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ORIGINAL PAPER

The Information Role of Earnings Conference Call Tone: Evidence from Stock Price Crash Risk

Xi Fu[1] · Xiaoxi Wu[2] · Zhifang Zhang[3]

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Abstract

This paper investigates whether and how the disclosure tone of earnings conference calls predicts future stock price crash risk. Using US public firms' conference call transcripts from 2010 to 2015, we find that firms with less optimistic tone of year-end conference calls experience higher stock price crash risk in the following year. Additional analyses reveal that the predictive power of tone is more pronounced among firms with better information environment and lower managerial equity incentives, suggesting that extrinsic motivations for truthful disclosure partially explain the predictive power of conference call tone. Our results shed light on the long-term information role of conference call tone by exploring the setting of extreme future downside risk, when managers have conflicting incentives either to unethically manipulate disclosure tone to hide bad news or to engage in ethical and truthful communication.

Keywords Ethical financial reporting · Earnings conference calls · Stock price crash risk · Tone · Truthful communication · Voluntary disclosure

JEL Classification D80 · G10 · G12 · G14 · G30 · M41

Introduction

We investigate whether and how the disclosure tone of earnings conference calls is useful in predicting firms' future stock price crash risk (i.e., extreme downside risk in returns). We are motivated by the ethical dilemma faced by managers in disclosure choices (Evans et al. 2001; Liu et al. 2015). On the one hand, managers may hide bad news and use optimistic language opportunistically for impression management purposes during conference calls (e.g., Clatworthy and Jones 2003; Liu et al. 2015; Merkl-Davies and Brennan 2007; Yuthas et al. 2002). Once the stockpile of bad news exceeds a certain threshold, stock price crashes occur, resulting in great losses to investors (Jin and Myers 2006). On the other hand, due to reputation concerns, managers may provide truthful information during conference calls instead of unethically manipulating call tone (e.g., Frecka 2008; Lee 2017; Yuthas et al. 2002). Moreover, the spontaneous and interactive nature of conference calls limits managers' ability to unethically manipulate disclosure tone.

Previous literature highlights both the importance and the lack of credibility of qualitative information in voluntary disclosures. Quantitative information conveys only a partial picture of firm performance, while qualitative information completes the picture and provides incremental information for investors (Arslan-Ayaydin et al. 2016; Cho et al. 2009, 2010). We focus on one of the most important channels of voluntary disclosures, earnings conference calls, which are a direct platform for managers to communicate with investors and contain rich qualitative information on firm performance

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✉ Xi Fu
Xi.Fu@liverpool.ac.uk

Xiaoxi Wu
xiaoxi.wu@unibocconi.it

Zhifang Zhang
Zhifang.Zhang@wbs.ac.uk

[1] University of Liverpool Management School, University of Liverpool, Chatham Street, Liverpool L69 7ZH, UK

[2] Bocconi University, Via Röntgen 1, Milan 20136, Italy

[3] Warwick Business School, University of Warwick, Scarman Road, Coventry CV4 7AL, UK

and outlook (e.g., Brown et al. 2004; Matsumoto et al. 2011; Price et al. 2012). Unlike written disclosures, conference calls contain managers' own spoken words and spontaneous conversations between managers and call participants (i.e., analysts and investors), providing a useful setting for researchers and investors to observe managers' disclosure behavior directly.

Disclosure tone captures both what and how information is disclosed (Loughran and McDonald 2016), reflecting both firms' performance and managers' disclosure incentives. Some research on conference calls (Davis et al. 2015; Price et al. 2012) finds that the tone conveys useful information to the stock market. However, the broad literature on accounting and business communication suggests that managers may use tone of corporate disclosures either to convey information truthfully or to inflate audiences' perceptions opportunistically (e.g., Bozzolan et al. 2015; Cho et al. 2010; Huang et al. 2014; Merkl-Davies and Brennan 2007; Patelli and Pedrini 2014). This study examines whether managers engage in truthful communication or manipulate conference call tone opportunistically in the context of firms facing extreme downside risk.

Stock price crash risk captures a firm's extreme downside risk and may cause major losses to investors and damage stock market stability (Chen et al. 2001; Hutton et al. 2009). According to Jin and Myers' (2006) agency theoretic framework, it relates to firm-specific events and arises from information asymmetry between managers and external stakeholders due to managers' bad news hoarding behavior. Previous literature reveals relations between various corporate disclosure attributes and stock price crash risk. For example, Hutton et al. (2009) find that opaque firms are more likely to experience stock price crashes, and Kim et al. (2019) find a negative relation between annual reports' readability and stock price crash risk. Motivated by previous research, we investigate whether call tone conveys forward-looking information that helps investors predict stock price crash risk.

We construct a large sample of US public firms' conference call transcripts from 2010 to 2015. We apply firm-fixed effects models to control for unobservable time-invariant omitted variables and firm disclosure style, and lead-lag regressions to mitigate potential reverse causality issues. We find that less optimistic tone is associated with higher stock price crash risk, consistent with the notion that managers engage in truthful communication during conference calls. Our main results are robust to alternative model specifications, word classifications, tone measures and stock price crash risk measure.

We then conduct additional analyses to investigate the mechanisms for the negative predictive power of optimistic conference call tone for stock price crash risk. First, we find that the tone of both the presentation and question-and-answer (hereafter, Q&A) sections predict stock price crash risk, and that the predictive power of the Q&A section tone is driven mainly by manager tone, not analyst tone, indicating that the predictive power is driven by managers' own truthful disclosure intentions. Second, sub-sample analyses suggest that the predictive power of call tone is more pronounced for firms with better information environment (proxied by analyst following) and firms with less equity-based managerial incentives (proxied by CEO option incentives). These findings indicate that managers respond to extrinsic motivations (i.e., external monitoring by analysts and equity incentives) by engaging in truthful communication in conference calls.

This paper makes significant contributions to the literature on ethical financial reporting, corporate voluntary disclosure and stock price crash risk. First, it contributes to the small yet important stream of research on ethical financial reporting behavior in oral financial disclosures. Most previous studies of ethical reporting focus on written disclosures, with limited direct observation of managers' own behavior (e.g., Breuer et al. 2018; Cho et al. 2010; Craig and Amernic 2018; Patelli and Pedrini 2015). Conference calls provide an appropriate setting for observing managers' disclosure behavior and style directly. Our results show that managers' ethical financial reporting in conference calls facilitates investors' predictions of stock price crash risk in the next year, which is crucial to protect investors' interests. Second, this paper contributes to the literature on voluntary disclosure by examining how conference call tone predicts stock price crash risk over the long term. Specifically, rather than focusing on short-term market reactions to conference call tone, as in previous studies (e.g., Davis et al. 2015; Price et al. 2012), we provide new evidence on the forward-looking information role of call tone in predicting extremely bad corporate outcomes in the long term (i.e., one year). Third, this study adds to the literature on stock price crash risk. Given the detrimental consequences of stock price crashes on investors' benefits, investors must understand how to predict extremely bad events using soft information from qualitative disclosures. We also provide evidence supporting common assumptions in the previous literature that crash risk reflects firm-specific bad news and that managers may possess *ex ante* private information about such risk (Roll 1988).

In the remainder of this paper, we review the literature and develop hypotheses, describe the data and empirical methods, and present our empirical results. We then discuss the study's implications and limitations, and directions for future research, before drawing conclusions.

