Maastricht University

Bachelor's Thesis MaRBLe

Effects of Central Bank Communication on the Stock Market Volatility

Bachelor Economics and Business Economics

Viktória Račková

Supervised by Julian Ashwin

Student ID: I6306896

Date: January 20, 2025

Word Count: 7527

Page Count: 32

Abstract

This thesis investigates the relationship between central bank communication and stock market volatility in the United States and the European Union. By applying textual analysis techniques, the study quantifies the hawkish-dovish tone of Federal Open Market Committee (FOMC) and European Central Bank (ECB) policy documents using a Hawk-score metric. Both aggregate and topic-specific scores are analyzed to explore their effects on realized and implied volatility. The findings highlight inconsistencies across geographic regions and volatility measures. Aggregate results suggest that hawkish communication has a calming effect on markets in the EU, while exhibiting a contrasting effect in the US. In contrast, topic-specific analyses reveal dual associations in both markets. Notably, realized volatility in the US responds significantly to hawkish communication on policy and growth topics, whereas in the European market, it is implied volatility that reacts to hawkish communication on global and price topics. This analysis furthers the understanding of central bank communication as a policy tool and provides insights into how communication shapes market dynamics.

Keywords

Central Bank Communication
Stock Market Volatility
Textual Analysis
Hawk-score
Realized Volatility
Implied Volatility
FOMC
ECB

Contents

1 Introduction

Central bank communication has emerged as a critical topic in contemporary economic and financial research. A rising number of studies have explored the effects of central bank communication on financial markets, either by analyzing the tone or sentiment expressed in released documents or by examining the policy implications. But why has central bank communication attracted so much attention? And why does it matter? Central bank communication provides key signals about monetary policy, the economic outlook, and market risk sentiment. Most importantly, as suggested by macroeconomic theory, it shapes investor behavior and expectations. Understanding how central bank communication affects financial markets not only assists in forecasting market reactions but also enables central banks to strategically manage their messaging to influence market responses effectively.

While the majority of the existing literature focuses on market reactions through price and returns analysis, substantially less attention has been paid to the relationship between central bank communication and asset volatility. To address this gap, this paper aims to uncover the relationship between central bank communication and stock market volatility. Specifically, it examines the tone of central bank communication, categorized as hawkish or dovish, to answer the central research question: *How does the central bank communication's hawkish-dovish tone affect stock market volatility, and what topics drive these effects?*

This analysis focuses on two major economic regions, namely, the United States and the European Union. Communication is measured through documents from the FOMC and the ECB, including policy decisions, policy statements, accounts, and minutes. Volatility is analyzed using both realized and implied volatility measures, with S&P 500 and VIX representing the U.S. market and STOXX Europe 600 and VSTOXX representing the European market. The analysis compares these document-volatility combinations conditional on geographic regions to provide a cross-comparative perspective. This approach enables a comprehensive examination of how central bank communication influences investor expectations and immediate market reactions in two of the world's most significant economic regions.

To measure the hawkish-dovish tone of central bank communication, this study employs computational linguistics, specifically a dictionary-based method. The resulting tone estimation includes both an aggregate standardized Hawk-score and topic-specific scores. The relationship between communication tone and volatility is modeled using Ordinary Least

Squares (OLS) estimation. The analysis is based on the key assumption that a short window of one trading day is sufficient to capture the immediate market reaction to central bank communication. Using a longer window could introduce unrelated information, potentially biasing the results.

The findings reveal an inconsistent relationship between central bank communication and stock market volatility. Aggregate models show weak relationships in combinations such as FOMC minutes with implied volatility and ECB decisions with realized volatility, with effects in opposite directions. However, topic-specific models uncover stronger associations, such as FOMC decisions with realized volatility and ECB decisions with implied volatility. Notably, the aggregate Hawk-score often exhibits a negative relationship in the EU, suggesting that hawkish language tends to calm the market, while in the US, it shows a positive relationship, indicating that hawkish language increases volatility. Topic-specific associations further highlight nuanced, twofold effects in both markets.

