The Information Content of Tone Dispersion: Evidence from Earnings Conference Call Q&As*

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Abstract

Verbal features of a text matter for its information content. We quantify a text's verbal features along two distinct dimensions: tone level and tone dispersion. We employ the FinBERT model to textually analyze question-and-answer (Q&A) sessions of earnings conference calls and measure tone level and tone dispersion. We find share prices respond more sensitively to earnings news accompanied with highly tone-dispersed Q&A sessions, and these Q&A sessions are associated with larger stock trading volume upon earnings announcements. These results hold after controlling for investor attention proxies, and alternative stories are discussed. Combined, our findings suggest that conference calls with higher tone dispersion produce a greater quantity of incremental information beyond cold financial figures, thus resulting in enhanced price impacts and heightened trading volume. Additional analyses verify this information production hypothesis.

JEL Classification: G14, G23, M12

Keywords: Tone Dispersion, FinBERT, Textual Analysis, Earnings Conference Call

1 Introduction

Tone level, or sentiment, of firm news articles, financial disclosures, and conference call transcripts has been extensively examined in academic research. Using textual analysis techniques, many papers extract investor sentiment via calculating the differential in quantities of positive and negative information and then having it properly scaled. For example, Yang et al. (2020) propose FinBERT, a specialized BERT model for financial communications, to classify each sentence within a text as either positive, negative, or neutral. A text may consist entirely of neutral sentences throughout while another text of similar length may have many positive sentences and the same number of negative sentences. Clearly, both texts may be classified as tone-neutral and considered least informative.

However, these two texts present distinct verbal features along an ignored dimension: tone dispersion. Specifically, holding a neutral tone throughout, the former text is least tone-dispersed and likely contains really dry and even boring content. In contrast, the latter text is substantially tone-dispersed, simultaneously delivering positive and negative information flows, and likely getting across fascinating and insightful ideas. Intuitively, we conjecture that texts with higher tone dispersion tend to deliver more information, holding tone level and other factors constant.

In this paper, we argue that tone dispersion, the second dimension of a text's verbal features, captures incremental information on top of tone level's information content. We employ share price responses to firm earnings news as the main empirical setup. In particular, we investigate how tone dispersion of earnings conference call question-and-answer (Q&A) sessions would affect share price responses to firm earnings news. Technically, we combine

the dispersion measure as defined in Bachmann, Elstner, and Sims (2013) and the FinBERT model, a finance-specialized natural language processing (NLP) model, to quantify the verbal features of analyst-executive conversations during Q&A sessions of earnings conference calls.

We motivate and formulate the information production hypothesis that highly tone-dispersed Q&As are associated with a larger quantity of new information being produced. Therefore, we expect that share prices respond more sensitively to firm earnings news accompanied with highly tone-dispersed conversations between analysts and executives during the Q&As, and these highly tone-dispersed Q&A sessions be associated with greater abnormal trading volume upon earnings announcements. Our evidence supports this hypothesis. Specifically, we find the sensitivity of immediate share price responses to earnings news is 15.96% to 22.02% (9.38% to 19.09%) higher if accompanied with analyst (executive) tone dispersion being greater than its cross-sectional median. We also find the abnormal trading volume is 2.18% (2.17%) higher for earnings conference calls with higher-than-median analyst (executive) tone dispersion.

We conduct additional analyses to mitigate concerns and distinguish from competing stories. One particular concern is whether the effects of tone dispersion on share price responses to earnings news and on stock trading volume could be potentially driven by alternative channels other than our proposed information production channel. For example, one may argue that conference calls with highly tone-dispersed Q&A sessions may attract abnormally high levels of attention from institutional investors and therefore enlarge the sensitivity of share price responses to earnings news without actually producing more information.

We mitigate this concern in two steps. First, following Ben-Rephael, Da, and Israelsen

(2017), we construct a firm-level measure of abnormal institutional investor attention at the daily frequency using Bloomberg Readership data. Our graphical evidence suggests that Bloomberg terminal users allocate their attention in almost identical ways around firm earnings news regardless of high or low Q&A tone dispersion. Second, we replicate our main results but directly control for investor attention (and its interaction with earnings news wherever applicable). We find the effects of tone dispersion are qualitatively the same and quantitatively similar.

In the last section of empirical analyses, we explicitly verify our information production hypothesis. First, we investigate what specific information is being produced during earnings conference call Q&As. We aim to quantify the differential in information production quantity between Q&A sessions with high and low tone dispersion. Following Huang, Lehavy, Zang, and Zheng (2018), we prepare a list of ten topics and count the number of mentioning each topic during a Q&A.[1] Presumably, the more frequently a topic is discussed during a Q&A, the more information is being produced about the topic.

Among all Q&A sessions of earnings conference calls in each year-quarter, we select the top 100 with highest analyst (executive) tone dispersion and the bottom 100 with lowest analyst (executive) tone dispersion. Specifically, "Business Outlook" is mentioned 85.0 (87.3) times on average among the 100 highest-ATD (ETD) conference call Q&As and mentioned only 53.6 (55.4) times on average among the 100 lowest-ATD (ETD) conference call Q&As. The differential is 31.3 (31.9), indicating that "Business Outlook" is almost 60%

[1]Huang et al. (2018) textually analyze analyst reports and corporate disclosures and list their top ten topics for the "capital goods industry", namely, Business Outlook, Financial Outlook, Growth, Raw Materials and Input Price, Sales and Revenue, Comparing Financial, Geographic Segments, Cashflows and Financing, Valuation Model, and Defense Contract.

more frequently mentioned during the 100 highest-ATD (ETD) Q&As than during the 100 lowest-AVD (ETD) Q&As. Substantial differentials hold as we move along the list of topics. Additional evidence indicates that measures of analyst and executive tone dispersion are positively correlated with these topic number counts.

Inspired by Bushee, Gow, and Taylor (2018), we decompose executive tone dispersion into two components: ETD Infor (the part of ETD that is explained by information quantity) and ETD Obfus (the unexplained part). Our graphical evidence indicates that the total information quantity of executives' answers to analyst questions is generally increasing in executive tone dispersion but monotonically increasing in ETD Infor, the informative component of ETD. We also find a "reverse U-shaped" relation between executives information quantity and ETD Obfus, the unexplained component. The regression results further confirm that our main results on ETD are driven by ETD Infor. Overall, our results directly verify the information production roles of executive tone dispersion during earnings conference call Q&A sessions.

Our paper contributes to the literature on information content of earning conference calls. Earlier work argues that conference calls deliver share-price-relevant information to the stock markets.[2] Recent work empirically explores the implications of analysts' and managers' tone levels during earnings conference calls.[3] Our paper focuses on the second dimension of a

[2]Bowen, Davis, and Matsumoto (2002) and Kimbrough (2005) find that earnings conference calls are associated with improved accuracy of analyst forecasts, suggesting that new information, beyond what's already disclosed in legally required corporate filings and announcements, has become available to analysts. Frankel, Johnson, and Skinner (1999) and Bushee, Matsumoto, and Miller (2003) find heightened levels of trading activity and return volatility during earnings conference calls, supporting the view that stock markets extract incremental information from earnings conference calls.

[3]At the individual firm level, Price, Doran, Peterson, and Bliss (2012) find that earnings conference call tone levels significantly predict abnormal return, trading volume, and post-earnings announcement drift. Borochin, Cicon, DeLisle, and Price (2018) examine how linguistic tone levels of managers and analysts distinctly affect how investors assess firm value uncertainty. In a related vein, Chen, Nagar, and Schoenfeld

text's verbal features: tone dispersion. Specifically, we use the FinBERT model to quantify the verbal features of analysts-executives conversations during earnings conference call Q&A sessions and empirically explore their implications for share price responses to earnings news and for stock trading volumes.

Our paper also contributes to the literature on unexpected earnings news and share price responses. This literature focuses on earnings response coefficient (ERC) that captures the sensitivity of share price responses to firm earnings news. Collins and Kothari (1989) document the cross-sectional heterogeneity and time-series variation in ERC. Following Collins and Kothari (1989), many papers document the factors that affect the relationship between abnormal returns and unexpected earnings.[4] Chen, Nagar, and Schoenfeld (2018) and Matsumoto, Pronk, and Roelofsen (2011) find that the disclosure tone in a conference call also affects ERC. Our paper joins this literature and employs ERC as the main playfield to examine our information production hypothesis. The incremental information content of highly tone-dispersed Q&As is captured by the enhanced sensitivity of share price responses to firm earnings news.

(2018) find that investors also respond differently to the tone levels of managers and analysts. At the aggregate market level, Jiang, Lee, Martin, and Zhou (2019) find that manager tone levels of earnings conference calls significantly predict future aggregate stock market returns. Furthermore, F.Larcker and Zakolyukina (2012) find that extremely positive managerial tone levels in conference calls predict financial restatement, suggesting that manager tone levels can be used to identify firms' deceptive behavior. Huang, Teoh, and Zhang (2014) argue that the firms with an abnormal positive tone level in earnings press releases are associated with negative future earnings and cash flows. Blaua, DeLisle, and Price (2015) argue that short sellers incorporate managerial tones in conference calls into their trading decisions. In particular, their evidence suggests that short sellers target firms with unusually positive managerial tones. Finally, Allee and DeAngelis (2015) argue that the managerial tone structure is related to firm performance and financial reporting practices.

[4]These factors include, namely, firm audit qualifications (Choi and Jeter (1992)), auditor's reputation (Teoh and Wong (1993)), change of firm auditor (Hackenbrack and Hogan (2002)), uncertainty in analyst earnings forecasts (Imhoff and Lobo (1992)), the default risk in firm debt (Dhaliwal and Reynolds (1994) and Billings (1999)), market-wide investor sentiment (Mian and Sankaraguruswamy (2012)), and many others (Ghosh, Gu, and Jain (2005), Keung, Lin, and Shih (2010), Chi and Shanthikumar (2017)).

Last but not least, our paper is intrinsically connected to the literature on limited investor attention. Hirshleifer, Lim, and Teoh (2009) find that investors are more distracted from the focal firm's earnings news when a greater number of other firms are announcing their earnings on the same day. Similarly, Dellavigna and Pollet (2009) find that investor attention to firm earnings news is particularly low on Fridays. Our paper joins this literature and employs a similar empirical setup to test our information production hypothesis. We justify that our results that support the information production hypothesis are not driven by investor attention: We directly control for these proxies of investor attention in our regressions. Our work focuses on the information production effects of verbal interactions between analysts and executives during earnings conference call Q&As and their implications for share price responses to earnings news and firm-level stock trading volume.

Our paper proceeds as follows. Section 2 provides background information for our empirical framework. Section 3 describes how we quantify tone level and tone dispersion for conversations between analysts and executives during earnings conference call Q&A sessions. Section 4 develops the hypotheses for empirical tests and presents our main findings, Section 5 conducts robustness checks, and Section 6 concludes.

2 Institutional Background

Earnings conference calls have become an increasingly important mechanism of voluntary disclosure for US companies to communicate with external capital markets. Conference calls usually follow quarterly earnings press releases within a few hours. Besides routinely disclosing information, the executives have opportunities to comment on firm financial per-

formances for the most recent quarter as well as highlight their future implications. An earnings conference call begins with management opening remarks, which generally reiterate important issues in the press release, and is typically followed by a question-and-answer (Q&A) session with participant analysts. Particular issues not covered in the press release are often discussed in the Q&A session.

Q&A sessions of earnings conference calls enable analysts to verbally interact with executives. Unlike static documents such as 10-K or 10-Q filings, Q&A conversations between analysts and executives are of an interactive and dynamic nature and likely to contain incremental information beyond cold figures in press releases. Prior studies focus on analyzing the particular choices of words by analysts and executives in conference calls using dictionary-based methods.[5] However, these dictionary-based methods may not be able to fully capture the value-relevant information conveyed in a conference call, and textual analyses using latest machine learning techniques are called in to provide more insights for extracting information from conference call Q&A sessions.[6]

As earnings conference calls become an important medium of communication, some researchers start to analyze their implications for share prices. Chen et al. (2018) textually analyze the tone of managers and analysts and find that intraday prices react significantly to analyst tone, but not to management tone, for the full duration of the discussion. Matsumoto et al. (2011) find that discussion periods are relatively more informative than presentation periods, and this greater information content is positively associated with analyst following. They also find that managers provide increased disclosures during the presentation segment

[5]These studies are surveyed in the literature review section.

[6]For example, Li, Mai, Shen, and Yan (2021) construct scores of five corporate cultural values, namely, innovation, integrity, quality, respect, and teamwork using the word embedding model.

when firm performance is poor, but relatively more information is released during discussion periods in these circumstances. However, these papers do not realize the importance of analyst-executive interaction in the earnings conference calls. Our paper is the first to apply the FinBERT model to measure tone dispersion to investigate its implications for firm share prices and implied volatility around earnings news.

3 Measure Construction: Tone Dispersion

3.1 Data Source: Conference Call Manuscripts

Our conference call data cover Standard and Poor's (S&P) 1500 firms from 2006 to 2020. We first obtain the list of S&P1500 firms from **Execucomp**, and then extract quarterly earnings conference call transcripts from **Capital IQ**. Our initial sample consists of 86,768 quarterly earnings conference call transcripts for 2,294 unique companies. In our textual analyses, we remove all names, titles and affiliations, and only focus on what the executives and analysts said during the Q&A session.[7] Analyst earnings forecasts are from IBES. Share price, number of shares outstanding, and other stock trading variables are from CRSP. Data of firm characteristics are from Compustat. Quarterly data of institutional share ownership at the individual firm level are from Thomson/Refinitiv.

[7] A conference call consists of a management presentation session and a Q&A session. The presentation session is of "prepared remarks" or "prepared comments", while the Q&A session is more likely to contain some spontaneous responses by managers to analysts' questions or remarks. Therefore, the Q&A session captures material information on how the management team verbally interact with participating analysts. From each Q&A session, we can extract the conference call date, names of corporate executives, names of analysts, and analyst affiliation.

3.2 The FinBERT Model

Natural Language Processing (NLP) provides a strong and effective way to understand the large body of conference calls. NLP's most revolutionary stream is Bidirectional Encoder Representations from Transformers, the BERT model (Devlin, Chang, Lee, and Toutanova (2019)). Its key technical innovation is applying the bidirectional training of Transformer, a popular attention model, to language modeling. Unlike directional models which read the text input sequentially (left-to-right or right-to-left), BERT is bidirectional: It can learn the context of a word based on its surroundings (left and right of the word). Building upon the BERT model, Yang et al. (2020) propose FinBERT, a specialized BERT for financial communications.[8] Specifically, FinBERT is trained on the following three financial communication corpora.

- Corporate Reports 10-K and 10-Q: 2.5B tokens
- Earnings Call Transcripts: 1.3B tokens
- Analyst Reports: 1.1B tokens

FinBERT results in state-of-the-art performance on financial sentiment classification, which is a core financial NLP task. We utilize FinBERT to classify every sentence of quarterly earnings conference call transcripts as positive, negative or neutral.

[Insert Table 1 Here]

Table 1 presents the difference between the FinBERT model and the dictionary-based methods in Loughran and McDonald (2011) using the Q&A session from Apple, Inc. on

[8]FinBERT is open-source and can be downloaded from: https://github.com/yya518/FinBERT

November 2nd, 2017 as an example. Specifically in the beginning, CEO Tim Cook says "...Apple is in a really unique position to lead in this area", and FinBERT correctly classifies what Time Cook says here as "Positive". However, employing the dictionary-based approach in Loughran and McDonald (2011) would have it classified as "Null" simply because this whole sentence does not include any words in their list of words that have positive meanings. Similar issues with this dictionary-based approach happen again as we move along this example.[9]

Next, we compare tone level measures generated using the FinBERT model and the Loughran and McDonald (2011) method. We construct tone level measures for analysts and executive, respectively. The first column in Table 2 presents the correlation between analyst tone level measures calculated using these two alternative methods for the whole sample. We can see that the whole sample correlation between measures of analyst tone level calculated using these two approaches is 0.52; this correlation stays fairly stable across all 11 SUE groups, ranging within [0.46, 0.52]. Regarding executive tone level, the correlation between the two measures calculated using FinBERT and Loughran and McDonald (2011)'s approach is 0.69 for the whole sample, and again this correlation stays fairly stable across all 11 SUE groups, ranging within [0.66, 0.70]. Therefore, our FinBERT measures of analyst and executive tone level are highly correlated with, but different from, Loughran and McDonald (2011)'s measures.

[Insert Table 2 Here]

[9]Please refer to Huang, Wang, and Yang (2023) for more detailed descriptions on the benefits of using the FinBERT model to extract information from financial texts.

