What NLP Sentiment Can't Hear

How Vocal Delivery Improves Earnings-Call NLP Sentiment

Abstract: This research brief examines whether vocal delivery improves the economic interpretation of earnings-call NLP sentiment. Text sentiment models can identify whether management language is positive, neutral, or negative, but they do not observe whether that language is delivered with vocal confirmation, control, or strain. Using **41,395 Russell 3000 earnings-call observations** from **July 15, 2020 through September 30, 2025**, covering **2,862 unique tickers**, we sort text sentiment and proprietary management-calibrated vocal measures into quintiles and evaluate event-sample-relative excess returns over **10-, 20-, and 30-trading-day horizons**. The results show that voice improves NLP sentiment on both sides of the sentiment distribution. In the highest NLP sentiment quintile, adding high vocal Valence improves the positive-text signal: over the next 10 trading days, positive text alone produces an event-sample-relative excess return of **+0.07%**, while positive text paired with high vocal Valence produces **+0.46%**, an incremental **+39 basis points** with an event-date clustered t-statistic of **2.03**. The hit rate increases from **49.0%** to **51.7%**. The stronger evidence appears on the downside. In the lowest NLP sentiment quintile, high Vocal Strain observations produce a 20-trading-day event-sample-relative excess return of **-0.67%**, compared with **+0.36%** for low-strain negative-text observations, a spread of approximately **-103 basis points** with an event-date clustered t-statistic of **-3.13**. Low Balanced Delivery produces similar downside separation. The findings suggest that vocal delivery is best understood not as a replacement for NLP sentiment, but as a conditioning layer: voice helps investors distinguish positive language delivered with confirming vocal tone from routine positive language, and negative language delivered under strain from negative language delivered with control.

Key Takeaways

Voice improves positive NLP sentiment when delivery confirms the words.
In the highest NLP sentiment quintile, positive text paired with high vocal Valence produces stronger 10-trading-day returns and higher hit rates than positive text alone.

Voice sharply conditions negative NLP sentiment.
The same negative-text bucket produces materially different return profiles depending on whether management delivery is strained or controlled. The strongest and most stable evidence appears on the downside.

Voice is a conditioning layer, not a substitute for NLP.
Text identifies the direction of management language; voice helps assess whether that language is delivered with confirmation, control, or strain.

Why the Same Words Are Not the Same Signal

Earnings-call NLP sentiment has become a standard way to convert management language into structured investment data. Text is scalable, sentiment can be measured consistently, and positive, negative, and neutral language can be ranked across companies, quarters, and speakers. This approach builds on a large literature showing that corporate language contains economically relevant information and that domain-specific textual analysis can improve interpretation of financial disclosures (Loughran and McDonald 2011; Larcker and Zakolyukina 2012).

But earnings calls are not ordinary documents. They are live communication events. Management is not only choosing words; management is delivering those words under pressure. NLP sentiment can identify favorable or unfavorable language, but it cannot hear whether positive language is delivered with vocal confirmation or whether negative language is delivered with strain. Prior research shows that nonverbal and paralinguistic features of executive speech can contain information about managerial affect, reporting credibility, and future firm outcomes (Mayew and Venkatachalam 2012; Hobson, Mayew, and Venkatachalam 2012).

This creates a practical limitation for text-only sentiment models. Positive language delivered with strong vocal Valence may carry a different signal than positive language delivered flatly. Negative language delivered calmly may not carry the same implication as negative language delivered with vocal strain. In both cases, the words alone are incomplete: text identifies the direction of the language, while voice helps investors assess confirmation, control, or strain.

A prior SSRN brief, *Voice Beyond Words: Evidence That Managerial Tone Predicts Returns When Text Does Not*, examined cases where textual sentiment was neutral and found that voice contained economically relevant information when NLP had little directional signal. This brief asks a different question: when NLP sentiment is already positive or negative, does vocal delivery make that sentiment signal more useful? The evidence suggests that it does. High vocal Valence strengthens positive NLP sentiment, while Vocal Strain and reduced Balanced Delivery make negative NLP sentiment materially more concerning.

Data and Methodology

Data

The audio files for this analysis are sourced from S&P Global and cover available Russell 3000 earnings calls from July 15, 2020 through September 30, 2025. The primary H=20 analysis includes 41,395 earnings-call observations across 2,862 unique tickers; eligible counts are similar at the H=10 and H=30 horizons, with small differences due to return-window availability. The analysis focuses on the question-and-answer portion of the calls, where management responses are less scripted and more likely to reflect real-time communication under investor questioning. To focus on senior management communication, the sample is restricted to remarks by the Chief Executive Officer and Chief Financial Officer, or equivalent top-ranked management speakers.

