Do Words Matter? Evidence from Bank Indonesia's Communication, Interest Rates, Inflation, and Stock Market Volatility

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Abstract

While many studies have explored the effects of interest rates and inflation on financial market volatility, far less is known about how central bank communication interacts with these channels in emerging markets. This study examines how Bank Indonesia's communication, specifically its sentiment and clarity, moderates the impact of key macroeconomic variables, namely the policy interest rate and inflation, on stock market volatility in Indonesia. Using Natural Language Processing (NLP) techniques on official speeches from 2014 to 2024, this study estimates moderation regression models with Ordinary Least Squares (OLS) as a baseline and Robust Least Squares (RLS) to reduce the influence of outliers and obtain more reliable estimates under potential heteroskedasticity. Results indicate that both positive sentiment and clear communication from Bank Indonesia are associated with reduced market volatility. However, heightened clarity can intensify market reactions when policy moves are aggressive or unexpected. Increases in policy rates and effective inflation control both help stabilize volatility, but their impact depends in part on the quality of central bank communication. Robustness checks confirm the stability of these findings across estimation methods and in the presence of outliers. Overall, the findings provide new evidence from an emerging market context and show that well-designed central bank communication can shape how financial markets respond to interest rate and inflation shocks, offering concrete guidance for improving monetary policy communication in Indonesia.

1. INTRODUCTION

The role of central bank communication in monetary policy has undergone a significant transformation over recent decades. Before the 1990s, many central banks operated under a veil of secrecy, providing minimal information to the public and often communicating in coded language (Kahveci & Odabaş, 2016; Masciandaro et al., 2023; Sohn & Vyshnevskyi, 2023). This approach left market participants facing high uncertainty and frequent surprises in response to policy decisions. However, since the 1990s, central banks have adopted more transparent and proactive communication strategies, with the realization that clear and open messaging can anchor expectations and enhance the effectiveness of monetary policy (Blinder et al., 2024; Levin, 2014; Warjiyo & Juhro, 2022).

Indonesia has embraced this shift, especially since adopting the Inflation Targeting Framework (ITF) in 2005, which requires Bank Indonesia (BI) to communicate inflation targets and policy strategies transparently (Agung et al., 2011; Warjiyo & Juhro, 2022). Regular press releases, monetary policy reports, and speeches are now central to BI's efforts to guide public and market expectations for inflation and interest rates, aiming to reduce uncertainty and strengthen accountability.

A growing body of research demonstrates that the quality of central bank communication, particularly its clarity and consistency, can significantly affect financial markets by reducing volatility and enhancing policy transmission (Anastasiou et al., 2023; Binder, 2017; Brzeszczyński et al., 2021; Vyshnevskyi et al., 2024). Studies have found that clear, straightforward communication lowers exchange rate and asset price volatility, while ambiguous or inconsistent statements can lead to market confusion and heightened fluctuations (Bulir et al., 2012; Nicolay & de Oliveira, 2019; Vyshnevskyi et al., 2024). The risk of miscommunication and unintended market reactions has made central banks increasingly cautious in crafting their public messaging. Recent studies show that clear and transparent communication can increase the predictability of monetary policy, reduce uncertainty, and lower financial market volatility, thereby strengthening the overall transmission of monetary policy (Casiraghi & Perez, 2022; Vyshnevskyi et al., 2024).

Indonesia's stock market (IHSG) is particularly sensitive to macroeconomic developments and central bank signals. Historically, IHSG volatility has surged during periods of economic crisis, reflecting vulnerabilities to both internal and external shocks. For example, from 1984 to 2021, average annual volatility reached 21%, with spikes during financial crises (World Bank, 2025). High stock market volatility can increase investment risk premiums, deter capital accumulation, and threaten overall financial stability (Feng et al., 2023; Valenti et al., 2018; Vuong et al., 2022). Empirical evidence indicates that effective central bank communication, especially in terms of tone (sentiment) and clarity, influences market reactions and is associated with more stable financial conditions (Binder, 2017; Brzeszczyński et al., 2021; Kaminskas & Jurkšas, 2024; Vyshnevskyi et al., 2024).

While there is growing international evidence on the effects of central bank communication, most studies focus on advanced economies and often emphasize the direct impact of announcements or forward guidance surprises on asset prices. For example, research on the Federal Reserve and the European Central Bank shows that clearer and

more predictable communication can reduce yield and exchange-rate volatility, while unexpected or hawkish signals tend to trigger sharp market adjustments (Ahrens et al., 2024; Blinder et al., 2024; Brzeszczyński et al., 2021; Gertler & Horvath, 2018; Guo et al., 2024). These studies generally conclude that in well-developed financial systems, communication transparency, consistency, and sentiment are critical in shaping how markets process information about future interest rate paths and inflation.

Evidence from emerging and developing economies is more recent and mixed. Studies on inflation-targeting and communication in emerging markets indicate that greater transparency and clarity can help anchor expectations and dampen volatility, but the effects are often mediated by institutional credibility, market depth, and financial literacy (Bulir et al., 2012; Nicolay & de Oliveira, 2019; Vyshnevskyi et al., 2024). In some cases, clearer messages in the presence of large or unexpected policy moves can even amplify short-term market reactions, reflecting higher sensitivity to perceived policy shocks. For Indonesia, Ahokpossi et al. (2020) show that monetary policy communication matters for yields and exchange rates, yet the interaction between communication quality and macroeconomic instruments in shaping stock market volatility remains largely unexplored. This research specifically examining how the components of communication, sentiment and clarity, moderate the influence of interest rates and inflation on financial market volatility, especially in emerging markets like Indonesia, remains limited.