3.3 Definition of Tone Dispersion

We apply the dispersion formula in Bachmann et al. (2013) to define tone dispersion:

$$TD_t = \sqrt{Frac_t^+ + Frac_t^- - \left(Frac_t^+ - Frac_t^-\right)^2} \tag{1}$$

where $Frac_t^+$ is the fraction of positive sentences out of all sentences a text; similarly, $Frac_t^-$ is the fraction of negative sentences.[10] In particular, we differentiate between executives and analysts by calculating one measure to capture executive tone dispersion and a separate measure to capture analyst tone dispersion. Specifically, we apply this definition as follows:

- Analyst Tone Dispersion

$$ATD_{i,t} = \sqrt{Frac_{i,t}^{a,+} + Frac_{i,t}^{a,-} - \left(Frac_{i,t}^{a,+} - Frac_{i,t}^{a,-}\right)^2} \tag{2}$$

  $Frac_{i,t}^{a,+}$ is the fraction of positive sentences contributed by the analysts in the quarterly earnings conference call transcript of firm i for quarter t; similarly, $Frac_{i,t}^{a,-}$ is the fraction of negative sentences. That is, $ATD_{i,t}$ measures how tone-dispersed the analysts are in a conference call and ranges from 0 (if all sentences are of either negative tone or positive tone throughout, representing the lowest tone dispersion) to +1 (if 50% of sentences are of positive tone, and all the other 50% are of negative tone, representing the highest tone dispersion).

[10] This measure of dispersion is the cross-sectional weighted standard deviation of the verbal interaction when the positive sentence is coded as +1, the negative sentence as -1, and the neutral category as 0; this is a standard quantification method for qualitative survey data.

- Executive Tone Dispersion

$$ETD_{i,t} = \sqrt{Frac_{i,t}^{e,+} + Frac_{i,t}^{e,-} - \left(Frac_{i,t}^{e,+} - Frac_{i,t}^{e,-}\right)^2} \tag{3}$$

where $Frac_{i,t}^{e,+}$ is the fraction of positive sentences contributed by the executives in the quarterly earnings conference call transcript of firm i for quarter t; similarly, $Frac_{i,t}^{e,-}$ is the fraction of negative sentences. That is, $ETD_{i,t}$ measures how tone-dispersed the executives are in a conference call and ranges from 0 (if all sentences are of either negative tone or positive tone throughout, representing the lowest tone dispersion) to +1 (if 50% of sentences are of positive tone, and all the other 50% are of negative tone, representing the highest tone dispersion).

Notably, these measures of tone dispersion differ from the tone level or sentiment measures employed in prior studies (Blaua et al. (2015), Price et al. (2012), Henry (2008), Jiang et al. (2019)) in two important ways. First, our measures of tone dispersion are constructed based on tone classifications at the sentence level using the FinBERT model while prior studies construct tone level measures at the level of word number counts. Specifically, they focus on the numbers of positive and negative words, respectively, in a given conference call (or its Q&A session) according to the word lists of Loughran and McDonald (2011).[11] Second, our measures of tone dispersion may be considered as the "second moment" for Q&A session verbal features whereas the "first moment" is tone level.

[Insert Figure 1 Here]

[11]Prior studies generally use (#PositiveWords - #NegativeWords), properly scaled, as the tone measure that considers both the optimistic and pessimistic sentiment of a conference call.

Figure 1 graphically compares tone level and tone dispersion, the first and second dimensions of verbal features. For example, the tone level measure assigns the value of 1 to a short text which has 10 positive sentences and 0 negative sentence, and assigns the value of 0 to a long text which contains 50 positive sentences and 50 negative sentences (Panel A, Figure 1). For the latter case, the tone level of a conference call is deemed neutral and prior studies argue that conference calls of a neutral tone produce little or limited information. The tone dispersion measure defined in Equation (1) would assign the value of 0 to the short text but the value of 1 to the long text (Panel B, Figure 1). Therefore, tone level and tone dispersion capture the verbal features of a text along two different dimensions. Table 3 compares tone level measures for analysts and executives and tone dispersion measures for analysts and executives, respectively. The whole sample correlation is 0.29 for analyst and executive tone level and 0.38 for analyst and executive tone dispersion. These correlations along 11 SUE groups are presented as well.

[Insert Table 3 Here]

Figure 2 provides descriptive features of tone dispersion measures across earnings surprises. We plot the 5th, 25th, 50th, 75th, 95th percentiles of analyst tone dispersion (ATD) in Panel A and executive tone dispersion (ETD) in Panel B. We find that the level and the distribution of analyst tone dispersion does not show clear patterns along earnings surprises.

[Insert Figure 2 Here]

4 Hypothesis Development and Empirical Analyses

4.1 Hypothesis Development

Analysts and investors obtain a substantial amount of share price-related information from financial statements. Many of them, however, still attend earnings conference calls and ask questions for the executives to answer during Q&A sessions. Analysts usually feature the contexts briefly and then clearly state their questions; these questions and the ways they put them are highly likely to verbally stimulate how the executives would respond. We conjecture that stock markets can extract incremental information beyond cold financial figures from these verbal interactions between analysts and executives. We argue that such information will be quickly incorporated into firm share prices. In particular, we argue that highly tone-dispersed Q&A sessions are associated with greater quantity of incremental information being produced. Our first hypothesis is on the relation between tone dispersion of Q&A sessions and share price responses to unexpected earnings.

Information Production Hypothesis 1: Earnings conference calls with highly tone-dispersed Q&A sessions produce more new information and thus have larger price impacts per unit of earnings surprise.

This hypothesis emphasizes that the new information being produced during highly tone-dispersed Q&A sessions results in a larger share price response per unit of unexpected earnings.[12] If our hypothesis of more sensitive share price responses to unexpected earnings is truly driven by the information production channel, one may wonder whether there are any

[12]We also discuss alternative explanations that may compete with our information production hypothesis in the empirical section.

other possible effects this channel may have implications for. Following the literature, we have located variables that capture the abnormal trading volumes upon earnings announcements.

Information Production Hypothesis 2: Earnings conference calls with highly tone-dispersed Q&A sessions produce more new information and thus are associated with larger abnormal trading volume upon earnings announcements.

4.2 Variable Definitions and Summary Statistics

This section defines the dependent variables, key independent variables, and covariates in empirical analyses and presents their summary statistics. Cumulative abnormal returns, CAR(t_1,t_2), are cumulative DGTW-adjusted returns in percentage points from t_1 to t_2. Following Hershleifer, Lim and Teoh (2009), daily abnormal trading volume is constructed as the difference between the natural log of daily trading volume and the 30-day average of log daily trading volume from day -40 to day -11. AbVol(0,1) is the two-day average of daily trading volume on the earnings announcement date and the very next day. AbVol(0,3) is the four-day average of daily trading volume on the earnings announcement date and the next three days.

Standardized unexpected earnings (SUE) are calculated as the difference between actually announced earnings per share and analyst forecast consensus, and then scaled by share price at the previous quarter end. Following Dellavigna and Pollet (2009), we sort all SUEs into 11 quantiles where quantile 6 is for zero earnings surprises, quantiles 1-5 for negative earnings surprises, and quantiles 7-11 for positive earnings surprises. Analyst tone dispersion (ATD)

and executive tone dispersion (ETD) are constructed following Bachmann et al. (2013). High ATD is an indicator variable that equals one if the Q&A session of a conference call has a level of analyst tone dispersion that is higher than the quarterly cross-sectional median, and zero otherwise. High ETD is an indicator variable that equals one if the Q&A session of a conference call has a level of executive tone dispersion that is higher than the quarterly cross-sectional median, and zero otherwise.

The covariates are constructed as follows. ln(NumEA) is the natural log of the total number of all other firms announcing their quarterly earnings on the same day. Friday is an indicator variable that equals one if a firm announces its quarterly earnings on a Friday. Analyst tone level (ATL) and executive tone level (ETL) are calculated separately for analysts and executives. ln(AnaLength) is the natural log of the total number of sentences all analysts say in an earnings conference call's Q&A session, and ln(ExeLength) is the natural log of the total number of sentences all executives say in an earnings conference call's Q&A session. ln(MarketCap) is the natural log of a firm's market capitalization (i.e. the product of share price and the number of shares outstanding). Turnover is the ratio of trading volume over number of shares outstanding at the previous quarter end. Ret_q is a firm's holding period return for the previous quarter, and Momentum_3q is a firm's nine-month holding period return before Ret_q. InstOwn measures a firm's percentage ownership by 13f institutional investors. ln(NumEst) is the natural log of total number of estimates to form a firm's analyst consensus for its to-be-announced quarterly earnings. AIA is abnormal institutional investor attention to a firm, an indicator variable that is equal to one if the news reading and news searching activities for the firm by all Bloomberg terminal users at the

daily frequency exceeds a threshold following Ben-Rephael et al. (2017). Table 4 provides summary statistics for all variables employed in the empirical analyses.

[Insert Table 4 Here]

We focus on earnings conference calls that take place on the same day with earnings announcements. To ensure the accuracy of SUE, we require at least three analyst earnings forecasts as input to form a consensus. The final sample has 46,231 observations for empirical analyses, representing 1,846 unique firms spanning 2006Q1 - 2020Q4. Table 4 presents the summary statistics for the outcome variables, key independent variables, and covariates.

4.3 Graphical Analyses

In this section, we compare share price responses to earnings news between earnings conference calls with highly tone-dispersed Q&As and those without. Both analyst tone dispersion (ATD) and executive tone dispersion (ETD) are compared in all three panels of Figure 3. Along the horizontal axis are the 11 quantiles where quantile 6 is for zero earnings surprises, quantiles 1-5 for negative earnings surprises, and quantiles 7-11 for positive earnings surprises following Dellavigna and Pollet (2009). The vertical axis is for cumulative abnormal returns averaged across all observations within the same SUE quantile. Panel A focuses on immediate share price response over a three-day window, CAR(-1,1). The blue curves are for earnings conference call Q&As with tone dispersion greater than its cross-sectional median and the orange curves for those with lower-than-median tone dispersion. In both graphs of Panel A, we can see that all curves are monotonically increasing in SUE sort, and the positive slope is greater for earnings conference call Q&As with high tone dispersion.

This pattern holds for both analyst tone dispersion and executive tone dispersion. That is, earnings conference call Q&As with high tone dispersion immediate are associated with share price responses being more sensitive to earnings news.

[Insert Figure 3 Here]

Panel B focuses on delayed share price response over the next 45 days, CAR(2,46). Again, we compare the curves for earnings conference call Q&As with high and low tone dispersion, and we make this comparison for analyst tone dispersion and executive tone dispersion separately. Interesting, the two graphs in Panel B are largely flat and suggest no clear post-earnings-announcement drift. These flat curves indicate that information contained in earnings news and disclosed via earnings conference calls has been quickly incorporated into firm share prices in our sample period of 2006Q1 - 2020Q4. The curves in Panels A and B jointly suggest that a greater quantity of new information is being produced during earnings conference call Q&As with high tone dispersion.[13]

[13]To present a more complete picture of share price dynamics around earnings conference calls, we also prepare two graphs that focuse on share price patterns before earnings announcements over the (-15,-2) period. All curves in these two graphs are upward sloping but the slopes are much smaller in magnitude if compared to the curves in Panel A. There seems no clear differential in slopes between high and low tone dispersion, and this applies to both analyst tone dispersion and executive tone dispersion.

4.4 Main Empirical Findings

4.4.1 Model Specification

Following Hirshleifer, Lim, and Teoh (2009) and Dellavigna and Pollet (2009), the following specification is employed for empirical tests:

$$\begin{aligned} CAR_{i,t}(t_1,t_2) &= \phi_0 + \phi_1 SUE_{i,t} + \phi_2 SUE_{i,t} * HighToneDispersion_{i,t} \\ &\quad + \phi_3 HighToneDispersion_{i,t} + \Phi_4' X_{i,t} + \Phi_5' (SUE_{i,t} * X_{i,t}) + \epsilon_{i,t} \end{aligned}$$

where t_1 and t_2 are time points relative to the earnings announcement of firm i for quarter t, and $X_{i,t}$ is the vector of covariates. The main coefficient of interest is ϕ_2, indicating whether a differential exists in the sensitivity of $CAR(t_1,t_2)$ to SUE between conference calls with and without a highly tone-dispersed Q&A session.[14]

4.4.2 Analyst and Executive Tone Dispersion

Table 5 shows how tone dispersion matters for share price responses to SUE. Panel A of Table 5 includes no control variables, Panel B includes control variables, and Panel C includes both the control variables and the interaction terms of control variables with SUE.[15] The first two columns in Panel A presents the share price dynamics around firm earnings conference calls with high and low analyst tone dispersion. The coefficient for SUE in Column (1) suggests that immediate share price response to SUE is positive and statistically significant. As

[14] In similar settings, Hershleifer, Lim and Teoh (2009) and DellaVigna and Pollet (2009) take the ratio of ϕ_2 over ϕ_1 to assess the economic significance of the sensitivity differential.

[15] The full list of coefficients for Panel C of Table 5 is provided in the online appendix. All control variables in Panel C are demeaned.

SUE increases from one sort to the next, CAR(-1,1) will increase by 1.09 percentage points (pps) on average. The coefficient of the interaction term SUE*High ATD is positive and statistically significant, indicating that immediate share prices respond more sensitively to earnings news when analyst tone dispersion is high. That is, earnings conference calls with higher analyst tone dispersion during the Q&A sessions have larger price impacts per unit of earnings surprises.

This differential effect on immediate share price response is of economic significance as well. The economic significance of the coefficient for SUE*High ATD can be assessed over the coefficient for SUE, i.e., 0.24/1.09=22.02%, suggesting that share prices respond with 22.02% more sensitively to earnings news for conference calls with higher-than-median analyst tone dispersion in the Q&A sessions. The coefficient for SUE and that for SUE*High ATD in Column (2) are statistically insignificant, suggesting no post-earnings-announcement drift among observatiosn with either high or low analyst tone dispersion during our sample period 2006Q1 - 2020Q4.[16] These coefficients are qualitatively the same and quantitatively similar in Panels B and C.

[Insert Table 5 Here]

Columns (3) and (4) in Table 5 show that executive tone dispersion also affects share price responses to earnings news. The coefficient of the interaction term SUE*High ETD in Column (3) is positive and statistically significant, indicating that earnings conference calls with higher-than-median executive tone dispersion during the Q&A sessions have larger price impacts per unit of earnings surprises. The economic significance of the coefficient for

[16]The magnitude of the negative coefficient for SUE is much smaller than that in Column (1).

SUE*High ETD can be assessed over the coefficient for SUE as well, i.e., 0.21/1.10=19.09%, suggesting that share prices respond with 19.09% more sensitivity to earnings news for conference calls with higher-than-median executive tone dispersion in the Q&A sessions. Again, the coefficient for SUE and that for SUE*High ATD in Column (2) are statistically insignificant, suggesting no post-earnings-announcement drift among observatiosn with either high or low executive tone dispersion during our sample period 2006Q1 - 2020Q4.

Columns (5) and (6) in Panel A includes both measures of analyst and executive tone dispersion, and their interaction terms with SUE, as a horse race. We find that the price effects of both analyst and executive tone dispersion remain statistically significant for immediate price response CAR(-1,1). That is, earnings conference calls with higher analyst or executive tone dispersion during the Q&A sessions are associated with larger immediate price responses per unit of earnings surprise. These patterns generally hold for Panels B and C except that the coefficient for SUE*High ETD turns statistically insignificant in Panel C.

Overall, our main findings in Table 5 suggest that both analyst tone dispersion and executive tone dispersion matter for how sensitively share prices respond to earnings surprises, all of which are consistent with our information production story. However, alternative explanations may still compete to explain these results that highly tone-dispersed Q&A sessions are associated with having larger price impacts per unit of earnings surprises. For example, in good news setting (i.e. unexpected positive earnings), one can argue that higher executive tone dispersion means firm managers have added more caution into the answers to analysts' questions. From the external investors' perspectives, this may be interpreted as "rational" and "prudent" managers providing a balanced view of the business, resulting in positive

share price responses of larger magnitudes to positive earnings news.

In negative news setting (i.e. unexpected negative earnings), higher executive tone dispersion means that managers may try to "sugar coat" bad performances during the Q&As. This sugar-coating behavior may result in distrust by investors, leading to compounded negative effects. That is, sugar coating bad performances can result in negative share price responses of larger magnitudes to negative earnings news. Overall, these alternative explanations compete with our information production story to explain our findings. Therefore, we provide additional evidence on abnormal trading volume to support our information production story in the next section.