Speech Craft Analytics performs its own transcription of the calls in order to preserve features of spoken communication that are often removed from commercial transcripts, including filler words, repetitions, repairs, and disfluencies. These elements are important because vocal delivery and spoken-language structure are part of the communication event. To reduce noise from short or incomplete utterances, observations with fewer than four alpha tokens are excluded.

Text and Voice Measures

Text sentiment is measured using Sentiment Polarity, a continuous measure of positive or negative textual tone. For the main tests, Sentiment Polarity is converted into percentile ranks and sorted into quintiles. The lowest quintile represents the most negative text, while the highest quintile represents the most positive text. This approach reflects the broader financial-text literature showing that language in corporate disclosures and conference calls can contain information relevant to investors (Loughran and McDonald 2011; Larcker and Zakolyukina 2012).

Voice measures are proprietary Speech Craft Analytics measures generated from management-calibrated vocal models. These models summarize executive vocal delivery along economically interpretable dimensions, including nervousness, entropy, arousal, assertiveness, vocal Valence, and Balanced Delivery. The use of management-calibrated vocal measures is motivated by evidence that vocal information in earnings calls can be economically meaningful, as well as by recent work emphasizing the importance of measuring vocal tone in corporate disclosure settings rather than relying only on generic speech-emotion constructs (Mayew and Venkatachalam 2012; Hobson, Mayew, and Venkatachalam 2012; Ewertz 2025; Pope 2026b).

The analysis emphasizes three voice constructs.

First, **Vocal Strain** is defined as:

$$\text{Vocal Strain} = \text{Nervousness} + \text{Entropy} + \text{Arousal} - \text{Assertiveness} - \text{Valence} - \text{Balanced Delivery}.$$

Vocal Strain is intended to capture a broad strained-delivery state rather than nervousness alone. It increases when management sounds more nervous, uncertain, or activated, and decreases when management sounds more assertive, positive in vocal affect, and balanced in delivery.

Second, **Balanced Delivery** captures whether management's vocal delivery is more controlled, measured, and stable. Balanced Delivery is used as an independent check on the Vocal Strain result. If negative text is more concerning when delivered under strain, it should also be more concerning when delivered with lower Balanced Delivery.

$$\text{Balanced Delivery} = (\text{Negative Text}+\text{Low Balanced Delivery})-(\text{Negative Text}+\text{High Balanced Delivery})$$

Third, **vocal Valence** captures the positive or negative affective quality of the speaker's vocal delivery. In the positive-text tests, vocal Valence is used to examine whether favorable language becomes more informative when it is delivered with a more positive vocal tone.

$$\text{Vocal Valence} = (\text{Positive Text}+\text{High Vocal Valence})-(\text{Positive Text Alone})$$

All voice measures are SCA features that are converted into percentile ranks and sorted into quintiles.

Experimental Design

This brief extends prior evidence that voice contains information when text sentiment is neutral. The earlier neutral-text design asks whether voice matters when NLP has little directional signal. The current design asks a different question: whether voice improves the interpretation of explicitly positive and negative NLP sentiment.

The analysis proceeds in three steps.

First, observations are sorted into quintiles based on Sentiment Polarity. The primary negative-text tests focus on the lowest text sentiment quintile, while the primary positive-text tests focus on the highest text sentiment quintile. Broader Q1–Q2 and Q4–Q5 text buckets are also examined as supporting tests.

Second, within each text bucket, observations are sorted by vocal delivery. For negative text, the main comparisons are high versus low Vocal Strain and low versus high Balanced Delivery. For positive text, the main comparison examines whether positive text paired with high vocal Valence improves on positive text alone. Supporting positive-text tests also examine high vocal Arousal and high Positive Affect.

Third, returns are compared within the same text sentiment bucket. This is the key identification idea for a practitioner audience: the text category is held constant, so differences in subsequent returns reflect the incremental information associated with vocal delivery.

The primary negative-text comparison is:

$$(\text{Negative Text} + \text{High Vocal Strain}) - (\text{Negative Text} + \text{Low Vocal Strain}).$$

A negative spread indicates that strained delivery makes negative text more concerning. The corresponding Balanced Delivery comparison is:

$$(\text{Negative Text} + \text{Low Balanced Delivery}) - (\text{Negative Text} + \text{High Balanced Delivery}).$$

Again, a negative spread indicates that weaker or less controlled delivery makes negative text more concerning.