This analysis is grounded in the view that central bank communication operates as an informational and expectations channel within the monetary policy transmission mechanism. Clear and consistent messages reduce uncertainty about the future path of policy rates and inflation, thereby influencing risk premia and volatility in financial markets (Blinder et al., 2024; Ehrmann & Talmi, 2020). In this framework, sentiment captures the tonal assessment of the macroeconomic outlook, while clarity reflects how easily market participants can process and interpret the policy narrative. When communication is both positive and clear, investors are more likely to form aligned expectations about future policy, dampening excessive reactions to news; when messages are ambiguous or pessimistic, disagreement and perceived risk can rise, leading to higher volatility (Ahokpossi et al., 2020; Nicolay & de Oliveira, 2019; Vyshnevskyi et al., 2024).

Indonesia and Bank Indonesia constitute a particularly relevant setting for this analysis. BI operates a flexible inflation targeting regime in a financially open, bank-dominated economy where equity markets remain sensitive to both domestic and global shocks (Agung et al., 2011; Ahokpossi et al., 2020). Episodes of pronounced IHSG volatility, combined with the increasing reliance on forward-looking communication in BI's policy mix (Warjiyo & Juhro, 2022), make Indonesia a natural laboratory to study how the tone and clarity of central bank messages interact with interest rates and inflation in shaping stock market stability.

This study seeks to fill this gap by analyzing Bank Indonesia's communication patterns over time, focusing on sentiment, transparency, and clarity, and examining their moderating effects on the relationship between key macroeconomic variables (interest rates and inflation) and the volatility of the Indonesian stock market (IHSG). Bank Indonesia provides a

particularly relevant case because it operates an inflation-targeting framework in a large, open emerging economy where equity markets are highly sensitive to both domestic and global shocks, so the effectiveness of its communication is directly linked to its monetary policy and financial stability mandates. By integrating Natural Language Processing (NLP) techniques and econometric analysis using BI speeches and macroeconomic data from 2014-2024, this research offers new insights into how central bank communication can be optimized as a policy tool to support financial market stability. The findings are expected to contribute academically by extending the literature on monetary policy communication in emerging markets and practically by providing guidance for Bank Indonesia and other policymakers in designing effective communication strategies to maintain financial stability.

2. RESEARCH METHOD

This study employs a quantitative explanatory-verificatory design rooted in the positivist paradigm, as the objective is to test how monetary variables and textual attributes of Bank Indonesia's communication jointly shape stock market volatility. The analysis adopts a non-reactive, deductive approach, utilizing data collected in a non-contrived, real-world setting (Yunita & Silalahi, 2024). The empirical investigation is based on a monthly time-series framework covering January 2014 to December 2024, a period sufficient to capture regime shifts in both macroeconomic policy and market sentiment. By leveraging naturally occurring official speech data and observed market variables, the research ensures that findings are grounded in actual market dynamics rather than artificial or experimental conditions.

The empirical dataset combines three complementary streams: (i) a textual corpus of Bank Indonesia's monthly Governor speeches and Monetary Policy Reports, scraped from the central bank's website and converted to plain text for subsequent NLP analysis; (ii) macro-financial indicators comprising the BI-Rate and year-on-year Consumer Price Index (CPI) inflation, obtained from Bank Indonesia's monetary statistics and Statistics Indonesia (BPS); and (iii) market data consisting of daily high-low prices for the Jakarta Composite Index (IHSG) obtained from the Indonesia Stock Exchange. All raw inputs span January 2014 to December 2024, are aligned to a common monthly frequency, and merged into a single time series panel.

Monthly IHSG volatility is computed with the Parkinson (1980) range-based estimator (1), which exploits the intramonth distance between the highest and lowest prices and is more efficient than volatility measures based solely on closing returns (Khoo et al., 2025). Formally,

$$\sigma = \sqrt{\frac{1}{4\ln(2)} \sum_{i=1}^{N} \left(\ln \left(\frac{H_i}{L_i} \right) \right)^2} \tag{1}$$

where H_i and L_i denote, respectively, the intraday high and low prices on day i. By exploiting the full daily price range rather than only closing prices, the Parkinson estimator delivers a more efficient, range-based measure of true price dispersion; the scaling constant $\frac{1}{4\ln(2)}$

normalizes the statistic so that σ is directly comparable to the standard deviation of log returns.

Interest-rate policy is proxied by the BI-Rate, while inflation is measured as annual CPI growth. BI communication provides two moderating constructs: sentiment, a continuous score from -1 (negative) to +1 (positive) derived from a fine-tuned transformer classifier, and clarity, a readability index normalized between 0 and 1 that combines average sentence length, lexical density, and the share of complex words.