[Insert Table 6 Here]

4.4.3 Abnormal Trading Volume

We empirically explore the effects of analyst and executive tone dispersion on stock trading volume upon earnings announcements in Table 6. Following Hershleifer, Lim and Teoh (2009), daily abnormal trading volume is constructed as the difference between current daily trading volume and the average of daily trading volume over the past 30 days from day -40 to day -11. The first three columns focus on the two-day average abnormal trading volume over the earnings announcement date and the next day while the last three columns focus on the earnings announcement date and the next three days. In addition to the list of control variables in Panel B of Table 5, we further control for Abs SUE, the absolute value of "SUE-6".[17]

[17]To be consistent with the list of control variables in Table 5, analyst tone level and executive tone level are included as regressors in Table 6. Nonetheless, observations with tone level measures substantially

The coefficient for High ATD in column (1) is positive and statistically significant at the 1% level. Specifically, the abnormal trading volumn, AbVol(0,1), is 2.18% higher for earnings conference calls with higher-than-median analyst tone dispersion. This coefficient is of economic significance as well taking into account the sample mean of AbVol(0,1) being 75.89 percentage points. Similarly, in Column (2), the coefficient for High ETD is positive and statistically significant at the 1% level, indicating a 2.17% higher AbVol(0,1) for earnings conference calls with higher-than-median executive tone dispersion. A horserace in Column (3) suggests measures of both analyst and executive tone dispersion affect abnormal trading volume upon earnings announcements. We conduct additional analyses with AbVol(0,3) in the last three columns and find similar patterns.

To sum up, the results in Tables 5 and 6 jointly suggest that greater quantity of new information is being produced during earnings conference calls with highly tone-dispersed Q&A session. These results strongly support our information production hypotheses. We continue to mitigate concerns regarding our information production channel in the next section.

4.4.4 Affecting Attention from Institutional Investors

One concern regarding the information production channel is whether verbal interactions between the executives and analysts during conference call Q&A sessions affect investor attention; that is, share prices may respond more sensitively to earnings news not because

deviating from neutral tone, either positive or negative, can be arguably associated with higher trading volume. We conduct additional analyses in the online appendix where we control for the absolute value of tone level measures in lieu of analyst tone level and executive tone level. The results are qualitatively the same and quantitatively similar.

of new information being produced during the Q&A sessions but because of highly tone-dispersed Q&A sessions attracting investor attention. Arguably, abnormally higher investor attention may induce higher sensitivity of share price responses to unexpected earnings and greater trading volume. This concern is mitigated as follows.

[Insert Figure 4 Here]

First, we look into investor attention around earnings announcements and check for any differential pattern in investor attention for earnings conference calls with high and low tone dispersion. Figure 4 uses Bloomberg Readership data that capture firm-level news reading and news searching activities by all Bloomberg terminal users at the daily frequency. Following Ben-Rephael et al. (2017), Abnormal Institutional Attention (AIA) is generated as an indicator variable that is equal to one if Bloomberg terminal users are paying abnormally high attention to a firm on a particular day, and zero otherwise. Both panels of this figure suggest that Bloomberg terminal users allocate their attention to firm-level news in a similar pattern around earnings announcements regardless of the tone dispersion measure being high or low. This pattern indicates that the differential in investor attention due to high tone dispersion is unlikely to be a major threat for the validity of our main results to support information production hypothesis.

[Insert Table 7 Here]

Second, we directly control for AIA and replicate our main results in Tables 5 and 6. Specifically, we include AIA as an additional covariate into Table 6 and include both AIA and SUE*AIA into Table 5. From Table 7, we can see that the key results in Tables 5

and 6 remain qualitatively the same and quantitatively similar.[18] Overall, our graphical evidence and regression analyses both support the information production hypothesis for measures of tone dispersion, in particular, after controlling for the channel of attracting investor attention.

4.5 What New Information is being Produced?

We argue that new information beyond cold financial figures is being produced during earnings conference call Q&As and that greater quantity of such information is being produced during highly tone-dispersed Q&As than those with low tone dispersion. Given our evidence on share price responses to earnings news and on abnormal trading volume upon earnings announcements, however, one may ask, "What specific information is being produced during earnings conference call Q&As? Is there any greater quantity of share-price-relevant information being produced during highly tone-dispersed Q&As?"

To directly address these questions, we follow Huang, Lehavy, Zang, and Zheng (2018) and count the number of mentioning a particular topic throughout an earnings conference call Q&A session. For illustrative purposes, we aim to quantify information by counting the number of certain topics being mentioned during earnings conference call Q&As. Our premise is that the more frequently a topic is discussed during a Q&A session, the more information is being produced about the topic. We aim to provide descriptive evidence and show that conference call Q&As of high tone dispersion tend to produce a greater amount of information.

[18]The sample period of Bloomberg Readership data is 2010 - 2017, a subset of the sample period in our main empirical results 2006 - 2020.

[**Insert Table 8 Here**]

Technically, we compare the average number of mentioning a particular topic between conference call Q&As with high and low tone dispersion. Panel A in Table 8 compares the 100 highest-ATD and the 100 lowest-ATD conference call Q&As selected from all Q&A observations at the quarterly frequency. Clearly, we can see that there is a substantial gap in the number of mentioning each of the ten topics listed in Huang et al. (2018) between the 100 highest-ATD and the 100 lowest-ATD conference call Q&As. For example, on average, "Business Outlook" is mentioned 85.0 times among the 100 highest-ATD conference call Q&As and mentioned only 53.6 times among the 100 lowest-ATD conference call Q&As. The differential is 31.3, indicating that "Business Outlook" is almost 60% more frequently mentioned among the 100 highest-ATD conference call Q&As than the 100 lowest-AVD conference call Q&As. Similar differentials hold as we move along the list of topics, namely, "Financial Outlook", "Growth", "Raw Materials and Input Price", etc. Panel B compares the 100 highest-ETD and the 100 lowest-ETD conference call Q&As selected from all Q&A observations at the quarterly frequency. Again, we can see that there is a substantial gap in the number of mentioning each of the ten topics.

[**Insert Table 9 Here**]

Next, we employ the approach above again but focus on earnings conference call Q&As that are close to a neutral tone. Panel A in Table 9 compares the 100 highest-ATD and the 100 lowest-ATD conference call Q&As that are deemed almost tone-neutral. Specifically, we first calculate LM-2011 tone level and then focus on the Q&A observations whose analyst

tone level and executive tone level stay within [-0.3, +0.3].[19] We can see that on average "Business Outlook" is mentioned 86.3 times among the 100 highest-ATD conference call Q&As whose LM-2011 tone level stays within [-0.3, +0.3]. This topic is mentioned only 56.3 times among the 100 lowest-ETD conference call Q&As. Panel B presents a similar pattern. Therefore, Table 9 confirms that the pattern we have observed in Table 8 remain after controlling for tone level measures within the [-0.3, +0.3] range.

[Insert Table 10 Here]

Finally, we provide the correlation matrix between tone dispersion measures and topic number counts in Table 10. Specifically, we count the number of mentioning a particular topic throughout each Q&A session and then calculate the correlation between tone dispersion measures and the number of mentioning a particular topic.[20] The whole sample correlation is 23.4% (21.6%) for ATD (ETD) and "Business Outlook", 27.1% (27.9%) for "Financial Outlook", 28.7% (31.4%) for "Growth", 25.8% (25.3%) for "Raw Materials and Input Price", and is 27.8% (27.1%) for "Sales and Revenue". In the last two columns, we calculate the correlation between tone dispersion measures and topic number counts but require both analyst and executive tone levels to be within the [-0.3, +0.3] range. We find the correlations remain robust to this close-to-neutral-tone condition.

To sum up, our evidence in this section suggests that each topic in the list is mentioned more frequently among highly tone-dispersed Q&As. We find that highly tone-dispersed Q&As on average produce a greater quantity of new information, beyond cold financial

[19]The LM-2011 tone level measure has a range of [-1, +1], and we employ this range of [-0.3, +0.3] for conference call Q&A observations considered as "almost tone-neutral".

[20]We keep the same order of 10 topics with previous tables for easier comparison.

figures, under the topics of Business Outlook, Financial Outlook, Growth, Raw Materials and Input Price, Sales and Revenue, Geographic Segments, and so on. The raw number count of mentioning these topics is also positively correlated with analyst and executive tone dispersion. We confirm these patterns on information production and tone dispersion still hold among conference call Q&As that are deemed almost tone-neutral.

4.6 Decomposing Executive Tone Dispersion

In this section, we aim to directly verify the information production roles of executive tone dispersion during earnings conference call Q&A sessions. We first quantify the information content for each of the 10 topics following Huang et al. (2018) and then aggregate across these 10 topics to obtain total information quantity of executives' answers to analyst questions throughout a Q&A session. Next, we sort all observations into deciles on a quarterly basis based on their ETD scores. Within each ETD decile, we calculate the equal-weighted average across Q&A sessions' total information quantity. The blue bars in Figure 5 represent the relation between information quantity and ETD decides. We find that total information quantity of executives' answers to analyst questions is generally (but not monotonically) increasing in executive tone dispersion.

[Insert Figure 5 Here]

Inspired by Bushee, Gow, and Taylor (2018), we decompose ETD into two components: ETD Infor (the part of ETD that is explained by information quantity) and ETD Obfus (the unexplained part). We sort all observations into deciles based on their ETD Infor scores (ETD Obfus scores), and the orange (gray) bars represent the relation between information

quantity and ETD Infor deciles (ETD Obfus deciles). The orange bars show that total information quantity of executives' answers to analyst questions is monotonically increasing in ETD Infor, the informative component of ETD. Interestingly, the gray bars present a "reverse U-shaped" relation between executives' information quantity and the unexplained component of executive tone dispersion. Overall, our graphical evidence indicates that executives deliver greater amount of information during highly tone-dispersed Q&A sessions, suggesting our main regression results could be largely driven by the informative component of ETD.

Table 11 provides the regression results. High ETD Infor (High ETD Obfus) is an indicator variable that equals one if the Q&A session of a conference call has a level of ETD Infor (ETD Obfus) that is higher than the quarterly cross-sectional median, and zero otherwise. Columns (1) and (2) includes no control variables, the next two columns includes control variables and fixed efffects, and the last two columns further include the interaction terms of control variables with SUE. All control variables in columns (5) and (6) are demeaned before generating interaction terms with SUE. The coefficient for the interaction term "SUE*High ETD Infor" is positive and statistically significant in columns (1), (3), and (5). The coefficient for the interaction term "SUE*high ETD Obfus" is positive but marginally statistically significant in column (1) and insignificant in columns (3) and (5). These results further confirm that our main results on ETD are largely driven by ETD Infor.

[Insert Table 11 Here]

5 Robustness Checks

5.1 Alternative Windows for CAR

We conduct additional analyses using alternative windows for share price responses to earnings news and the results are reported in Table A4. Columns (1) - (3) include no control variables, Columns (4) - (6) include the same set of control variables as Panel B of Table 5, and the last three columns further include the interaction terms of control variables with SUE. We find our results on immediate share price responses and delayed share price responses to earnings news are qualitatively the same and quantitatively similar with these alternative windows.

5.2 Additional Covariates

We also conduct additional analyses by including more control variables into the regressions and the results are reported in Table A5. Following Hershleifer, Lim and Teoh (2009), we include Report Lag, the number the days between formation date of analyst earnings forecast consensus and the actual earnings announcement in columns (1) and (2) as a covariate. Following their work, we also include the squared and cubit terms of Report Lag into the regressions as additional covariates. Columns (3) and (4) include Leverage, Profit, and BM as additional covariates. We also further control for contrastive words and euphemism words (and their interactions with SUE) in the last four columns.

5.3 Absolute Tone Levels

Tables 6 and 7 include analyst and executive tone levels as control variables. We replicate these results on abnormal trading volume but control for the absolute value of tone level measures in lieu of tone levels. The rationale is that Q&A sessions with either extremely positive tones or extremely negative tones can both lead to high abnormal trading volume; that is, we should control for the absolute value of tone level measures. Table A6 shows that the results in Tables 6 and 7 are robust to controlling for absolute tone levels.

5.4 Observations with Extreme Tones

One may be concerned that our main results could be largely driven by the observations with extreme tones. We therefore replicate the results in Tables 5 and 6 by removing observations with extreme tone levels. Specifically, we remove observations that satisfy any of the following four conditions: (1) analyst tone level greater than its cross-sectional 95th percentile; (2) analyst tone level lower than its cross-sectional 5th percentile; (3) executive tone level greater than its cross-sectional 95th percentile; (4) executive tone level lower than its cross-sectional 5th percentile. Table A7 shows that the results in Tables 6 and 7 are robust to removing these observations with extreme tones.

6 Conclusion

Tone level and tone dispersion, two dimensions of a text's verbal features, matter for its information content. In this paper, we textually analyze earnings conference call Q&A

manuscripts and quantify the verbal features of analysts-executives conversations during the Q&As along these two dimensions. We hypothesize that more information is being produced beyond cold financial figures when Q&As are highly tone-dispersed. We conjecture that the new information being produced via these conversations is incorporated into share prices. Empirically, we find that share prices respond more sensitively to earnings news accompanied with highly tone-dispersed Q&A sessions, and these Q&A sessions are associated with larger stock trading volume upon earnings announcements. Further analyses mitigate concerns of competing stories and alternative channels.

Future research may look further into the vocal features of analysts-executives conversations throughout conference call Q&A sessions and empirically examine their implications for share price responses to unexpected earnings. Additional analyses would find it desirable to extract incremental information from voice recordings of conference call Q&As and empirically examine its predictive power over future corporate events (e.g. earnings announcements, large share price changes, corporate insider trading, etc.). It would also be interesting to explore the asset pricing implications of comparing vocal patterns between analysts and executives throughout conference call Q&As.

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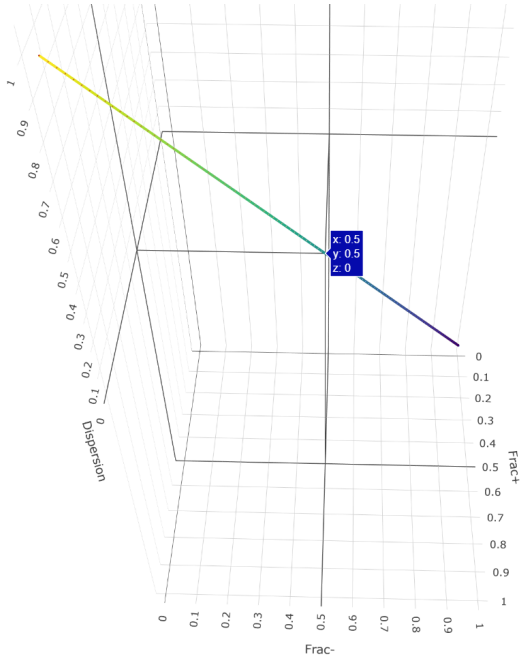
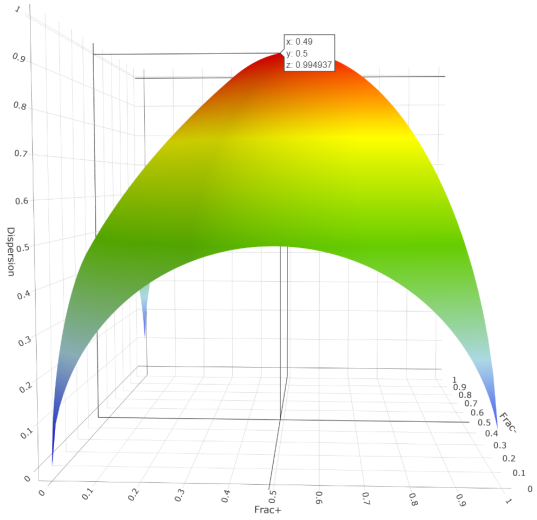
Figure 1: Two Verbal Features: Tone Level and Tone Dispersion

This figure compares tone level and tone dispersion, two dimensions of verbal features. Two examples may be considered where a short text has 10 positive sentences and 0 negative sentence and a long text has 50 positive and 50 negative sentences. Panel A shows that the tone level measure takes the value of 1 for the short text and takes the value of 0 for the long text. That is, the short text has an extremely positive tone and the long test has a neutral tone. Panel B shows that the tone dispersion measure takes the value of 0 for the short text but the value of 1 for the long text. That is, the short text has no tone dispersion while the long text has maximized tone dispersion.