Related Literature and Hypotheses Development

Literature on Earnings Conference Calls

Since the 1990s, earnings conference calls have emerged as an important channel for voluntary corporate disclosures (Bushee et al. 2003). These calls reduce information asymmetry between firms and investors (Brown et al. 2004; Matsumoto et al. 2011), and provide useful information to financial market participants such as sell-side and buy-side financial analysts, individual investors and auditors (e.g., Hobson et al. 2017; Jung et al. 2016; Matsumoto et al. 2011). Previous research highlights that attributes of these calls (including their tone) are informative for investors. For example, Matsumoto et al. (2011) find that call length reflects the information content of a call and that longer calls are more informative to the market. Lee (2016) focuses on spontaneity in managers' conference call language, and documents that the market responds negatively to calls where the presentation and Q&A sections are similar because managers are using pre-scripted speeches to answer analysts' questions.

Compared with written financial documents, which are carefully worded, conference calls are more interactive and spontaneous. They allow managers to disclose information flexibly, facilitating the revelation of managers' discretionary incentives and behavior (Bloomfield 2008; Merkl-Davies and Brennan 2007). Previous studies find that when managers engage in financial misstatement intentionally, their conference call language may reveal the truth (Burgoon et al. 2016; Hobson et al. 2012; Larcker and Zakolyukina 2012). Therefore, managers' verbal and vocal cues in conference call disclosures are more suited than written disclosures to detecting their unethical reporting behavior.

Importantly, a burgeoning body of research investigates the tone of conference calls. Tone represents the sentiment of narrative disclosures (Henry and Leone 2016; Loughran and McDonald 2011). It indicates how optimistic the disclosure is, and reflects the firm's past, current and future situations. Typically measured by the use of positive and negative words (e.g., Davis et al. 2015; Loughran and McDonald 2011, 2016), tone captures both what information is disclosed (i.e., the disclosure content) and how (i.e., the optimism of disclosure). Tone significantly influences how investors perceive a firm's performance and future prospects. For instance, Davis et al. (2015) report that, after controlling for firms' past and future financial performance and characteristics, cumulative abnormal returns correlate significantly with managers' tone during conference calls, illustrating significant short-term market reactions to call tone.

Despite the importance of conference call disclosures, there is limited evidence on managers' reporting behavior in these calls from an explicitly ethical financial reporting perspective. Most relevantly, Burgoon et al. (2016), Hobson et al. (2012) and Larcker and Zakolyukina (2012) report that managers' linguistic characteristics and vocal cues in conference calls may reveal financial restatements, indicating the importance of conference call communication characteristics for detecting managers' unethical reporting behavior. Unlike these previous studies, we explore the setting of extreme future downside risk captured by stock price crash risk, where managers have conflicting incentives either to unethically manipulate disclosure tone to hide bad news, or to engage in ethical financial reporting and disclose truthfully.

Literature on Stock Price Crash Risk

According to Jin and Myers' (2006) theoretical framework, stock price crash risk arises from information asymmetry between inside managers and outside investors. It therefore focuses on idiosyncratic returns affected by firm-specific information rather than market-wide risk factors (Roll 1988). Stock price crash risk is an important measure capturing the asymmetry of return distribution, and especially extreme negative returns in the left tail, for individual stocks. The 2008 financial crisis highlighted the detrimental impact of stock price crash risk on investors. Since retail investors tend to construct their portfolios by investing in a small number of firms (Barber and Odean 2013), stock price crashes of individual firms within their portfolios have huge negative effects on their personal wealth due to under-diversification of their portfolios. Several streams of literature investigate potential determinants of stock price crash risk, including managers' idiosyncratic characteristics (Andreou et al. 2017; Kim et al. 2016), corporate governance quality (Andreou et al. 2016), external monitoring mechanisms (Xu et al. 2013) and informal institutional mechanisms (Chen et al. 2019).

The prior literature also examines the role of corporate disclosures in predicting stock price crash risk. For example, it has been found that opaque firms are more likely to experience stock price crashes (Hutton et al. 2009), and that aggressive tax strategies raise incentives for managers to hoard bad news and hence increase stock price crash risk (Kim et al. 2011b). DeFond et al. (2015) show that mandatory IFRS adoption increases disclosure transparency, thereby decreasing non-financial firms' stock price crash risk. In terms of corporate disclosure attributes, firms with higher-quality corporate social responsibility disclosures may experience lower stock price crash risk (Kim et al. 2014), and less readable annual reports are associated with higher stock price crash risk (Kim et al. 2019), suggesting that managers hide bad news in complex financial reports.

Our paper differs from previous studies by exploring spoken disclosures in conference calls. These calls allow managers to present information in a less-constrained manner, and contain ad hoc conversations between managers and call participants, making managers' own disclosure behavior and style more observable to investors. Therefore, conference calls provide a suitable setting for investigating managers' disclosure incentives and behavior.

Hypotheses Development

How conference call tone predicts stock price crash risk is unclear, because managers often face an ethical dilemma in making financial reporting decisions (Evans et al. 2001; Liu et al. 2015). This leads to two competing hypotheses. On the one hand, managers may be driven by self-interest and unethical intentions, and may engage in unethical financial reporting when the benefits of mis-presentation outweigh those of being honest or ethical, even if unethical behavior may be harmful to investors (Gibson et al. 2013; Hannan et al. 2006; Liu et al. 2015). Consequently, the credibility of voluntary disclosures is widely questioned. According to agency theory, managers are incentivized to overstate performance by strategically concealing bad news and accelerating the release of good news (e.g., Huang et al. 2014; Kim and Zhang 2016). Optimistic language is important in evaluating unethical financial narratives, as it reflects firms' attempts to distort perceptions (Yuthas et al. 2002).[1] Ample evidence reveals that disclosure tone can be manipulated to hide bad news and inflate investors' perceptions of the firm (Merkl-Davies and Brennan 2007).

Optimistic language may serve as an impression management strategy, emphasizing positive aspects of the business and obfuscating negative news (Cho et al. 2010; Clatworthy and Jones 2003; Hooghiemstra 2000; Merkl-Davies and Brennan 2007). Therefore, we expect optimistic earnings conference call tone to positively predict stock price crash risk, leading to our first hypothesis (i.e., the impression management hypothesis) as below:

Hypothesis 1 The optimistic tone in earnings conference calls is positively associated with stock price crash risk.

On the other hand, managers have incentives to engage in ethical financial reporting and provide truthful information during conference calls. First, there are various motivations for truthful disclosures. Managers may have an ethical responsibility to speak in the interests of investors (Yuthas et al. 2002), and the financial market values ethical and transparent corporate disclosures (Jo and Kim 2008). The business ethics literature views the accuracy and transparency of financial information as fundamental to ethical financial reporting (Frecka 2008; Holley 1998; Lee 2017; Ruppel and Harrington 2000; Whitener et al. 1998). Thus, managers may engage in ethical behavior to gain a reputation for behaving ethically and honestly (Jones 1995).

Moreover, the spontaneous and interactive nature of conference calls limits managers' ability to manipulate disclosure tone unethically and opportunistically. Psychology research has long established that truth-tellers and deceivers exhibit different linguistic and behavioral tendencies due to cognitive processes and emotions (e.g., DePaulo et al. 2003; Newman et al. 2003; Pennebaker et al. 2003; Vrij et al. 2000; Zuckerman and Driver 1985). Several relevant accounting studies investigate whether managers' language in conference calls may reveal the truth about firm performance. Larcker and Zakolyukina (2012) find that linguistic features in conference calls help investors detect managers' intentional misstatements. Similarly, Hobson et al. (2012) show that managers' vocal cues may also help predict financial misstatements. Collectively, these studies suggest that when managers intentionally engage in unethical financial reporting, their language in earnings conference calls gives them away and reveals the truth.