Table 1. Variables and Operational Definitions

Category	Variable	Definition & measurement
Dependent	Stock-market volatility	Monthly Parkinson volatility of the IHSG, computed from daily high-low prices
Independent	Policy interest rate	Monthly BI-Rate, %
	Inflation	YoY CPI inflation, %
Moderators	BI communication: Sentiment (Alamsyah et al., 2019, 2022)	Monthly sentiment index (-1 to +1) derived from an NLP-based text-classification model applied to BI speeches
	BI communication: Clarity	Composite clarity index (0-1) based on readability measures (average sentence length, lexical density, and share of complex words)

Source: Author's compilation (2025)

To create the sentiment and clarity indices, each speech is first converted into machine-readable text and subjected to a standard NLP pre-processing pipeline. This includes lowercasing, removal of punctuation, numbers, and non-standard characters, deletion of Indonesian stop-words, and stemming to reduce words to their base form. The cleaned corpus is then segmented into sentences, which constitute the unit of analysis for both sentiment and clarity.

For sentiment, a subset of sentences is manually annotated by two independent coders as negative, neutral, or positive with respect to the economic outlook and policy stance. Intercoder reliability exceeds the conventional 0.80 threshold, indicating consistent labelling. The labelled sentences are then split into an 80:20 training-validation partition, and a BERT-based transformer model is fine-tuned via the OpenAI API for three-way text classification. The choice of a transformer architecture, rather than a dictionary or bag-of-words approach, is motivated by its ability to capture contextual meaning and word order, which is crucial for interpreting nuanced policy language in central bank communication. The fine-tuned model outputs, for each sentence, class probabilities that are transformed into a continuous sentiment score on the [-1, +1] interval, where -1 denotes strongly negative and +1 strongly positive sentiment. Model performance on the validation set is satisfactory, with accuracy, precision, recall, and F1-scores all at or above 0.88, and confusion-matrix inspection confirming balanced classification across the three sentiment categories.

Clarity is operationalized as a readability-based index, normalized between 0 and 1, that combines average sentence length, lexical density, and the share of complex words in each speech. Higher values indicate text that is syntactically simple and lexically less dense, and therefore easier to process for a reasonably informed, non-specialist audience. This construct follows the approach in Bulir et al. (2012), Ferrara & Angino (2021), Nicolay & de Oliveira (2019), Vyshnevskyi et al. (2024), who use textual complexity as a measurable proxy for the clarity of monetary policy communication in the absence of direct survey-based indicators. In this study, "clarity" is thus interpreted not as the absence of technical content, but as the extent to which complex policy narratives are expressed in linguistically tractable form for market participants.

The econometric framework consists of two moderated multiple linear regressions that relate stock-market volatility to monetary policy variables and communication metrics. Formally, the baseline specifications are:

$$\sigma_t = \beta_0 + \gamma_1 X_{1,t} + \sum_{i=1}^2 \delta_i \left(X_{1,t} \times Z_{i,t} \right) + \sum_{i=1}^2 \lambda_i Z_{i,t} + \epsilon_{1,t} \tag{2}$$
$$\sigma_t = \beta_0 + \gamma_2 X_{2,t} + \sum_{i=1}^2 \theta_i \left(X_{2,t} \times Z_{i,t} \right) + \sum_{i=1}^2 \lambda_i Z_{i,t} + \epsilon_{2,t} \tag{3}$$

where σ_t is Parkinson volatility, $X_{1,t}$ the policy rate, $X_{2,t}$ inflation, and $Z_{i,t}$ are sentiment and clarity.

A linear specification is chosen for three reasons. First, it allows a transparent interpretation of coefficients as marginal effects and interaction (moderation) terms, which is consistent with the study's objective of identifying whether communication alters the sensitivity of volatility to policy variables. Second, the monthly sample size (T = 132) is relatively small for more parameter-intensive nonlinear or GARCH-type models, which would complicate inference without necessarily improving the interpretation of the moderating role of communication. Third, any remaining heteroskedasticity is handled through robust standard errors and Robust Least Squares estimation, as discussed below, ensuring that inference remains valid without imposing a specific parametric volatility process.

Baseline estimation uses Ordinary Least Squares (OLS) with Huber-White (HC1) robust standard errors, a correction applied after the White test revealed heteroskedasticity in Model (2), while Model (3), although homoscedastic, retains the same adjustment for consistency. Robustness is evaluated via Robust Least Squares (RLS) with bisquare M-estimation, which down-weights the lone extreme residual linked to the March 2020 market shock and confirms that both the sign and significance of every coefficient remain stable across estimators.

To secure the classical assumptions, multicollinearity is controlled through mean-centering and verified with Variance Inflation Factors (VIF); heteroskedasticity is re-checked with the Breusch-Pagan/White tests; serial correlation is monitored using the Durbin-Watson statistic and the Breusch-Godfrey LM test, both indicating independent errors; and residual normality is assessed through the standard normality test recommended by Ekananda (2019). Model specification is further validated by the Ramsey RESET test, while

goodness-of-fit metrics (R^2, adjusted R^2, and F-statistics) confirm that the explanatory variables together account for a meaningful share of IHSG volatility. While these tests address the classical OLS assumptions, the timing-based identification strategy described above should be viewed as a reduced-form approach to mitigating endogeneity rather than a full structural solution; more elaborate designs such as VAR/SVAR or instrumental-variable frameworks are left for future research extensions.

