Lesson from stock price crash: The impact of crash risk experience on CEO and firm

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Abstract

The experience of chief executive officers (CEOs) and firms is associated with their subsequent decisions. This paper examines the consequences of stock price crash risk using a sample of U.S. public firm-year observations. We find that stock price crash risk subsequently reduces managerial confidence levels proxied by CEO's option-based and earnings call transcript's text-based measures. In addition, firms that experience a high crash risk seek to adjust their CEO compensation structure by reducing total payment, bonus, and stock options. Such firms also tend to replace their CEOs, typically with less-confident ones. Furthermore, we find that CEOs with high confidence levels reduce investment to enhance shareholder value after their crash experience. Overall, both CEOs and firms appear to learn from their crash risk experiences, suggesting that experience-driven conservatism from the crash risk influences CEO and corporate decisions.

Keywords: Stock price crash risk, Managerial confidence, Textual analysis, CEO experience

JEL Classification: G30, G41

1. Introduction

The firm's managers have an incentive to withhold bad information from the investors, called as bad news hoarding (Graham et al., 2005; Kothari et al., 2009). However, they cannot continue to do so for a substantial period of time. If such information is revealed in the market, it leads to a significant change of investors' expectations about the future prospects of the firm and can lead to a crash of the firms' stock price (Hutton et al., 2009; Jin and Myers, 2006). The literature posits this manifestation as stock price crashes and provides empirical evidence about the relationship between managerial traits and crash risk. For instance, Kim et al. (2016) suggest that managerial confidence induces a higher crash risk, as such confident managers who have bullish views on their firms' future performance, are more likely to fail to disclose negative information in a timely manner.

A number of natural questions arises in the above context. First, if CEOs experience a significant crash risk of their firm's stock price, would they still retain their managerial confidence? Meanwhile, would the firm discipline their CEO after a high crash risk experience? As CEO is generally the most responsible for the firm's management, it might be necessary to avoid potential future crashes from the firm's perspective. With this regard, the second question is that, would the firm after a high crash risk experience seek to adjust their CEO's compensation? Finally, would such the firm change their CEO? In particular, would they still prefer to hire a confident one again? Although a large number of prior studies has examined stock price crash risk's determinants, its impact is far less clear. Habib et al. (2018) also highlight a scarceness of research for the consequence of firms' stock price crash risk. This paper thus seeks to contribute to the literature by adding new evidence on the consequences of stock price crash risk.

According to a large body of literature, an impactful experience for a CEO can influence their decision-making in corporate policy (e.g., Bernile et al., 2017; Bertrand and Schoar, 2003; Billett and Qian, 2008; Custódio et al., 2013; Dittmar and Duchin, 2016; Kolasinski and Li, 2013; Lewis et al.,

2014). Extending this view, our study focuses on a high stock price crash risk as an impactful experience for a CEO (or a firm). Thus, we hypothesize the aforementioned questions, which are the impact of stock price crash risk on CEO and corporate decisions.

We explore the consequences of stock price crash risk using a sample from the U.S. between 1993 and 2018. To assess a firm's stock price crash risk, we follow the methodologies of prior literature (Chen et al., 2001; Hutton et al., 2009; Kim et al., 2011). First, we find that stock price crash risk negatively affects managerial confidence levels, proxied by the CEO's option-based and the firm's earnings conference call text-based measures. Specifically, in addition to a conventional sentiment text-based measure, we introduce a new measure of managerial confidence, whereas the option-based confidence measure has been widely used in the CEO literature (e.g., Campbell et al., 2011). This finding suggests that CEOs may learn from their experience observing a high crash risk, and thus, they tend to revise their optimistic belief about the firm's prospects, resulting in lower confidence measures.

Second, we examine whether firms seek to adjust their CEO's compensation structure after their high crash risk experience. We find that they subsequently reduce their CEO's total pay, indicating a possible punishment for the crash risk, and this appears to be driven by decrease in CEO's bonus and option-based pay. Prior studies argue that CEO compensation structure, such as option-based pay, is associated with their bad news hoarding (Chen et al., 2021; Kim et al., 2011). Thus, our result is viewed as the effort that the firm convinces the CEO to behave in a way that avoids future crashes, further indicating the lesson from the firm's crash risk experience.

Third, we analyze the likelihood of CEO turnover. As we expected, a firm's high crash risk experience is strongly and positively associated with the turnover of their CEO. More importantly, we provide evidence that their CEO hiring practices are also affected, similar to the argument in Banerjee et al. (2018). Using a cross-sectional sample of the CEO turnover, we find that the firm prefers to hire a less-confident CEO, compared to the departing CEO, after their high crash risk experience. Therefore,

we repeatedly argue that the firm learns from their crash risk experience in this way as they seek to prevent future stock price crashes.

Furthermore, this paper performs the additional analyses to address potential endogeneity concerns as follows: First, we show that our results are not driven by the firm's poor performance, ruling out an alternative explanation. Second, we re-estimate our previous regressions with the firm fixed effects, whereas our main analysis basically controls for the industry level. Third, we employ the propensity score matching technique and construct the matched sample. Our results are generally robust to after controlling for the firm fixed effects or the matching process. Fourth, we construct residual and predicted value of stock price crash risk to capture the portion that does not explained by several firm and CEO characteristics (that we include as the control variables). We still find that the results using residual crash risk generally remain.

As a final empirical test in this paper, we extend our main conjecture to the relationship between managerial confidence and corporate investment (also, the value of investment). Interestingly, we find that, if CEOs with a high confidence have experienced their firm's stock price crash during their tenure at that firm, they subsequently reduce investment compared to the pre-crash period, indicating that the overinvestment tendency by managerial confidence is mitigated after stock price crash. We further find that the value of the investment by confident CEOs is also improved for the post-crash period, while it is significantly lower in the pre-crash period. These results indicate that the CEO's lesson from their crash experience and thus, leads them to enhance shareholder value by moderating their overinvestment that might be relatively wasteful spending.

This paper contributes to the literature in several ways. First, our study is in line with the call of Habib et al. (2018) that emphasizes a necessity for more research about the consequences of stock price crash risk, further contributing to the finance and accounting literature on stock price crash risk (Hutton et al., 2009; Kim et al., 2016). Second, we add empirical evidence to the literature on

managerial confidence (Campbell et al., 2011; Malmendier and Tate, 2005). To the best of our knowledge, this study is the first attempt to examine the impact of stock price crash risk on CEO and corporate decisions, such as managerial confidence and the related CEO hiring practices. Third, we introduce a new measure of managerial confidence, text-based confident tone in the firm's earnings calls, in addition to the CEO's option-based measure and a conventional sentiment tone. Thus, our study adds to not only the literature exploring alternative managerial confidence measures, such as media-based one (Hirshleifer et al., 2012; Malmendier and Tate, 2008), but also the recent studies for the application of textual analysis in finance (e.g., Davis et al., 2015; Loughran and McDonald, 2011). Finally, our study argues that facing firm's stock price crash (or a high crash risk) can be an impactful experience for both the CEO and firm as they learn from their crash risk experience. Thus, we also contribute to the behavioral corporate finance literature focusing on experience-driven traits, such as conservatism (e.g., Dittmar and Duchin, 2016; Faulkner and García-Feijóo, 2022).

The remainder of this paper is organized as follows: Section 2 reviews related literature and develops the hypotheses. Section 3 describes our data and sample selection. Section 4 presents our empirical analysis that examines the impact of stock price crash risk on CEO and corporate decisions. Section 5 discusses additional analyses including tests addressing alternative explanations of the results. Section 6 finally concludes the paper.

2. Literature review and hypotheses development

2.1. The impact of CEO's prior experiences

The literature posits that a CEO's characteristics, personality traits, and lifetime experience influence corporate policies (see, e.g., Bertrand and Schoar, 2003; Custódio et al., 2013; Dittmar and Duchin, 2016; Lewis et al., 2014). In particular, the effect an impactful experience can have on a CEO's decision-making behavior is evident in prior studies. For instance, their education (Malmendier and

Tate, 2005), early-life exposure to natural disasters (Bernile et al., 2017), early-life experiences such as of the Great Depression and military services (Malmendier et al., 2011), prior work experience such as being a financial expert, and general managerial skills (Custódio et al., 2013; Custódio and Metzger, 2014).

However, beyond the aforementioned CEO's early-life, early-career, or education experiences, we expect that a CEO's relatively recent experience can also shape their managerial traits. There is some literature highlighting the effect a CEO's recent experience may have on their traits and decision-making, such as managerial confidence. On the one hand, Billett and Qian (2008) suggest that a CEO's positive experience from their previous acquisitions leads them to become more confident. As a result, such CEOs tend to make more frequent acquisitions, but the subsequent acquisitions are value-destroying on average. The evidence in Billett and Qian (2008) is generally consistent with the argument that managerial confidence can lead to over-acquisitions, thereby destroying shareholder value (Malmendier and Tate, 2008).

On the other hand, Kolasinski and Li (2013) argue that a CEO's negative experience may lead them to be less-confident. In their study, managerial confidence positively influences acquisition decisions, which is also consistent with the findings by Malmendier and Tate (2008). However, the authors find that, after a CEO experiences inside trading losses at their current firm, such (over)confident CEOs become less acquisitive on average, indicating less-confidence.[1] This implies that CEOs learn from their negative experiences, and then cautiously decide on future acquisitions. The results in Kolasinski and Li (2013) also show that acquisitions by CEOs with such trading-loss experiences no longer tend to be value-destroying, indicating the consequences of more cautious (and

[1] Kolasinski and Li (2013) define a CEO as being "overconfident" ("postoverconfident" or "once-overconfident") if they make insider purchases and then loses money on them on average within the next (past) two years. The authors then find a positive effect of "overconfidence," but a negative one of "postoverconfidence" on the firm's likelihood of acquisition.

better) acquisitions by post-learned CEOs.