In the setting of extreme downside risk in stock returns, if managers engage in truthful communication and reveal relevant information in conference calls, their tone is expected to reflect negative information relevant to stock price crash risk, with less optimism (i.e., more use of negative words) when stock price crash risk is higher. Negative words may be more truthful than positive words in corporate disclosures. Previous literature shows that voluntary disclosures of bad news are generally more credible and truthful than disclosures of good news because managers have incentives to embellish positive aspects of firm performance (e.g., Hutton et al. 2003; Rogers and Stocken 2005). With regard to disclosure tone, in gaging truthful communication, negative words have more discriminating power than positive words (Loughran and McDonald 2011). Negative words are less ambiguous than positive words because managers commonly negate positive words when releasing bad news, but rarely negate negative words in making positive statements (Loughran and McDonald 2016).

Therefore, if managers engage in truthful communication in conference calls, we expect less optimistic tone when stock price crash risk is higher. Accordingly, we predict that managers may engage in ethical financial reporting and truthful communication and exhibit less optimistic tone when stock price crash risk is higher. Our second hypothesis (i.e., the truthful communication hypothesis) is as follows:

[1] Analytical research on voluntary disclosure argues that qualitative disclosures are "cheap talk" that may lack credibility, especially when difficult to verify (e.g., Baginski et al. 2016; Kartik 2009; Stocken 2000). Thus, managers may opportunistically inflate the tone of conference calls through excessive use of positive words to hide bad news. We gratefully acknowledge a reviewer for suggesting this point.

Table 1 Distribution of observations over industries and years

Panel A: Distribution of observations over industries

SIC industry	SIC codes	Freq.	Percent	Cum.
Agriculture, forestry & fishing	0–999	24	0.21	0.21
Mining	1000–1499	910	8.02	8.23
Construction	1500–1799	106	0.93	9.17
Manufacturing	2000–3999	5342	47.09	56.25
Transportation, communications, electric, gas & sanitary services	4000–4999	1355	11.94	68.2
Wholesale trade	5000–5199	351	3.09	71.29
Retail trade	5200–5999	727	6.41	77.7
Finance, insurance and real estate	6000–6799	309	2.72	80.42
Services	7000–8999	2186	19.27	99.69
Public administration	9100–9999	35	0.31	100
Total		11,345	100	

Panel B: Distribution of observations over years

Year	Freq.	Percent	Cum.
2010	1802	15.88	15.88
2011	2037	17.96	33.84
2012	1873	16.51	50.35
2013	1877	16.54	66.89
2014	1896	16.71	83.61
2015	1860	16.39	100
Total	11,345	100	

Panel A shows the distribution of observations of individual firm-years across 10 SIC industries. Panel B shows the distribution for the period 2010–2015

Hypothesis 2 The optimistic tone in earnings conference calls is negatively associated with stock price crash risk.

Data and Methodology

Sample

Our sample was constructed using earnings conference call transcripts of US public firms from Thomson Reuters Eikon. We focus on the post-crisis period from 2010 to 2015 to avoid potential confounding effects of the 2008 financial crisis. Daily and monthly stock data were downloaded from CRSP, accounting information was obtained from Compustat, and data on analysts' forecasts were drawn from I/B/E/S. The final sample contains 11,345 annual earnings conference call transcripts in English for firms with available financial data.[2]

[2] This paper focuses on the predictive power of fourth-quarter conference call tone, when firms make forecasts over longer horizons than in the other three quarters. Nevertheless, untabulated results show consistent evidence of the predictive power of call tone for stock price crash risk using quarterly tone data.

Table 1 Panel A shows the sample distribution by SIC industry groups. Our sample covers a wide range of industries, with observations from "Manufacturing" contributing 47.09% of the sample. Table 1 Panel B presents the sample's relatively even distribution by year from 2010 to 2015.

Model Specification

To investigate whether the tone of earnings conference calls predicts stock price crash risk, we use the following regression model in our empirical analysis:

$$CRASH\_RISK_{i,t} = \alpha + \beta \times TONE_{i,t-1} + \sum_{j=1}^{N} \gamma^{j} \times CONTROL^{j}_{i,t-1} + Firm\ Fixed\ Effect + Year\ Fixed\ Effect + \mu_{i,t} \quad (1)$$

To address potential endogeneity issues, we employ firm-fixed effects to mitigate issues relating to unobservable

time-invariant omitted variables.[3] The application of firm-fixed effects allows us to estimate the predictive power of tone for stock price crash risk while controlling for within-firm variation. Year-fixed effects are also included to control for macroeconomic shocks. In addition, we apply lead-lag regressions to mitigate reverse causality issues. In Eq. (1), the coefficient of interest is β, which captures how earnings conference call tone predicts stock price crash risk.

Measuring Stock Price Crash Risk

We measure stock price crash risk following Hutton et al. (2009), Kim et al. (2011a) and Callen and Fang (2017). Stock price crash risk focuses on idiosyncratic returns affected by firm-specific information rather than market factors (Roll 1988). First, we estimate the following regression model using weekly returns for each firm and fiscal year:

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

where $r_{i,t}$ is the return on stock i in week t, and $r_{m,t}$ is the return on the CRSP value-weighted market index in week t. To estimate this regression model, a firm must have at least 26 weekly returns available in a fiscal year. Lead and lag returns for the market index are included to allow for non-synchronous trading. Since the residuals from Eq. (2) are highly skewed (Hutton et al. 2009), the firm-specific weekly return (W_{it}) is defined as the log of one plus the residual term:

$$W_{i,t} = \ln\left(1 + \varepsilon_{i,t}\right) \quad (3)$$

Three measures reflecting the asymmetry of firm-specific weekly returns are used as proxies for stock price crash risk. The first proxy, *COUNT*, is based on the number of firm-specific weekly returns exceeding 3.20 standard deviations above and below the mean firm-specific weekly return over the fiscal year. *COUNT* equals downside minus upside frequencies. A higher value of *COUNT* indicates a higher frequency of crashes.

The second proxy is the negative skewness of firm-specific weekly returns (*NCSKEW*), calculated as follows:

$$NCSKEW = -\frac{N(N-1)^{\frac{3}{2}} \sum W_{i,t}^3}{(N-1)(N-2)\left(\sum W_{i,t}^2\right)^{\frac{3}{2}}} \quad (4)$$

where N is the number of firm-specific weekly returns of firm i in a fiscal year. According to Chen et al. (2001), scaling the raw third moment by the standard deviation cubed allows comparison of stocks with different variances, and is a common standardization method in skewness statistics. A negative sign in front of the third moment denotes that a higher value of *NCSKEW* indicates a higher level of crash risk (i.e., a more left-skewed distribution).

The last proxy measures the down-to-up volatility of firm-specific weekly returns (*DUVOL*). All weeks in a fiscal year are divided into two groups: down weeks with firm-specific weekly returns below the annual mean, and up weeks with firm-specific weekly returns above the annual mean. *DUVOL* is the natural logarithm of the ratio of the standard deviation of firm-specific weekly returns in down weeks to that in up weeks:

$$DUVOL = \ln\left(\frac{(N_U - 1)\sum W_{i_D,t}^2}{(N_D - 1)\sum W_{i_U,t}^2}\right) \quad (5)$$

where $W_{i_D,t}/W_{i_U,t}$ is firm i's firm-specific weekly return in a down/up week, and N_D/N_U is the number of down/up weeks in a fiscal year. A higher value of *DUVOL* (i.e., a more left-skewed distribution) indicates that a stock is more "crash prone".