3.   RESULTS AND DISCUSSIONS
3.1.   Empirical Findings

This subsection reports the empirical findings in two stages. First, we apply Natural Language Processing (NLP) to the Governor's monthly speeches to construct sentiment (-1 to +1) and clarity (0 to 1) indices and describe how these evolve across policy cycles. Second, we use these communication measures in moderated regression models to test whether they dampen or amplify the effects of the BI-Rate and year-on-year CPI inflation on Jakarta Composite Index (IHSG) volatility.

Table 2. Descriptive Statistics

	Volatility (σ)	Interest Rate (X_1)	Inflation (X_2)	Sentiment (Z_1)	Clarity (Z_2)
Mean	0.0085	0.0546	0.0365	0.1781	0.7373
Median	0.0075	0.0563	0.0328	0.1915	0.7380
Maximum	0.0407	0.0775	0.0836	0.3810	0.8100
Minimum	0.0038	0.0350	0.0132	-0.1150	0.5050
Std. Dev.	0.0042	0.0136	0.0172	0.1036	0.0439
Skewness	3.8322	0.1377	0.9056	-0.4212	-1.6707
Kurtosis	27.1474	1.8740	3.1155	2.7333	9.1675
Jarque-Bera	3530.129	7.390	18.114	4.293	270.613
Probability	0.0000	0.0248	0.0001	0.1169	0.0000
Observations	132	132	132	132	132

Source: Author's calculations (2025)

The descriptive statistics in Table 2 show that all series exhibit sufficient time variation while remaining within plausible macro-financial ranges. Monthly IHSG volatility (σ) has a mean of 0.0085, suggesting generally stable equity returns in normal times. However, the maximum value of 0.0407, observed at the height of the COVID-19 sell-off, indicates that the market can become around five times more volatile when systemic risk surges, whereas the minimum of 0.0038 corresponds to periods of well-anchored expectations and benign macroeconomic conditions. The policy rate (BI-Rate, X_1) averages 5.46% (median 5.63%) and moves between 3.50% and 7.75% (σ = 1.36%), reflecting Bank Indonesia's active adjustment of its main instrument to balance inflation and exchange-rate objectives. Inflation

(X_2) averages 3.65%, with values between 1.32% and 8.36% ($\sigma = 1.72$ per cent), capturing both low-inflation environments and pronounced cost-push shocks. Taken together, these patterns indicate that the sample spans tranquil, tightening, and stress periods, providing a suitable setting to examine how communication interacts with monetary policy in shaping stock-market volatility.

On the communication front, the sentiment index (Z_1) is generally positive, with a mean of 0.17808 and $\sigma = 0.10363$, yet the lower bound of -0.11500 indicates moments when BI adopted an unmistakably cautious or even pessimistic tone, typically in the face of global turmoil or sharp domestic price spikes. Finally, the clarity index (Z_2) averages 0.73728, moves within a narrow band (0.50500-0.81000), and exhibits a modest standard deviation of 0.04388. This profile suggests that while the BI's rhetoric occasionally dips in readability, it remains consistently high by international standards, providing a relatively stable informational channel through which tone can fluctuate. Collectively, these statistics justify the study's two-stage approach: first interrogating how sentiment and clarity evolve, then examining how both attributes moderate the transmission of monetary and inflation shocks to stock-market volatility.

Bank Indonesia Communication Analysis

This section evaluates the informational content of Bank Indonesia's policy statements over 2014-2024 using two linguistic dimensions extracted from the Governor's monthly speeches: sentiment and clarity. Sentiment captures the tonal polarity of the message, while clarity reflects how easily an informed, non-specialist audience can process the text. Together, these attributes summarize the communication channel through which BI's policy moves reach financial markets, and the subsequent sub-sections link their dynamics to salient macro-financial events.
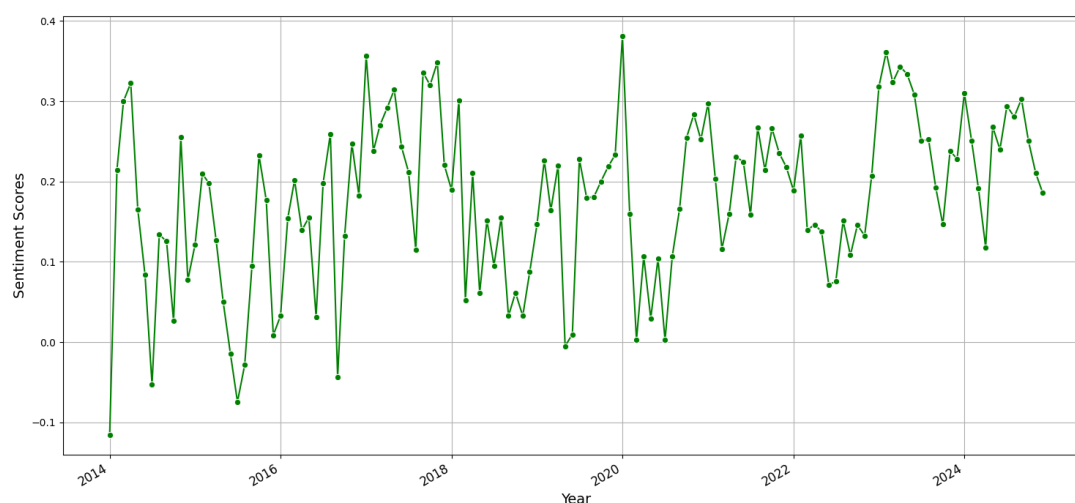

Figure 1 Sentiment Scores of Bank Indonesia Speeches (2014-2024)
Source: Author's calculations (2025)

The sentiment expressed in Bank Indonesia's monetary policy communication over the 2014-2024 period exhibits clear temporal shifts, reflecting the central bank's adaptation to

evolving macroeconomic conditions. As quantified in this study, sentiment scores were extracted from Governor's speeches and visualized in Figure 1.