Banerjee et al. (2018) focus on the firm's litigation experience (specifically, securities class actions). The authors find that executive confidence leads to higher litigation risk, but its impact on the future litigation risk is reduced for firms that have previously been sued. Hence, the authors argue that an impactful event, such as litigation experience, can make confident managers question the validity of their over-optimistic beliefs. Moreover, Faulkner and García-Feijóo (2022) recently suggest hot-stove effects in the corporation that the CEO's past corporate distress experiences in their career make them more conservative, and thus, result in the change of their firm's payout policy.

Facing the firm's stock price crash (or a high crash risk) can be an impactful experience for both the CEO and firm, and thus, it might lead them to modify their decision-makings. Extending this line of thought, we expect the significant changes in CEO and corporate decisions, such as managerial confidence, CEO compensation, and CEO turnover, after they observe a high stock price crash risk. While a large body of prior studies on stock price crash risk has investigated its determinants,[2] the potential consequences of stock price crash risk are relatively less clear, as noted in Habib et al. (2018). Therefore, our study seeks to contribute to the literature by adding new evidence on the consequence of stock price crash risk. Similar to our research motivation, Harper et al. (2020) find that the power of CEOs becomes weaker after their firm's high stock price crash risk.

2.2. Consequences after a high stock price crash risk

This paper develops empirically testable hypotheses to explore the consequences of stock price crash risk. We first focus on the CEO's option exercising, which generally depends on their own decision. Malmendier and Tate (2005) suggest that both the CEO's personal wealth and career concern

[2] For the review for determinants of a stock price crash, see, Habib et al. (2018).

are bounded to the firm. In addition, as we stated in previous subsection, the CEO's prior experience can affect their decision-making in several aspects. For instance, CEOs who observe a high crash risk of their firm's stock price may be concerned about their career, and thus question the validity of their managerial style.

We also aim to adopt textual analysis to alternatively measure managerial confidence. As suggested by Davis et al. (2015), tone of the firm's earnings conference calls is not fully explained by current and future performance. Instead, the authors suggest that manager-specific factors, such as optimistic (or pessimistic), are significantly associated. Following this logic, we argue that observing a high crash risk may lead managers to be more cautious, and thus, negatively affects managerial confidence proxied by tone of the subsequent earnings conference calls. Overall, from the CEO's perspective, such an impactful experience can affect their managerial confidence regarding their option exercising and the earnings calls' tone.

Similar to our expectation, Banerjee et al. (2018) find that a CEO's confidence level (proxied by option-based measure) decreases after their firm's litigation experience. In other words, a CEO may learn from an impactful shock. Collectively, learning from the high crash risk experience can make a CEO more cautious and conservative, thereby resulting in less-confident. We state the following hypothesis as the first possible consequence:

H1. *A high stock price crash risk reduces managerial confidence level.*

To align the interests of shareholders and management, the executive compensation structure plays a significant role (Jensen and Meckling, 1976). In particular, Kim et al. (2011) find that the executive's equity incentives, typically from stock options, induce their bad news hoarding behavior and eventually lead to a higher stock price crash risk. Shareholders (or the board) who observe such a high crash risk may realize that their CEO's compensation is suboptimal in terms of the crash risk.

Therefore, to prevent future crashes, such a post-crash firm may adjust its CEO compensation structure, such as reducing option-based payment.

Consistent with this line of thought, Kamiya et al. (2021) recently find that firms are likely to adjust their CEO compensation structure after they experience a cyber-attack (which is an impactful shock in their study). As a result, the authors suggest that the firms may learn from an actual shock, and they seek to prevent the future one. If we assume that the firm's high stock price crash risk is an impactful shock, we expect the following hypothesis as the second consequence from the firm's perspective:

H2. *Firms that experience a high stock price crash risk seek to adjust their CEO compensation.*

Prior literature posits that the key mechanism of stock price crashes is a firm's faulty information management, particularly, bad news hoarding (Hutton et al., 2009; Jin and Myers, 2006). Since releasing accumulated bad news affects the stock market investors' prospects (thus, a crash of stock price occurs), the high crash risk may indicate not only a fall in value but also a loss of trust in the stock market. In addition, it can worsen future access to capital. Although such a loss of trust is difficult to recover in a short period of time, existing shareholders (or the board) of the firm are likely to send a signal of their willingness to recover the firm's trust in the stock market. From such a post-crash firm's perspective, one possible way to quickly send this signal could be a replacement of the current CEO who was responsible for that high crash risk. If the firm seeks to replace its current CEO, then CEO may perceive the threat of turnover after observing a high stock price crash risk, also possibly promoting a CEO to modify their behavior to preserve their careers.

Furthermore, note that after the firm's high crash risk experience, they may seek to effectively prevent their future stock price crashes by ameliorating their CEO hiring decisions. For instance, after observing a high crash risk, a firm may realize the fact that managerial confidence induces bad news

hoarding, leading to a higher crash risk. Therefore, if such post-crash experienced firms decide to replace their CEO, they may prefer less-confident individuals as their new CEO compared to the prior one. Collectively, we expect the following H3 as the possible consequence of stock price crash risk:

H3*. Firms that experience a high stock price crash risk are more likely to turnover their CEOs, and they prefer to hire a less-confident CEO.*

3. Data

3.1. Stock price crash risk

In this study, we calculate three measures of stock price crash risk, as suggested in the literature (Chen et al., 2001; Kim et al., 2011). Specifically, we employ the negative conditional firm-specific return skewness (*NCSKEW*) and down-to-up volatility (*DUVOL*). We first estimate the firm-specific weekly returns for each firm and each year using the following expanded market model regression:

$$r_{i,\tau} = \beta_{0i} + \beta_{1i} r_{m,\tau-2} + \beta_{2i} r_{m,\tau-1} + \beta_{3i} r_{m,t} + \beta_{4i} r_{m,\tau+1} + \beta_{5i} r_{m,\tau+2} + \varepsilon_{i,\tau} \quad (1)$$

where $r_{i,\tau}$ is the return on the firm (stock) i in week τ, and m denotes the value-weighted market index from the Center for Research in Security Prices (CRSP). Then, we derive the firm-specific weekly return ($W_{i,\tau}$) by taking the natural logarithm of one plus the residual return ($\varepsilon_{i,\tau}$).

First, we calculate *NCSKEW* as the negative of the ratio of the third moment of firm-specific weekly returns normalized by the standard deviation of firm-specific weekly daily returns raised to the third power (Chen et al., 2001). In sum, the following equation describes *NCSKEW* for each firm i in year t (n is the number of weekly returns for each firm i in year t):

$$NCSKEW_{i,t} = \frac{-[n(n-1)^{\frac{3}{2}} \sum W_{i,\tau}^3]}{(n-1)(n-2)(\sum W_{i,\tau}^2)^{3/2}} \quad (2)$$

Second, to calculate *DUVOL*, we separate all the weeks with firm-specific weekly returns

below the annual average as "down" weeks and those above the annual average as "up" weeks. n_{UP} and n_{DOWN} refer to the number of "up" weeks and "down" weeks for firm *i* during year *t*, respectively. *DUVOL* is the natural logarithm of the ratio of the standard deviation of firm-specific weekly returns over down weeks to its standard deviation over up weeks (Chen et al., 2001). A higher *DUVOL* implicates more left-skewed weekly return distribution, which corresponds to the higher crash risk. In sum, the following equation describes *DUVOL* for each firm *i* in year *t*:

$$DUVOL_{i,t} = \log\left[\frac{(n_{UP}-1)\sum_{DOWN} W_{i,\tau}^2}{(n_{DOWN}-1)\sum_{UP} W_{i,\tau}^2}\right] \quad (3)$$

Third, we identify crash weeks in a given fiscal year *t* for a given firm *i* as firm-specific weekly returns that fall more than 3.20 standard deviations below the mean firm-specific weekly returns over the entire fiscal year following Hutton et al. (2009) and Kim et al. (2011). We then construct an indicator for such an extreme crash of the firm's stock price (*CRASH*), which equals one for a firm-year observation that has at least one crash week during the fiscal year and zero otherwise.

3.2. Managerial confidence

We use two measures of managerial confidence. First, we focus on the CEO's option-based continuous measure. The literature posits that rational managers would sufficiently exercise their options in moneyness under the assumption that their personal wealth is less-diversified (e.g., Hirshleifer et al., 2012; Malmendier and Tate, 2005). Specifically, we follow Campbell et al. (2011) to compute the average moneyness of the CEO's option for each year. The average realized value per option is the total value of the CEO's exercisable option holdings divided by the number of the CEO's exercisable option holdings. The average exercise price is the firm's stock price at the end of the fiscal year less the average realized value per option. Finally, we calculate average moneyness as the firm's

stock price divided by the average exercise price minus one, *CEO confidence* (Banerjee et al., 2015).[3]

Second, we propose a new text-based measure of managerial confidence using the firm's earnings conference call. More specifically, our measure, *Confident tone*, is calculated as the percentage of the difference between confident and pessimistic words in the transcript. To do this, we first count all the total number of words from the transcript of earnings call,[4] as suggested by the finance literature on the textual application, such as sentiment analysis (e.g., Loughran and McDonald, 2011; 2014). Next, following the logic of Hasan et al. (2019), we manually obtain the list of synonyms for confident words: "confident," "confidence," "overconfidence," "overconfident," "optimistic," "optimism," "overoptimistic," and "overoptimism," and the list of pessimistic words: "pessimistic," "pessimism," "overpessimistic," "overpessimism," "reliable," "steady," "practical," "conservative," "frugal," "cautious," and "gloomy." from the Oxford English Dictionary. Note that these words are used in the literature on media-based managerial confidence (Hirshleifer et al., 2012; Malmendier and Tate, 2008). As a result, the list of confident or pessimistic synonyms contains various adjectives (including all the words that we have described above).[5] Matching the transcript's words to this list of confident or pessimistic synonyms, we then count the number of such confident or pessimistic words.[6]

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[3] We also identify an overconfident CEO if a CEO holds vested options that are above 67% moneyness at least twice in the sample period, as suggested by the literature (Campbell et al., 2011; Malmendier and Tate, 2005). We then set this indicator for overconfident CEOs*, Holder67*, to one from the first time the CEO exhibits such a behavior, and otherwise zero (e.g., Banerjee et al., 2018).