This paper contributes to the literature in several ways. First, it enhances the estimation of hawkish-dovish language through a dictionary-based approach that leverages topic-specific combinations of modifiers and keywords, building on the work of Gardner et al. (2022) and Gonzalez and Tadle (2021). Second, it extends the literature by examining the effects of central bank communication on stock market volatility through pre-specified topic scores, providing a more context-specific understanding of these dynamics. Third, the paper highlights a significant distinction in the communication content of the FOMC and the ECB, revealing differences in the frequency and focus of topics discussed. For instance, while the FOMC's communication is more evenly distributed across topics, the ECB predominantly focuses on policy implications.

The remainder of this paper is organized as follows. Section 2 reviews the literature on quantifying the central bank communication and its effects on financial markets. Section 3 introduces the communication and volatility datasets used in the analysis. Section 4 outlines the methodology, including the modeling of variables, control factors, and the regression approach. Section 5 presents a robustness check of the methodology. Finally, Section 6 concludes.

Literature Review

Numerous researchers have examined central bank communication and its impact on financial markets. Existing studies predominantly focus on two key areas: first, the quantification of both monetary and non-monetary communication, and second, the role of communication as a complementary policy tool and its influence on market participants. This paper contributes to the literature by addressing both of these strands.

The first area of contribution centers on textual analyses, a collection of methods used to examine communication in financial markets. With the rapid advancement of technology, natural language processing (NLP), along with dictionary methods and computational linguistics, has emerged as a widely adopted approach. These methods are particularly effective for textual analyses when sentiment, tone, clarity, and content are the center of interest. Among sentiment analysis tools, the most widely recognized model is the Loughran-McDonald dictionary, which was developed from 10-K financial filings to better represent the sentiment of economic language compared to general sentiment models (Loughran & McDonald, 2010, 2015). Gu et al. (2022) and Hoang (2020) have utilized the Loughran-McDonald dictionary to assess the positive and negative tones of central bank communication, including the FOMC minutes and ECB speeches as well as their effects on asset movements.

In addition to sentiment analysis, the classification of communication tone as hawkish or dovish has become increasingly common. This approach was first introduced by Lucca and Trebbi (2009), who developed a dictionary to classify hawkish and dovish terms in FOMC statements. Subsequent advancements include the work of Apel and Grimaldi (2012), who incorporated two-word combinations to analyze the tone of the Swedish central bank, and Picault and Renault (2017), who extended this approach by creating a dictionary with up to ten-word combinations to quantify ECB communication. Recent developments, such as the dictionary by Gardner et al. (2022), have further refined the method by organizing words into modifiers and keywords and analyzed their combinations to generate individual scores.

More advanced models for textual analysis include semi-automated methods, Latent Semantic Analysis (LSA), and other NLP-based techniques. Semi-automated methods integrate manual, human-defined classifications with machine-based processing, making them useful for tone and sentiment classification. Meanwhile, LSA employs mathematical techniques to uncover relationships between terms across documents, providing deeper insights into the contextual relationships of word phrases. Researchers including Crayton (2018), Ehrmann and Talmi (2020), Kryvtsov and Petersen (2021), Rosa (2011), and Tobback et al. (2017) have leveraged these models to examine the interplay between central bank communication, monetary policy, and investor expectations.

Latent Dirichlet Allocation (LDA) stands out as one of the most popular methods for topic modeling of both monetary and non-monetary communication. This probabilistic model identifies latent topics within a corpus by modeling each document as a mixture of topics and each topic as a distribution over words. LDA has been widely used by authors such as Feldkircher et al. (2021), Gonzalez and Tadle (2021), Hansen and McMahon (2016), and Marozzi (2022) to uncover thematic patterns in central bank communication and their implications for financial markets.