The plot traces the monthly trajectory of sentiment scores over the eleven-year period. The scores range from a low of -0.12 (January 2014) to a high of 0.38 (January 2020), with most months post-2017 consistently recording values above 0.20. Early years are characterized by volatility and caution, with frequent neutral and negative readings: for instance, June and July 2015 registered near-zero or negative sentiment (-0.01 and -0.07, respectively), reflecting the macroeconomic pressures of that period.

A pronounced structural shift is observed from 2017 onwards, where almost all months exhibit positive sentiment. For example, November 2017 reaches a notably optimistic score of 0.35, and this trend of positivity persists into the subsequent years. The heatmap also reveals subtle seasonal effects, with January, April, and November frequently marking higher sentiment values. For instance, January 2017 and January 2020 scored 0.36 and 0.38 respectively, often coinciding with major policy announcements or economic outlooks.

During the COVID-19 shock, a period of sharply elevated global uncertainty, BI's sentiment scores show an immediate response. Figure 1 shows that sentiment jumped to 0.38 in January 2020 but then dropped sharply in April (0.03) and May (0.03) as the economic impact of the pandemic became clearer. Despite these shocks, sentiment did not remain depressed; BI soon reverted to a more optimistic tone, with scores returning to the 0.10-0.30 range in the second half of 2020 and thereafter.

The overall trend, as visualized in Figure 1, demonstrates considerable fluctuation in the early years, with sentiment regularly oscillating between negative and positive values. Yet, from 2017 onwards, sentiment not only stabilized but also trended upwards, clustering in the positive zone. From 2021 to 2024, it stayed consistently positive, with monthly scores ranging between 0.15 and 0.35, except for minor dips that coincided with episodes of heightened external uncertainty, such as global inflation surges or political transitions (e.g., the slight decline at the end of 2024). The lowest score of -0.12 in January 2014 aligns with a period of significant economic strain, including rupiah depreciation and current account deficits. Conversely, the highest sentiment values, such as 0.38 in January 2020, occur in contexts where the central bank sought to reinforce public confidence or signal robust policy measures.

These detailed sentiment dynamics underscore the evolving role of BI's communication as an active instrument in monetary policy. Figure 1 reveals a marked improvement in communication tone since 2017 and the agility with which BI adapts its messaging to macroeconomic developments. This shift, from cautious, sometimes negative sentiment in earlier years, to a more measured and positive outlook in recent years, demonstrates a strategic evolution towards greater transparency and consistency in Indonesia's central banking communication.
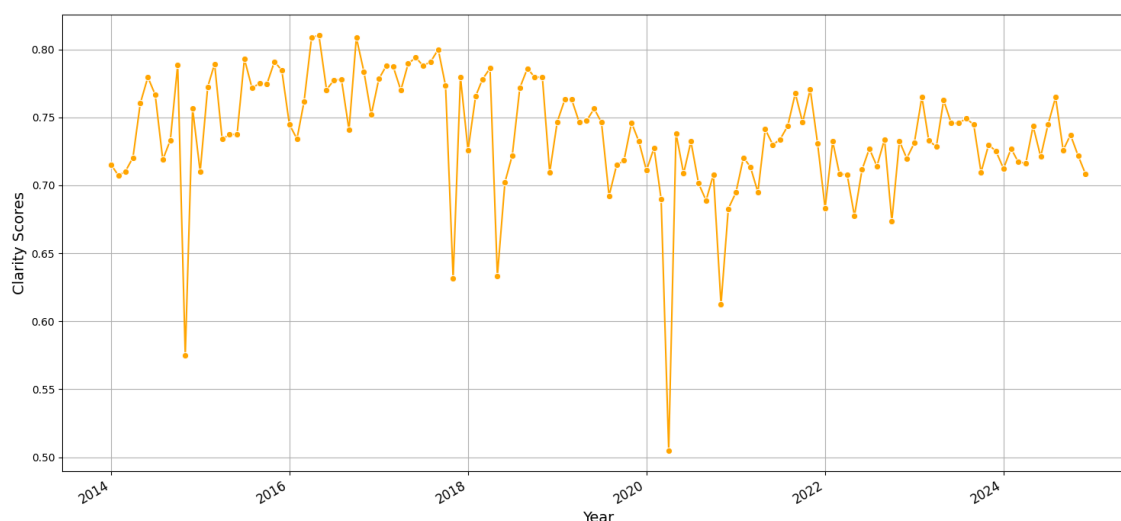
Figure 2 Clarity Score of Bank Indonesia Speeches (2014-2024)
Source: Author's calculations (2025)

Beyond sentiment, the clarity of central bank communication is closely linked to policy transparency, communication credibility, and the management of market expectations. This study quantifies clarity using linguistic metrics: average sentence length; lexical density; and the proportion of complex words, applied to the full text of BI's Governor speeches from 2014 to 2024. Figure 2 shows that clarity is generally high but temporarily declines when new instruments are introduced or uncertainty spikes, before returning to its usual range once the policy path is better understood. These movements suggest that BI varies the density and complexity of its language to provide credible guidance and to anchor expectations as macro-financial conditions change.