[4] The firm's earnings conference call usually begins with a managers' presentation by providing information they wish to disclose or further highlight and follows by a question-and-answer (Q&A) session with participants, such as analysts. In this paper, we construct our text-based measure of managerial confidence based on the entire conference call's transcript, as suggested by the related literature (e.g., Hasan et al., 2019).

[5] For example, "sanguine," "convinced," and "assured" are classified as synonyms for confident words, and "downbeat," "depressed," and "hopeless" are classified as synonyms for pessimistic words.

[6] We also consider all bigrams (i.e., two-continuous-words) in the call transcript, and check whether a bigram in which confident synonyms are negated; for example, "not confident" or "no confidence." As suggested by Hirshleifer et al. (2012), we classify such bigrams as pessimistic words.

We also construct a conventional text-based measure, *Positive tone*, the percentage of the difference between positive and negative words, using Loughran and McDonald's (2011) sentiment dictionary.[7] This measure has been widely adopted in the literature using the textual analysis (e.g., Davis et al., 2015; Marquez-Illescas et al., 2019). Furthermore, we construct a complexity of earnings call, defined as the percentage of words with more than two syllables (Loughran and McDonald, 2011). Since firms host their earnings conference call every fiscal quarter, there are approximately four observations per firm per year. Thus, we take the average value during the fiscal year.

3.3. Sample selection

We obtain financial information, stock price data, and CEO related information from various databases (Compustat, CRSP, Thomson 13F, and Execucomp) during 1993–2018. We exclude firms in regulated industries (i.e., utilities and financial industries), which are Standard Industrial Classification (SIC) code 4900–4999 and 6000–6999. Specifically, for our primary variables, we measure stock price crash risk and managerial confidence from CRSP and Execucomp, respectively. We also collect firms' transcripts of their earnings conference call between 2002 and 2018 from Thomson Reuters StreetEvents.

We control for a set of variables that might affect CEO and corporate decisions, such as managerial confidence and management compensation. In terms of firm characteristics, we include firm size (*SIZE*), the market-to-book ratio (*MTB*), leverage (*LEV*), return on assets (*ROA*), tangibility (*PPE*), and the research and development expense (*RD*). In addition, we consider industry competitiveness (*HHI*), by calculating the sum of the squares of market share within the industry. We also include the institutional ownership (*INST OWNERSHIP*) from Thomson 13F. To capture

[7] We use Loughran and McDonald's (2011) dictionary based on the text data from 1993 to 2021. Their dictionary is updated in January 2022 (https://sraf.nd.edu/loughranmcdonald-master-dictionary/).

differences of opinion among investors, we control for the detrended stock trading volume (*DTURNOVER*). The firm's stock return volatility (*SIGMA*) and average return (*RET*) are also included. Furthermore, we control for the firm's financial reporting opacity measure (*OPAQUE*) and its square term (*OPAQUE SQUARE*), as suggested by prior studies related to stock price crash risk (Chen et al., 2001; Hutton et al., 2009).

For the CEO level, we control for several characteristics that the extant literature shows to affect managerial decision-making. We include the CEO's total compensation (*CEO TOTALPAY*), ownership (*CEO OWNERSHIP*), and their tenure at the firm and age (*CEO TENURE* and *AGE*). Finally, we construct an indicator of CEOs who are also the chair of the board (*CEO-CHAIRMAN*) from Execucomp, which can control for the potential effect of CEO power (Al Mamun et al., 2020).

Table 1 presents the summary for our primary sample, such as descriptive statistics and pairwise correlations between stock price crash risk and confidence measures. Detailed definitions of variables are in Appendix. All the continuous variables are winsorized at the 1st and 99th levels, to avoid the potential impact of outliers. As illustrated in the correlation matrix, stock price crash risk measures, *NCSKEW*, *DUVOL*, and *CRASH*, are strongly (and positively) correlated. Furthermore, the conventional option-based measure (*CEO confidence*), our text-based measure (*Confident tone*), and a widely-used sentiment measure (*Positive tone*) are also positively correlated, supporting the validity of our measurement of managerial confidence.

[Insert Table 1 here]

4. Results

4.1. Stock price crash risk and managerial confidence

We perform the multivariate test for H1 using *NCSKEW*, *DUVOL*, and *CRASH* as the measure

of stock price crash risk. In Table 2 (and subsequent tables), we basically control for fiscal year and SIC two-digit industry fixed effects,[8] to consider potential effects from the year- and industry-specific time-invariant characteristics as in Banerjee et al. (2018). All the independent variables in the multivariate regressions are one-year lagged. To examine the impact of stock price crash risk on the change in managerial confidence for the same CEO, we exclude firm-year observations with CEO turnovers (at the year *t*).[9]

Table 2 reports the results, and we find that the firm's stock price crash risk negatively affects their CEO's subsequent confidence level. Controlling for the lagged value of *CEO confidence* in Models (4)–(6), we still find the same results. We suggest that, after CEOs observe a high stock price crash risk (which is caused by their bad news hoarding), they tend to reduce their confidence level, also indicating that the CEO's experience facing a high crash risk could be an influential shock. In addition, this result is consistent with Banerjee et al. (2018) that the firm's lawsuit experience negatively impacts the CEO's (option-based) confidence.

Although a large body of the literature uses the CEO's option-based measure for managerial confidence, we adopt an alternative approach using text-based measures. Specifically, Davis et al. (2015) show that tone of the firm's earnings conference calls is not fully explained by their performance; instead, it depends on manager-specific optimism. Following this logic, we construct our new measure, *Confident tone*, and examine the impact of stock price crash risk on it. We also use the conventional measure, *Positive tone*, from the Loughran and McDonald's (2011) dictionary, as in the most literature on textual tone (e.g., Marquez-Illescas et al., 2019).

Table 3 reports the results using the text-based measures. Panel A shows that stock price crash risk negatively affects both *Confident tone* and *Positive tone*, further supporting our H1. In addition,

[8] We check whether our results are robust to controlling for the firm fixed effects in Section 5.2.

[9] We obtain qualitatively similar results (unreported) if we include observations with CEO turnovers.

we examine whether stock price crash risk merely affects the complexity or the total lengths of speech in the firm's conference calls because of the following two reasons. First, after a high stock price crash risk, the firm's managers may use more complex (or ambiguous) words in the whole speech. Second, they may explain more information in the conference calls, increasing the total number of words. The larger the total words, the lower the tone measure as it is the percentage of the total number of words. In Panel B, we examine these possibilities that might affect our Panel A's results and find no impact of stock price crash risk.

[Insert Tables 2 and 3 here]

4.2. Impact on CEO compensation

The second hypothesis (H2) that we propose is about CEO compensation structure. In addition to considering the CEO's total compensation, we decompose it into, bonus, salary, and equity-based compensation. Note that equity-based compensation is further divided into option- and stock-based pay. To examine the impact of stock price crash risk on the change in CEO compensation more accurately (i.e., for the same CEO), we focus on the non-turnover sample in Table 4.

In Models (1)–(3) of Panel A, we find that the firm's stock price crash risk leads to a drop in their CEO's subsequent total compensation. This suggests that shareholders (or the board) of the firm with a high crash risk experience hold their CEO responsible for that, and thus give them a punishment by reducing the total payment.

Prior studies posit that CEO's equity incentives, more specifically, option-based pay could encourage more bad news hoarding and thus a higher stock price crash risk (Chen et al., 2021; Kim et al., 2011). Thus, it is possible that the firm with a high crash risk experience would decrease the CEO's incentive to take a high-risk behavior, such as bad news hoarding.

Consistent with this line of thought, in Models (4)–(6) of Panels A and B, we find that the coefficients of stock price crash risk (i.e., *NCSKEW*, *DUVOL*, and *CRASH*) are negatively estimated on the CEO's bonus and option-based pay, indicating evidence that a firm with the prior year's high crash risk seeks to prevent a future crash by adjusting their CEO's compensation structure, particularly on CEO bonus and option-based pay. Furthermore, it suggests that the abovementioned punishment is mainly driven by the reduction of those components.

Overall, we argue that our findings in Table 4 indicate the firm's learning in compensation practice toward its CEO from the high crash risk experience. We also note that the results in Table 4 remain qualitatively unchanged if we replace the dependent variables with the ratios scaled by the CEO's total compensation.

[Insert Table 4 here]

4.3. Impact on CEO turnover and hiring practices

Next, we conduct the analysis on CEO turnover and hiring practices (H3). First, using an indicator for CEO turnover we perform logit regressions with the year and industry fixed effects, and the control variables. Table 5's Panels A and B reports the results. Specifically, Panel A shows significantly positive estimates of stock price crash risk at the 1% levels, implying that the firm with sufficiently high crash risk experience (at the year t–1) are likely to change their CEOs. To account for the CEO's retirement (due to their old age), Panel B excludes the turnover observations that the departing CEO is more than 60 years old, and we still find the consistent results.

To assess whether the firm's CEO hiring practice is affected by stock price crash risk, Panel C of Table 5 focuses on a cross-sectional sample when CEO turnover arises (at the year t). The dependent variable is a newly-hired CEO's confidence, proxied by the three-year average of their option-based confidence measure (i.e., *Mean confidence [t ,t+2]*). We also control for the departing

CEO's three-year average value prior to their turnover. Here, we find that the departing and hired CEOs' confidence are positively associated, possibly indicating the firm's underlying CEO hiring practice, such as preferring more or less-confident individuals all the time on average. However, more importantly, we find that the prior year's stock price crash risk negatively affects a newly-hired CEO's confidence, suggesting that the firm prefers to hire a less-confident CEO after their high crash risk experience. This is consistent with Banerjee et al. (2018) arguing that a firm's CEO hiring practice is affected by its prior litigation in their study.