The second strand of literature focuses on the effects of central bank communication on market participants, highlighting the interrelation of financial segments. Stock market prices have been a primary focus, with numerous studies investigating price movements before and after monetary announcements, minutes, speeches, news, interviews, and other forms of communication. For instance, Apel and Grimaldi (2012), Gorodnichenko et al. (2021), Kaminskas and Jurkšas (2024), Rosa (2011), and Uwatt et al. (2023) consistently find significant relationships between central bank communication and stock market movements. In addition, not only official monetary releases have a significant effect on the behaviour of market participants, but also non-monetary news happen to be useful indicators for forecasting stock market reactions as well as macroeconomic variable movements (AL-Rjoub, 2016; Ashwin, 2024; Ashwin et al., 2024; Nikkinen & Sahlström, 2004). Expanding the scope to money and bond market securities, studies such as Cieslak and Schrimpf (2018), Crayton (2018), Hoang (2020), and Istrefi et al. (2024) reveal that medium-maturity bond prices exhibit the most pronounced reactions to central bank communication.

The literature indicates that positive and dovish signaling boosts investor confidence and asset prices, while clear and transparent communication tends to stabilize markets. Conversely, unexpected announcements often provoke acute market reactions (Cieslak & Schrimpf, 2018; González & Tadle, 2020; Gu et al., 2022; Marozzi, 2022; Tobback et al., 2017). The significant relationships identified in these studies demonstrate that central bank communication is a powerful tool in influencing asset prices, enhancing market stability, and shaping investor expectations. Furthermore, Crayton (2018), Gardner et al. (2022), and Gertler and Horvath (2018) emphasize that the period of the zero lower bound, when the traditional monetary policy lost its effectiveness, the central bank communication emerged as a critical part of policy toolkit. These authors demonstrate that the tone of central bank communication can, at times, be more influential than the policy measures themselves.

In contrast, significantly less attention has been devoted to the association between central bank communication and market volatility. While most studies focus on either implied or realized volatility, the existing literature presents mixed findings, leaving gaps in a more comprehensive understanding. For instance, Kaminskas and Jurkšas (2024) and Picault and Renault (2017) find that positive sentiment in ECB communication reduces implied volatility. Conversely, Ehrmann and Talmi (2020), Gallo et al. (2023), Gertler and Horvath (2018), Hansen and McMahon (2016), and Rosa (2013) report that surprising or inconsistent language increases both implied and realized volatility. Further studies, such as Astuti et al. (2022), Bennani (2019), Marozzi (2022), and Papadamou et al. (2014) suggest that clear, transparent, and consistent communication reduces both implied and realized volatility across over 40 economies globally. Similarly, Hubert and Labondance (2019) and Vähämaa and Äijö (n.d.) find that neutral language reduces implied volatility. However, Schmeling and Wagner (2023) observe that while positive tone decreases implied volatility, it has no significant effect on realized volatility within the EU.

These diverse and, at times, conflicting findings highlight the need for further analysis and comparative studies to clarify the role of central bank communication in influencing market volatility.

2 Data

The data in this analysis consists of central bank communication documents from the US and the EU, as well as implied and realized volatility measures, which together provide insights into market responses to monetary policy releases. This section describes the main datasets in detail, while the methodology used to process and analyze them is outlined in Section 3.

2.1 Volatility

The central focus of this paper is volatility in the US and the EU stock markets. Volatility not only serves as a key indicator of market uncertainty but also provides insights into how financial markets interpret and respond to central bank announcements. To examine the effects of central bank communication on stock market movements, I analyze and compare both implied and realized volatility measures.

First, implied volatility reflects the market's expectations of future price fluctuations over a specific period, providing insight into potential price uncertainty (Chen & Clements, 2007). To measure implied volatility for the US stock market, I collect daily prices of VIX from Yahoo Finance. The VIX, derived from real-time put and call option prices on S&P500, is one of the most widely recognized measures of market volatility ("CBOE", 2024). Similarly, for the EU market, I use daily prices of VSTOXX sourced from FactSet. The VSTOXX, based on real-time options prices of the EURO STOXX 50, is the most distinguished volatility index for the Eurozone. The dataset covers VIX prices from January 1994 to December 2024 and VSTOXX prices from January 1999 until November 2024. Both indices are closely monitored by a wide range of market participants, making them ideal forward-looking measures of volatility.

