sample restricted to MMYs from four automakers with returns and insider trading information. Appendix provides detailed description on the construction of each complaint measure. p-values are reported in parentheses. *, **, and *** indicate significance at the 10, 5, and 1 percent level, respectively.

Panel A: All Make-Model-Year Observations

	#SINCIDENT	*#SINJURED*	*#SCRASH*	*#SFIRE*	*#SDEATH*	*FACTOR*
INTERCEPT	-2.382	-2.298	-2.148	-2.283	-2.246	-2.386
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
COMPLAINT	1.484	2.381	2.184	2.213	2.893	4.035
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
FIRM FE	INCLUDED					
Adj.R2	0.04	0.028	0.033	0.021	0.005	0.053
Observations	812,290	812,290	812,290	812,290	812,290	812,290

Panel B: Make-Model-Year Observations with Insider Trading Data

	#SINCIDENT	*#SINJURED*	*#SCRASH*	*#SFIRE*	*#SDEATH*	*FACTOR*
INTERCEPT	-2.294	-2.211	-2.223	-2.199	-2.167	-2.285
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
COMPLAINT	1.308	2.055	1.845	1.909	2.516	3.444
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
FIRM FE	INCLUDED					
Adj. R^2	0.039	0.027	0.032	0.025	0.009	0.049
Observations	317,100	317,100	317,100	317,100	317,100	317,100

Table 3: Customer Complaints and Stock Returns around Auto Recalls

Table 3 reports coefficients estimates for all recall announcements (N=526) from the following regression model:

$$CAR[t_1,t_2] = \beta_0 + \beta_1 COMPLAINT + \beta_2 DMV + \beta_3 DBM + \beta_4 DMOMENTUM + \varepsilon \quad (2)$$

In Panel A (Panel B) the dependent variable is cumulative abnormal returns (raw return minus CRSP value-weighted index return) over the [+2,+63] ([-1,+1]) trading window relative to a recall announcement. *COMPLAINT* is one of the six standardized complaint measures *(#SINCIDENT, # SINJURED, # SCRASH, # SFIRE, # SDEATH, and FACTOR*). We sort *MV, BM*, and *MOMENTUM* into decile ranks separately for each firm and then standardize to range between zero and one for the firm. Appendix provides detailed description on the construction of each variable. t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10, 5, and 1 percent level, respectively.

Panel A: Long-Window Stock Returns

	Dependent Variable: CAR[+2,+63]					
	#SINCIDENT	*#SINJURED*	*#SCRASH*	*#SFIRE*	*#SDEATH*	*FACTOR*
INTERCEPT	0.040	0.037	0.036	0.035	0.030	0.038
	(0.74)	(0.70)	(0.68)	(0.66)	(0.57)	(0.70)
COMPLAINT	-0.097 **	-0.099 **	-0.093 **	-0.107 **	-0.067 *	-0.104 **
	(-2.47)	(-2.45)	(-2.39)	(-2.43)	(-1.90)	(-2.41)
DMV	-0.090 **	-0.090 **	-0.090 **	-0.094 **	-0.087 **	-0.092 **
	(-2.10)	(-2.09)	(-2.09)	(-2.15)	(-2.03)	(-2.11)
DBM	0.026	0.028	0.029	0.026	0.028	0.029
	(0.68)	(0.75)	(0.78)	(0.70)	(0.76)	(0.77)
DMOMENTUM	-0.117***	-0.117***	-0.116***	-0.117***	-0.116***	-0.117***
	(-3.10)	(-3.11)	(-3.10)	(-3.10)	(-3.08)	(-3.11)
Firm FE	INCLUDED					
Adj. R^2	0.062	0.061	0.061	0.063	0.057	0.062
Observations	526	526	526	526	526	526