Nevertheless, we further note a concern that may arise from the way we analyze in Panel C of Table 5. Because newly-hired CEOs may receive yet less option-based pay during their first three-years, or it is also possible that they cautiously shows their confidence during that period. Thus, we use an indicator for (over)confident CEO, *Holder67*, as suggested by the literature (e.g., Campbell et al., 2011; Malmendier and Tate, 2005). This conventional measure is also referring to the most representative way to identify whether a CEO is (over)confident or not. More specifically, we set an indicator for newly-hired CEOs to one (i.e., *I(Newly-hired CEO is classified as Holder67*) if they exhibit the following behavior: they postpone the exercise of vested options that are above at least 67% moneyness, and if they do so at least twice during their tenure at the firm, and zero otherwise. Finally, we classify newly-hired CEOs as (over)confident if they firstly show such a postponement from the fiscal year that two years later after their appointment at the firm.

Table 6 performs the cross-sectional logit regressions when CEO turnover arises (at the year *t*). In Panel A, we find that a high stock price crash risk negatively influences the likelihood of the firm's newly-hired CEO is (eventually) classified as *Holder67*, again, supporting our H3 that the firm's CEO hiring practices are affected by their high crash risk experience. Furthermore, we interact the same indicator (*Holder67*) for the departing CEO and stock price crash risk prior to the CEO turnover. In Panel B, we find that when the firm decides to change their CEO after a high crash risk experience, they prefer a less-confident individual, particularly the prior CEO was (over)confident.

[Insert Tables 5 and 6 here]

5. Additional tests

5.1. Does stock price crash risk capture poor firm performance?

An alternative explanation for our results is the effect of the firm's poor accounting performance. For instance, if CEOs observe their firm's negative net income, they may realize that their over-optimistic view on the firm's future prospects should be adjusted, resulting in the reduction of managerial confidence. It is also possible that CEOs seek to quickly exercise their stock options before the release of their firm's negative performance. Similarly, a firm may adjust their CEO's compensation or replace them because of poor performance (instead of a stock price crash risk that year). Taken together, our results could merely reflect the effect of poor firm performance. We thus examine whether the firm's negative returns drive our results in this subsection. Note that *ROA* and crash risk are negatively correlated in our sample (see, correlation matrix in Table 1).

Table 7 reports the results. Specifically, we examine the interacting effect of poor performance and stock price crash risk on managerial confidence level (Panel A), CEO compensation structure (Panel B), and CEO turnover analysis (Panel C). Taking a closer look at the estimates of *ROA*, we find straightforward results that firms with poor performance (i.e., lower *ROA*) in the prior year are generally associated with a lower CEO option-based confidence, lower CEO compensation, a higher threat of CEO turnover, and a lesser likelihood of hiring confident CEO when CEO turnover arises.

If this alternative explanation is plausible (i.e., the effect of firm performance dominates to the impact of crash risk), we should observe that, for example, the positive interaction terms and insignificant estimates of crash risk on managerial confidence. However, we find that the interaction terms never show the opposite coefficients compared to the estimates of stock price crash risk in all Models of Table 7. More interestingly, we find some estimates of the interaction terms have the same

direction with the estimates of crash risk. In particular, we consistently find that firms with a higher stock price crash risk but also a higher *ROA* are more likely to reduce their CEO bonus pay (see, the interaction terms in Models (4)–(6) of Panel B). It indicates the possibility that firms experiencing a high stock price crash risk (due to bad news hoarding) punish their CEOs even their performance was good. Collectively, this subsection supports that our main results do not merely reflect the firm's negative accounting performances.

[Insert Table 7 here]

5.2. Firm fixed effect and propensity score matching regressions

To alleviate the bias concern from (time-invariant) omitted variables, we perform our regressions with the firm fixed effects. Table 8 reports the results that re-examine our previous hypotheses from 1 to 3. Specifically, Panel C of Table 8 (for the CEO turnover analysis) uses the linear probability model to preserve our sample size. In addition, in Models (7)–(9) of Panel C where the dependent variable is an indicator of whether the CEO is classified as overconfident (i.e., *Holder67*) at year *t*, we run regressions with the triple-interaction terms between stock price crash risk at year *t*–1, the indicator for CEO turnover at year *t*, and the lagged dependent variable.

Although we cannot find significant results for CEO bonus pay (Models (4)–(6) of Panel B), other models generally show the consistent results at the conventional level. Thus, our results are generally robust to control for the firm fixed effects, which account for unobserved firm-level time-invariant characteristics. In sum, we conclude that unobserved (and thus omitted) variables do not drive the results of our main analyses.

We also employ the propensity score matching (PSM) technique in Table 9. Specifically, we regress an indicator that equals one for firm-year observations with *NCSKEW* or *DUVOL* in the top quartile in that year, and zero for the bottom quartile, on all the control variables by the logit model.

In case of *CRASH*, we directly run a logit regression. We then construct the matched sample by using the nearest neighborhood 1-to-1 matching (without replacement) only for the same fiscal year and industry.

Table 9 reports the results of the impact of stock price crash risk on managerial confidence and CEO compensation for the matched sample. Note that we exclude CEO turnover observations in the matching process in line with our previous analyses. Both Panels A and B generally support that our results are still robust after the matching process.

[Insert Tables 8 and 9 here]

5.3. Re-estimation using residual and predicted stock price crash risk

In addition to the previous subsection, we aim to address potential concern as much as possible, such as reverse causality and persistency of stock price crash risk. This subsection focuses on a "residual" measure of stock price crash risk (or "abnormal" crash risk). We define the residual and predicted value from Eq. (4).

$$\text{Crash risk}_{i,t-1} = \beta_0 + \beta_1 \text{Crash risk}_{i,t-2} + \theta' \text{Control variables}_{i,t-2} + \delta_j + \delta_{t-1} + \varepsilon_{i,t-1}, \quad (4)$$

where *Crash risk* is *NCSKEW*, *DUVOL*, and *CRASH* and *Control variables* are as in Table 2. δ_j and δ_{t-1} indicate industry and year fixed effects, respectively. Specifically, we define the predicted value of stock price crash risk as $\widehat{\text{Crash risk}}_{i,t-1}$, and residuals as the difference between the actual and predicted value, $\varepsilon_{i,t-1}$. In Table 9, we include these rather than the raw value of stock price crash risk. Note that this approach using the residual terms enables us to capture the portion of stock price crash risk that does not account for several firm and CEO characteristics that we have included.

Panels A–C of Table 10 re-estimates Tables 2 and 3. We find that the predicted value of stock

price crash risk is positively associated with CEO option-based confidence measure and positive tone from the earnings call. We interpret that it might indicate the possible reverse causality because the literature posits that managerial confidence leads more bad news hoarding, resulting in a higher stock price crash risk (Kim et al., 2016). Nonetheless, more importantly, the residual terms in Panels A-C consistently show the negative estimates in line with our hypothesis. In addition, we find no significant relation between the predicted crash risk and *Confident tone*, as shown in Panel B, further supporting the validity of our new measure for managerial confidence.

Panels D–F of Table 10 re-estimates Table 4, typically focusing on CEO total pay, bonus, and option pay, respectively. We repeatedly note that the predicted crash risk shows positive estimates on CEO total and option pay (owing to the possible endogeneity). However, we still find that the residual terms of stock price crash risk negatively affect them, also including CEO bonus.

Panels G–I of Table 10 focus on the CEO turnover analysis (i.e., Tables 5 and 6). Although we find weak evidence that the residuals of crash risk negatively affect a newly-hired CEO's confidence, all these estimates in Panels H and I have at least negative coefficients.

In this subsection, we find the possibility of potential endogeneity concern, such as reverse causality; however, we argue that endogeneity is unlikely to drive our main results as we find supportive evidence using the residual terms. In unreported tests, we also obtain qualitatively similar results using the firm fixed effects with the residuals and predicted crash risk.

[Insert Table 10 here]

5.4. Does the crash experience affect the relationship between CEO confidence and investment?

In this study, we thus far argue that the firm's stock price crash risk significantly impacts CEO and corporate decisions, such as reducing managerial confidence level. If so, the crash experience may

affect a (confident) CEO's investment decision as well. The literature posits that CEO confidence leads to overinvestment in the firm, so it may harm shareholders' wealth (Malmendier and Tate, 2005). According to our conjecture, CEOs who learn from their firms' crash experience are expected to adjust their (over)confident behavior.

To examine this extension of our hypothesis, we focus on "the CEO's crash experience," denoted by *I(After First CRASH)*. Specifically, we sort the firm-CEO observations in our primary sample and identify the CEO's first crash experience during their tenure at the firm (i.e., the first occurrence of *CRASH* for firm-CEO observations).[10] After the CEO's first crash experience, we set *I(After First CRASH)* as one; otherwise, it is zero.

In Table 11, we perform an additional analysis about investment and the value of investment following Banerjee et al. (2015). In Panel A where we use the firm's capital expenditure divided by its beginning-of-year assets as the dependent variable, we confirm that CEOs with a high confidence generally overinvest compared to CEOs with a low confidence for both pre- and post-crash periods. Nevertheless, if such CEOs experienced their firm's stock price crash, we find that this relation becomes weak, indicating that the tendency toward overinvestment by CEO confidence (due to its definition of excessively optimistic view on the future return of investment) is mitigated after an impactful shock, which is the firm's stock price crash in our study.

Furthermore, Panel B shows that the crash experience positively influences the effect of CEO confidence on the value of investments. In Model (2), the value of investments is not significantly different between firms with high- and low-confident CEOs in the post-crash period, while CEO confidence negatively affects the value of investments in the pre-crash (see, *CEO confidence* × *b* in Model (1)).

[10] If the post-crashed CEO (i.e., a CEO with *I(After First CRASH)* of one) is replaced with a new CEO, then *I(After First CRASH)* is again set to be zero.

In Models (3) and (4), the triple interaction terms (*CEO confidence* × *a* × *b*) are positively significant at the 1% level after controlling for the industry and firm fixed effects, respectively. These suggest that the lesson from the crash experience may encourage confident CEOs to reduce relatively wasteful investment (thus, that might be value-destroying) and to enhance shareholder value. Overall, evidence from Table 11 supports our main hypothesis that the crash experience moderates confident CEOs' behaviors that might be detrimental to shareholder value.