The time series analysis reveals that clarity scores remained consistently high, with values typically ranging from 0.70 to 0.80 throughout the period. This suggests that BI maintained a generally clear and accessible communication style, even during episodes of economic turbulence. Notable exceptions, occasional sharp dips in clarity, such as in early 2015 (score around 0.58), mid-2018 (0.63), and mid-2020 (0.51), coincide with periods of heightened external shock or crisis. These temporary reductions in clarity may reflect the inherent complexity and uncertainty of policy responses during such times, as the bank grappled with communicating unprecedented challenges, such as global financial market volatility and the COVID-19 pandemic.

Despite these sporadic declines, clarity rapidly returned to its previous high levels. For instance, after the marked dip in 2020, corresponding to the initial pandemic shock, the clarity scores quickly rebounded above 0.70, reflecting BI's commitment to transparent and comprehensible communication even in crisis management. The peak clarity scores, exceeding 0.80 (e.g., late 2017 and parts of 2018), correspond to periods where BI delivered especially concise and structured policy guidance, likely in response to positive macroeconomic developments or major strategic announcements.

Over the full observation window, the clarity scores display modest cyclical fluctuations but no significant long-term decline, indicating institutional learning and adaptation in crafting effective public messages. Clarity generally stays in the upper part of the 0-1 scale, with most observations clustered around 0.70-0.78, and only temporary dips during episodes of heightened external uncertainty, such as the monetary tightening episodes of 2014-2015 and 2018 or the COVID-19 shock. The overall high and stable level of clarity suggests that BI's communication not only became more positive over time (as reflected in the sentiment scores) but also more systematically clear, which supports policy transparency, strengthens public trust and enhances the predictability of its monetary stance.

Taken together, the evidence from sentiment and clarity dynamics points to an increasingly deliberate communication strategy. More cautious tones tend to cluster around tightening phases, while more positive sentiment accompanies easing or more accommodative periods, indicating the use of language as a tool for expectation management. At the same time, the sustained clarity of BI's messages, particularly after crisis-related dips, shows a consistent effort to keep policy objectives, risk assessments and strategic priorities understandable for a broad range of stakeholders, thereby reinforcing the institution's broader credibility in monetary policy. Having established these dynamic patterns and the informational content of BI's communication, the next section examines how these linguistic features interact with key macroeconomic variables by analyzing their impact on financial market volatility through regression analysis.

3.2   Results

This section presents the results of a moderation regression analysis aimed at empirically identifying the influence of macroeconomic policy variables, namely, the interest rate and annual inflation, as well as the quality of Bank Indonesia's communication, on Indonesian stock market (IHSG) volatility from January 2014 to December 2024. The analysis utilizes a monthly panel comprising 132 observations, with the dependent variable defined as monthly IHSG volatility (σ), and the main independent variables including the interest rate (X_1), annual inflation (X_2), and two key communication dimensions: sentiment (Z_1) and clarity (Z_2).

Prior to estimation, all independent and moderating variables were processed using mean-centering. This approach, which subtracts each observation from its respective variable mean, serves to mitigate potential multicollinearity among predictors and to facilitate the interpretation of regression coefficients, where the constant term represents IHSG volatility under average conditions of all predictors. Interaction terms were then constructed by multiplying the mean-centered principal variables (interest rate or inflation) with the mean-centered moderators (sentiment and clarity), enabling direct interpretation of the moderation effects when variables deviate from their means.

Two modeling strategies were applied. First, the Ordinary Least Squares (OLS) method with Huber-White (HC1) robust standard errors was employed as the baseline, given initial diagnostic tests (White test) indicated general heteroskedasticity in the residuals, particularly for Model (2). The HC1 adjustment ensures the robustness of standard errors, thus validating statistical inference despite the presence of heteroskedasticity. Second, as a robustness check,

Robust Least Squares (RLS) estimation based on M-estimation with a bisquare weighting function was performed. This technique automatically reduces the influence of extreme observations, such as the significant volatility spike in March 2020 during the COVID-19 pandemic, thus ensuring that the regression results are not unduly distorted by outliers.

Table 3. Regression Estimation Results

Variable	Model (2)	Model (3)
Intercept (β_0)	0.0069***	0.0069***
	(0.0003)	(0.0002)
Main Independent Variables		
Interest rate (X_1)	-0.0382**	-
	(0.0149)	-
Inflation (X_2)	-	-0.0180*
	-	(0.0107)
Communication Dimensions		
Sentiment (Z_1)	-0.0089**	-0.0090**
	(0.0039)	(0.0038)
Clarity (Z_2)	-0.0211***	-0.0262***
	(0.0043)	(0.0053)
Interaction Effects		
$X_1 \times Z_1$	0.3303	-
	(0.2468)	-
$X_1 \times Z_2$	1.1071***	-
	(0.2534)	-
$X_2 \times Z_1$	-	0.1381
	-	(0.1347)
$X_2 \times Z_2$	-	0.9511***
	-	(0.2711)
Model Statistics		
R^2	0.330	0.298
Adjusted R^2	0.304	0.270
F-statistics (Prob.)	12.43***	10.69***
Durbin-Watson	1.73	1.70
White's Test (p-value)	0.005†	0.139
Breusch-Godfrey LM (p-value)	0.259	0.168
Maximum VIF	4.68	3.28
No. of observations	132	132