The primary positive-text comparison is:

$$(\text{Positive Text} + \text{High Vocal Valence}) - (\text{Positive Text Alone}).$$

A positive spread indicates that favorable language becomes more informative when it is delivered with confirming positive vocal tone.

Return Measurement and Inference

For each holding period $H \in \{10,20,30\}$, the analysis uses winsorized H-day excess returns. The exhibit values are reported as **event-sample-relative excess returns**, defined as the observation's winsorized excess return minus the average winsorized excess return across all eligible observations at the same horizon:

$$\text{Event-Sample-Relative Excess}_{i,H} = \text{Excess}_{i,H} - \bar{\text{Excess}}_{H}.$$

This transformation centers each horizon around the average earnings-call event in the analyzed sample. Positive values indicate performance above the average event at that horizon; negative values indicate performance below the average event.

T-statistics are clustered by event date to account for common event-day effects across companies reporting on the same day. For matrix cells, t-statistics test each cell mean against zero. For contrast tables, t-statistics test the difference in means between the signal and comparison groups. Counts, hit rates, mean event-sample-relative excess returns, spreads, and clustered t-statistics are reported for the main exhibits.

Exhibit 1. Same Negative Text, Different Voice, Different Return

The 5×5 matrix below sorts observations by NLP sentiment quintile and Vocal Strain quintile. The key test is within the most negative text bucket, where text sentiment is held constant and vocal delivery varies.

Vocal Strain quintile	Q1 Low Text	Q2	Q3 Mid Text	Q4	Q5 High Text
Q5 High Vocal Strain	-0.67% (-2.63)	0.11% (0.46)	0.12% (0.46)	0.01% (0.05)	0.25% (1.08)
Q4	0.16% (0.57)	0.34% (1.34)	-0.21% (-0.88)	-0.15% (-0.66)	0.00% (0.01)
Q3 Mid Vocal Strain	-0.59% (-2.49)	-0.07% (-0.29)	-0.35% (-1.50)	0.08% (0.33)	0.23% (0.91)

Vocal Strain quintile	Q1 Low Text	Q2	Q3 Mid Text	Q4	Q5 High Text
Q2	0.43% (1.86)	0.06% (0.23)	-0.10% (-0.42)	-0.11% (-0.45)	-0.31% (-1.28)
Q1 Low Vocal Strain	0.36% (1.44)	0.11% (0.49)	-0.20% (-0.84)	-0.03% (-0.12)	0.41% (1.52)

Note: Cells show H=20 event-sample-relative excess return, with event-date clustered t-statistics in parentheses.

Within the lowest NLP sentiment quintile, high Vocal Strain observations produce an H=20 event-sample-relative excess return of -0.67%, while low Vocal Strain observations produce +0.36%. The same text bucket therefore has sharply different return outcomes depending on vocal delivery. The pattern should not be interpreted as a perfectly monotonic dose-response across all strain quintiles. Rather, the exhibit shows that negative-text observations are materially weaker when delivery is strained or less clearly controlled, with the pre-specified high-versus-low contrast producing the clearest separation.Exhibit 2. Voice-Conditioned Negative Sentiment Across Horizons

Horizon	NLP condition	Voice condition	Controlled-delivery return	Strained / weaker-delivery return	Spread	t-stat	Hit-rate change
H=10	Negative text Q1	High Vocal Strain vs Low Vocal Strain	+0.18%	-0.32%	-0.50%	-1.88	-4.35 pts
H=20	Negative text Q1	High Vocal Strain vs Low Vocal Strain	+0.36%	-0.67%	-1.03%	-3.13	-4.39 pts
H=30	Negative text Q1	High Vocal Strain vs Low Vocal Strain	+0.15%	-0.87%	-1.01%	-2.46	-2.11 pts

The pattern is consistent across horizons. The spread is negative at H=10, H=20, and H=30. It is economically meaningful at H=10, strongest at H=20, and remains large at H=30. This reduces the likelihood that the result is a one-horizon artifact.