[Insert Table 11 here]

5. Conclusion

In this study, we investigate the consequences of the firm's stock price crash risk. Prior studies posit that an impactful experience for a CEO can influence corporate policies (e.g., Custódio et al., 2013; Dittmar and Duchin, 2016). Extending this view, we suggest that the CEO (or firm) are likely to moderate their decisions after they experience an extreme crash of their firm's stock price (or high crash risk). In particular, we contribute to the literature on stock price crash risk as the most studies have focused on its determinants, and thus, the impact of stock price crash risk is still less clear.

Using a large U.S. sample between 1993–2018 and the textual analysis, we find that the firm's high stock price crash risk significantly reduces subsequent managerial confidence proxied by option- and text-based measures. In addition, firms seek to adjust their CEO's compensation structure after the exposure of a high crash risk. We also find that the firm's high crash risk positively affects their CEO turnover likelihood, and further influences CEO hiring practices. Overall, we argue that stock price crash risk appears to offer some lessons to both the CEO and the firm.

This paper can also contribute to the literature by making potential suggestions for future studies. Following the most representative literature on managerial confidence (Malmendier and Tate, 2005), we examine whether the relation between CEO confidence and corporate investment (and its

value) is affected by the CEO's crash experience in the last subsection. Similarly, for instance, if our hypothesis extends to the effect of managerial confidence on dividend policy (Banerjee et al., 2018; Deshmukh et al., 2013), CEOs who have a high confidence level but after the crash experience could pay dividends differently compared to before the crash experience. Besides, there exist several testable arguments in terms of the effect of managerial traits on corporate policies, such as capital structure, and innovative activities (Galasso and Simcoe, 2011; Hirshleifer et al., 2012; Malmendier et al., 2011).

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Table 1. Sample summary

This table presents the descriptive statistics of our sample from 1993 to 2018, and pairwise correlations between stock price crash risk, managerial confidence measures, and firm characteristics (size, market-to-book ratio, and return on assets). All the continuous variables are winsorized at the 1st and 99th percentiles. N, SD, P25, and P75 denote the number of observations, standard deviations, and 25th and 75th percentiles, respectively. Variables definitions are in Appendix A.

	N	Mean	SD	P25	Median	P75
Stock price crash risk measures						
NCSKEW	30,627	0.1207	0.8238	-0.3533	0.0616	0.5297
DUVOL	30,627	0.0358	0.2563	-0.1363	0.0264	0.1965
CRASH	30,627	0.2319	0.4221	0.0000	0.0000	0.0000
Option-based confidence measure						
CEO confidence	25,616	0.8756	1.5152	0.0631	0.3781	1.0005
Text-based measures from the firm's earnings call transcripts (2002~2018)						
Confidence tone	7,459	-0.2588	0.1248	-0.3271	-0.2464	-0.1738
Positive tone	7,459	0.4876	0.4707	0.1713	0.4811	0.7989
Complexity	7,459	14.1906	1.5402	13.1310	14.1222	15.1628
Total words	7,459	8124.2910	1990.4930	6849.7500	8308.2500	9446.5000
Firm and CEO variables						
SIZE	30,627	7.2445	1.5728	6.1245	7.1182	8.2809
MTB	30,627	3.1531	6.6681	1.4850	2.3482	3.8109
LEV	30,627	0.1941	0.1885	0.0207	0.1675	0.2953
ROA	30,627	0.0318	0.1809	0.0147	0.0527	0.0907
PPE	30,627	0.2695	0.2170	0.1015	0.2053	0.3810
RD	30,627	0.0371	0.0749	0.0000	0.0041	0.0464
HHI	30,627	0.0735	0.0678	0.0350	0.0485	0.0803
INST OWNERSHIP	30,627	0.6137	0.3273	0.4481	0.7107	0.8646
DTURNOVER	30,602	0.0346	0.9086	-0.2677	0.0182	0.3099
SIGMA	30,627	0.0482	0.0266	0.0301	0.0416	0.0586
RET	30,627	-0.1486	0.2103	-0.1684	-0.0850	-0.0445
OPAQUE	30,401	0.2382	0.2272	0.1028	0.1737	0.2960
CEO TOTALPAY	30,627	7.9337	1.0705	7.1799	7.9655	8.7015
CEO OWNERSHIP	30,627	1.8510	3.7874	0.0000	0.2680	1.3400
CEO TENURE	28,926	1.7806	0.8836	1.0986	1.7918	2.3979
CEO AGE	29,778	4.0155	0.1315	3.9318	4.0254	4.1109
CEO-CHAIRMAN	30,627	0.5233	0.4995	0.0000	1.0000	1.0000
CEO TURNOVER	30,627	0.1105	0.3135	0.0000	0.0000	0.0000

Correlation matrix	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) NCSKEW	1.000								
(2) DUVOL	0.891***	1.000							
(3) CRASH	0.634***	0.514***	1.000						
(4) CEO confidence	-0.027***	-0.023***	-0.036***	1.000					
(5) Confident tone	-0.024**	-0.019*	-0.011	0.122***	1.000				
(6) Positive tone	-0.077***	-0.081***	-0.025***	0.080***	0.238***	1.000			
(7) SIZE	0.103***	0.083***	0.089***	-0.095***	-0.215***	0.111***	1.000		
(8) MTB	-0.017***	-0.022***	-0.011***	0.174***	0.043***	0.074***	0.066***	1.000	
(9) ROA	-0.016***	-0.035***	-0.003	0.094***	-0.118***	0.071***	0.372***	0.170***	1.000

Table 2. Impact of stock price crash risk on managerial confidence: CEO option-based measure

This table presents the results of the effect of stock price crash risk on CEO confidence level. We exclude observations that replace CEO at the year *t*. The dependent variable is *CEO confidence*, the option-based continuous measure. Variables definitions are in Appendix A. Parentheses contain *t*-statistics based on robust standard errors adjusted for heteroscedasticity and clustered by firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable = CEO confidence (option-based continuous measure)						
	(1)	(2)	(3)	(4)	(5)	(6)
NCSKEW (t-1)	-0.0918***			-0.0525***		
	(-7.735)			(-5.890)		
DUVOL (t-1)		-0.2466***			-0.1472***	
		(-6.180)			(-4.896)	
CRASH (t-1)			-0.1776***			-0.0639***
			(-7.649)			(-3.583)
CEO confidence (t-1)				0.6112***	0.6115***	0.6112***
				(33.995)	(34.056)	(34.012)
SIZE (t-1)	-0.0507***	-0.0518***	-0.0514***	-0.0096	-0.0100	-0.0113
	(-2.802)	(-2.852)	(-2.852)	(-0.987)	(-1.031)	(-1.161)
MTB (t-1)	0.0196***	0.0197***	0.0197***	0.0017	0.0018	0.0018
	(7.121)	(7.126)	(7.139)	(1.235)	(1.256)	(1.286)
LEV (t-1)	-0.0867	-0.0845	-0.0801	0.0597	0.0606	0.0648
	(-0.725)	(-0.705)	(-0.669)	(1.123)	(1.137)	(1.216)
ROA (t-1)	0.9387***	0.9369***	0.9497***	0.4286***	0.4262***	0.4334***
	(2.849)	(2.851)	(2.861)	(4.745)	(4.714)	(4.787)
PPE (t-1)	-0.3283**	-0.3267**	-0.3308**	-0.0470	-0.0460	-0.0469
	(-2.513)	(-2.498)	(-2.534)	(-0.761)	(-0.744)	(-0.757)
R&D (t-1)	1.3040***	1.3000***	1.3086***	1.0928***	1.0895***	1.0966***
	(3.478)	(3.464)	(3.490)	(5.504)	(5.472)	(5.511)
HHI (t-1)	1.0893**	1.0810**	1.0985**	0.2348	0.2316	0.2402
	(2.137)	(2.121)	(2.158)	(0.935)	(0.922)	(0.958)
INST OWNERSHIP (t-1)	0.1309**	0.1317**	0.1294**	0.0559*	0.0566**	0.0545*
	(2.205)	(2.218)	(2.184)	(1.953)	(1.981)	(1.905)
DTURNOVER (t-1)	0.0506***	0.0504***	0.0491***	-0.0029	-0.0030	-0.0043
	(3.356)	(3.339)	(3.253)	(-0.239)	(-0.248)	(-0.357)
SIGMA (t-1)	5.8625***	5.5153***	5.9897***	1.1979	1.0164	0.9088
	(2.778)	(2.629)	(2.824)	(1.055)	(0.892)	(0.795)
RET (t-1)	0.4849**	0.4459*	0.4766**	0.2759**	0.2550**	0.2414*
	(2.048)	(1.898)	(2.024)	(2.197)	(2.023)	(1.906)
OPAQUE (t-1)	0.4776***	0.4809***	0.4695***	0.0175	0.0190	0.0150
	(3.521)	(3.542)	(3.457)	(0.237)	(0.258)	(0.203)
OPAQUE SQUARE (t-1)	-0.1593***	-0.1597***	-0.1560***	-0.0300	-0.0303	-0.0286
	(-2.846)	(-2.852)	(-2.772)	(-0.883)	(-0.893)	(-0.839)
CEO TOTALPAY (t-1)	0.1023***	0.1025***	0.1019***	-0.0139	-0.0139	-0.0136
	(3.965)	(3.969)	(3.953)	(-0.871)	(-0.871)	(-0.852)
CEO OWNERSHIP (t-1)	0.0219***	0.0221***	0.0219***	0.0131***	0.0131***	0.0131***
	(2.923)	(2.941)	(2.929)	(3.367)	(3.387)	(3.379)
CEO TENURE (t-1)	0.1176***	0.1176***	0.1169***	0.0166	0.0166	0.0162
	(5.804)	(5.805)	(5.776)	(1.486)	(1.485)	(1.451)
CEO AGE (t-1)	-0.4216**	-0.4222**	-0.4196**	-0.1344*	-0.1343*	-0.1349*
	(-2.569)	(-2.572)	(-2.559)	(-1.711)	(-1.710)	(-1.716)
CEO-CHAIRMAN (t-1)	0.0097	0.0098	0.0110	0.0089	0.0088	0.0093
	(0.251)	(0.255)	(0.285)	(0.486)	(0.479)	(0.506)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
N	19,685	19,685	19,685	18,890	18,890	18,890
Adj R2	0.0895	0.0888	0.0895	0.464	0.463	0.463