Measuring Conference Call Disclosure Tone

Our independent variable of interest is the tone of conference calls, measured using the frequency of positive and negative words in sample call transcripts.[4] We rely on positive and negative wordlists from Loughran and McDonald's dictionary,[5] which was specifically developed for financial disclosures and is one of the most widely used and comprehensive dictionaries for tone measurement in financial documents.

We calculate the tone of the whole call (*TONE_C*), the presentation section (*TONE_P*) and the Q&A section (*TONE_Q*) as the difference between the numbers of positive and negative words scaled by the total number of words in the call or a specific section. We also calculate managers' (participants') tone, *TONE_MAN* (*TONE_PAR*) as the difference between positive and negative words scaled by the total words spoken by managers (participants) during the Q&A section. Higher values of tone variables indicate higher levels of optimism.[6]

[3] Results are not sensitive to the use of industry-fixed effects instead of firm-fixed effects.

[4] In this paper, tone is defined as disclosure tone and is measured by the use of positive or negative words. This definition differs from the linguistic concept of 'evaluation marker' and the psychology concept of 'affective states'. We thank a reviewer for raising this point.

[5] We use the March 2015 version of the dictionary, available at http://www3.nd.edu/~mcdonald/Word_Lists.html.

[6] Higher values of tone variables also indicate low levels of pessimism. Loughran and McDonald (2016) show that measuring tone using positive words may introduce measurement error and lead to low statistical power in empirical tests. To mitigate this concern, we perform robustness tests using the net pessimistic tone measure (calculated as the percentage of negative words in the total number of words). The results in Online Appendix Table A1 suggest that our findings are robust.

Control Variables

The control variables in our regression models follow previous research on stock price crash risk (Andreou et al. 2016; Chen et al. 2001; DeFond et al. 2015; Hutton et al. 2009; Kim and Zhang 2016; Kim et al. 2016). To control for investor belief heterogeneity, we include the detrended stock trading volume ($\Delta TURNOVER$) to measure differences of opinion among investors. To capture the potential persistence of the third moment of stock returns and address concerns about dynamic endogeneity, we use the lag value of the negative skewness of past firm-specific stock returns (*NCSKEW*) as a control variable. Stocks with higher past returns and higher volatilities have greater potential to experience crashes; therefore, the average and standard deviation of firm-specific weekly return (*MEANFSRET* and *STDFSRET*) over the previous year are included in the regression. In addition, conference call discussions and tone may reflect firm fundamentals and historical performance. To control for firm performance and the discussion content of calls, various quantitative performance and fundamental characteristics are considered: firm size (*SIZE*), which is the natural logarithm of a firm's market capitalization; market-to-book ratio (*MTB*); financial leverage (*LEV*), which is the ratio of long-term debt to total assets; and return on assets (*ROA*). Finally, given analysts' important role in firms' information environment, we include the natural logarithm of the number of analysts following the firm (# *ANALYSTS*).

Empirical Results

Descriptive Statistics

In testing whether conference call tone may predict stock price crash risk, the key underlying assumptions are that this risk reflects firm-specific information, and that managers possess private information about it. To justify these assumptions, we randomly selected 50 crash events, identified relevant news in the crash weeks through Nexis, and analyzed the nature of this news. The results are presented in Table 2 Panel A. We find that 28 of these crash events were accompanied by firm-specific news in that week. This news was largely performance- or operations-related, such as corporate expansion, change of distributor or manager, or acquisition announcements. The nature of these news events suggests that, in many cases, managers had private *ex ante* information that was informative in predicting crash risk, which may have been reflected in the conference call tone.

Table 2 Panel B presents summary statistics for main variables. The mean values of *COUNT*, *NCSKEW* and *DUVOL* are 0.014, 0.076 and 0.042, respectively. The average overall conference call tone (*TONE_C*) is 0.671 and the mean value of *TONE_P* is 0.985, while the mean of *TONE_Q* is 0.417, suggesting that the tone of the presentation section is on average more optimistic than that of the Q&A section. In the Q&A section, the mean value of *TONE_MAN* is 0.672, while that of *TONE_PAR* is −0.184, consistent with Brockman et al.'s (2015) evidence that manager tone conveys more optimism than participant tone.

Table 3 presents the correlation matrix. Panel A shows that all three measures of stock price crash risk are significantly and negatively correlated with earnings conference call tone, and that these measures are highly positively correlated, indicating that they capture common aspects of stock price crash risk. Panel B displays correlations between pairs of tone measures. As expected, all tone measures are positively correlated, but with distinct linguistic styles for different sections and speakers.

Main Results

Table 4 presents the firm-fixed effect regression results for stock price crash risk on lagged overall conference call tone.[7] In columns (1) to (3), *COUNT*, *NCSKEW* and *DUVOL* are the dependent variables, respectively. The results show that, for all three stock price crash risk measures, the coefficient on *TONE_C* is negative and statistically significant at the 1% level. With respect to economic significance, in model (1), one standard deviation (0.461) increase in *TONE_C* leads to a $0.461 \times 0.092 = 0.042$ decrease in *COUNT*. In model (2), the coefficient on *TONE_C* is −0.174, with a *t* statistic of −4.95, indicating that increasing *TONE_C* by one standard deviation decreases *NCSKEW* by $0.461 \times 0.174 = 0.080$. In model (3), the coefficient on *TONE_C* is −0.103, with a *t* statistic of −4.69, which indicates that one standard deviation increase in *TONE_C* leads to a decrease in *DUVOL* by $0.461 \times 0.103 = 0.047$. Additionally, recent research reveals that the appropriateness of panel OLS and the usefulness of hypothesis testing based on t-statistics are affected by sample size (Kim et al. 2018). Using Kim et al.'s (2018) method, for the 5% significance level and a two-tail test for a sample with 8004 observations, the adjusted critical value for the t-statistic is −3.55. Thus, the coefficient on *TONE_C* in each of columns (1) to (3) in Table 4 is negative and remains statistically significant at the 5% level.[8] Taken together, conference call tone optimism negatively predicts stock price crash

[7] The number of observations shown in Table 4 is 8004, which is smaller than the sample size discussed in the "Sample" sub-section because we use lead-lag regression, as specified in Eq. (1).

[8] Our subsequent analyses are also robust when using the adjusted critical value for t-statistics calculated using Kim et al.'s (2018) method.

Table 2 Descriptive statistics

Panel A: Relevant news in crash week

Category	Frequency	Percent
No news	22	44
Operations-related event	11	22
Earnings release	6	12
Under-performance	5	10
Merger and acquisition	3	6
Executive turnover	1	2
Other	1	2
SEC investigation	1	2
Total	50	100

Panel B: Descriptive statistics for key variables

Variable	Number	Mean	Std	P25	Median	P75
CRASH	11,345	0.216	0.411	0.000	0.000	0.000
COUNT	11,345	0.014	0.620	0.000	0.000	0.000
NCSKEW	11,345	0.076	0.840	−0.409	0.016	0.479
DUVOL	11,345	0.042	0.520	−0.308	0.016	0.360
ΔTURNOVER	11,345	−0.005	0.107	−0.038	−0.005	0.026
STDFSRET	11,345	0.045	0.023	0.028	0.040	0.056
MEANFSRET	11,345	−0.124	0.136	−0.154	−0.078	−0.039
SIZE	11,345	7.041	1.858	5.786	7.015	8.266
MTB	11,345	2.913	3.390	1.114	1.896	3.287
LEV	11,345	0.189	0.180	0.003	0.160	0.308
ROA	11,345	0.010	0.148	−0.003	0.039	0.077
#ANALYSTS	11,345	2.036	1.051	1.386	2.197	2.833
TONE_C	11,345	0.671	0.461	0.361	0.658	0.976
TONE_P	11,345	0.985	0.682	0.527	0.975	1.436
TONE_Q	11,345	0.417	0.457	0.121	0.408	0.704
TONE_MAN	11,345	0.672	0.514	0.331	0.647	0.992
TONE_PAR	11,345	−0.184	0.661	−0.560	−0.156	0.245
RE_TONE_C	10,008	0.002	0.447	−0.305	−0.006	0.296