Exhibit 3. Balanced Delivery Confirms the Same Interpretation

Horizon	NLP condition	Voice condition	Controlled-delivery return	Weaker-delivery return	Spread	t-stat
H=10	Negative text Q1	Low Balanced Delivery vs High Balanced Delivery	+0.14%	-0.27%	-0.41%	-1.57
H=20	Negative text Q1	Low Balanced Delivery vs High Balanced Delivery	+0.36%	-0.52%	-0.89%	-2.73
H=30	Negative text Q1	Low Balanced Delivery vs High Balanced Delivery	+0.23%	-0.73%	-0.97%	-2.24

Balanced Delivery provides a separate test of the same idea. Negative text is more concerning when delivered with less controlled vocal delivery. The signal is not simply “nervousness.” It is a broader delivery pattern: strain, uncertainty, reduced balance, and weaker control.

Exhibit 4. Convergence and Divergence

Regime	Definition	Practitioner interpretation
Positive convergence	Positive text + constructive voice	Words and delivery align positively
Positive divergence	Positive text + strained voice	Favorable words, less reassuring delivery
Negative convergence	Negative text + strained voice	Negative words and strained delivery align
Negative divergence	Negative text + constructive voice	Negative words delivered with greater control

Horizon	Contrast	Spread	t-stat
H=10	Negative divergence minus negative convergence	+0.46%	1.74
H=20	Negative divergence minus negative convergence	+0.76%	2.25
H=30	Negative divergence minus negative convergence	+0.72%	1.68

This is the convergence/divergence argument in its most useful form. The same negative text sentiment can mean different things depending on the voice. Negative language delivered under strain is not equivalent to negative language delivered with control.

What Positive Text Adds to the Story

The main evidence in this brief is strongest on the downside, but positive text also benefits from a voice layer. The relevant question is not only whether high-Valence positive statements outperform low-Valence positive statements. For practitioners, the cleaner question is whether adding voice improves the signal already produced by positive NLP sentiment.

The answer is yes, particularly at the 10-trading-day horizon. In the highest NLP sentiment quintile, positive-text observations produced an H=10 event-sample-relative excess return of +0.07%. When those same positive-text observations were paired with

high vocal Valence, the return increased to +0.46%. The incremental return was +39 basis points, with an event-date clustered t-statistic of 2.03. The hit rate also improved from 49.0% for positive text alone to 51.7% when positive text was paired with high vocal Valence.

Horizon	Positive-text signal	Positive text alone	Positive text + high Valence	Incremental return	t-stat	Hit-rate lift
H=10	Q5 NLP sentiment + Q5 vocal Valence	+0.07%	+0.46%	**+0.39%**	**2.03**	+2.72 pts
H=20	Q5 NLP sentiment + Q5 vocal Valence	+0.12%	+0.46%	**+0.34%**	**1.43**	+1.83 pts
H=30	Q5 NLP sentiment + Q5 vocal Valence	+0.24%	+0.73%	**+0.48%**	**1.65**	+2.14 pts

Note: *Cells report event-sample-relative excess returns. The incremental return compares the high-Valence overlay with the full positive-text Q5 benchmark at the same horizon. T-statistics are event-date clustered.*

The interpretation is that voice can help distinguish routine positive language from positive language delivered with stronger vocal confirmation. Positive earnings-call language is often expected, polished, and promotional. A text-only model may identify favorable wording, but it cannot determine whether the delivery sounds consistent with that favorable framing. Vocal Valence adds that layer.

The result is still asymmetric. Positive text paired with high vocal Valence improves on positive text alone, especially at H=10. But the more robust and economically sharper finding remains on the downside: negative text is much more strongly conditioned by Vocal Strain and reduced Balanced Delivery. Positive vocal Valence helps confirm favorable language; Vocal Strain helps identify when unfavorable language sounds materially worse.

Audio Illustration: American Express — Positive Text, Strained Delivery

The positive-text results are more modest in the broad sample, but the concept is easy to hear in individual examples. American Express provides a useful illustration because the transcript and the voice point in different directions.

In one earnings-call exchange, management described consumer activity with the phrase “spending continues to be strong.” A conventional NLP sentiment model would naturally classify that language as positive. The words are favorable, direct, and easy to score as constructive.

The voice layer asks a different question: does the delivery sound as positive as the words? In this example, the vocal signal was more nervous or strained than the favorable wording suggested. That makes the sentence an example of positive-text / strained-voice divergence.

> Audio example: American Express management makes a strong positive statement under vocal strain. [Listen to the clip.]

The purpose of the example is not to make an investment claim from one sentence. It is to make the measurement problem tangible. Text identifies what was said. Voice helps determine whether the delivery confirms the words, weakens them, or raises a question that text alone would miss.