Table 3. Impact of stock price crash risk on managerial confidence: text-based measure from earnings call

This table presents the results of the effect of stock price crash risk on the firm's managerial confidence level. We exclude observations that replace CEO at the year *t*. The dependent variables are measured by the firm's earnings conference call transcripts. In Panel A, *Confident tone* (*Positive tone*) is the percentage of the number of confident minus pessimistic (positive minus negative) words in the transcript. In Panel B, *Complexity* is the percentage of the number of complex words in the transcript. *Ln(Total words)* is the natural logarithm of the total number of words in the transcript. Control variables are as in Table 2. Variables definitions are in Appendix A. Parentheses contain *t*-statistics based on robust standard errors adjusted for heteroscedasticity and clustered by firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Textual analysis measures from earnings call transcripts						
Dependent variable	Confident tone			Positive tone		
	(1)	(2)	(3)	(4)	(5)	(6)
NCSKEW (t-1)	-0.0056***			-0.0352***		
	(-3.032)			(-5.810)		
DUVOL (t-1)		-0.0134**			-0.1098***	
		(-2.339)			(-5.644)	
CRASH (t-1)			-0.0088***			-0.0317***
			(-2.596)			(-2.620)
Control variables (t-1)	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
N	6,752	6,752	6,752	6,752	6,752	6,752
Adj R2	0.197	0.197	0.197	0.255	0.254	0.252

Panel B: Complexity and Total words of earnings call transcripts						
Dependent variable	Complexity			Ln(Total words)		
	(1)	(2)	(3)	(4)	(5)	(6)
NCSKEW (t-1)	-0.0339			0.0005		
	(-1.583)			(0.119)		
DUVOL (t-1)		-0.1086			-0.0003	
		(-1.610)			(-0.023)	
CRASH (t-1)			0.0328			-0.0037
			(0.793)			(-0.455)
Control variables (t-1)	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
N	6,752	6,752	6,752	6,752	6,752	6,752
Adj R2	0.233	0.233	0.232	0.315	0.315	0.315

Table 4. Impact of stock price crash risk on CEO compensation

This table presents the results of the effect of stock price crash risk on CEO compensation. We exclude observations that replace CEO at the year *t*. Control variables are as in Table 2. Variables definitions are in Appendix A. Parentheses contain *t*-statistics based on robust standard errors adjusted for heteroscedasticity and clustered by firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: CEO's total compensation, bonus, and salary									
Dependent variable	Ln(1+Total pay)			Ln(1+Bonus)			Ln(1+Salary)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NCSKEW (t-1)	-0.0308***			-0.0582***			-0.0007		
	(-5.946)			(-2.817)			(-0.151)		
DUVOL (t-1)		-0.1049***			-0.1854***			-0.0094	
		(-6.229)			(-2.790)			(-0.522)	
CRASH (t-1)			-0.0431***			-0.0766*			0.0199**
			(-4.252)			(-1.819)			(1.986)
Control variables (t-1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	20,126	20,126	20,126	20,126	20,126	20,126	20,126	20,126	20,126
Adj R2	0.682	0.682	0.682	0.429	0.429	0.429	0.339	0.339	0.339

Panel B: CEO's equity-based compensation									
Dependent variable	Ln(1+Equity pay)			Ln(1+Option pay)			Ln(1+Stock pay)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NCSKEW (t-1)	-0.0179			-0.0594**			0.0328		
	(-0.795)			(-2.040)			(1.201)		
DUVOL (t-1)		-0.0984			-0.1741*			0.0059	
		(-1.360)			(-1.896)			(0.068)	
CRASH (t-1)			-0.0324			-0.1241**			0.1045**
			(-0.728)			(-2.176)			(2.014)
Control variables (t-1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	20,126	20,126	20,126	20,126	20,126	20,126	20,126	20,126	20,126
Adj R2	0.246	0.246	0.246	0.162	0.162	0.162	0.380	0.380	0.380

Table 5. Impact of stock price crash risk on CEO turnover and hiring practices

This table presents the results of CEO turnover analysis. In Panel A, the dependent variable is an indicator for CEO turnover that equals 1 if the CEO is newly hired at the fiscal year *t*, and 0 otherwise. In Panel B, we exclude possible retirement that the departing CEO is more than 60 years old. In Panel C, the dependent variable is a newly-hired CEO's three-year average option-based confidence level, and control for the prior CEO's one. Panels A and B contain the control variables as in Table 2. Panel C contains the control variables (as in Table 2) except for CEO-specific variables. Variables definitions are in Appendix A. Parentheses contain *t*-statistics based on robust standard errors adjusted for heteroscedasticity and clustered by firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: likelihood of CEO turnover			
Dependent variable		I(CEO turnover)	
	(1)	(2)	(3)
NCSKEW (t-1)	0.1250***		
	(4.895)		
DUVOL (t-1)		0.3152***	
		(3.725)	
CRASH (t-1)			0.1395***
			(2.713)
Control variables (t-1)	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes
N	27,923	27,923	27,923
Pseudo R2	0.0781	0.0775	0.0771

Panel B: likelihood of CEO turnover excluding retirement			
Dependent variable		I(CEO turnover excluding retirement)	
	(1)	(2)	(3)
NCSKEW (t-1)	0.1289***		
	(3.751)		
DUVOL (t-1)		0.3938***	
		(3.360)	
CRASH (t-1)			0.1193*
			(1.691)
Control variables (t-1)	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes
N	26,448	26,448	26,448
Pseudo R2	0.0641	0.0639	0.0629

Panel C: CEO hiring practice when CEO turnover arises			
Dependent variable		Mean confidence [t, t+2]	
	(1)	(2)	(3)
NCSKEW (t-1)	-0.0600***		
	(-2.733)		
DUVOL (t-1)		-0.1354*	
		(-1.843)	
CRASH (t-1)			-0.0871**
			(-2.136)
Mean confidence [t-3, t-1]	0.1723***	0.1724***	0.1709***
	(4.974)	(4.953)	(4.936)
Control variables (t-1)	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes
N	1,267	1,267	1,267
Adj R2	0.150	0.147	0.148

Table 6. Impact of stock price crash risk on CEO hiring practices: alternative CEO confidence measure

This table presents the results of the effect of stock price crash risk on CEO hiring practices when CEO turnover arises, using alternative measure for CEO confidence level. The dependent variable is an indicator that equals 1 if the newly-hired CEO is eventually classified as overconfident CEO, *Holder67*, that CEO holds vested options that are at least 67% in the money, and if such CEO does so at least twice during their tenure at the firm, and 0 otherwise. In Panel B, we interact stock price crash risk measures with an indicator of whether the departing CEO was *Holder67* or not. Control variables are as in Table 2 except for CEO-specific variables. Variables definitions are in Appendix A. Parentheses contain *t*-statistics based on robust standard errors adjusted for heteroscedasticity and clustered by firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable = I(Newly-hired CEO is classified as Holder67)			
Panel A: likelihood of hiring overconfident CEO when CEO turnover arises			
	(1)	(2)	(3)
NCSKEW (t-1)	-0.1571***		
	(-3.053)		
DUVOL (t-1)		-0.4778***	
		(-2.891)	
CRASH (t-1)			-0.3272***
			(-3.254)
Control variables (t-1)	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes
N	2,704	2,704	2,704
Pseudo R2	0.0582	0.0580	0.0587
Panel B: Interacting with prior overconfident CEO			
	(1)	(2)	(3)
NCSKEW (t-1)	0.0018		
	(0.024)		
DUVOL (t-1)		-0.0599	
		(-0.245)	
CRASH (t-1)			0.0430
			(0.285)
I(Prior CEO was Holder67): a	0.9760***	0.9643***	1.0832***
	(10.652)	(10.570)	(10.517)
NCSKEW (t-1) × a	-0.3137***		
	(-3.086)		
DUVOL (t-1) × a		-0.8756***	
		(-2.689)	
CRASH (t-1) × a			-0.6688***
			(-3.378)
Control variables (t-1)	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes
N	2,704	2,704	2,704
Pseudo R2	0.0911	0.0903	0.0919

Table 7. Effect of the firm performance

This table presents the re-estimation of our previous results with the interacting effect of the firm's return on assets and stock price crash risk. Panels A, B, and C follow our previous Tables 3, 4, and 5, respectively, including the interaction terms between *ROA* and stock price crash risk measures. In Panels A and B, we exclude observations that replace CEO at the year *t*. All models include the control variables, industry and year fixed effects. Variables definitions are in Appendix A. Parentheses contain *t*-statistics based on robust standard errors adjusted for heteroscedasticity and clustered by firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Interacting effect on managerial confidence measures									
Dependent variable	CEO confidence			Confident tone			Positive tone		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NCSKEW (t-1)	-0.0877***			-0.0058***			-0.0314***		
	(-7.264)			(-2.845)			(-4.887)		
DUVOL (t-1)		-0.2221***			-0.0138**			-0.0987***	
		(-5.536)			(-2.226)			(-4.821)	
CRASH (t-1)			-0.1935***			-0.0103***			-0.0213
			(-8.031)			(-2.653)			(-1.637)
ROA (t-1): a	0.9643***	1.0246***	0.8961***	0.0007	0.0012	-0.0034	-0.0516	-0.0431	-0.0374
	(2.837)	(3.052)	(2.667)	(0.027)	(0.044)	(-0.143)	(-0.587)	(-0.452)	(-0.467)
NCSKEW (t-1) × a	-0.1502			0.0057			-0.0753		
	(-1.512)			(0.348)			(-1.575)		
DUVOL (t-1) × a		-0.8706***			0.0105			-0.2182*	
		(-3.396)			(0.242)			(-1.646)	
CRASH (t-1) × a			0.4650			0.0319			-0.1793*
			(1.636)			(0.989)			(-1.662)
N	19,685	19,685	19,685	6,736	6,736	6,736	6,736	6,736	6,736
Adj R2	0.0896	0.0895	0.0899	0.198	0.197	0.197	0.255	0.255	0.252