Robust standard errors Huber-White-Hinkley (HC1) are reported in parentheses.
***$p < 0.01$; **$p < 0.05$; *$p < 0.10$. †White's test p-value < 0.05 indicates presence of heteroskedasticity.
Source: Author's calculations (2025)

Table 3 shows that the BI policy rate in Model (2) has a negative and statistically significant coefficient (-0.0382, $p < 0.05$), indicating that higher policy rates are associated with lower IHSG volatility. Periods of policy tightening therefore tend to calm equity markets, consistent with the idea that decisive rate hikes can anchor inflation expectations and reduce uncertainty about the policy stance. In Model (3), the coefficient on inflation is also negative and significant (-0.0180, $p < 0.10$), suggesting that better-controlled inflation coincides with more stable stock-market conditions rather than with heightened turbulence.

The communication variables are likewise economically and statistically important. Sentiment enters with a negative and significant coefficient in both models (-0.0089 and -0.0090, $p < 0.05$), indicating that more positive language in BI speeches is linked to lower stock-market volatility and can reassure investors. Clarity also has a negative and highly significant coefficient (-0.0211 and -0.0262, $p < 0.01$), implying that, on average, clearer communication is associated with calmer markets. Taken together, these results suggest that both the tone and the readability of BI's messages matter for how strongly markets react to macroeconomic news.

The interaction terms highlight how communication reshapes the impact of policy shocks. For the policy rate, the interaction with sentiment is positive but statistically insignificant, indicating that variations in the optimistic or pessimistic tone of communication do not materially change the market's sensitivity to interest-rate movements. By contrast, the interactions between the policy variables and clarity are positive and strongly significant in both models (1.1071 and 0.9511, $p < 0.01$). This means that higher clarity magnifies the market response to changes in the BI-Rate and to movements in inflation. Intuitively, clarity acts as a double-edged sword: in normal times, clear communication reduces noise and volatility, but when policy moves are large or unexpected, very explicit messages make the signal harder to ignore, so price adjustments become sharper and short-term volatility can temporarily rise.

To ensure the validity and reliability of the regression results, this study conducted a series of robustness checks to mitigate the potential distortion caused by extreme observations or outliers. Robustness was assessed by comparing the baseline Ordinary Least Squares (OLS) estimates with Huber-White (HC1) robust standard errors to Robust Least Squares (RLS) estimates based on M-estimation with a bisquare weighting function, for both Model (2) and (3).

Table 4. Robustness Check Results

Variable	Baseline OLS (HC1) Model (2)	Robust LS Model (2)	Baseline OLS (HC1) Model (3)	Robust LS Model (3)
Intercept (β_0)	0.00694	0.00662	0.00692	0.00661
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Interest rate (X_1)	-0.03821	-0.02676	-	-
	(0.012)*	(0.028)*	-	-

Table 4. (continued)

Variable	*Baseline* OLS (HC1) Model (2)	*Robust* LS Model (2)	*Baseline* OLS (HC1) Model (3)	*Robust* LS Model (3)
Inflation (X_2)	-	-	-0.01801	-0.01315
	-	-	(0.096)†	(0.186)
Sentiment (Z_1)	-0.00893	-0.00504	-0.00904	-0.00539
	(0.025)*	(0.002)**	(0.018)*	(0.001)**
Clarity (Z_2)	-0.02116	-0.01772	-0.02623	-0.01994
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
$X_1 \times Z_1$	0.33031	0.16203	-	-
	(0.183)	(0.178)	-	-
$X_1 \times Z_2$	1.10711	0.91841	-	-
	(0.000)***	(0.000)***	-	-
$X_2 \times Z_1$	-	-	0.13812	0.04715
	-	-	(0.307)	(0.569)
$X_2 \times Z_2$	-	-	0.95106	0.71353
	-	-	(0.001)***	(0.003)**

Values in parentheses are p-values.
***$p < 0.01$; **$p < 0.05$; *$p < 0.10$; †$p < 0.10$
Source: Author's calculations (2025)

Diagnostic tests indicate that the specifications are statistically reliable. White's test points to heteroskedasticity in Model (2) ($p = 0.005$), which is addressed through Huber-White (HC1) robust standard errors, while Model (3) does not exhibit heteroskedasticity ($p = 0.139$). The Durbin-Watson statistics (1.73 and 1.70), together with the Breusch–Godfrey LM tests, show no evidence of residual autocorrelation, and the maximum VIF values (4.68 and 3.28) are well below conventional thresholds, suggesting the absence of problematic multicollinearity. Robust Least Squares estimates with bisquare weighting confirm the OLS results: key coefficients preserve their signs and significance, and visual inspection of standardized residuals shows that only one extreme outlier around March 2020 is present and is effectively down-weighted. Overall, the coefficient patterns are stable across estimators, indicating that the main findings are not driven by estimation method or by a handful of extreme observations.

In sum, the regression evidence reveals that both monetary policy actions and the quality of Bank Indonesia's communication exert significant influence on stock-market volatility. Higher policy rates and better-controlled inflation are associated with calmer markets, while more positive and clearer communication further dampens volatility on average. At the same time, the interaction results show that very explicit communication can amplify short-term market reactions to large or unexpected policy moves, underscoring the

need for BI to balance transparency with flexibility when conveying its policy stance to financial markets.