This table shows summary statistics for relevant news in crash weeks (Panel A) and key variables for US firms with earnings conference calls during the period 2010–2015 (Panel B). All continuous variables are winsorized at the 1st and 99th percentiles

risk, consistent with the truthful communication hypothesis (Hypothesis 2).[9] Furthermore, the information role of call tone in predicting stock price crash risk is both statistically and economically significant.[10]

Robustness Checks

Addressing Word Misclassification

It is crucial to control for the effect of word misclassification (Loughran and McDonald 2016). Appendix B presents the

[9] Our results are robust after controlling for additional variables, including short-term market reactions, other conference call characteristics, annual report characteristics and complexity, executive characteristics and incentives, and corporate governance features. Relevant results are presented in the Online Appendix. While firm-fixed effect regression controls for time-invariant omitted factors, it fails to control for selection bias caused by time-varying factors. To this end, we adopt a propensity score-matching approach. The treatment group (control group) includes firms with conference call tone above (below) the median. These groups are matched to be as statistically alike as possible, with covariates the same as controls in the main regressions. The matched firms use a nearest neighbor algorithm with caliper 0.01, no replacement and results restricted to common support. After matching, we still find a significant and negative association between conference call tone and stock price crash risk.

[10] The economic significance of the coefficient on *TONE_C* is comparable with previous literature (e.g., Blau et al. 2015). Additionally, as we focus on the long-term predictive power of tone, the economic significance of predictive power is smaller than that over a shorter horizon. As conference calls are a timely disclosure platform, call tone is expected to have stronger economic significance over a shorter horizon.

Table 3 Correlations

Panel A: Dependent and control variables

	COUNT	*NCSKEW*	*DUVOL*	*TONE_C*	*ΔTURNOVER*	*STDFSRET*	*MEANFSRET*	*SIZE*	*MTB*	*LEV*	*ROA*
COUNT	1										
NCSKEW	**0.79**	1									
DUVOL	**0.65**	**0.90**	1								
TONE_C	**−0.06**	**−0.09**	**−0.10**	1							
ΔTURNOVER	0.01	**0.05**	**0.05**	**−0.03**	1						
STDFSRET	−0.02	**0.05**	**0.05**	**−0.13**	**0.22**	1					
MEANFSRET	**0.04**	−0.02	**−0.03**	**0.12**	**−0.25**	**−0.96**	1				
SIZE	**0.03**	0.01	0.02	**0.13**	**−0.03**	**−0.58**	**0.50**	1			
MTB	**−0.05**	**−0.05**	**−0.05**	**0.11**	**0.06**	**0.03**	**−0.04**	**0.17**	1		
LEV	0.01	0.01	0.01	**−0.06**	**0.03**	**−0.13**	**0.10**	**0.21**	0.01	1	
ROA	0.01	**−0.03**	**−0.02**	**0.13**	**−0.03**	**−0.49**	**0.50**	**0.37**	**−0.05**	0.01	1
#ANALYSTS	**0.06**	**0.07**	**0.08**	**0.07**	**−0.03**	**−0.24**	**0.22**	**0.50**	**0.09**	**0.15**	**0.16**

Panel B: Tone measures

	TONE_C	*TONE_P*	*TONE_Q*	*TONE_MAN*
TONE_C	1			
TONE_P	**0.84**	1		
TONE_Q	**0.75**	**0.38**	1	
TONE_MAN	**0.70**	**0.38**	**0.89**	1
TONE_PAR	**0.40**	**0.18**	**0.60**	**0.23**

This table presents Pearson correlation coefficients between pairs of key variables. All continuous variables are winsorized at the 1st and 99th percentiles. Values in bold represent correlations significant at the 1% level

30 most frequently used negative and positive words in our sample. "Question" and "questions" account for more than 25% of all negative words in our sample, but are commonly used neutrally by analysts. For example, analysts usually start their questions with "I have a question on…". To ensure that our results are not driven by word misclassification, we measure tone in two alternative ways: (1) using a term-weighting scheme to reduce the impact of these two words; and (2) excluding "question" and "questions" from the negative wordlist. Untabulated results confirm that our main results are robust to using these two alternative measures.

Stock Price Crash Risk and Residual Tone

The primary tone measurement in main analyses is measured using conference call dialogue relating to both past performance and forward-looking statements. Thus, the tone measurement may be driven by firms' historical performance and fundamental attributes. To mitigate such concerns, we use a residual tone measurement to proxy for the unexpected optimistic or pessimistic component of tone that cannot be explained by firms' fundamental characteristics or past financial performance (Borochin et al. 2018; Huang et al. 2014).

The residual tone is calculated from a cross-sectional regression of tone on firms' current year performance and fundamentals. Following previous research (Borochin et al. 2018; Huang et al. 2014), our residual tone measurement (*RE_TONE_C*) is calculated as the residual term (ϵ) of the following regression:[11]

$$\begin{aligned} TONE_{jt} = {} & \alpha + \beta_1 EARN_{jt} + \beta_2 RET_{jt} + \beta_3 SIZE_{jt} + \beta_4 BTM_{jt} \\ & + \beta_5 STD\_RET_{jt} + +\beta_6 STD\_EARN_{jt} + \beta_7 AGE_{jt} \\ & + \beta_8 BUSSEG_{jt} + \beta_9 GEOSEG_{jt} + +\beta_{10} LOSS_{jt} \\ & + \beta_{11} \Delta EARN_{jt} + \beta_{12} AFE_{jt} + \beta_{13} AF_{jt} + \epsilon_{jt} \end{aligned} \quad (6)$$

[11] In order to obtain the residual tone measure, we regress conference call tone (*TONE*) on the ratio of EBIT to beginning total assets (*EARN*), contemporaneous annual stock returns (*RET*), the natural logarithm of the market capitalization at the end of one fiscal year (*SIZE*), book-to-market ratio at the end of one fiscal year (*BTM*), the standard deviation of monthly stock return over one fiscal year (*STD_RET*), the standard deviation of *EARN* over the previous five years (*STD_EARN*), the natural logarithm of one plus age from the first year the firm entered the CRSP dataset (*AGE*), the natural logarithm of one plus the number of business segments (*BUSSEG*), the natural logarithm of one plus the number of geographic segments (*GEOSEG*), a dummy variable which equals 1 when *EARN* is negative (*LOSS*), the first difference of *EARN* (*ΔEARN*), analyst forecast error (*AFE*), and analyst consensus forecast for one-year-ahead earnings per share divided by stock price per share at the end of the fiscal year (*AF*).