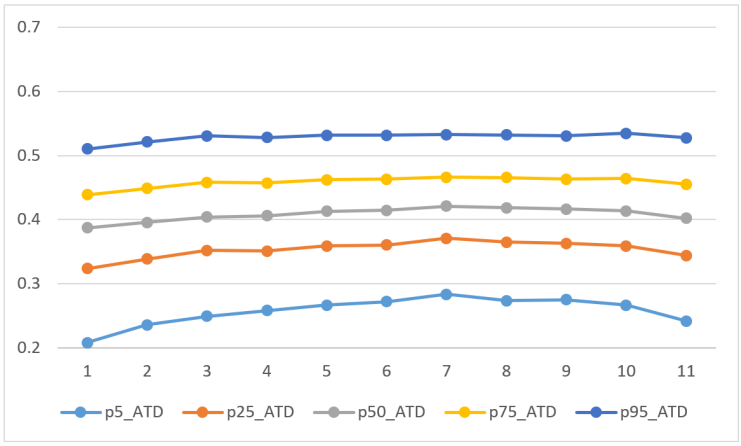
(a) Panel A: Tone Level Line



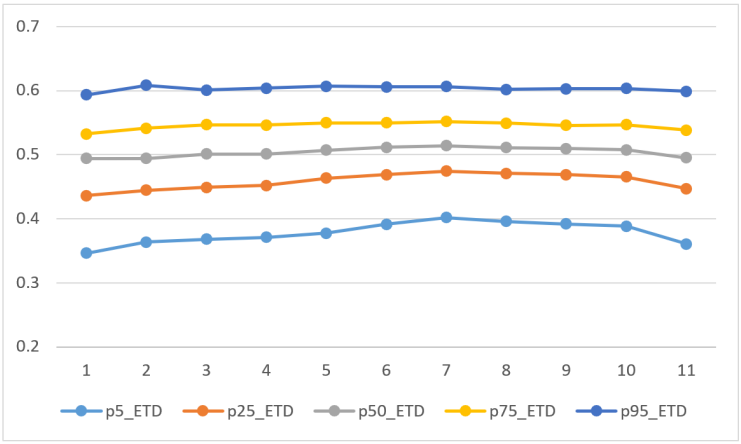
(b) Panel B: Tone Dispersion Surface

Figure 2: Tone Dispersion and Earnings Surprises

Descriptive features of tone dispersion measures are provided along different levels of earnings surprises. Following Dellavigna and Pollet (2009), we sort all standardized unexpected earnings (SUE) into 11 quantiles where quantile 6 is for zero earnings surprises, quantiles 1-5 for negative earnings surprises, and quantiles 7-11 for positive earnings surprises. The horizontal axis is for SUE quantiles and the vertical axis is for the numerical values of tone dispersion measures averaged across all observations within the same SUE quantile. We plot the 5th, 25th, 50th, 75th, 95th percentiles. Panel A focuses on analyst tone dispersion (ATD) and Panel B on executive tone dispersion (ETD). High ATD is an indicator variable that equals one if the Q&A session of a conference call has a level of analyst tone dispersion that is higher than the quarterly cross-sectional median, and zero otherwise. High ETD is an indicator variable that equals one if the Q&A session of a conference call has a level of executive tone dispersion that is higher than the quarterly cross-sectional median, and zero otherwise.



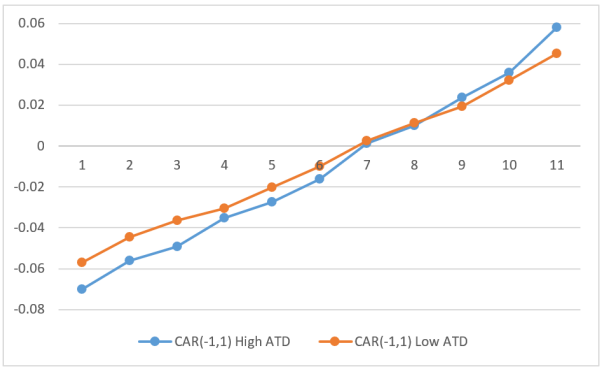
(a) Panel A: Analyst Tone Dispersion

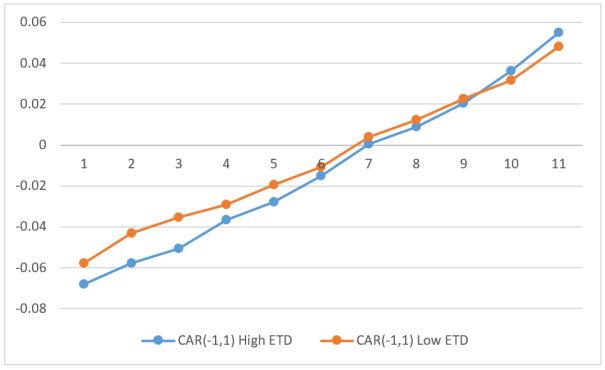


(b) Panel B: Executive Tone Dispersion

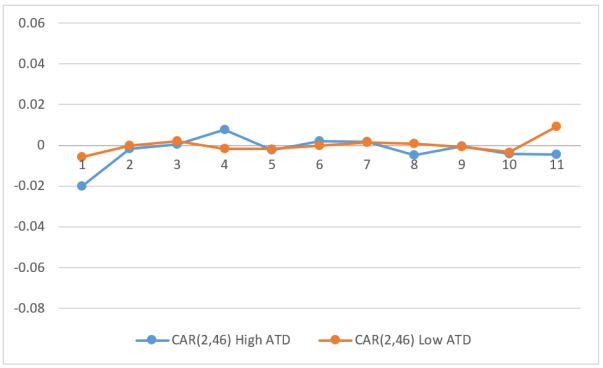
Figure 3: Share Price Responses to SUE: The Role of Tone Dispersion

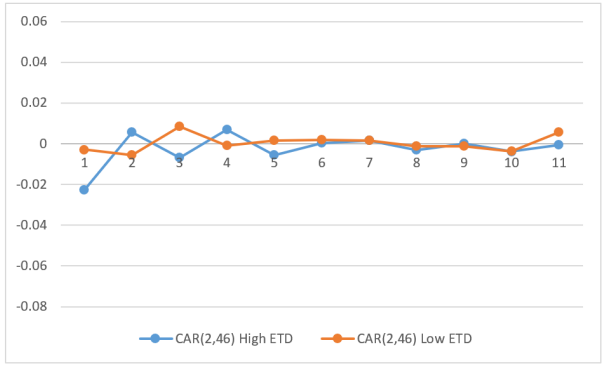
This figure compares the differentials in share price responses to earnings surprises between earnings conference calls with highly tone-dispersed Q&As and those without. Both analyst tone dispersion (ATD) and executive tone dispersion (ETD) are compared for each panel. Following Dellavigna and Pollet (2009), we sort all standardized unexpected earnings (SUE) into 11 quantiles where quantile 6 is for zero earnings surprises, quantiles 1-5 for negative earnings surprises, and quantiles 7-11 for positive earnings surprises. The horizontal axis is for SUE quantiles and the vertical axis is for cumulative abnormal returns averaged across all observations within the same SUE quantile. Panel A focuses on immediate share price response over a three-day window, CAR(-1,1), while Panel B focuses on delayed share price response over the next 45 days, CAR(2,46).





(a) Panel A: CAR(-1,1) to SUE: High and Low Tone Dispersion

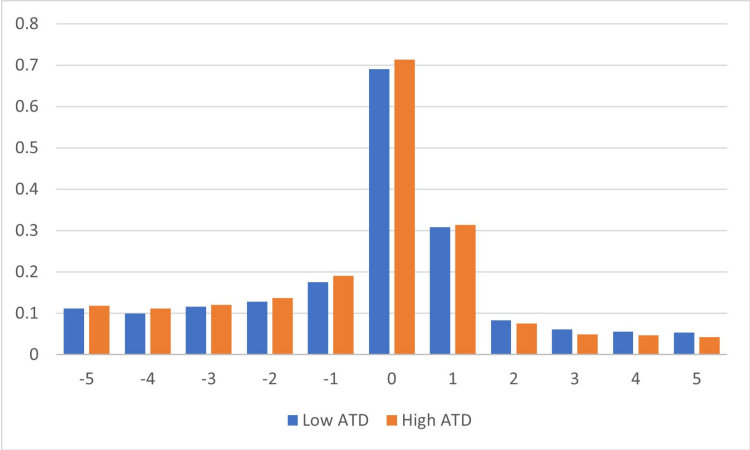




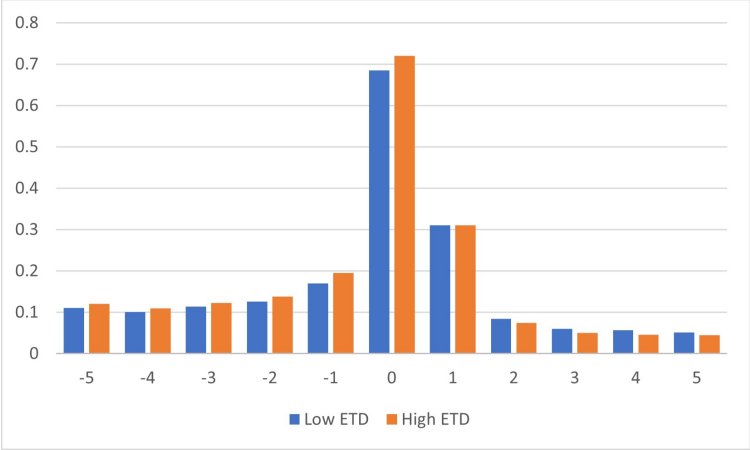
(b) Panel B: CAR(2,46) to SUE: High and Low Tone Dispersion

Figure 4: Tone Dispersion and Institutional Investor Attention

This figure compares abnormal institutional investor attention (AIA) to individual firms 5 days before and 5 days after earnings announcements. AIA is abnormal institutional investor attention to a firm, an indicator variable that is equal to one if the news reading and news searching activities for the firm by all Bloomberg terminal users at the daily frequency exceeds a threshold following Ben-Rephael et al. (2017). Panel A plots the daily average of firm-level AIA for earnings conference calls with high analyst tone dispersion in orange bars and for those with low analyst tone dispersion in blue bars. High ATD is an indicator variable that equals one if the Q&A session of a conference call has a level of analyst tone dispersion that is higher than the quarterly cross-sectional median, and zero otherwise. Panel B plots the daily average of firm-level AIA for earnings conference calls with high executive tone dispersion in orange bars and for those with low executive tone dispersion in blue bars. High ETD is an indicator variable that equals one if the Q&A session of a conference call has a level of executive tone dispersion that is higher than the quarterly cross-sectional median, and zero otherwise.



(a) Panel A: Analyst Tone Dispersion



(b) Panel B: Executive Tone Dispersion

Figure 5: Information Quantity and Executive Tone Dispersion

This figure presents the relation between the total information quantity of executives' answers to analyst questions in a Q&A session and measures of executive tone dispersion (ETD). We first quantify the information quantity for each of the 10 topics following Huang et al. (2018) and then aggregate across these 10 topics to obtain total information quantity. All observations are sorted into deciles on a quarterly basis based on their ETD scores. Within each ETD decile, we calculate the equal-weighted average across Q&A sessions' total information quantity. The blue bars represent the relation between information quantity and ETD decides. Following the same spirit of Bushee, Gow, and Taylor (2018), we further decompose ETD into two components: ETD Infor (the part of ETD that is explained by information quantity) and ETD Obfus (the unexplained part). We sort all observations into deciles based on their ETD Infor scores (ETD Obfus scores), and the orange (gray) bars represent the relation between information quantity and ETD Infor deciles (ETD Obfus deciles).

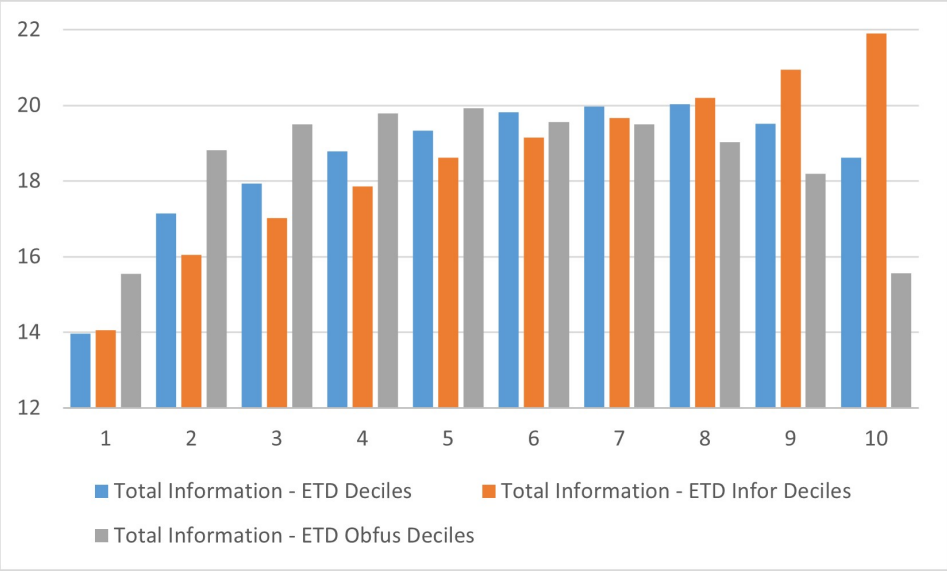


Table 1: Tone Classification: Compare FinBERT and LM2011

This table compares tone classifications by the FinBERT model and the Loughran and McDonald (2011) method for the same manuscript of analyst-executive conversations during an earnings conference call's Q&A session. This example is extracted from the quarterly earnings conference call for Apple, Inc. on November 2nd, 2017.

Speaker	Sentence	FinBERT	LM2011
Tim Cook (CEO)	Not today, not the apps that you'll see on the App Store today, but what it will be, what it can be, I think its profound and I think Apple is in a really unique position to lead in this area.	Positive	NULL
Tim Cook (CEO)	It's having the right product lineup for the market.	Positive	NULL
Amit Jawaharlaz Daryanani (RBC Capital Markets)	And are yield and efficiencies broadly much more severe this time versus what you've seen historically?	Negative	Neutral*
Luca Maestri (CFO)	As I mentioned, particularly on the App Store, which is very important to us, the number of paying accounts has grown a lot.	Positive	NULL
Luca Maestri (CFO)	But we also have other businesses that are growing very, very fast and actually accelerating year-ago quarter.	Positive	NULL

*Note: The word "efficiency" is classified as positive in Loughran and McDonald (2011) and "severe" as negative. "NULL" means the sentence does not contain any word listed in Loughran and McDonald (2011) dictionaries.

Table 2: Comparing Tone Levels using FinBERT and LM2011

This table presents the correlation between measures of tone level using the FinBERT model and the Loughran and McDonald (2011) method. Analyses are conducted for analysts and executives, respectively. Whole sample correlation, as well as subsample correlation depending on levels of unexpected earnings, is provided for both analyst and executive tone level. Standardized unexpected earnings (SUE) are calculated as the difference between actually announced earnings per share and analyst forecast consensus, and then scaled by share price at the previous quarter end. Following Dellavigna and Pollet (2009), we sort all SUEs into 11 quantiles where quantile 6 is for zero earnings surprises, quantiles 1-5 for negative earnings surprises, and quantiles 7-11 for positive earnings surprises.

SUE Group	Analyst Tone Level	Executive Tone Level
All	0.52	0.69
SUE = 1	0.46	0.69
SUE = 2	0.46	0.66
SUE = 3	0.50	0.67
SUE = 4	0.48	0.67
SUE = 5	0.50	0.69
SUE = 6	0.52	0.68
SUE = 7	0.52	0.70
SUE = 8	0.52	0.70
SUE = 9	0.50	0.68
SUE = 10	0.51	0.67
SUE = 11	0.51	0.69

Table 3: Compare Analyst and Executive Verbal Features

This table presents the correlation of tone level measures for analysts and executives and the correlation of tone dispersion measures for analysts and executives, respectively. All measures of tone level and tone dispersion are constructed using the FinBERT model. Whole sample correlation, as well as subsample correlation depending on levels of unexpected earnings, is provided for both analyst and executive tone level. Standardized unexpected earnings (SUE) are calculated as the difference between actually announced earnings per share and analyst forecast consensus, and then scaled by share price at the previous quarter end. Following Dellavigna and Pollet (2009), we sort all SUEs into 11 quantiles where quantile 6 is for zero earnings surprises, quantiles 1-5 for negative earnings surprises, and quantiles 7-11 for positive earnings surprises.