This example also clarifies the paper’s asymmetric empirical finding. Positive-text divergence is intuitive and audible in specific cases, but the broad-sample evidence is strongest on the downside: when management uses negative language, voice provides a more powerful separation between controlled disclosure and strained disclosure.

Limitations and Interpretation

The results should be interpreted as evidence that vocal delivery conditions the return implications of NLP sentiment, not as proof that voice reveals managerial intent or deception. Vocal Strain is a measured delivery state, not a psychological diagnosis. The economic interpretation is that when negative language is delivered with vocal strain or reduced Balanced Delivery, the market appears to process that communication differently over subsequent trading days.

The analysis also shows that voice does not improve NLP sentiment symmetrically. Positive text shows some evidence of confirmation through vocal affect, but the strongest and most stable results appear in negative-text observations. This asymmetry is consistent with a practitioner view of earnings calls: positive language is often expected and polished, while negative language requires more contextual interpretation.

How This Extends the Neutral-Text Evidence

Our earlier SSRN brief, *Voice Beyond Words: Evidence That Managerial Tone Predicts Returns When Text Does Not*, showed that voice matters when text sentiment is neutral; when NLP has little directional signal. This brief extends that evidence in a different direction. The neutral-text finding says: when the words do not say much, voice can still carry information. **The current finding**

says: when the words are positive, voice helps determine whether the language is delivered with confirming vocal tone; when the words are negative, voice helps determine how concerning they are.

Together, the two results define a coherent role for voice in earnings-call analysis. Voice is most useful when text is incomplete, ambiguous, or in need of interpretation. That includes neutral text, where NLP is muted; positive text, where vocal Valence helps distinguish routine favorable language from more convincing positive communication; and negative text, where Vocal Strain and reduced Balanced Delivery help distinguish controlled disclosure from strained disclosure.

Why This Matters for Investors

For investors already using NLP sentiment, the issue is not whether text contains information. It does. The issue is signal quality inside the same text bucket. A positive NLP score does not tell the investor whether favorable language is delivered with confirming vocal tone. A negative NLP score does not tell the investor whether unfavorable language is delivered with control or strain. Voice adds a second-stage filter that helps re-rank NLP sentiment signals by delivery quality.

The empirical results show why this matters. In the highest NLP sentiment quintile, positive text paired with high vocal Valence produces stronger subsequent returns than positive text alone. That result suggests that voice can help identify which favorable language deserves more weight. Positive text is common on earnings calls; positive text delivered with confirming vocal tone is more selective.

The downside result is stronger. In the lowest NLP sentiment quintile, negative text paired with high Vocal Strain produces materially weaker subsequent returns than negative text delivered with lower strain. Negative text paired with low Balanced Delivery shows a similar pattern. For an investor, this means negative NLP sentiment should not be treated as one uniform signal. Some negative language is routine caution. Some are delivered with control. Some are delivered under strain. Voice helps separate those cases.

This is the practical value of voice/text convergence and divergence. Convergence helps identify when the words and delivery point in the same direction: favorable words delivered with positive vocal Valence, or unfavorable words delivered with Vocal Strain. Divergence helps identify when the words and delivery do not carry the same implication: favorable words delivered with strain, or unfavorable words delivered with greater control.

The practical use case is not voice instead of NLP; it is voice on top of NLP. Voice gives investors a way to re-rank NLP sentiment signals after the text model has done its job. NLP sentiment identifies the direction of management language. Vocal delivery helps determine how much weight to put on that language.

Conclusion

NLP sentiment captures what management said. Voice helps interpret how management said it. The evidence in this brief shows that combining text and vocal delivery produces a more decision-useful signal than text alone.

The positive-text evidence shows that voice can confirm favorable language. In the highest NLP sentiment quintile, high vocal Valence improves the H=10 event-sample-relative excess return from +0.07% for positive text alone to +0.46%, with a clustered t-statistic of 2.03 and a hit-rate improvement from 49.0% to 51.7%.

The stronger evidence appears on the downside. In the lowest NLP sentiment quintile, high Vocal Strain underperforms low Vocal Strain by approximately 50 basis points over 10 trading days, 103 basis points over 20 trading days, and 101 basis points over 30 trading days. Low Balanced Delivery produces similar downside separation.

The practitioner implication is direct: NLP sentiment identifies the direction of the words; vocal delivery helps determine whether those words are confirmed, controlled, or strained. Voice does not replace text. It makes text-based sentiment more investable.

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