3.3   Discussions

The results of this study show that Bank Indonesia's communication plays a strategic moderating role in shaping the impact of monetary policy, specifically interest rate and inflation changes, on stock market volatility. This is consistent with the communication analysis in section 3.1, which documented systematic shifts in both sentiment and clarity in response to evolving domestic and global conditions.

First, the sentiment analysis indicates that a more positive tone in BI's policy messages is associated with lower stock market volatility. This pattern aligns with evidence that reassuring or optimistic central bank communication can mitigate uncertainty and dampen excessive market reactions (Ehrmann & Talmi, 2020; Nicolay & de Oliveira, 2019). Conversely, more negative or cautious language tends to heighten perceived risk and is linked to higher volatility, in line with studies showing that pessimistic communication increases risk premia and amplifies market stress (Bennani, 2020; Correa et al., 2021).

Second, communication clarity exerts both direct and moderating effects. On average, clearer and more accessible BI statements are associated with calmer markets, supporting the view that simple, well-structured messages help investors interpret monetary policy more accurately and reduce noise in price formation (Bulir et al., 2012; Vyshnevskyi et al., 2024). At the same time, the positive and significant interaction between clarity and policy variables suggests that clarity can behave like a double-edged sword. In normal times, higher clarity helps stabilize volatility, but when policy moves are large or unexpected, very explicit communication can increase the salience of adverse news and temporarily intensify market reactions (Ferrara & Angino, 2021; Vyshnevskyi et al., 2024).

Third, the direct effects of the policy variables themselves are consistent with a stabilizing role for credible monetary policy. Higher BI-Rate levels and better-contained inflation are associated with lower IHSG volatility, indicating that decisive tightening and well-anchored inflation expectations reduce macroeconomic uncertainty and support more orderly price adjustments. These results are consistent with previous evidence that greater transparency and clearer central bank communication in emerging markets can reduce financial-market volatility and disagreement about inflation expectations (Ahokpossi et al., 2020; Bulir et al., 2012; Nicolay & de Oliveira, 2019; Vyshnevskyi et al., 2024).

Overall, the findings reinforce the view that central bank communication is not merely an auxiliary element of monetary policy, but an integral instrument with a tangible impact on financial market stability (Ahokpossi et al., 2020; Blinder et al., 2024; Ehrmann et al., 2023; Nicolay & de Oliveira, 2019). In the Indonesian context, high-quality communication, combining a measured positive tone with well-calibrated clarity, can help reduce uncertainty, shape how markets respond to interest rate and inflation shocks, and thereby support BI's broader objective of maintaining financial stability.

4.   CONCLUSIONS

This study examines how BI's communication, measured through sentiment and clarity extracted from the Governor's monthly speeches, interacts with monetary policy to influence stock market volatility in Indonesia. Using Natural Language Processing to construct monthly communication indices over 2014-2024 and moderated multiple linear regressions estimated with OLS and Robust Least Squares, the analysis shows that communication is a central channel through which interest rate and inflation dynamics are transmitted to the stock market.

The empirical results point to three main findings. First, higher BI-Rate levels and better contained inflation are associated with lower IHSG volatility, suggesting that credible tightening and well-anchored inflation expectations reduce macroeconomic uncertainty and allow stock prices to adjust more smoothly. Second, the communication dimensions exert their own direct effects on volatility: more positive sentiment in BI's speeches is systematically related to calmer markets, while higher clarity is also linked to lower volatility. These patterns support the view that a reassuring tone and accessible language help market participants interpret the policy stance and underlying risk assessment more accurately, thereby lowering disagreement and stabilizing financial conditions. Third, the interaction terms reveal that clarity behaves as a state-dependent instrument. On average, greater clarity reduces volatility, but during large, abrupt, or unexpected policy moves, very explicit communication can make adverse news more salient and temporarily amplify market sensitivity to interest rate and inflation shocks, giving clarity a dual stabilizing-amplifying nature.

These findings have clear implications for BI. In tranquil periods, maintaining a coherent narrative with a measured positive tone and a high level of clarity can help anchor expectations, reduce uncertainty, and keep stock market volatility at moderate levels. During episodes of stress or substantial policy adjustment, BI needs to calibrate not only the size and timing of its policy moves but also the level of detail and emphasis in its communication, so that transparency is preserved without unnecessarily amplifying short-run volatility. Communication should therefore be treated as a policy instrument managed jointly with interest rate decisions and inflation objectives, rather than as a purely descriptive afterthought.

Looking ahead, the empirical framework developed in this study provides a practical tool for policymakers and communication strategists to design and monitor central bank messages in real time. For BI and other central banks, tracking sentiment and clarity indices alongside conventional macro indicators can help identify when communication is stabilizing markets and when it risks amplifying the impact of large or unexpected policy moves, allowing timely adjustment of tone, framing, and level of detail. Embedding such monitoring into the regular policy process would enable more systematic learning about which communication strategies work best under different states of the economy and future research can extend this approach by linking alternative text-based measures, high-frequency financial data, and cross-country comparisons to develop operational guidelines for

communication that supports both effective monetary transmission and resilient financial markets.

5.   ACKNOWLEDGEMENT

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