SUE Group	Tone Level	Tone Dispersion
All	0.29	0.38
SUE = 1	0.21	0.34
SUE = 2	0.24	0.38
SUE = 3	0.22	0.39
SUE = 4	0.24	0.40
SUE = 5	0.25	0.34
SUE = 6	0.27	0.39
SUE = 7	0.27	0.36
SUE = 8	0.29	0.37
SUE = 9	0.28	0.37
SUE = 10	0.28	0.35
SUE = 11	0.29	0.39

Table 4: Summary Statistics

This table presents the summary statistics for the dependent variables, key independent variables, and covariates in empirical analyses. Cumulative abnormal returns, CAR(t_1,t_2), are cumulative DGTW-adjusted returns in percentage points over day t_1 to day t_2. Following Hershleifer, Lim and Teoh (2009), daily abnormal trading volume is constructed as the difference between the natural log of daily trading volume and the 30-day average of log daily trading volume from day -40 to day -11. AbVol(0,1) is the two-day average of daily trading volume on the earnings announcement date and the very next day. AbVol(0,3) is the four-day average of daily trading volume on the earnings announcement date and the next three days. Standardized unexpected earnings (SUE) are calculated as the difference between actually announced earnings per share and analyst forecast consensus, and then scaled by share price at the previous quarter end. Following Dellavigna and Pollet (2009), we sort all SUEs into 11 quantiles where quantile 6 is for zero earnings surprises, quantiles 1-5 for negative earnings surprises, and quantiles 7-11 for positive earnings surprises. High ATD is an indicator variable that equals one if the Q&A session of a conference call has a level of analyst tone dispersion that is higher than the quarterly cross-sectional median, and zero otherwise. High ETD is an indicator variable that equals one if the Q&A session of a conference call has a level of executive tone dispersion that is higher than the quarterly cross-sectional median, and zero otherwise. ln(TotalNumEA) is the natural log of the total number of all other firms announcing their quarterly earnings on the same day. Friday is an indicator variable that equals one if a firm announces its quarterly earnings on a Friday. Analyst tone level (ATL) and executive tone level (ETL) are calculated separately for analysts and executives. ln(AnaLength) is the natural log of the total number of sentences all analysts say in an earnings conference call's Q&A session, and ln(ExeLength) is the natural log of the total number of sentences all executives say in an earnings conference call's Q&A session. ln(MarketCap) is the natural log of a firm's market capitalization (i.e. the product of share price and the number of shares outstanding). Turnover is the ratio of trading volume over number of shares outstanding at the previous quarter end. Ret_q is a firm's holding period return for the previous quarter, and Momentum_3q is a firm's nine-month holding period return before Ret_q. InstOwn_Perc measures a firm's percentage ownership by 13f institutional investors. ln(NumEst) is the natural log of total number of estimates to form a firm's analyst consensus for its to-be-announced quarterly earnings. AIA is abnormal institutional investor attention to a firm, an indicator variable that is equal to one if the news reading and news searching activities for the firm by all Bloomberg terminal users at the daily frequency exceeds a threshold following Ben-Rephael et al. (2017). Abs SUE is the absolute value of "SUE-6".

VarName	N Obs	Mean	SD	P5	P25	Median	P75	P95
CAR(-1,1)	46849	0.25	8.45	-12.97	-3.83	0.18	4.34	13.49
CAR(2,46)	46752	-0.05	13.30	-19.03	-6.69	-0.36	6.01	19.71
AbVol(0,1)	46849	75.89	49.97	-0.77	41.78	73.38	106.93	162.30
AbVol(0,3)	46849	54.84	42.97	-10.07	25.75	52.05	81.12	129.16
SUE	46849	7.14	2.62	2.00	5.00	7.00	9.00	11.00
High ATD	46849	0.50	0.50	0.00	0.00	0.00	1.00	1.00
High ETD	46849	0.50	0.50	0.00	0.00	0.00	1.00	1.00
ln(TotalNumEA)	46849	4.41	1.06	2.20	3.87	4.75	5.19	5.51
Friday	46849	0.07	0.26	0.00	0.00	0.00	0.00	1.00
ATL	46849	0.06	0.08	-0.07	0.00	0.06	0.10	0.18
ETL	46849	0.18	0.09	0.04	0.12	0.18	0.24	0.34
ln(AnaLength)	46723	4.10	0.52	3.22	3.81	4.14	4.44	4.86
ln(ExeLength)	46751	5.06	0.52	4.16	4.80	5.13	5.41	5.75
ln(MarketCap)	46849	14.99	1.67	12.54	13.78	14.82	16.11	17.99
Turnover	46849	2.33	1.66	0.74	1.24	1.82	2.83	5.94
Ret_q	46849	0.03	0.22	-0.31	-0.07	0.04	0.14	0.34
Momentum_3q	46849	0.09	0.35	-0.46	-0.08	0.10	0.27	0.61
InstOwn_Perc	46454	0.81	0.22	0.46	0.72	0.85	0.93	1.06
ln(NumEst)	46849	2.30	0.63	1.10	1.79	2.30	2.77	3.26
AIA	38204	0.50	0.50	0.00	0.00	0.00	1.00	1.00
Abs SUE	46849	2.43	1.50	0.00	1.00	2.00	4.00	5.00

Table 5: Share Price Responses to SUE: Tone Dispersion

This table shows how tone dispersion matters for share price responses to SUE. Cumulative abnormal returns, CAR(t_1,t_2), are cumulative DGTW-adjusted returns in percentage points over day t_1 to day t_2. Standardized unexpected earnings (SUE) are calculated as the difference between actually announced earnings per share and analyst forecast consensus, and then scaled by share price at the previous quarter end. Following Dellavigna and Pollet (2009), we sort all SUEs into 11 quantiles where quantile 6 is for zero earnings surprises, quantiles 1-5 for negative earnings surprises, and quantiles 7-11 for positive earnings surprises. High ATD is an indicator variable that equals one if the Q&A session of a conference call has a level of analyst tone dispersion (ATD) that is higher than the quarterly cross-sectional median, and zero otherwise. High ETD is an indicator variable that equals one if the Q&A session of a conference call has a level of executive tone dispersion (ETD) that is higher than the quarterly cross-sectional median, and zero otherwise. Panel A includes no control variables, Panel B includes control variables, and Panel C further include the interaction terms of control variables with SUE. All control variables in Panel C are demeaned before generating interaction terms with SUE. All variables are defined in Table 4. Standard errors are double-clustered at the firm level and year-quarter level, t-statistics are reported with coefficients, firm-fixed effects and year-quarter-fixed effects are included in all columns. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: No covariates are included.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	CAR(-1,1)	CAR(2,46)	CAR(-1,1)	CAR(2,46)	CAR(-1,1)	CAR(2,46)
SUE	1.09***	-0.01	1.10***	-0.05	1.04***	-0.03
	(25.88)	(-0.24)	(24.67)	(-0.88)	(22.47)	(-0.44)
SUE*High ATD	0.24***	-0.06			0.19***	-0.07
	(6.51)	(-0.90)			(5.21)	(-1.04)
High ATD	-1.82	0.25			-1.45***	0.33
	(-6.44)	(0.51)			(-5.00)	(0.65)
SUE*High ETD			0.21***	0.02	0.15***	0.04
			(4.30)	(0.30)	(3.07)	(0.59)
High ETD			-1.97***	-0.17	-1.56***	-0.29
			(-5.07)	(-0.30)	(-3.92)	(-0.50)
Covar	No	No	No	No	No	No
SUE*Covar	No	No	No	No	No	No
Firm FE & YQ FE	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	46,746	46,648	46,746	46,648	46,746	46,648
Adj R^2	0.14	0.02	0.14	0.02	0.14	0.02

Panel B: Covariates are included but "SUE*Covar" are not included

VARIABLES	(1) CAR(-1,1)	(2) CAR(2,46)	(3) CAR(-1,1)	(4) CAR(2,46)	(5) CAR(-1,1)	(6) CAR(2,46)
SUE	1.01***	-0.02	1.02***	-0.06	0.98***	-0.03
	(25.56)	(-0.26)	(23.79)	(-1.04)	(21.92)	(-0.46)
SUE*High ATD	0.17***	-0.08			0.14***	-0.09
	(4.65)	(-1.30)			(3.87)	(-1.45)
High ATD	-1.68***	0.40			-1.39	0.50
	(-5.95)	(0.88)			(-4.90)	(1.05)
SUE*High ETD			0.13***	0.02	0.09*	0.04
			(2.83)	(0.25)	(1.93)	(0.63)
High ETD			-1.76***	-0.25	-1.40***	-0.41
			(-4.51)	(-0.47)	(-3.54)	(-0.75)
Covar	Yes	Yes	Yes	Yes	Yes	Yes
SUE*Covar	No	No	No	No	No	No
Firm FE & YQ FE	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	46,129	46,033	46,129	46,033	46,129	46,033
Adj R2	0.18	0.03	0.18	0.03	0.18	0.03

Panel C: Both covariates and "SUE*Covar" are included.

VARIABLES	(1) CAR(-1,1)	(2) CAR(2,46)	(3) CAR(-1,1)	(4) CAR(2,46)	(5) CAR(-1,1)	(6) CAR(2,46)
SUE	0.94***	-0.03	0.96***	-0.08	0.92***	-0.05
	(26.62)	(-0.51)	(25.48)	(-1.59)	(22.95)	(-0.85)
SUE*High ATD	0.15***	-0.07			0.13***	-0.09
	(4.04)	(-1.18)			(3.52)	(-1.35)
High ATD	-1.55***	0.33			-1.34***	0.45
	(-5.35)	(0.72)			(-4.52)	(0.93)
SUE*High ETD			0.09***	0.03	0.05	0.06
			(2.02)	(0.48)	(1.15)	(0.82)
High ETD			-1.47***	-0.37	-1.14***	-0.52
			(-3.90)	(-0.70)	(-2.92)	(-0.95)
Covar	Yes	Yes	Yes	Yes	Yes	Yes
SUE*Covar	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE & YQ FE	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	46,129	46,033	46,129	46,033	46,129	46,033
Adj R2	0.18	0.03	0.19	0.03	0.19	0.03

Table 6: Abnormal Trading Volume

This table presents the effects of analyst and executive tone dispersion on stock trading volume upon earnings announcements. Following Hershleifer, Lim and Teoh (2009), daily abnormal trading volume is constructed as the difference between current daily trading volume and the average of daily trading volume over the past 30 days from day -40 to day -11. AbVol(0,1) is the two-day average abnormal trading volume over the earnings announcement date and the next day. AbVol(0,3) is the average abnormal trading volume over four days upon earnings announcements. Abs SUE, the absolute value of "SUE-6", is included into all regressions where the dependent variable is abnormal trading volume. All variables are defined in Table 4. Standard errors are double-clustered at the firm level and year-quarter level, t-statistics are reported with coefficients, firm-fixed effects and year-quarter-fixed effects are included in all columns. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	AbVol(0,1)	AbVol(0,1)	AbVol(0,1)	AbVol(0,3)	AbVol(0,3)	AbVol(0,3)
High ATD	2.18***		1.94***	1.65***		1.51***
	(4.31)		(3.77)	(3.70)		(3.32)
High ETD		2.17***	1.87***		1.33***	1.10***
		(5.35)	(4.48)		(3.73)	(2.99)
Covar	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE & YQ FE	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	46,129	46,129	46,129	46,129	46,129	46,129
Adj R2	0.33	0.33	0.33	0.29	0.29	0.29

Table 7: Control for AIA

This table replicates the main results in Tables 5 and 6 but further controls for abnormal institutional investor attention (AIA) in both panels and its interaction with SUE in Panel A. AIA is abnormal institutional investor attention to a firm, an indicator variable that is equal to one if the news reading and news searching activities for the firm by all Bloomberg terminal users at the daily frequency exceeds a threshold following Ben-Rephael et al. (2017). All variables are defined in Table 4. Standard errors are double-clustered at the firm level and year-quarter level, t-statistics are reported with coefficients, firm-fixed effects and year-quarter-fixed effects are included in all columns. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A. Replicate main results in Table 5 but further control for AIA and SUE*AIA

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	CAR(-1,1)	CAR(2,46)	CAR(-1,1)	CAR(2,46)	CAR(-1,1)	CAR(2,46)
SUE	0.91***	-0.03	0.93***	-0.07	0.88***	-0.05
	(26.35)	(-0.81)	(23.50)	(-1.49)	(21,32)	(-1.05)
SUE*High ATD	0.16***	-0.04			0.14***	-0.05
	(4.48)	(-0.73)			(3.97)	(-0.88)
High ATD	-1.65***	0.19			-1.43***	0.29
	(-6.34)	(0.42)			(-5.56)	(0.60)
SUE*High ETD			0.10*	0.03	0.06	0.04
			(1.96)	(0.51)	(1.17)	(0.73)
High ETD			-1.56***	-0.35	-1.20***	-0.44
			(-3.73)	(-0.84)	(-2.82)	(-1.02)
Covar	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE & YQ FE	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	37,685	37,601	37,685	37,601	37,685	37,601
Adj R2	0.19	0.03	0.20	0.03	0.20	0.03

Panel B: Replicate main results in Table 6 but further control for AIA

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	AbVol(0,1)	AbVol(0,1)	AbVol(0,1)	AbVol(0,3)	AbVol(0,3)	AbVol(0,3)
High ATD	2.43***		2.16***	1.88***		1.72***
	(4.58)		(3.96)	(4.00)		(3.53)
High ETD		2.61***	2.29***		1.61***	1.35
		(7.16)	(5.98)		(4.50)	(3.56)
Covar	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE & YQ FE	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	37,685	37,685	37,685	37,685	37,685	37,685
Adj R2	0.35	0.35	0.35	0.31	0.31	0.31

Table 8: Topic Number Counts

This table compares the topic number counts of earnings conference call Q&As. Following Huang et al. (2018), we select the following ten topics: Business Outlook, Financial Outlook, Growth, Raw Materials and Input Price, Sales and Revenue, Comparing Financials, Geographic Segments, Cashflows and Financing, Valution Model, and Defense Contract. Specifically, we pick the top 100 conference call Q&As of highest analyst tone dispersion (ATD) and the bottom 100 conference call Q&As of lowest ATD per year-quarter in Panel A. We count the number of mentioning a particular topic throughout a Q&A session and then calculate the average number of mentioning a particular topic among top 100 conference call Q&As of highest ATD and among the bottom 100 conference call Q&As of lowest ATD, respectively. The differential in each topic's average number count is provided in the last column. Panel B adopts the same procedure but focuses on executive tone dispersion (ETD).

Panel A: Analyst Tone Dispersion and Information Differential

Topic	Top 100 ATD	Bottom 100 ATD	Top - Bottom
Business Outlook	85.0	53.6	31.3
Financial Outlook	65.3	37.1	28.2
Growth	59.8	31.4	28.5
Raw Materials and Input Price	51.8	28.4	23.4
Sales and Revenue	47.1	24.2	22.9
Comparing Financial	46.2	28.8	17.4
Geographic Segments	42.0	23.4	18.6
Cashflows and Financing	39.6	23.5	16.1
Valuation Model	39.3	27.1	12.2
Defense Contract	22.3	16.2	6.1

Panel B: Executive Tone Dispersion and Information Differential

Topic	Top 100 ETD	Bottom 100 ETD	Top - Bottom
Business Outlook	87.3	55.4	31.9
Financial Outlook	68.2	37.3	30.9
Growth	63.0	30.3	32.7
Raw Materials and Input Price	54.9	30.3	24.6
Sales and Revenue	49.1	25.1	23.9
Comparing Financial	47.6	30.6	17.0
Geographic Segments	45.1	22.5	22.6
Cashflows and Financing	40.8	23.1	17.6
Valuation Model	40.2	28.3	11.9
Defense Contract	22.3	16.3	6.0

Table 9: Topic Number Counts: Conditional on FinBERT Tone Level within [-0.3, +0.3]

This table replicates Table 8 but provides conditional results on FinBERT tone levels within the [-0.3, +0.3] range. Following Huang et al. (2018), we select the following ten topics: Business Outlook, Financial Outlook, Growth, Raw Materials and Input Price, Sales and Revenue, Comparing Financials, Geographic Segments, Cashflows and Financing, Valution Model, and Defense Contract. We remove all observations with either analyst tone level outside the [-0.3, +0.3] range or executive tone level outside the [-0.3, +0.3] range. Specifically, in Panel A, we pick the top 100 conference call Q&As of highest ATD and the bottom 100 conference call Q&As of lowest ATD per year-quarter. We count the number of mentioning a particular topic throughout a Q&A session and then calculate the average number of mentioning a particular topic among top 100 conference call Q&As of highest ATD and among the bottom 100 conference call Q&As of lowest ATD, respectively. The differential in each topic's average number count is provided in the last column. Panel B adopts the same procedure but focuses on ETD.