Second, realized volatility captures historical price fluctuations of an asset, reflecting the magnitude of its past price movements (Haugen et al., 1991). To construct a comparative measure to implied volatility, I gather daily prices of S&P500 and STOXX Europe 600. These indices serve as representative market portfolios for the US and the EU, respectively, and are extensively followed by investors. The S&P500 dataset spans from January 1994 to December 2024, while STOXX Europe 600 (STOXX) ranges from April 2004 to December 2024.

2.2 Central Bank Communication

To analyze the central bank communication and conduct a comparative analysis, I utilize web scraping techniques to gather statements and minutes from the Federal Open Market Committee releases, and monetary policy decisions and accounts from the European Central Bank's Governing Council monetary policy publications.

Firstly, FOMC statements and ECB policy decisions are public announcements regarding policy decisions. Due to the homogeneity in their content, I will collectively refer to them as policy decisions. The FOMC holds regularly scheduled meetings every six weeks, which makes 8 meetings per year. The data set of FOMC policy decisions spans from January 1994 to September 2024, comprising a total of 220 documents. In contrast, the frequency of ECB meetings has varied over the years with 24 annual meetings between 1999 and 2001, 12 meetings between 2002 and 2014, and 8 meetings per year from 2015 onward. The ECB policy decisions are collected from February 1999 to October 2024, resulting in a data set of 304 documents. Although both ECB and FOMC policy decisions are released on the same day as their respective meetings, the timing of policy implementation differs. FOMC policy decisions, being changes to the federal funds target rate, take effect immediately on the meeting day. Conversely, changes to the ECB's key interest rates[1] take effect within 7 days after the announcement, with the effective date always specified in the decision.

Second, the FOMC minutes and ECB monetary policy accounts provide a summary of issues addressed during committee or council meetings. These documents also review financial, economic and monetary developments, as well as policy options (Bank, 2022). For simplicity, I will refer to both of these documents as minutes through out the analysis. The FOMC minutes from regularly scheduled meetings are released 3 weeks after the corresponding policy decision, while ECB minutes are released 4 weeks after the policy decision. This lag between the policy decision and the release of minutes highlights the importance of analyzing how new information is dispersed to the market. The dataset FOMC minutes spans from March 1994 to November 2024, comprising 249 documents. In comparison, the ECB began publishing minutes only in 2015. Consequently, the dataset of ECB minutes runs from February 2015 to November 2024, making it the shortest dataset in this analysis with 81 documents.

[1] Key ECB interest rates refer to the rates on the deposit facility, the main refinancing operations, and the marginal lending facility.

3 Methodology

This section provides a detailed explanation of the methodology[2] used in this paper. To investigate the relationship between changes in volatility and central bank communication, I employ OLS estimation. Before formally introducing the models and hypotheses, it is essential to process and prepare each individual variable. Consequently, this section first outlines the methodology for modeling and processing the variables, followed by a comprehensive introduction of the regression models and associated hypotheses. Additionally, the assumptions underlying the OLS estimation including homoscedasticity and no autocorrelation, are tested to ensure the validity of the results. Detailed diagnostics of these assumptions, their outcomes and inference adjustments are provided in Appendix B.

3.1 Processing Volatility

As outlined in Section 2.1, this analysis includes both implied and realized volatility. Due to the absence of intraday data, I approximate daily volatility using daily Open, Close, High, and Low prices. Given the differences in the nature of implied and realized volatility datasets, the modeling approach varies accordingly. Additionally, the daily volatility data is filtered to align with the dates of central bank communication releases.

For implied volatility, which is derived from a volatility index, VIX and VSTOXX, I estimate daily volatility changes using the following formula:

$$\Delta \upsilon_t = 100 \times (\log(P_{Close,t}) - \log(P_{Open,t}))$$

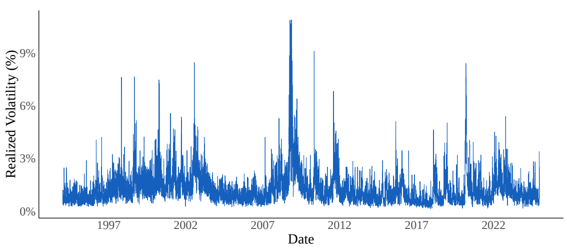
This formula calculates the change in implied volatility, υ_t, based on the opening and closing prices of the volatility index. The opening price, $P_{Open,t}$, reflects the market's sentiment at the beginning of the day, while the closing price, $P_{Close,t}$, captures how expectations evolve by the end of the trading session. This approach ensures a reliable proxy for daily changes in implied volatility, effectively representing how investor sentiment shifts during the day (Chou et al., 2012).