Panel B: Short-Window Stock Returns

	Dependent Variable: CAR[-1,+1]					
	#SINCIDENT	*#SINJURED*	*#SCRASH*	*#SFIRE*	*#SDEATH*	*FACTOR*
INTERCEPT	-0.026***	-0.026***	-0.027***	-0.027***	-0.026***	-0.026***
	(-2.82)	(-2.83)	(-2.84)	(-2.84)	(-2.75)	(-2.84)
COMPLAINT	0.005	0.005	0.007	0.008	0.003	0.006
	(0.45)	(0.40)	(0.54)	(0.62)	(0.25)	(0.46)
DMV	0.016 **	0.016 **	0.016 **	0.016 **	0.016 **	0.016 **
	(2.17)	(2.18)	(2.20)	(2.27)	(2.15)	(2.21)
DBM	0.015 **	0.015 **	0.015 **	0.015 **	0.015 **	0.015 **
	(2.07)	(2.01)	(1.97)	(2.03)	(1.97)	(1.99)
DMOMENTUM	0.015 **	0.015 **	0.015 **	0.015 **	0.015 **	0.015 **
	(2.40)	(2.42)	(2.42)	(2.44)	(2.40)	(2.42)
Firm FE	INCLUDED					
Adj. R^2	0.036	0.036	0.037	0.037	0.036	0.037
Observations	526	526	526	526	526	526

Table 4: Insider Trading and Customer Complaints

Table 4 reports coefficients estimates for all recall announcements (N=526) from the following regression model:

$$ABVSELL = \beta_0 + \beta_1 COMPLAINT + \beta_2 DMV + \beta_3 DBM + \beta_4 DMOMENTUM + \varepsilon \quad (3)$$

where *ABVSELL* is abnormal dollar value of net insider selling over 3 months ending before the recall report date. *COMPLAINT* is one of the six standardized complaint measures (*#SINCIDENT, # SINJURED, # SCRASH, # SFIRE, # SDEATH, and FACTOR*). We sort *MV, BM,* and *MOMENTUM* into decile ranks separately for each firm and then standardize to range between zero and one for the firm. Appendix provides detailed description on the construction of each variable. t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10, 5, and 1 percent level, respectively.

	Dependent Variable: ABVSELL					
	#SINCIDENT	*#SINJURED*	*#SCRASH*	*#SFIRE*	*#SDEATH*	*FACTOR*
INTERCEPT	-0.245**	-0.168	-0.167	-0.165	-0.128	-0.242*
	(-1.98)	(-1.23)	(-1.23)	(-1.20)	(-0.91)	(-1.95)
COMPLAINT	0.653**	0.306*	0.300*	0.346**	0.065	0.545**
	(2.22)	(1.74)	(1.80)	(1.96)	(0.50)	(2.49)
DMV	0.004	-0.037	-0.034	-0.022	-0.063	-0.032
	(0.03)	(-0.28)	(-0.26)	(-0.16)	(-0.49)	(-0.23)
DBM	0.401	0.410	0.406	0.414	0.424	0.360
	(1.47)	(1.54)	(1.52)	(1.54)	(1.60)	(1.31)
DMOMENTUM	-0.630***	-0.647***	-0.650***	-0.647***	-0.661***	-0.611***
	(-2.78)	(-2.85)	(-2.86)	(-2.84)	(-2.89)	(-2.73)
FIRM FE			INCLUDED			
Adj. R2	0.016	0.008	0.008	0.009	0.007	0.020
Observations	526	526	526	526	526	526

Table 5: Customer Complaints and Severity of Recalls

Table 5 reports coefficients estimates for all recall announcements (N=526) from the following regression model:

$$Ln(NDEFECT)_{i,t+1} = \alpha_0 + \alpha_1 COMPLAINT_{i,t} + \varepsilon \quad (4)$$

where *Ln(NDEFECT)* is the logarithm of number of potential cars affected in the recall. *COMPLAINT* is one of the six standardized complaint measures (*#SINCIDENT, # SINJURED, # SCRASH, # SFIRE, # SDEATH, and FACTOR*) and calculated as defined in Appendix. t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10, 5, and 1 percent level, respectively.

	Dependent Variable: LnNDEFECT					
	#SINCIDENT	*#SINJURED*	*#SCRASH*	*#SFIRE*	*#SDEATH*	*FACTOR*
INTERCEPT	9.084***	9.173***	9.140***	9.497***	9.346***	9.177***
	(37.65)	(37.92)	(37.76)	(37.56)	(38.07)	(38.09)
COMPLAINT	4.983***	4.900***	4.830***	4.113***	3.879***	5.133***
	(9.94)	(9.22)	(9.36)	(7.87)	(8.59)	(9.09)
FIRM FE			INCLUDED			
Adj. R^2	0.177	0.157	0.161	0.110	0.114	0.160
Observations	526	526	526	526	526	526