Table 4 Tone of conference call and stock price crash risk

	(1) $COUNT_t$	(2) $NCSKEW_t$	(3) $DUVOL_t$
$TONE\_C_{t-1}$	−0.092***	−0.174***	−0.103***
	(−3.59)	(−4.95)	(−4.69)
$\Delta TURNOVER_{t-1}$	0.061	0.029	−0.050
	(0.70)	(0.24)	(−0.65)
$NCSKEW_{t-1}$	−0.139***	−0.221***	−0.119***
	(−13.21)	(−15.67)	(−14.28)
$STDFSRET_{t-1}$	−0.494	−1.219	2.339
	(−0.20)	(−0.36)	(1.14)
$MEANFSRET_{t-1}$	0.065	0.080	0.509
	(0.16)	(0.14)	(1.60)
$SIZE_{t-1}$	0.250***	0.456***	0.310***
	(9.01)	(11.64)	(12.64)
MTB_{t-1}	−0.003	0.002	0.002
	(−0.44)	(0.25)	(0.40)
LEV_{t-1}	0.227	0.456**	0.270**
	(1.55)	(2.35)	(2.34)
ROA_{t-1}	0.061	−0.069	−0.042
	(0.46)	(−0.39)	(−0.37)
$\#ANALYSTS_{t-1}$	0.034	0.088*	0.047
	(0.94)	(1.79)	(1.55)
Constant	−2.021***	−3.037***	−2.037***
	(−8.23)	(−8.59)	(−8.72)
Observations	8004	8004	8004
Adjusted R^2	0.06	0.10	0.10
Year-fixed effects	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes

This table presents regression results for the predictive power of conference call tone on SPCR. The dependent variables in Models (1), (2) and (3) are *COUNT*, *NCSKEW* and *DUVOL*, respectively. The key independent variable is conference call tone, *TONE_C*. All continuous variables are winsorized at the 1st and 99th percentiles. T-statistics reported in parentheses are based on standard errors clustered by firm. *, ** and *** represent significance at the 10%, 5% and 1% levels, respectively

We replace our primary tone variable with residual tone, and re-estimate our baseline regressions.[12] The results in Table 5 Panel A show that our main findings are robust to using residual tone. This confirms that more optimistic residual tone predicts lower stock price crash risk and mitigates concerns that the predictive power of tone may be driven by firms' fundamentals and quantitative information within disclosures.

[12] The original number of observations for *RE_TONE_C* is 10,008, and the final number of observations is 7231 in Table 5 owing to lead-lag regression specification.

Stock Price Crash Risk and Tone Change

We also test whether our finding for the information role of tone in predicting stock price crash risk is robust when considering tone change. Previous research shows that changes in disclosure tone alter investors' perceptions of firms. For example, Feldman et al. (2010) report that tone changes in firms' SEC filings significantly affect market returns around the filing date window. In the context of predicting stock price crash risk, we expect that when managers' tone becomes more optimistic, firms face lower stock price crash risk.

To test this, we conduct a change analysis. Following previous literature (e.g., Davis et al. 2012; Feldman et al. 2010; Henry and Leone 2016), we define tone change as the tone of managers' conference call disclosures in the current year compared with the previous year. The results (Table 5 Panel B) show that if tone becomes more optimistic in the current year than in the previous year, the firm will experience lower stock price crash risk.

Alternative Measure of Stock Price Crash Risk

In addition to *COUNT*, *NCSKEW* and *DUVOL*, previous literature (e.g., Kim et al. 2016; Andreou et al. 2016) also uses an alternative measure for stock price crash risk, *CRASH*. *CRASH* is defined as an indicator variable that equals 1 if a firm experiences one or more weeks with firm-specific weekly returns exceeding 3.20 standard deviations below the mean firm-specific weekly returns over the fiscal year, and 0 otherwise. The results for regressing *CRASH* on *TONE_C* and *RE_TONE_C* using logit regressions are reported in Table 5 Panel C. Model (1) shows that the coefficient on *TONE_C* is negative and statistically significant (−0.357, with a *t* statistic of 3.37), suggesting that firms with more optimistic conference call tone are less likely to experience a stock price crash, consistent with our main results. Similar inferences are drawn from using *RE_TONE_C*, as shown in Model (2).

Additional Analyses

This section investigates explanations for the underlying mechanism of the predictive power of call tone for stock price crash risk.

Different Call Sections and Participants

In this sub-section, we explore whether the negative predictive power of optimistic conference call tone is attributable to managers' own truthful communication intentions or failure to withhold bad news. First, we analyze the predictive power of the tone of the presentation and Q&A sections,

Table 5 Results of robustness tests

	(1) $COUNT_t$	(2) $NCSKEW_t$	(3) $DUVOL_t$
Panel A: Residual tone of conference call and stock price crash risk			
$RE\_TONE\_C_{t-1}$	−0.083***	−0.156***	−0.094***
	(−3.00)	(−4.16)	(−4.07)
Controls	Yes	Yes	Yes
Observations	7231	7231	7231
Adjusted R^2	0.06	0.11	0.10
Year-fixed effects	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes
Panel B: Change in tone of conference call and stock price crash risk			
$\Delta TONE\_C_{t-1}$	−0.043*	−0.119***	−0.076***
	(−1.89)	(−3.79)	(−3.97)
Controls	Yes	Yes	Yes
Observations	5504	5504	5504
Adjusted R^2	0.01	0.02	0.02
Year-fixed effects	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes

	(1) $CRASH_t$	(2) $CRASH_t$
Panel C: Tone of conference call and stock price crash indicator		
$TONE\_C_{t-1}$	−0.357***	
	(−3.37)	
$RE\_TONE\_C_{t-1}$		−0.307***
		(−2.70)
Controls	Yes	Yes
Observations	4703	4311
Pseudo R^2	0.09	0.09
Year-fixed effects	Yes	Yes
Firm-fixed effects	Yes	Yes

This table presents regression results of robustness tests using alternative tone and stock price crash risk measures. Panels A and B present results obtained using two alternative measures of tone, residual tone (*RE_TONE_C*) and change in tone (Δ*TONE_C*), respectively. The dependent variables in Models (1), (2) and (3) are *COUNT*, *NCSKEW* and *DUVOL*, respectively. Panel C presents results obtained using an alternative stock price crash risk measure, *CRASH*. The key independent variables in Models (1) and (2) of Panel C are conference call tone (*TONE_C*) and residual tone of earnings conference call (*RE_TONE_C*), respectively. All continuous variables are winsorized at the 1st and 99th percentiles. T-statistics reported in parentheses are based on standard errors clustered by firm. *, ** and *** Represent significance at the 10%, 5% and 1% levels, respectively

respectively. When managers have incentives to hoard bad news but fail to do so, we expect the negative predictive power of optimistic call tone to be driven by the Q&A section tone. This is because the presentation section can be carefully scripted in advance to strategically hide bad news, whereas in the Q&A section, managers may be pressured by questions from call participants into disclosing information required by participants, making them more likely to divulge their true opinions on firm performance and outlook (Matsumoto et al. 2011). The results (Table 6 Panel A) show that optimistic tone in both the presentation and Q&A sections has significant and negative predictive power for stock price crash risk. The more optimistic the tone of either section, the lower the stock price crash risk. Furthermore, the coefficients on the Q&A section tone are larger than those on the presentation section tone. This indicates that while the former is more important for predicting stock price crash risk, managers also engage in truthful disclosure in the presentation section.