Panel A: Analyst Tone Dispersion and Information Differential

Topic	Top 100 ATD	Bottom 100 ATD	Top - Bottom
Business Outlook	86.3	56.3	30.0
Financial Outlook	66.1	38.8	27.3
Growth	60.0	32.7	27.3
Raw Materials and Input Price	53.3	30.0	23.3
Sales and Revenue	48.2	25.4	22.8
Comparing Financial	47.2	30.3	16.9
Geographic Segments	42.3	24.5	17.8
Cashflows and Financing	39.5	24.6	14.9
Valuation Model	40.0	28.5	11.5
Defense Contract	22.8	17.0	5.8

Panel B: Executive Tone Dispersion and Information Differential

Topic	Top 100 ETD	Bottom 100 ETD	Top - Bottom
Business Outlook	89.1	55.8	33.3
Financial Outlook	69.4	37.5	31.8
Growth	63.6	30.5	33.1
Raw Materials and Input Price	56.3	30.5	25.8
Sales and Revenue	50.1	25.3	24.8
Comparing Financial	48.8	30.8	18.0
Geographic Segments	45.7	22.7	23.1
Cashflows and Financing	41.1	23.3	17.7
Valuation Model	41.1	28.5	12.6
Defense Contract	22.9	16.4	6.6

Table 10: Topic Number Counts: Correlation with Tone Dispersion Measures

This table provides correlation between measures of tone dispersion and the topic number counts of earnings conference call Q&As. Following Huang et al. (2018), we select the following ten topics: Business Outlook, Financial Outlook, Growth, Raw Materials and Input Price, Sales and Revenue, Comparing Financials, Geographic Segments, Cashflows and Financing, Valution Model, and Defense Contract. We count the number of mentioning a particular topic throughout a Q&A session and then calculate the correlation between tone dispersion measures, namely, analyst tone dispersion (ATD) and executive tone dispersion (ETD), and the number of mentioning a particular topic in an earnings conference call Q&A. The last two columns also report the conditional results on FinBERT tone levels within the [-0.3, +0.3] range.

Topic	ATD	ETD	ATD Conditional	ETD Conditional
Business Outlook	23.4%	21.6%	23.2%	22.6%
Financial Outlook	27.1%	27.9%	26.9%	28.8%
Growth	28.7%	31.4%	28.4%	31.8%
Raw Materials and Input Price	25.8%	25.3%	26.2%	26.9%
Sales and Revenue	27.8%	27.1%	28.1%	28.6%
Comparing Financial	22.9%	21.0%	22.8%	22.4%
Geographic Segments	23.4%	26.5%	23.1%	27.1%
Cashflows and Financing	22.1%	23.4%	21.4%	23.5%
Valuation Model	17.0%	15.3%	16.7%	16.4%
Defense Contract	13.1%	10.9%	12.9%	11.7%

Table 11: Informative and Noisy Components of Executive Tone Dispersion

This table explores how components of executive tone dispersion matter for share price responses to SUE. Cumulative abnormal returns, CAR(t_1,t_2), are cumulative DGTW-adjusted returns in percentage points over day t_1 to day t_2. Standardized unexpected earnings (SUE) are calculated as the difference between actually announced earnings per share and analyst forecast consensus, and then scaled by share price at the previous quarter end. Following Dellavigna and Pollet (2009), we sort all SUEs into 11 quantiles where quantile 6 is for zero earnings surprises, quantiles 1-5 for negative earnings surprises, and quantiles 7-11 for positive earnings surprises. We quantify the information content for each of the 10 topics following Huang et al. (2018) and then aggregate across these 10 topics to obtain total information quantity of executives' answers to analyst questions throughout a Q&A session. We further decompose ETD into two components: ETD Infor (the part of ETD that is explained by information quantity) and ETD Obfus (the unexplained part). High ETD Infor (High ETD Obfus) is an indicator variable that equals one if the Q&A session of a conference call has a level of ETD Infor (ETD Obfus) that is higher than the quarterly cross-sectional median, and zero otherwise. Columns (1) and (2) includes no control variables, the next two columns includes control variables and fixed efffects, and the last two columns further include the interaction terms of control variables with SUE. All control variables in columns (5) and (6) are demeaned before generating interaction terms with SUE. All variables are defined in Table 4. Standard errors are double-clustered at the firm level and year-quarter level, t-statistics are reported with coefficients, firm-fixed effects and year-quarter-fixed effects are included in all columns. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	CAR(-1,1)	CAR(2,46)	CAR(-1,1)	CAR(2,46)	CAR(-1,1)	CAR(2,46)
SUE	1.03***	-0.06	0.97***	-0.05	0.92***	-0.06
	(20.31)	(-0.99)	(19.39)	(-0.79)	(20.48)	(-1.19)
SUE*High ETD Infor	0.29***	-0.05	0.20***	-0.08	0.18***	-0.06
	(5.44)	(-0.87)	(3.75)	(-1.31)	(3.50)	(-0.96)
High ETD Infor	-2.43***	0.47	-1.82***	0.60	-1.72***	0.41
	(-5.97)	(1.02)	(-4.31)	(1.32)	(-4.13)	(0.91)
SUE*High ETD Obfus	0.06*	0.09	0.04	0.06	0.00	0.06
	(1.78)	(1.27)	(1.10)	(0.93)	(0.10)	(0.91)
High ETD Obfus	-0.77***	-0.64	-0.83***	-0.50	-0.58**	-0.48
	(-2.77)	(-1.17)	(-3.02)	(-0.96)	(-2.15)	(-0.96)
Covar	No	No	Yes	Yes	Yes	Yes
SUE*Covar	No	No	No	No	Yes	Yes
Firm FE & YQ FE	No	No	Yes	Yes	Yes	Yes
N Obs	46,746	46,648	46,129	46,033	46,129	46,033
Adj R2	0.14	0.02	0.18	0.03	0.19	0.03

Online Appendix

To better understand the distinctions between tone level and verbal dispersion, Table A1 provides an interesting example when the executives answered analysts' questions during the Q&A session of AVX Corporation (NYSE:AVX)'s quarterly conference call on July 27, 2015. The first two columns classify each sentence into either positive or negative using the FinBERT model. We can see that in total this text example contains 10 positive and 6 negative sentences. Our executive tone dispersion (ETD) takes the numerical value of 0.6 based on Equation (3). This value measures how tone-dispersed the executive's narrative is. Accordingly to Loughran and McDonald (2011), columns 3 and 4 show that there are 5 positive and 5 negative words in total for this text, and thus its tone level is 0.[21] Reading through this text example, we find that the executives not only focus on their achievements but also admit to declining performance in certain product divisions. We argue this simultaneous use of both positive and negative tone choices by AVX's executives produces substantial new information beyond what's already disclosed in its quarterly earnings announcement.

[21]Prior studies generally argue that texts of extreme tones are most informative while texts of neutral tones are least informative and only contain limited information.

Table A1: Example

Table A1 presents the executive boards' answer to the question of analyst from the Q&A session of AVX Corporation (NYSE:AVX) on July 27th, 2015.

Executive Boards' Sentence	**Pos**	**Neg**	**#Pos**	**#Neg**
By division, ceramics, it's 14%, same – down 1% from the previous quarter	0	1	0	0
Our tantalum products was 27%, or up 1% from the previous quarter	1	0	0	0
Our Advanced Group was up 1 point from – at 29%	1	0	0	0
The KED or resale was up 1%, 18% versus 17% the last quarter	1	0	0	0
And connectors were down 1%, at 12% versus the 13% of last quarter	0	1	0	0
And looking at the market sectors, automotive was up 1 point at 22%	0	0	0	0
The cellular was down 1 point at 12%; computer stayed flat at 17%; consumer was up 1%, at 8%; industrial, flat at 13%; medical, flat at 8%; military, flat at 4%; networking, flat at 4%; and telecom, down 1% at 12%	0	0	0	0
Yes	0	0	0	0
And we've been very active this quarter	1	0	0	0
And we're currently, have several customers – several companies that we're in negotiation with, looking at in the initial stages	0	0	0	0
And we said in the last call, one of our charters this year is to close on an acquisition	0	0	0	0
So – and but we're currently dealing with several companies.	0	0	0	0
Not at this time	0	0	0	0
Nothing I can comment on.	0	0	0	0
Yes	0	0	0	0
We saw in the commodity side around 2% to 3%.	0	0	0	0
Quarter-on-quarter.	0	0	0	0
I think we're still looking at similar kind of reductions until we see some change in industry demand.	0	0	0	0
Hey, Jim, it's Kurt Cummings	0	0	0	0
We mentioned in the opening remarks regarding mix, and that has an awful lot to do with our margin result	0	0	0	0
The margins have held up primarily because some of the commodity businesses, particularly telecom, on some of the resale businesses that we do, have been a little weaker	0	1	0	1
And when that happens, a higher percentage of our volume is devoted to the advanced products where the margin opportunity is better	1	0	2	0
We expect, particularly when distribution kicks in and the telecommunications to kick back in, that we'll have a less favorable mix going forward	1	0	1	0
And that's why I am predicting margins to decline just slightly	0	1	0	1
But it's a hard thing to predict overall for our company, with our mix of manufactured and resale products.	0	0	0	0
No I think it's not unusual because, especially in the European market, there's a lot of holidays, vacation schedules	0	0	0	0

Executive Boards' Sentence	Pos	Neg	#Pos	#Neg
So I'd say it's pretty typical that we'll see the U.S	0	0	0	0
fairly steady and Asia slightly up some, and maybe not as much of an increase as we would see in the European segment due to the shutdowns, but still slightly above this quarter.	1	0	0	1
Well, I think one of the questions is, is the automotive industry going to remain as it currently has for the last several quarters in terms of overall production and sales? There's – I know you've read as I have that we're seeing some slowdown in the automotive markets in China, which is one of the larger sections in terms of automotive production and sales	0	1	0	2
So I think that one has some reasonable subjectivity as far as stability as we go forward	1	0	1	0
And I guess, the other one is the telecom infrastructure, which we think with the new builds on the 4G base stations in China and India, could have some upside or strengthening in terms of overall percentage growth this coming quarter	1	0	1	0
Relative, as we said on the industrial markets and some of the other areas, we pretty much see them as being pretty constant to the current percentages.	0	0	0	0
Yes, as I mentioned I think a little bit earlier in the China Smartphones, they're looking at less high-value add content-type devices, which is impacting in terms of the phones	0	0	0	0
So some of our phones that are being designed in other areas have more of our value-added type products, whereas in the China market, as you know, the focus is on cost	0	0	0	0
And they're looking at driving those costs down as well as the selling price	0	0	0	0
And as far as the functionality maybe not the same functionality as you would see in a much higher-end type phone.	0	0	0	0
I think we're seeing more of the – not – more of the Chinese based local manufacturers where we're seeing that as a issue, not so much in some of the other areas outside of China in terms of producers of Smartphone.	0	1	0	0
Okay	0	0	0	0
Well, listen, we appreciate everybody's participation and interest in AVX	0	0	0	0
Our charter is to continue to drive revenue in the company and generate reasonable margins	1	0	0	0
So again, thank you, again for attending the call, and we look forward to our call in October.	0	0	0	0
Total	10	6	5	5

Table A2: Summary Statistics - Online Appendix Only

This table presents summary statistics for additional variables employed in this online appendix only. Cumulative abnormal returns, CAR(t_1,t_2), are cumulative DGTW-adjusted returns in percentage points over day t_1 to day t_2. Report Lag is the number of days between analyst earnings forecast consensus date and the actual earnings announcement date. Report Lag Sqr and Report Lag Cub are Report Lag to the power of 2 and 3, respectively. Leverage is the ratio of total debt over total assets. Profit is the profit margin defined as operating income after depreciation, divided by total assets. BM is the book-to-market ratio defined as the difference between total assets and total debt, divided by total assets. Following Hershleifer, Lim and Teoh (2009), we include Report Lag, its squared term Report Lag Sqr, and its cubic term Report Lag Cub, into regressions. Abs ATL is the absolute value of analyst tone leve, and Abs ETL is the absolute value of executive tone level.

VarName	N Obs	Mean	SD	P5	P25	Median	P75	P95
CAR(0,1)	46849	0.20	8.21	-12.71	-3.75	0.14	4.21	13.15
CAR(2,16)	46841	0.11	7.72	-10.86	-3.71	-0.11	3.62	11.47
CAR(2,31)	46817	0.01	0.11	-0.15	-0.05	0.00	0.05	0.17
Report Lag	46849	13.69	7.17	5.00	7.00	13.00	19.00	27.00
Report Lag Sqr	46849	238.78	283.37	25.00	49.00	169.00	361.00	729.00
Report Lag Cub	46849	4502.01	33031.54	125.00	343.00	2197.00	6859.00	19683.00
Leverage	38130	0.22	0.18	0.00	0.07	0.21	0.34	0.55
Profit	39712	0.08	1.49	-0.07	0.06	0.12	0.20	0.42
BM	38022	1.32	2.22	0.19	0.40	0.69	1.22	5.58
Abs ATL	46849	0.08	0.06	0.00	0.03	0.07	0.11	0.18
Abs ETL	46849	0.18	0.09	0.04	0.12	0.18	0.24	0.34

Table A3: The Full List of Regression Coefficients

This tables represents Table 5 Panel C and list all coefficients for covariates and the interaction terms of SUE with covariates. All variables are defined in Table 4. Standard errors are double-clustered at the firm level and year-quarter level, t-statistics are reported with coefficients, firm-fixed effects and year-quarter-fixed effects are included in all columns. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	CAR(-1,1)	CAR(2,46)	CAR(-1,1)	CAR(2,46)	CAR(-1,1)	CAR(2,46)
SUE	0.94***	-0.03	0.96***	-0.08	0.92***	-0.05
	(26.61)	(-0.50)	(25.48)	(-1.59)	(22.94)	(-0.84)
SUE*High ATD	0.15***	-0.07			0.13***	-0.09
	(4.05)	(-1.19)			(3.53)	(-1.36)
High ATD	-1.55***	0.33			-1.34***	0.45
	(-5.35)	(0.72)			(-4.53)	(0.94)
SUE*High ETD			0.09**	0.03	0.05	0.05
			(2.03)	(0.47)	(1.16)	(0.82)
High ETD			-1.47***	-0.37	-1.14***	-0.52
			(-3.90)	(-0.70)	(-2.92)	(-0.95)
SUE*ln(Total Num EA)	-0.04*	0.03	-0.04*	0.03	-0.04	0.03
	(-1.71)	(0.81)	(-1.77)	(0.91)	(-1.63)	(0.85)
SUE*Friday	-0.03	0.18	-0.03	0.18	-0.02	0.18
	(-0.32)	(1.22)	(-0.35)	(1.24)	(-0.25)	(1.23)
SUE*ATL	-0.20	0.75	-0.09	0.72	-0.14	0.79
	(-0.69)	(1.49)	(-0.29)	(1.47)	(-0.48)	(1.57)
SUE*ETL	1.15***	-0.07	1.08***	-0.16	1.07***	-0.16
	(4.39)	(-0.20)	(4.14)	(-0.40)	(4.15)	(-0.40)
SUE*ln(Analyst Length)	0.16***	-0.19	0.17***	-0.19	0.16***	-0.18
	(3.05)	(-1.17)	(3.23)	(-1.20)	(3.01)	(-1.16)
SUE*ln(Executive Length)	-0.01	0.16	-0.02	0.16	-0.01	0.16
	(-0.21)	(1.02)	(-0.24)	(1.02)	(-0.21)	(1.01)
SUE*ln(MarketCap)	-0.17***	-0.00	-0.17***	-0.00	-0.17***	0.00
	(-7.67)	(-0.01)	(-7.55)	(-0.00)	(-7.63)	(0.01)
SUE*Turnover	0.01	0.03	0.01	0.03	0.01	0.03
	(0.57)	(1.14)	(0.54)	(1.22)	(0.65)	(1.17)
SUE*Ret_q	0.25**	0.07	0.25**	0.07	0.25**	0.07
	(2.29)	(0.32)	(2.29)	(0.33)	(2.29)	(0.33)
SUE*Momentum_3q	0.09	0.09	0.09	0.09	0.09	0.09
	(1.37)	(0.87)	(1.40)	(0.88)	(1.38)	(0.89)
SUE*InstOwn_Perc	0.26**	-0.24	0.26**	-0.25	0.25**	-0.25
	(2.60)	(-1.14)	(2.57)	(-1.18)	(2.53)	(-1.16)
SUE*ln(Num Est)	-0.03	-0.02	-0.04	-0.02	-0.04	-0.03
	(-0.71)	(-0.29)	(-0.84)	(-0.32)	(-0.81)	(-0.33)