Panel B: Interacting effect on CEO compensation									
Dependent variable	Ln(1+Total pay)			Ln(1+Bonus)			Ln(1+Option pay)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NCSKEW (t-1)	-0.0305***			-0.0513**			-0.0591**		
	(-5.632)			(-2.418)			(-1.995)		
DUVOL (t-1)		-0.1024***			-0.1627**			-0.1670*	
		(-5.835)			(-2.405)			(-1.772)	
CRASH (t-1)			-0.0427***			-0.0599			-0.1282**
			(-3.913)			(-1.368)			(-2.211)
ROA (t-1): a	0.2894***	0.2939***	0.2926***	0.7986***	0.8238***	0.8515***	1.0364***	1.0563***	1.0199***
	(6.661)	(6.730)	(6.505)	(4.116)	(4.152)	(4.641)	(3.972)	(3.942)	(3.746)

NCSKEW (t-1) × a	-0.0116			-0.2487*			-0.0112		
	(-0.303)			(-1.661)			(-0.061)		
DUVOL (t-1) × a		-0.0851			-0.7951*			-0.2504	
		(-0.712)			(-1.901)			(-0.400)	
CRASH (t-1) × a			-0.0124			-0.4947*			0.1214
			(-0.130)			(-1.768)			(0.309)
N	20,126	20,126	20,126	20,126	20,126	20,126	20,126	20,126	20,126
Adj R2	0.682	0.682	0.682	0.429	0.429	0.429	0.162	0.162	0.162

Panel C: Interacting effect on CEO turnover and hiring practice

Dependent variable	I(CEO turnover)			I(CEO turnover excluding retirement)			Mean confidence [t, t+2]		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NCSKEW (t-1)	0.1248***			0.1293***			-0.0577***		
	(4.856)			(3.767)			(-2.613)		
DUVOL (t-1)		0.3120***			0.3974***			-0.1276*	
		(3.674)			(3.391)			(-1.714)	
CRASH (t-1)			0.1460***			0.1195*			-0.0859**
			(2.812)			(1.694)			(-2.114)
ROA (t-1): a	-0.5596*	-0.5989*	-0.4932	-0.5939	-0.6256*	-0.5444	0.3952***	0.3548***	0.4589***
	(-1.732)	(-1.876)	(-1.412)	(-1.576)	(-1.672)	(-1.463)	(3.411)	(3.316)	(3.396)
NCSKEW (t-1) × a	0.0123			0.1691			-0.2447		
	(0.087)			(1.140)			(-1.645)		
DUVOL (t-1) × a		0.3199			0.6290*			-0.5737	
		(0.863)			(1.680)			(-1.094)	
CRASH (t-1) × a			-0.3683			-0.0485			-0.3263**
			(-1.017)			(-0.124)			(-2.111)
N	27,923	27,923	27,923	26,448	26,448	26,448	1,267	1,267	1,267
Pseudo / Adj R2	0.0781	0.0776	0.0772	0.0642	0.0641	0.0629	0.151	0.148	0.150

Table 8. Firm fixed effect regressions

This table presents the re-estimation of our previous results controlling for firm fixed effects. Panels A and B follow our previous Tables 3 and 4, respectively. In Panel C, Models (1)–(6) follow our previous Table 5. In Models (7)–(9) of Panel C, to conduct firm fixed effect regressions, the dependent variable is an indicator that equals 1 from the first time the CEO is classified as overconfident CEO at year *t*, *Holder67,* who holds vested options that are at least 67% in the money, and if such CEO does so at least twice during their tenure at the firm, and 0 otherwise. We include its lagged value and the triple interactions with stock price crash risk and an indicator for CEO turnover. All models include the control variables, firm and year fixed effects. Variables definitions are in Appendix A. Parentheses contain *t*-statistics based on robust standard errors adjusted for heteroscedasticity and clustered by firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Firm fixed effect for managerial confidence									
Dependent variable	CEO confidence			Confident tone			Positive tone		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NCSKEW (t-1)	-0.0685***			-0.0026*			-0.0275***		
	(-5.894)			(-1.796)			(-5.410)		
DUVOL (t-1)		-0.1649***			-0.0095**			-0.0922***	
		(-4.402)			(-2.067)			(-5.605)	
CRASH (t-1)			-0.1312***			-0.0021			-0.0233**
			(-5.875)			(-0.769)			(-2.298)
N	21,418	21,418	21,418	7,459	7,459	7,459	7,459	7,459	7,459
Adj R2	0.334	0.333	0.334	0.496	0.496	0.496	0.561	0.561	0.559

Panel B: Firm fixed effect for CEO compensation									
Dependent variable	Ln(1+Total pay)			Ln(1+Bonus)			Ln(1+Option pay)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NCSKEW (t-1)	-0.0302***			-0.0067			-0.0582**		
	(-5.591)			(-0.335)			(-2.074)		
DUVOL (t-1)		-0.1071***			-0.0413			-0.1903**	
		(-6.247)			(-0.645)			(-2.165)	
CRASH (t-1)			-0.0481***			0.0338			-0.1684***
			(-4.442)			(0.816)			(-3.082)
N	22,134	22,134	22,134	22,134	22,134	22,134	22,134	22,134	22,134
Adj R2	0.713	0.713	0.713	0.556	0.556	0.556	0.341	0.341	0.341

Panel C: Firm fixed effect for CEO turnover and hiring practice

Dependent variable	I(CEO turnover)			I(CEO turnover excluding retirement)			I(CEO is classified as Holder67)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NCSKEW (t-1)	0.0105***			0.0068***			-0.0143***		
	(4.380)			(3.662)			(-4.645)		
DUVOL (t-1)		0.0232***			0.0191***			-0.0408***	
		(3.065)			(3.243)			(-3.973)	
CRASH (t-1)			0.0100**			0.0061*			-0.0162***
			(2.113)			(1.736)			(-2.753)
I(CEO turnover): a							0.1333***	0.1324***	0.1328***
							(9.750)	(9.738)	(8.652)
I(CEO was Holder67 (t-1)): b							0.8190***	0.8193***	0.8162***
							(134.788)	(135.010)	(130.201)
NCSKEW (t-1) × a × b							-0.0582***		
							(-2.692)		
DUVOL (t-1) × a × b								-0.2025***	
								(-2.792)	
CRASH (t-1) × a × b									-0.0896**
									(-2.116)
N	27,926	27,926	27,926	26,577	26,577	26,577	25,540	25,540	25,540
Adj R2	0.0628	0.0624	0.0622	0.0417	0.0416	0.0412	0.843	0.843	0.843

Table 9. Propensity score matching sample regressions

This table presents the re-estimation of our previous results for the matched sample. Panels A and B follow our previous Tables 3 and 4, respectively. All models include the control variables, industry and year fixed effects. Variables definitions are in Appendix A. Parentheses contain *t*-statistics based on robust standard errors adjusted for heteroscedasticity and clustered by firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: PSM for managerial confidence									
Dependent variable	CEO confidence			Confident tone			Positive tone		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NCSKEW (t-1)	-0.0725***			-0.0102***			-0.0280**		
	(-2.978)			(-2.803)			(-2.105)		
DUVOL (t-1)		-0.2871***			-0.0015			-0.1269***	
		(-3.932)			(-0.111)			(-3.002)	
CRASH (t-1)			-0.1814***			-0.0093			-0.0612***
			(-4.261)			(-1.457)			(-2.590)
N	2,316	2,426	3,558	740	712	1,362	740	712	1,362
Adj R2	0.111	0.116	0.0873	0.196	0.132	0.190	0.201	0.199	0.245

Panel B: PSM for CEO compensation									
Dependent variable	Ln(1+Total pay)			Ln(1+Bonus)			Ln(1+Option pay)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NCSKEW (t-1)	-0.0318***			-0.0637			-0.1267**		
	(-2.993)			(-1.495)			(-2.089)		
DUVOL (t-1)		-0.1087***			-0.2860**			-0.3916**	
		(-3.063)			(-2.016)			(-2.056)	
CRASH (t-1)			-0.0438**			-0.1438*			-0.1387
			(-2.330)			(-1.694)			(-1.240)
N	2,474	2,540	3,610	2,474	2,540	3,610	2,474	2,540	3,610
Adj R2	0.699	0.686	0.688	0.473	0.454	0.459	0.170	0.145	0.182