Next, we investigate whether the negative predictive power of the optimistic Q&A section tone is driven by managers or other call participants (mainly analysts). Previous research shows that both manager tone and participant tone convey useful information (Borochin et al. 2018; Brockman et al. 2015). However, it is difficult to predict *ex ante* whether both manager tone and participant tone have

Table 6 Analyses for different call sections and participants

	(1) $COUNT_t$	(2) $NCSKEW_t$	(3) $DUVOL_t$
Panel A: Different call sections			
$TONE\_P_{t-1}$	−0.033*	−0.049**	−0.030**
	(−1.86)	(−1.99)	(−1.99)
$TONE\_Q_{t-1}$	−0.055**	−0.122***	−0.076***
	(−2.37)	(−3.90)	(−3.84)
Adjusted R^2	0.06	0.10	0.10
Controls	Yes	Yes	Yes
Observations	8004	8004	8004
Year-fixed effects	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes
Panel B: Tone of managers and participants			
$TONE\_MAN_{t-1}$	−0.049**	−0.090***	−0.053***
	(−2.40)	(−3.32)	(−3.06)
$TONE\_PAR_{t-1}$	−0.014	−0.046**	−0.031**
	(−0.99)	(−2.39)	(−2.57)
Adjusted R^2	0.06	0.10	0.10
Controls	Yes	Yes	Yes
Observations	8004	8004	8004
Year-fixed effects	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes

Panel A presents regression results for the predictive power of tone in the presentation section (*TONE_P*) and the Q&A section (*TONE_Q*) on SPCR. Panel B shows results for the effect of manager tone (*TONE_MAN*) and participant tone (*TONE_PAR*) on stock price crash risk. The dependent variables in Models (1), (2) and (3) are *COUNT*, *NCSKEW* and *DUVOL*, respectively. All continuous variables are winsorized at the 1st and 99th percentiles. T-statistics reported in parentheses are based on standard errors clustered by firm. *, ** and ***Represent significance at the 10%, 5% and 1% levels, respectively

significant predictive power for stock price crash risk. On the one hand, manager tone may reflect useful forward-looking information. As managers possess private information, they know more about future crashes than call participants, and may communicate such negative outlooks truthfully using less optimistic tone. In this case, we would expect optimistic manager tone to have significant and negative predictive power and to drive the predictive power of the Q&A tone. On the other hand, participant tone may have greater predictive power, as previous research shows that analysts' participation and tone lead to stronger market reactions (Borochin et al. 2018; Brockman et al. 2015; Matsumoto et al. 2011). Thus, optimistic participant tone may also have negative predictive power for stock price crash risk and may drive the predictive power of the Q&A tone. The results (Table 6 Panel B) show that the coefficients on both *TONE_MAN* and *TONE_PAR* are significant, suggesting that both optimistic manager tone and optimistic participant tone in the Q&A section have significant and negative predictive power for stock price crash risk. Importantly, optimistic manager tone in the Q&A section has stronger and more negative predictive power than participant tone, both statistically and economically. These results indicate that managers, as corporate insiders, possess private information and engage in truthful communication during conference calls.[13]

Sub-sample Analyses

This sub-section presents our sub-sample analyses to further investigate how extrinsic motivations, such as external monitoring and managerial equity incentives, may affect managers' intentions to engage in truthful communication. First, we consider external monitoring from the firm's information environment. A better information environment leads to more transparent and truthful disclosure because it serves as a monitoring mechanism to curb unethical financial reporting. An important attribute of the corporate information environment is the analyst following, which improves the information environment, leading to higher-quality disclosures and lower information asymmetry (e.g., Frankel and Li 2004; Lang and Lundholm 1993; Yu 2008). With more analysts listening to a conference call, the firm's information flows more efficiently owing to stronger demand-side monitoring (Brochet et al. 2019). Thus, we expect that managers are motivated to engage in truthful communication when subjected to stronger external monitoring, and hence the information role of conference call tone will be more pronounced for firms with greater analyst following. The results (Table 7 Panel A) are consistent with this expectation.

Next, we consider managerial equity incentives. Previous literature suggests that these incentives may induce managers to engage in short-termist behavior to boost the current stock price at the expense of long-term firm value (Bebchuk 2009). Equity compensation may motivate managers to conceal bad news about firms' prospects (Benmelech et al. 2010), and such behavior may lead to higher stock price crash risk (Kim et al. 2011a). Thus, we expect that equity incentives may compromise managers' ethical and truthful communication intentions, causing the information role of conference call tone to be more pronounced when executives are less incentivized to hoard bad news. The results (Table 7 Panel B) provide supportive evidence for our prediction.[14]

[13] Both Borochin et al. (2018) and Brockman et al. (2015) focus on short-term market reactions to tone. Their findings indicate that investors are suspicious of managers' disclosure incentives and place more value on incentives than private information. However, this does not contradict our findings, which suggest that managers possess private information on potential stock price crashes and tend to communicate truthfully during conference calls.

[14] We divide our sample based on CEO option incentives. Our results are robust to using CFO option incentives instead.

Table 7 Sub-sample analyses: Information environment and managers' equity incentives

	(1) $COUNT_t$	(2) $COUNT_t$	(3) $NCSKEW_t$	(4) $NCSKEW_t$	(5) $DUVOL_t$	(6) $DUVOL_t$
	High	Low	High	Low	High	Low
Panel A: Analyst following						
$TONE\_C_{t-1}$	−0.104***	−0.046	−0.210***	−0.081	−0.126***	−0.053
	(−2.92)	(−1.15)	(−4.46)	(−1.52)	(−4.20)	(−1.61)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4521	3483	4521	3483	4521	3483
Adjusted R^2	0.06	0.07	0.10	0.12	0.10	0.11
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
CEO option incentives						
$TONE\_C_{t-1}$	−0.098*	−0.135***	−0.179***	−0.246***	−0.075*	−0.165***
	(−1.90)	(−2.77)	(−2.59)	(−3.43)	(−1.79)	(−3.91)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2440	2257	2440	2257	2440	2257
Adjusted R^2	0.07	0.08	0.10	0.12	0.10	0.11
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

This table presents results for the effect of conference call tone on stock price crash risk in sub-sample tests based on the information environment and managers' equity incentives. Panel A presents results for two sub-samples based on analyst following, and Panel B for two sub-samples based on CEO option incentives. All continuous variables are winsorized at the 1st and 99th percentiles. T-statistics reported in parentheses are based on standard errors clustered by firm. *, ** and ***Represent significance at the 10%, 5% and 1% levels, respectively

Taken together, the sub-sample analyses suggest that external monitoring from the corporate information environment curbs unethical financial reporting by limiting managers' ability to hoard bad news and manipulate disclosure tone, while managers' equity incentives have the opposite effect.

Research and Practical Implications

This paper makes three important research contributions. First, it adds to the previous literature on ethical financial reporting, which focuses mainly on written disclosures and is limited in its observation of managers' disclosure behavior in direct and spontaneous settings (e.g., Breuer et al. 2018; Cho et al. 2010; Craig and Amernic 2018). Bloomfield (2008) suggests that conference calls, which contain spontaneous conversations that reflect managers' thought processes and behavioral tendencies, may be more suited than written disclosures to examining theories based on lexical analysis. Answering Bloomfield's (2008) call for more research using the conference calls setting, our study contributes to the literature on ethical financial reporting.[15] Moreover, research on ethical financial reporting has focused largely on the determinants of and incentives for ethical/unethical financial reporting (e.g., Patelli and Pedrini 2014, 2015; Uddin and Gillett 2002) and firms' attitudes to decisions to engage in such behavior (e.g., Kaplan and Schultz 2007; Liu et al. 2015; Merchant and Rockness 1994). Our paper extends such research by explicitly exploring the implications of ethical reporting for investors in the setting of stock price crash risk.

[15] Our investigation of managers' ethical reporting behavior is based on a large sample of conference call transcripts. The closest previous study that explicitly investigates ethical reporting in the context of conference calls is by Camiciottoli (2011), who analyzes 10 call transcripts to examine the strategic usage of ethics-related language and finds that managers use conference call disclosures to convey a message of trustworthiness and confidence.

Second, this paper contributes to the literature on corporate voluntary disclosure, and especially conference call disclosure. We add to an important line of research on whether and how disclosure tone may be informative or manipulated by unethical managers for self-interests (e.g., Merkl-Davies and Brennan 2007; Patelli and Pedrini 2014, 2015) by showing that conference call tone provides investors with credible signals of extremely bad future outcomes (i.e., stock price crash risk). Moreover, whereas previous literature emphasizes the association between conference call tone and short-term market reactions (e.g., Davis et al. 2015), this paper provides new evidence for the relatively long-term, forward-looking information role of call tone for corporate outcomes.