ln(Total Num EA)	0.22	-0.15	0.22	-0.18	0.20	-0.16
	(1.12)	(-0.58)	(1.16)	(-0.68)	(1.04)	(-0.63)
Friday	0.07	-1.18	0.08	-1.23	0.03	-1.20
	(0.11)	(-1.14)	(0.12)	(-1.17)	(0.04)	(-1.15)
ATL	17.44***	-3.74	15.98***	-3.83	16.63***	-4.15
	(7.80)	(-1.02)	(7.12)	(-1.06)	(7.35)	(-1.12)
ETL	2.50	3.48	3.86**	4.19	3.84**	4.18
	(1.40)	(1.25)	(2.14)	(1.50)	(2.15)	(1.50)
ln(Analyst Length)	-1.19***	1.59	-1.36***	1.60	-1.26***	1.56
	(-2.87)	(1.25)	(-3.20)	(1.28)	(-2.94)	(1.25)
ln(Executive Length)	-0.00	-0.79	0.04	-0.78	-0.00	-0.78
	(-0.00)	(-0.65)	(0.07)	(-0.65)	(-0.00)	(-0.65)
ln(MarketCap)	-0.19	-2.73***	-0.21	-2.73***	-0.19	-2.74***
	(-0.83)	(-5.59)	(-0.94)	(-5.60)	(-0.87)	(-5.62)
Turnover	-0.11	-0.37**	-0.11	-0.38**	-0.12	-0.37**
	(-0.93)	(-2.03)	(-0.91)	(-2.09)	(-1.04)	(-2.05)
Ret_q	-1.15	-0.99	-1.15	-1.01	-1.18	-1.01
	(-1.50)	(-0.77)	(-1.51)	(-0.78)	(-1.55)	(-0.78)
Momentum_3q	-1.85***	-2.34**	-1.88***	-2.35**	-1.88***	-2.35**
	(-3.30)	(-2.27)	(-3.32)	(-2.28)	(-3.32)	(-2.28)
InstOwn_Perc	-2.18**	1.50	-2.18**	1.57	-2.13**	1.54
	(-2.59)	(0.89)	(-2.56)	(0.93)	(-2.52)	(0.91)
ln(Num Est)	0.37	-0.73	0.44	-0.71	0.43	-0.71
	(0.86)	(-1.10)	(1.01)	(-1.07)	(1.00)	(-1.06)
Covar	Yes	Yes	Yes	Yes	Yes	Yes
SUE*Covar	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE & YQ FE	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	46,129	46,033	46,129	46,033	46,129	46,033
Adj R2	0.185	0.030	0.185	0.030	0.186	0.030

Table A4: Alternative Windows for Share Price Responses

This tables represents Table 5 Panel C but uses alternative windows for share price responses. CAR(t_1,t_2), are cumulative DGTW-adjusted returns in percentage points over day t_1 to day t_2. All variables are defined in Tables 4 and A2. Standard errors are double-clustered at the firm level and year-quarter level, t-statistics are reported with coefficients, firm-fixed effects and year-quarter-fixed effects are included in all columns. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	CAR(0,1)	CAR(2,16)	CAR(2,31)	CAR(0,1)	CAR(2,16)	CAR(2,31)	CAR(0,1)	CAR(2,16)	CAR(2,31)
SUE	1.01***	0.03	-0.02	0.96***	0.03	-0.02	0.90***	0.00	-0.03
	(23.57)	(1.12)	(-0.39)	(23.19)	(0.85)	(-0.46)	(24.12)	(0.16)	(-0.80)
SUE*High ATD	0.19***	-0.04	-0.06	0.14***	-0.04	-0.07	0.13***	-0.03	-0.07
	(5.09)	(-1.11)	(-1.32)	(3.93)	(-1.14)	(-1.58)	(3.55)	(-0.96)	(-1.35)
High ATD	-1.41***	0.28	0.41	-1.39***	0.26	0.50	-1.33***	0.23	0.45
	(-5.04)	(1.07)	(1.09)	(-5.09)	(1.05)	(1.37)	(-4.70)	(0.88)	(1.17)
SUE*High ETD	0.15***	-0.04	0.00	0.09**	-0.04	-0.00	0.05	-0.02	0.02
	(3.32)	(-1.08)	(0.09)	(2.07)	(-1.09)	(-0.06)	(1.26)	(-0.46)	(0.34)
High ETD	-1.53***	0.47*	0.03	-1.37***	0.44*	0.02	-1.11***	0.29	-0.12
	(-4.17)	(1.80)	(0.06)	(-3.70)	(1.69)	(0.05)	(-3.10)	(1.04)	(-0.33)
Covar	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
SUE*Covar	No	No	No	No	No	No	Yes	Yes	Yes
Firm FE & YQ FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	46,746	46,738	46,711	46,129	46,121	46,094	46,129	46,121	46,094
Adj R2	0.14	0.02	0.02	0.18	0.03	0.03	0.19	0.03	0.03

Table A5: Additional Covariates and Interactions with SUE

This tables represents the last two columns in Table 5 Panel C but include additional covariates and their interactions with SUE. All variables are defined in Tables 4 and A2. Following Hershleifer, Lim and Teoh (2009), we include Report Lag, the number the days between formation date of analyst earnings forecast consensus and the actual earnings announcement in columns (1) and (2) as a covariate. We also include the squared and cubit terms of Report Lag into the regressions as covariates. Columns (3) and (4) include Leverage, Profit, and BM as additional covariates. Columns (5) and (6) control for an indicator of having more contrastive words than the cross-sectional median and its interaction term with SUE. Columns (7) and (8) control an indicator of having more euphemism words than cross-sectional median and its interaction term with SUE. Standard errors are double-clustered at the firm level and year-quarter level, t-statistics are reported with coefficients, firm-fixed effects and year-quarter-fixed effects are included in all columns. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	CAR(-1,1)	CAR(2,46)	CAR(-1,1)	CAR(2,46)	CAR(-1,1)	CAR(2,46)	CAR(-1,1)	CAR(2,46)
SUE	0.92***	-0.05	0.96***	-0.09	0.90***	-0.10	0.89***	-0.02
	(22.72)	(-0.96)	(21.77)	(-1.55)	(18.62)	(-1.22)	(20.94)	(-0.34)
SUE*High ATD	0.13***	-0.08	0.10**	-0.10	0.13***	-0.09	0.13***	-0.09
	(3.50)	(-1.30)	(2.23)	(-1.42)	(3.47)	(-1.38)	(3.42)	(-1.32)
High ATD	-1.34***	0.43	-1.00***	0.53	-1.32***	0.47	-1.30***	0.43
	(-4.49)	(0.88)	(-2.94)	(0.99)	(-4.47)	(0.96)	(-4.40)	(0.88)
SUE*High ETD	0.05	0.06	0.06	0.09	0.05	0.05	0.05	0.06
	(1.07)	(0.91)	(1.12)	(1.35)	(1.13)	(0.73)	(1.04)	(0.86)
High ETD	-1.11***	-0.57	-1.07**	-0.68	-1.13***	-0.49	-1.08***	-0.56
	(-2.82)	(-1.03)	(-2.40)	(-1.27)	(-2.90)	(-0.88)	(-2.79)	(-1.02)
Covar	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SUE*Covar	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE & YQ FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	46,129	46,033	37,245	37,184	46,129	46,033	46,129	46,033
Adj R2	0.19	0.03	0.19	0.03	0.19	0.03	0.19	0.03

Table A6: Abnormal Trading Volume: Controlling for Absolute Tone Levels

This table replicates the results of abnormal trading volume in Tables 6 and 7 but controls for the absolute value of tone level measures instead. Tone level measures for analysts and executives are controlled for in Tables 6 and 7. All variables are defined in Tables 4 and A2. Standard errors are double-clustered at the firm level and year-quarter level, t-statistics are reported with coefficients, firm-fixed effects and year-quarter-fixed effects are included in all columns. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A. Tone Dispersion for Analysts and Executives

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	AbVol(0,1)	AbVol(0,1)	AbVol(0,1)	AbVol(0,3)	AbVol(0,3)	AbVol(0,3)
High ATD	2.01***		1.75***	1.44***		1.27***
	(4.04)		(3.45)	(3.27)		(2.84)
High ETD		2.43***	2.18***		1.58***	1.39***
		(5.54)	(4.88)		(4.13)	(3.58)
Covar	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE & YQ FE	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	46,255	46,255	46,255	46,255	46,255	46,255
Adj R2	0.33	0.33	0.33	0.29	0.29	0.29

Panel B. Tone Dispersion for Analysts and Executives: Further Control for AIA

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	AbVol(0,1)	AbVol(0,1)	AbVol(0,1)	AbVol(0,3)	AbVol(0,3)	AbVol(0,3)
High ATD	2.06***		1.73***	1.53***		1.31***
	(4.11)		(3.36)	(3.41)		(2.84)
High ETD		3.04***	2.79***		1.96***	1.77***
		(8.20)	(7.24)		(5.38)	(4.62)
Covar	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE & YQ FE	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	37,685	37,685	37,685	37,685	37,685	37,685
Adj R2	0.35	0.35	0.35	0.31	0.31	0.31

Table A7: Remove Observations with Extreme Tone Levels

This table provides robustness checks by removing observations with either extreme analyst tone level or extreme executive tone level. Specifically, we remove an observation from our sample if it has an analyst tone level greater than its 95th percentile or lower than its 5th percetile or if it has an executive tone level greater than its 95th percentile or lower than its 5th percetile. All variables are defined in Table 4. Standard errors are double-clustered at the firm level and year-quarter level, t-statistics are reported with coefficients, firm-fixed effects and year-quarter-fixed effects are included in all columns. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A. Replicate main results in Table 5 but remove obs with extreme tone dispersion

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	CAR(-1,1)	CAR(2,46)	CAR(-1,1)	CAR(2,46)	CAR(-1,1)	CAR(2,46)
SUE	0.92***	-0.02	0.94***	-0.06	0.90***	-0.04
	(25.25)	(-0.44)	(24.44)	(-1.44)	(21.67)	(-0.66)
SUE*High ATD	0.14***	-0.08			0.13***	-0.09
	(3.54)	(-1.14)			(3.17)	(-1.23)
High ATD	-1.58***	0.29			-1.40***	0.38
	(-5.03)	(0.57)			(-4.34)	(0.73)
SUE*High ETD			0.09*	0.01	0.05	0.03
			(1.73)	(0.12)	(0.98)	(0.46)
High ETD			-1.44***	-0.34	-1.11**	-0.48
			(-3.45)	(-0.59)	(-2.60)	(-0.82)
Covar	Yes	Yes	Yes	Yes	Yes	Yes
SUE*Covar	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE & YQ FE	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	37,793	37,717	37,793	37,717	37,793	37,717
Adj R2	0.17	0.03	0.17	0.03	0.17	0.03

Panel B. Replicate main results in Table 6 but remove obs with extreme tone dispersion

	(1)	(2)	(3)	(1)	(2)	(3)
VARIABLES	AbVol(0,1)	AbVol(0,1)	AbVol(0,1)	AbVol(0,3)	AbVol(0,3)	AbVol(0,3)
High ATD	1.81***		1.56***	1.30***		1.15**
	(3.61)		(3.01)	(2.85)		(2.46)
High ETD		2.20***	1.95***		1.32***	1.14***
		(4.57)	(3.90)		(3.26)	(2.70)
Covar	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE & YQ FE	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	37,793	37,793	37,793	37,793	37,793	37,793
Adj R2	0.33	0.33	0.33	0.30	0.30	0.30

Table A8: Topic Number Counts: Conditional on LM2011 Tone Level within [-0.3, +0.3]

This table replicates Table 8 but provides conditional results on LM2011 tone levels within the [-0.3, +0.3] range. Measures of analyst and executive tone level are constructed following Loughran and McDonald (2011). Following Huang et al. (2018), we select the following ten topics: Business Outlook, Financial Outlook, Growth, Raw Materials and Input Price, Sales and Revenue, Comparing Financials, Geographic Segments, Cashflows and Financing, Valution Model, and Defense Contract. We remove all observations with either analyst tone level outside the [-0.3, +0.3] range or executive tone level outside the [-0.3, +0.3] range. Specifically, in Panel A, we pick the top 100 conference call Q&As of highest ATD and the bottom 100 conference call Q&As of lowest ATD per year-quarter. We count the number of mentioning a particular topic throughout a Q&A session and then calculate the average number of mentioning a particular topic among top 100 conference call Q&As of highest ATD and among the bottom 100 conference call Q&As of lowest ATD, respectively. The differential in each topic's average number count is provided in the last column. Panel B adopts the same procedure but focuses on ETD.

Panel A: Analyst Tone Dispersion and Information Differential

Topic	Top 100 ATD	Bottom 100 ATD	Top - Bottom
Business Outlook	93.2	76.3	16.8
Financial Outlook	71.3	53.1	18.2
Growth	63.6	44.4	19.2
Raw Materials and Input Price	58.0	42.4	15.6
Sales and Revenue	51.9	35.8	16.1
Comparing Financial	51.4	41.3	10.1
Geographic Segments	45.6	33.7	11.9
Cashflows and Financing	42.4	32.9	9.5
Valuation Model	44.8	38.7	6.0
Defense Contract	24.4	21.9	2.5

Panel B: Executive Tone Dispersion and Information Differential

Topic	Top 100 ETD	Bottom 100 ETD	Top - Bottom
Business Outlook	94.2	76.0	18.2
Financial Outlook	73.2	52.2	21.0
Growth	66.0	42.9	23.1
Raw Materials and Input Price	59.3	42.0	17.3
Sales and Revenue	52.7	35.4	17.3
Comparing Financial	52.2	41.2	10.9
Geographic Segments	47.3	32.5	14.8
Cashflows and Financing	43.3	32.2	11.1
Valuation Model	45.0	38.7	6.4
Defense Contract	24.4	21.9	2.5

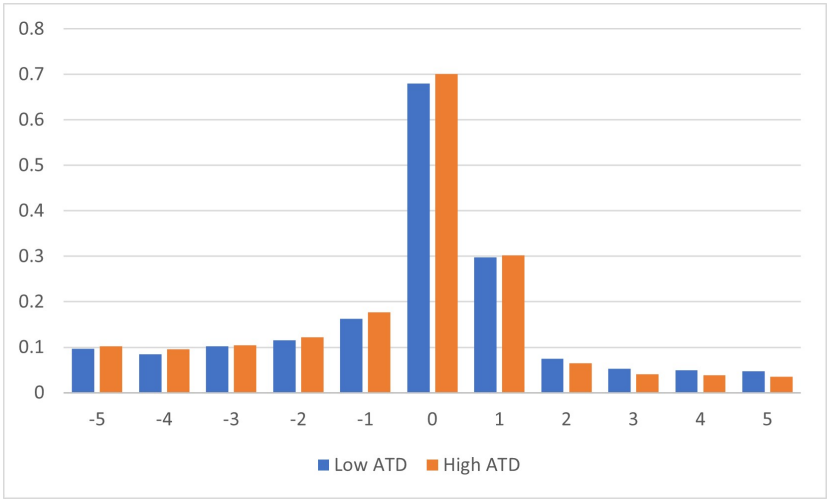
Table A9: Topic Number Counts: Correlation with Tone Dispersion Measures

This table replicates Table 10 but reports the conditional results on FinBERT tone levels within the [-0.3, +0.3] range. We provide correlation between measures of tone dispersion and the topic number counts of earnings conference call Q&As. Following Huang et al. (2018), we select the following ten topics: Business Outlook, Financial Outlook, Growth, Raw Materials and Input Price, Sales and Revenue, Comparing Financials, Geographic Segments, Cashflows and Financing, Valution Model, and Defense Contract. We count the number of mentioning a particular topic throughout a Q&A session and then calculate the correlation between tone dispersion measures, namely, analyst tone dispersion (ATD) and executive tone dispersion (ETD), and the number of mentioning a particular topic in a earnings conference call Q&A.