Table 10. Residual and predicted stock price crash risk

This table presents the re-estimation of our previous results using residuals and predicted value of stock price crash risk. To do so, we regress stock price crash risk at year *t*–1 on all the control variables as in Table 2 at year *t*–2 and obtain residuals and predicted value of the crash risk. All models include the control variables, industry and year fixed effects. Variables definitions are in Appendix A. Parentheses contain *t*-statistics based on robust standard errors adjusted for heteroscedasticity and clustered by firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Stock price crash risk	NCSKEW	DUVOL	CRASH	NCSKEW	DUVOL	CRASH
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Dependent variable = CEO confidence (option-based)						
Residual crash risk (t-1)	-0.0901***	-0.2488***	-0.1736***	-0.0905***	-0.2489***	-0.1714***
	(-8.041)	(-6.445)	(-7.437)	(-8.093)	(-6.460)	(-7.332)
Predicted crash risk (t-1)				1.1976***	4.2478***	2.5114***
				(5.154)	(6.079)	(4.497)
N	16,622	16,622	16,622	16,622	16,622	16,622
Adj R2	0.101	0.100	0.101	0.466	0.466	0.466
Panel B: Dependent variable = Confident tone (text-based)						
Residual crash risk (t-1)	-0.0059***	-0.0146**	-0.0087**	-0.0059***	-0.0145**	-0.0087**
	(-3.127)	(-2.464)	(-2.515)	(-3.128)	(-2.454)	(-2.511)
Predicted crash risk (t-1)				0.0065	0.0592	-0.0116
				(0.219)	(0.639)	(-0.157)
N	6,334	6,334	6,334	6,334	6,334	6,334
Adj R2	0.201	0.201	0.200	0.201	0.200	0.200
Panel C: Dependent variable = Positive tone (text-based)						
Residual crash risk (t-1)	-0.0331***	-0.1011***	-0.0289**	-0.0330***	-0.1022***	-0.0296**
	(-5.382)	(-5.155)	(-2.312)	(-5.370)	(-5.187)	(-2.364)
Predicted crash risk (t-1)				-0.4506***	-1.2639***	-1.2037***
				(-3.334)	(-2.980)	(-3.688)
N	6,334	6,334	6,334	6,334	6,334	6,334
Adj R2	0.255	0.255	0.252	0.257	0.256	0.255
Panel D: Dependent variable = Ln(1+Total pay)						
Residual crash risk (t-1)	-0.0325***	-0.1094***	-0.0463***	-0.0324***	-0.1080***	-0.0449***
	(-6.098)	(-6.368)	(-4.466)	(-6.107)	(-6.312)	(-4.358)
Predicted crash risk (t-1)				0.9469***	2.8424***	2.0518***
				(7.990)	(7.719)	(7.135)
N	17,769	17,769	17,769	17,769	17,769	17,769
Adj R2	0.692	0.692	0.691	0.694	0.694	0.693
Panel E: Dependent variable = Ln(1+Bonus)						
Residual crash risk (t-1)	-0.0527**	-0.1778**	-0.0627	-0.0527**	-0.1781**	-0.0625
	(-2.455)	(-2.557)	(-1.433)	(-2.455)	(-2.560)	(-1.425)
Predicted crash risk (t-1)				-0.1059	-0.5966	0.3303
				(-0.285)	(-0.516)	(0.355)
N	17,769	17,769	17,769	17,769	17,769	17,769
Adj R2	0.433	0.433	0.433	0.433	0.433	0.433

Panel F: Dependent variable = Ln(1+Option pay)

Residual crash risk (t-1)	-0.0728**	-0.1936**	-0.1612***	-0.0726**	-0.1910*	-0.1593***
	(-2.352)	(-1.982)	(-2.707)	(-2.344)	(-1.952)	(-2.670)
Predicted crash risk (t-1)				1.6400***	5.1940***	2.9884***
				(3.737)	(3.851)	(2.618)
N	17,769	17,769	17,769	17,769	17,769	17,769
Adj R2	0.168	0.168	0.168	0.168	0.168	0.168

Panel G: Dependent variable = I(CEO turnover)

Residual crash risk (t-1)	0.1257***	0.3267***	0.1337**	0.1254***	0.3280***	0.1340**
	(4.651)	(3.642)	(2.453)	(4.645)	(3.655)	(2.462)
Predicted crash risk (t-1)				0.8732*	2.6906*	1.4712
				(1.874)	(1.843)	(1.279)
N	24,562	24,562	24,562	24,562	24,562	24,562
Pseudo R2	0.0782	0.0777	0.0772	0.0785	0.0779	0.0773

Panel H: Dependent variable = Mean confidence [t, t+2] when CEO turnover at year t

Residual crash risk (t-1)	-0.0463*	-0.1024	-0.0641	-0.0469*	-0.1158	-0.0633
	(-1.885)	(-1.258)	(-1.359)	(-1.911)	(-1.431)	(-1.341)
Predicted crash risk (t-1)				-0.9461***	-3.0062***	-2.1419**
				(-2.694)	(-2.784)	(-2.346)
N	1,102	1,102	1,102	1,102	1,102	1,102
Adj R2	0.146	0.145	0.145	0.151	0.150	0.148

Panel I: Dependent variable = I(Newly-hired CEO is classified as Holder67) when CEO turnover at year t

Residual crash risk (t-1)	-0.1165**	-0.3676**	-0.3338***	-0.1173**	-0.3654**	-0.3336***
	(-2.046)	(-2.027)	(-2.949)	(-2.058)	(-2.014)	(-2.950)
Predicted crash risk (t-1)				1.1010	4.3060	1.8733
				(1.121)	(1.405)	(0.746)
N	2,114	2,114	2,114	2,114	2,114	2,114
Pseudo R2	0.0611	0.0610	0.0627	0.0615	0.0617	0.0629

Table 11. CEO confidence, investment, and the value of investment: effect of the crash experience

This table presents the results of the effect of the crash experience on the relation between CEO confidence and investment (Panel A), and the value of investment (Panel B). *First CRASH* indicates the CEO's first year of stock price crash experience (at least one crash week) during their tenure at the firm. *Industry Tobin's Q* is *Tobin's Q* minus the industry average value at that year, where *Tobin's Q* is the firm's total assets plus the market value of equity minus book value of equity scaled by total assets. Control variables are as in Table 2. Variables definitions are in Appendix A. Parentheses contain *t*-statistics based on robust standard errors adjusted for heteroscedasticity and clustered by firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Lesson for investment

	Before First CRASH	After First CRASH	Pooled	Pooled
Dependent variable	CAPEX (t) / Assets (t-1)			
	(1)	(2)	(3)	(4)
CEO confidence (t-1)	0.0057***	0.0046***	0.0061***	0.0050***
	(9.225)	(9.076)	(10.072)	(8.434)
I(After First CRASH): a			-0.0003	-0.0003
			(-0.323)	(-0.333)
CEO confidence (t-1) × a			-0.0015**	-0.0012*
			(-2.138)	(-1.849)
Control variables (t-1)	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	No
Firm Fixed Effect	No	No	No	Yes
N	9,233	12,572	21,805	21,805
Adj R2	0.554	0.527	0.540	0.685

Panel B: Lesson for value of investment

	Before First CRASH	After First CRASH	Pooled	Pooled
Dependent variable	Industry adjusted Tobin's Q			
	(1)	(2)	(3)	(4)
CEO confidence (t-1)	0.2068***	0.2420***	0.2155***	0.1624***
	(10.078)	(10.220)	(10.643)	(7.997)
CAPEX / Sales (t-1): b	0.5258***	-0.1176	0.3995***	-0.0021
	(3.493)	(-0.633)	(2.630)	(-0.012)
CEO confidence (t-1) × b	-0.1837***	-0.0248	-0.1797***	-0.1385***
	(-4.712)	(-0.701)	(-4.237)	(-2.705)
CEO confidence (t-1) × a × b			0.1644***	0.1770***
			(2.925)	(2.589)
CEO confidence (t-1) × a			0.0181	0.0043
			(0.641)	(0.155)
I(After First CRASH): a			-0.0738	-0.0961
			(-1.424)	(-1.548)
a × b			-0.4264	-0.0640
			(-1.501)	(-0.215)
Control variables (t-1)	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	No
Firm Fixed Effect	No	No	No	Yes
N	9,219	12,552	21,771	21,771
Adj R2	0.582	0.603	0.594	0.671

Appendix A. Variables definitions

Stock price crash risk measures

NCSKEW: Negative skewness of the firm's (weekly) returns over the fiscal year.

DUVOL: Natural logarithm of the ratio of the standard deviation of the firm's (weekly) returns for down weeks to the standard deviation of the firm's (weekly) returns for up weeks. We define down and up weeks as all the weeks with the firm's (weekly) returns below and above its annual average returns, respectively.

CRASH: Indicator variable that equals 1 for a firm-year observation that experiences at least one crash week during the fiscal year and 0 otherwise. We define crash weeks as those weeks during which the firm experiences its (weekly) returns 3.20 standard deviations below its annual average returns.

Managerial confidence measures

CEO confidence: Ratio of the CEO's average value per vested option to the average exercise price of the options.

Confident tone: Ratio of the number of confident words minus pessimistic words to the total number of words in the firm's earnings conference call transcript. We identify confident (pessimistic) words as synonyms for "confident," "confidence," "overconfidence," "overconfident," "optimistic," "optimism," "overoptimistic," and "overoptimism" ("pessimistic," "pessimism," "overpessimistic," "overpessimism," "reliable," "steady," "practical," "conservative," "frugal," "cautious," and "gloomy") from the Oxford English Dictionary.

Positive tone: Ratio of the number of positive words minus negative words (using Loughran and McDonald's (2011) dictionary) to the total number of words in the firm's earnings conference call transcript.

Holder67: Indicator variable that equals 1 from the first time the CEO holds vested options that are at least 67% in the money, and if such CEO does so at least twice during the sample period.

Other text-based measures

Complexity: Ratio of the number of words with more than two syllables (using Loughran and McDonald's (2011) dictionary) to the total number of words in the firm's earnings conference call transcript.

Total words: the total number of words in the firm's earnings conference call transcript.

Control variables

SIZE: Natural logarithm of the firm's total assets.

MTB: Ratio of the firm's market value of equity to book value of equity.

LEV: Ratio of the firm's total long-term debt to total assets.

ROA: Ratio of the firm's net income to total assets.

PPE: Ratio of the firm's property, plant, and equipment to total assets.

RD: Ratio of the firm's research and development expense to total assets.

HHI: Herfindahl–Hirschman index of the industry, the first two-digit SIC code, for all available observations in Compustat.

INST OWNERSHIP: Aggregated ownership that institutional investors hold, obtained from Thomson 13-F filings.

DTURNOVER: Average monthly share turnover over the fiscal year minus average monthly share turnover over the previous fiscal year, where monthly share turnover is the ratio of monthly trading volume to the total number of outstanding shares during the month.

SIGMA: Standard deviation of the firm's (weekly) returns in the fiscal year.

RET: Percentage of the firm's average (weekly) returns in the fiscal year.

OPAQUE: Last three years' moving sum of the absolute value of discretionary accruals (Hutton, Marcus and Tehranian, 2009; Kim, Wang and Zhang, 2016).

OPAQUE SQUARE: Square term of OPAQUE.

CEO TOTALPAY: Natural logarithm of one plus the CEO's total compensation (*tdc1* in ExecuComp).

CEO OWNERSHIP: CEO's share ownership percentage.

CEO TENURE: Natural logarithm of one plus the CEO's tenure (year-based).

CEO AGE: Natural logarithm of the CEO's age.

CEO-CHAIRMAN: Indicator variable that equals 1 if the CEO is the chair of the firm's board of directors and 0 otherwise.