Third, this paper adds to the literature on stock price crash risk prediction, which has investigated a range of potential determinants such as manager characteristics, corporate governance quality, external monitoring and informal institutional mechanisms (e.g., Andreou et al. 2016, 2017; Chen et al. 2019; Kim et al. 2016; Xu et al. 2013). To the best of our knowledge, this study is the first to link firm-level stock price crash risk with the disclosure attributes of conference calls. Given that stock price crashes cause serious damage to investors, understanding how soft information in corporate disclosures predicts such extremely bad events may help investors avoid such outcomes.

This paper also extends research on stock price crash risk by providing evidence supporting the common assumptions made by relevant literature that stock price crash risk reflects firm-specific bad news and that managers may possess *ex ante* private information about such risk (Roll 1988). This is important and useful for future studies based on similar premises.

The results have important practical implications for capital market participants and practitioners. First, for investors, we find that the tone of conference calls helps predict stock price crash risk in the next year. As stock price crashes have detrimental consequences for investors, our finding is crucial for protecting their interests and benefits, for example by enabling them to fire in their stop-loss orders. Investors should therefore include call tone as a useful factor in their information set when making investment decisions.

Second, we find that extrinsic motivations influence managers' truthful reporting behavior. Specifically, managers tend to report truthfully when the firm has good information environment because they are subject to stronger monitoring. This finding speaks to regulators' efforts to improve firms' disclosure credibility and information environment for capital market participants (e.g., Stein 2018; US Chamber of Commerce 2014). Conversely, we find that managers' equity compensation incentives compromise ethical managerial reporting behavior. For firms, while equity-based incentives may be designed to align managers' and shareholders' interests, our results reveal that high-equity incentives may have unintended consequences, such as damaging financial reporting ethics.

Limitations and Future Research Directions

This study inevitably has limitations that might be overcome in future research. First, the results suggest that managers engage in truthful disclosures in the context of extreme downside risk. Owing to the scope of the paper, we do not explore other contexts potentially relating to managers' truthful communication. Future studies might shed further light on this important issue. Second, we are mindful of debate in the literature over the concept and empirical measurement of disclosure tone (e.g., Henry and Leone 2016). Although we do not address this debate directly, we mitigate potential concerns by using alternative word classifications and alternative tone measures (i.e., residual tone and tone change) to test the robustness of our results. Third, our results indicate the importance of conference call tone for stock markets, raising questions about whether it might also be predictive for other standard asset pricing anomalies. The short sample period in this paper limits our ability to test such issues, so future research might investigate these research avenues. Fourth, we find that managers engage in truthful information disclosures due to strong monitoring induced by a good information environment and lower managerial equity incentives. It is also possible that managers unintentionally reveal truthful information during conference calls, but such cognitive processes are empirically unobservable. Future studies might develop novel measurements or explore other possible mechanisms for unintentional truthful communication.

Conclusion

This study investigates whether and how the tone of earnings conference calls predicts stock price crash risk. We develop and test two competing hypotheses regarding

the information role of call tone in predicting stock price crash risk based on theories and studies of ethical financial reporting and voluntary disclosure incentives. On the one hand, managers may use optimistic language as an impression management strategy to manipulate investors' perceptions of the firm, leading to a positive relation between optimistic conference call tone and stock price crash risk. On the other hand, managers have motivations for ethical disclosure and truthful communication, leading to a negative relation between optimistic call tone and stock price crash risk. We find strong evidence that more optimistic tone of conference calls predicts lower stock price crash risk, indicating that managers engage in truthful communication rather than unethically manipulating the tone. These results hold up to various robustness checks. Moreover, additional analyses suggest that the role of optimistic call tone in predicting stock price crash risk is more pronounced when the firm has greater analyst following or lower managerial option incentives, suggesting that monitoring from corporate information environment and managers' equity incentives are underlying mechanisms for managers' truthful communication.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Appendix 1

See Table 8.

Table 8 Variable definitions

Variable	Definition
Dependent variables: Stock price crash risk measures	
COUNT	The difference between the number of firm-specific weekly returns exceeding 3.20 standard deviations below the mean firm-specific weekly return over the fiscal year, and the number of firm-specific weekly returns exceeding 3.20 standard deviations above the mean firm-specific weekly return.
NCSKEW	The negative skewness of firm-specific weekly returns during the fiscal year period.
DUVOL	The natural logarithm of the ratio of the standard deviation of firm-specific weekly returns for down weeks to that for up weeks. Over a firm's fiscal year period, down (up) weeks are defined as all weeks with firm-specific weekly returns below (above) the annual mean.
CRASH	An indicator variable that equals 1 if a firm experiences one or more crash weeks in the fiscal year, and zero otherwise. Crash weeks are defined as those when a firm experiences firm-specific weekly returns exceeding 3.20 standard deviations below the mean for the fiscal year.
JUMP	The number of firm-specific weekly returns exceeding 3.20 standard deviations above the mean firm-specific weekly return for the fiscal year.
Test variables: Tone measures	
TONE_C	Tone over a whole earnings conference call, which is the ratio of the difference between the numbers of positive and negative words, to the total number of words over the whole call.
TONE_P	Tone over the presentation section of an earnings conference call, which is the ratio of the difference between the numbers of positive and negative words, to the total number of words in the presentation section.
TONE_Q	Tone in the Q&A section of an earnings conference call, which is the ratio of the difference between the numbers of positive words and negative words, to the total number of words during the Q&A section.
TONE_MAN	Manager tone during an earnings conference call, which is the ratio of the difference between the numbers of positive and negative words, to the total number of words spoken by managers during a call.
TONE_PAR	Participant tone during an earnings conference call, which is the ratio of the difference between the numbers of positive and negative words, to the total number of words spoken by participants during a call.
RE_TONE_C	The residual term of a cross-sectional regression of tone on the firm's current year performance and fundamentals.

Appendix 2

See Table 9.

Table 9 Top 30 Negative and positive words in conference calls

Ranking	Negative		Positive	
	Word	Percentage	Word	Percentage
1	Question	18.17	Good	11.95
2	Questions	7.58	Strong	6.56
3	Decline	3.63	Great	5.88
4	Loss	3.14	Better	3.99
5	Negative	1.99	Opportunities	3.66
6	Closing	1.80	Able	3.33
7	Restructuring	1.78	Opportunity	3.27
8	Difficult	1.74	Improvement	2.62
9	Against	1.73	Positive	2.55
10	Late	1.47	Benefit	2.20
11	Declined	1.41	Progress	2.11
12	Challenges	1.21	Best	1.92
13	Challenging	1.08	Improve	1.91
14	Closed	1.06	Pleased	1.91
15	Force	1.04	Improved	1.89
16	Critical	0.90	Success	1.28
17	Recall	0.90	Profitability	1.21
18	Impairment	0.89	Effective	1.19
19	Break	0.85	Excited	1.10
20	Litigation	0.79	Strength	1.07
21	Declines	0.76	Successful	1.06
22	Losses	0.76	Improving	1.04
23	Slow	0.71	Greater	1.01
24	Challenge	0.65	Improvements	1.00
25	Bad	0.65	Confident	1.00
26	Problem	0.61	Achieved	0.93
27	Weak	0.61	Advantage	0.88
28	Volatility	0.61	Gain	0.88
29	Lost	0.60	Despite	0.86
30	Weakness	0.59	Achieve	0.86

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