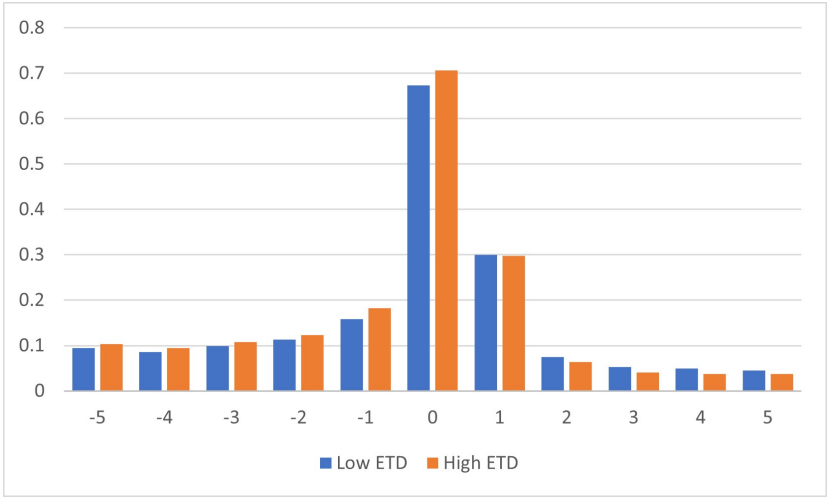
Topic	ATD Conditional - LM2011	ETD Conditional - LM2011
Business Outlook	17.4%	17.3%
Financial Outlook	23.3%	26.3%
Growth	25.6%	30.4%
Raw Materials and Input Price	22.9%	24.7%
Sales and Revenue	26.4%	27.8%
Comparing Financial	18.2%	19.0%
Geographic Segments	19.9%	24.7%
Cashflows and Financing	17.9%	20.2%
Valuation Model	11.8%	11.6%
Defense Contract	7.8%	6.8%

Figure A1: Tone Dispersion and Institutional Investor Attention

This figure replicates Figure 4 by further including year-, month-, and day-of-the-week- fixed effects. This figure compares abnormal institutional investor attention (AIA) to individual firms 5 days before and 5 days after earnings announcements. AIA is abnormal institutional investor attention to a firm, an indicator variable that is equal to one if the news reading and news searching activities for the firm by all Bloomberg terminal users at the daily frequency exceeds a threshold following Ben-Rephael, Da, and Israelsen (2017). Panel A plots the daily average of firm-level AIA for earnings conference calls with high analyst tone dispersion in orange bars and for those with low analyst tone dispersion in blue bars. High ATD is an indicator variable that equals one if the Q&A session of a conference call has a level of analyst tone dispersion that is higher than the quarterly cross-sectional median, and zero otherwise. Panel B plots the daily average of firm-level AIA for earnings conference calls with high executive tone dispersion in orange bars and for those with low executive tone dispersion in blue bars. High ETD is an indicator variable that equals one if the Q&A session of a conference call has a level of executive tone dispersion that is higher than the quarterly cross-sectional median, and zero otherwise.



(a) Panel A: Analyst Tone Dispersion



(b) Panel B: Executive Tone Dispersion

Technical Notes on The BERT Model

BERT, the abbreviation of **B**idirectional **E**ncoder **R**epresentations from **T**ransformers, is the language model that bring two core innovations to language modelling. The first is the transformer architecture from machine translation, which can deal with longer dependencies than RNN-based ones. The second is the Masked Language Modelling (MLM), in which a random 15% of all tokens are masked and the model predicts them, enabling true bi-directionality (B of BERT).

To understand the BERT, we need introduce some basic concepts used in the BERT model. The first one is Transformer. Let us use an example to illustrate it.

"**Angela Merkel** once said **she** wanted to leave politics before **she** became a "half-dead wreck". On December 8th the 67-year-old **German chancellor** will make good on **her** pledge, stepping down after 16 years to make way for a coalition led by Olaf Scholz. Beyond catching up on **her** sleep, **Mrs Merkel** has offered few clues as to what **she** might do next. What inspiration might **she** draw from other retired leaders? "[22]

The bold words refer to the same person – Angela merkel. It's not too difficult for us to figure out that they have the same meaning across the text. However, it is quite an uphill task for a computer. This is where the Transformer plays a major role.

A Sequence-to-Sequence Models

A sequence-to-sequence model (Sutskever et al. (2014),Cho et al. (2014)) is a model that takes a sequence of items (words, letters, features of an images...etc) and outputs another

[22]From Economist Report on Dec. 14th, 2021

sequence of items. A trained sequence-to-sequence model would work like the Figure A2. The encoder processes each item in the input sequence, it compiles the information it captures into a vector (called the context). After processing the entire input sequence, the encoder sends the context over to the decoder, which begins producing the output sequence item by item.

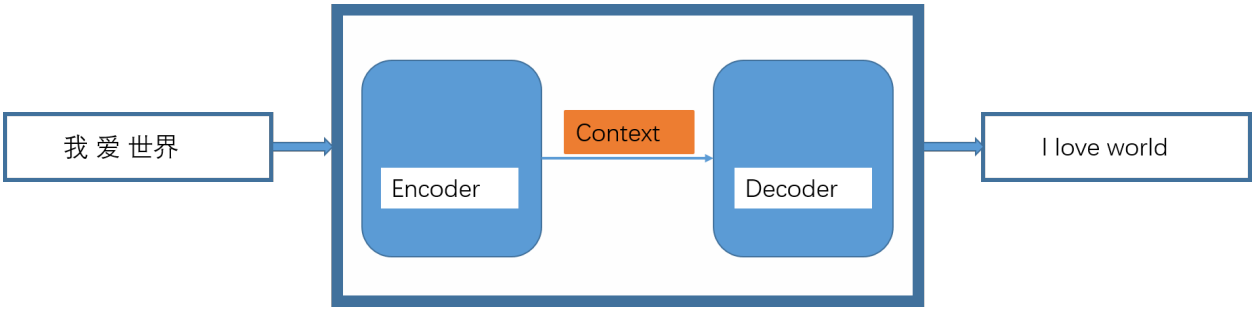


Figure A2: Sequence-to-Sequence Model

The context is a vector. The encoder and decoder tend to both be recurrent neural networks (RNNs).You can set the size of the context vector which is basically the number of hidden units in the encoder RNN. The Figure A3 set up the size of vector to be 6.

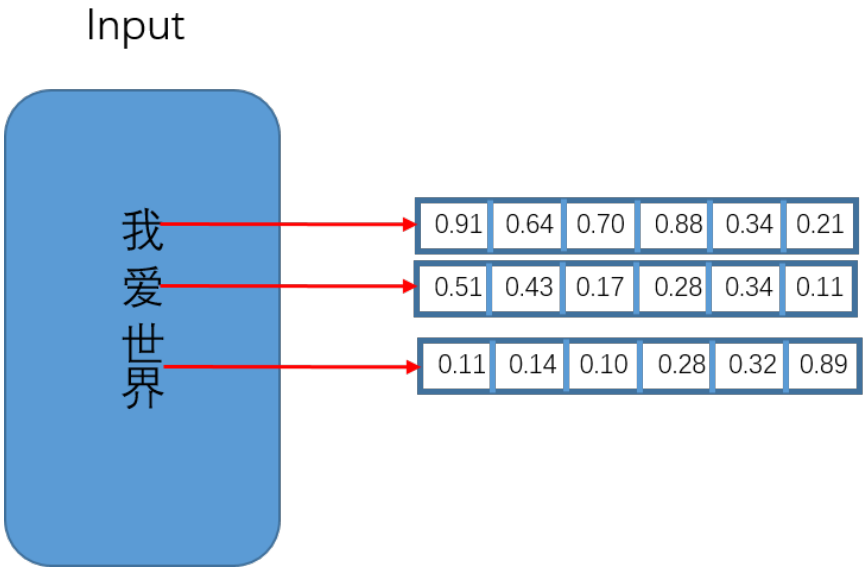


Figure A3: Word Vector

A RNN encoder takes the word vector and a hidden state as inputs at each time step. The word can be transformed into a vector through "word embedding" algorithms, which turn words into vector spaces that capture a lot of the semantic information of the words (e.g. king - man + woman = queen). The next RNN step takes the second input word vector and hidden state in previous step to create the output of new hidden state. Since the encoder and decoder are both RNNs, each time step one of the RNNs does some processing, it updates its hidden state based on its inputs and previous output represented by hidden state. The last hidden state is actually the context we pass along to the decoder RNN. The decoder also maintains a hidden state that it passes from one time step to the next.

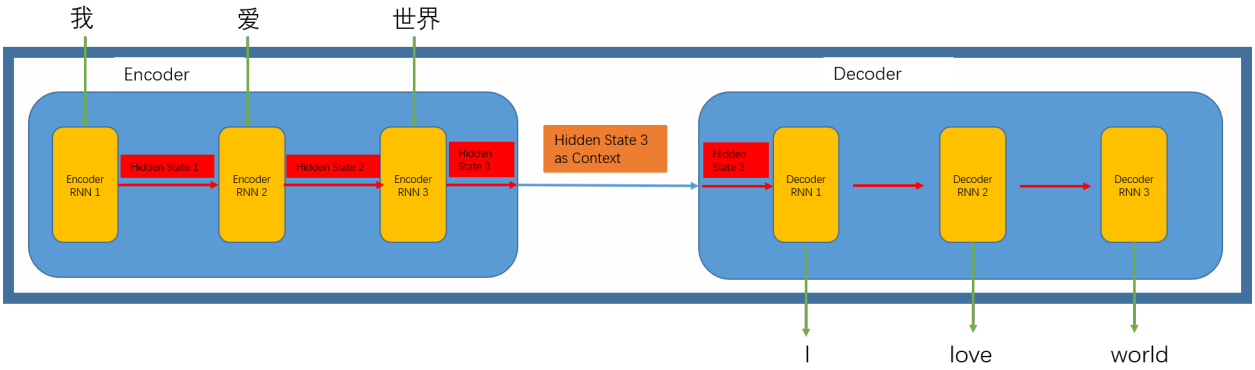


Figure A4: Mechanism of Sequence to Sequence Model

B The Attention Model

It is challenging for these models to deal with the long sentences since the context vector turn out to be a bottleneck. Bahdanau et al. (2014) and Luong et al. (2015) introduce the "Attention", which allows the model to focus on the relevant parts of the input sequence as needed. An attention model differs from a classic sequence-to-sequence model in two main ways: First, the encoder passes all the hidden states to the decoder instead of the last hidden

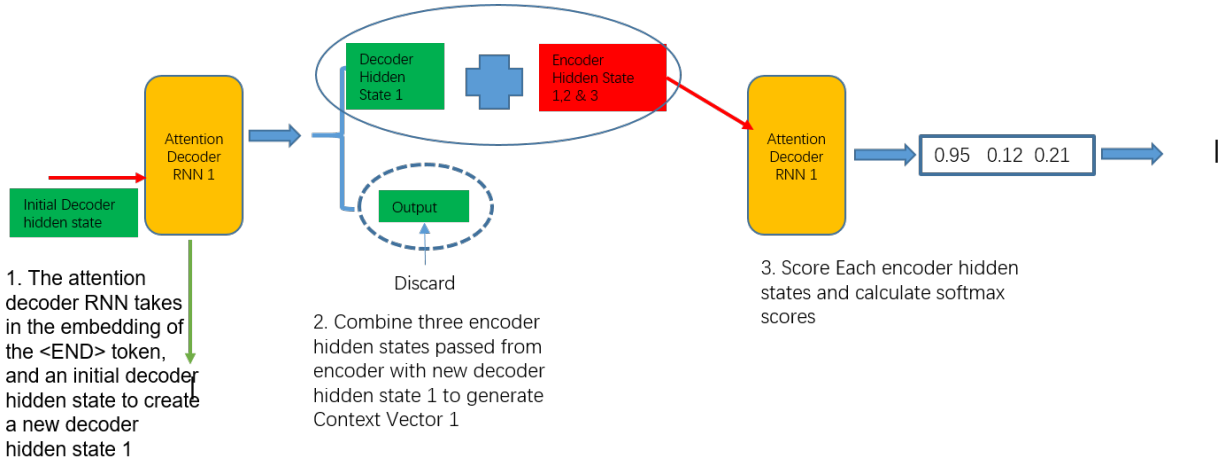


Figure A5: Attention Decoder

state. Second, an attention decoder does an extra step before producing its output. To focus on the parts of the input that are relevant to the corresponding decoding, the decoder looks at the set of encoder hidden states it received – each encoder hidden state is most associated with a certain word in the input sentence, give each hidden state a score (let's ignore how the scoring is done for now), and multiply each hidden state by its softmaxed score, thus amplifying hidden states with high scores, and drowning out hidden states with low scores. This scoring exercise is done at each time step on the decoder side.

Attention can process pairs of texts, like for textual entailment ("does Sentence 1 imply Sentence 2, contradict it, or neither?") In that case, people want a model that would compare each word in Sentence 1 with each word in Sentence 2, to figure out which ones were probably referring to the same topic.

Attention is just that. You have two sequences of words (or generally "positions"). You form a big grid, with one sequence on the vertical axis and one on the horizontal, so each cell contains one possible pair of words. Then you have some way of deciding when words "match," and for each word, you do some computation that combines it with the ones it

"matched with."

With attention, you can just as easily do it to compare the same text with itself. (This is called "self-attention," but it's become so common that people are tending to drop the "self-" part.)

You can see how this would help with stuff like resolving pronouns or word ambiguities. Instead of keeping every piece of ambiguity on some finite scratchpad, and hoping you'll have enough room, you immediately link every word with every other word that might help illuminate it. Pronouns and noun phrases link up in one step. "Bike" and "hog" link up in one step.

Transformer

The Transformer, created by Vaswani et al. (2017), is a model that uses attention to boost the speed of NLP. Attention is viewed as a thing you sort of sprinkled on top of an existing model to improve it. Not as the core functional unit, like CNN or RNN layers, which you stack together to make a model.

The Transformer is nothing more than an architecture where the core functional unit is attention. You stack attention layers on top of attention layers, just like you would do with CNN or RNN layers. In more detail, a single "layer" of the Transformer does the following:

An attention step A step of local computation at each word/position, not using any of the others Then you just stack these blocks. The first attention step anoints each word with some extra meaning, derived from other words that might be related to it. The first local computation step does some processing on this – this could be stuff like "OK, it seems we

found two different nouns that could match this pronoun; let's cook up a query designed to help decide between them." Then the next attention step takes the new, better-understood version of each word and reaches out again to all the others, with new, more sophisticated requests for context. And again, and again.

Interestingly, the sequence is the same size at every layer. There's always one position per word (or "wordpiece" or "byte pair" or whatever – generally these models divide up texts not quite at word boundaries). But the value stored for each position, which starts out as just the word, becomes a progressively more "understood" or "processed" thing, representing the word in light of more and more sophisticated reverberations from the context.

The input to the Transformer includes, not just the word at each position, but a running counter that just says "this is word #1," "this is word #2,"" etc. If this wasn't there, the Transformer wouldn't be able to see word order. Attention qua attention doesn't care where things are, just what they are (and "want"). But since the Transformer's attention can look at this running counter, it can do things like "this word is looking for words that are closeby."

The running counter allows the Transformer to learn, in principle, the same fixed local filters a CNN would use. CNN-like behavior is one limiting case, where the attention step ignores the words and uses only the position counter. (The other limiting case is attention without a position counter, where only the words are used.)

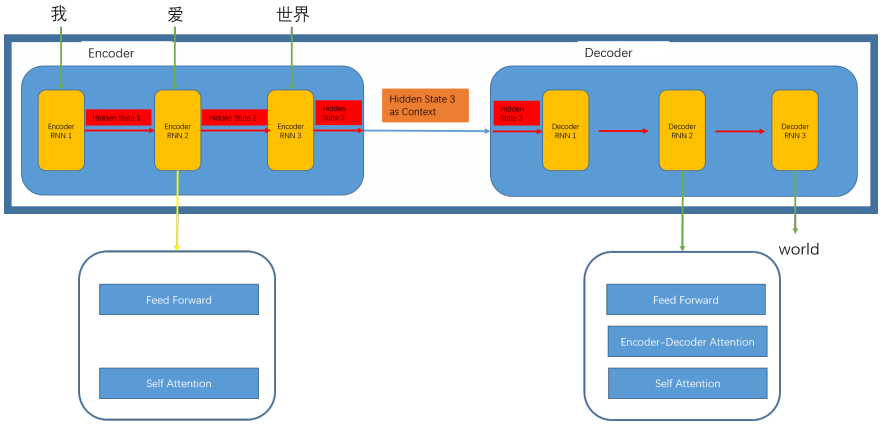


Figure A6: Transformer

The BERT Model

BERT is a Transformer. You stack some number of the "blocks" described above. You choose how many blocks to stack. You choose how to much data to store in your representation of each position (the "hidden size").

If you stack up 12 blocks, with hidden size 768, that's "BERT_BASE."

The challenging part is in getting lots of good training data, and in finding a good training objective. BERT have has a different training objective where instead of predicting the next word from a partial sentence, it predicts "masked out" words from surrounding context.