[2]The code and data used for this thesis are publicly available on GitHub: https://github.com/VikyRackova/Effects-of-Central-Bank-communication-on-stock-market-volatility.git

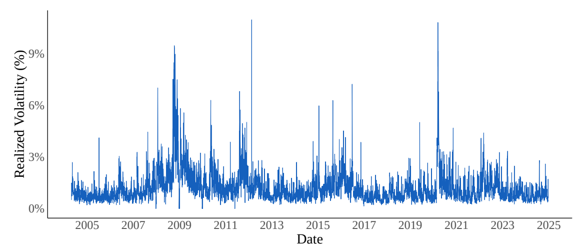
For realized volatility, which captures actual price fluctuations of S&P500 and STOXX, I calculate the spread between the highest daily selling price, $P_{High,t}$, and the lowest daily selling price, $P_{Low,t}$, using:

$$\sigma^2{}_t = 100 \times (\log(P_{High,t}) - \log(P_{Low,t}))$$

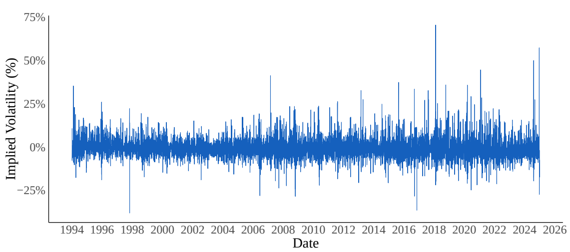
This formula approximates the intraday price range, σ_t^2, representing the variance in prices during the trading session. The High-Low spread is a common and effective measure of realized volatility as it reflects the magnitude of price movements throughout the day, even without intraday data (Garman & Klass, 1980). By using logarithmic differences, these calculations create a proportional measurement of price changes. This approach is thus consistent with financial modeling practices, robust to compounding effects and comparable across datasets.



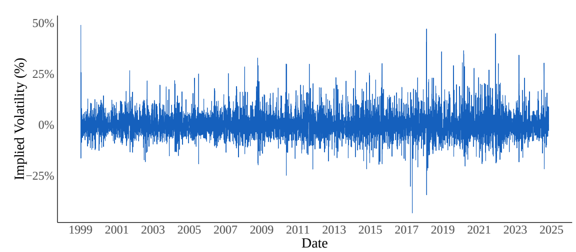
(a) S&P500



(b) STOXX



(c) VIX



(d) VSTOXX

Figure 1: Implied and Realized Volatility in the US and EU stock market

3.2 Textual Analysis

To quantify central bank communication, I employ a dictionary method designed to identify word and phrase combinations that generate a Hawk-score, effectively categorizing the tone of the language as either hawkish or dovish.

A hawkish tone reflects a central bank's focus on tightening monetary policy to control inflation or stabilize the economy. This stance is typically associated with raising interest rates or reducing quantitative easing measures. For example, a statement from the FOMC, "*With underlying inflation still expected to be relatively low, the Committee believes that policy accommodation can be removed at a pace that is likely to be measured,*" demonstrates a hawkish tone, as it signals a gradual removal of accommodative policies. In contrast, a dovish tone emphasizes stimulating economic growth and employment, even if it involves tolerating higher inflation temporarily. A dovish stance often results in lower interest rates. For instance, a statement from the FOMC, "*Today's action by the FOMC brings the decline in the target federal funds rate since the beginning of the year to 275 basis points,*" demonstrates a dovish tone, highlighting policy easing to support the economy. A neutral stance occurs when a central bank maintains interest rates at their current level, signaling neither tightening nor easing of monetary policy (Gertler & Horvath, 2018). Figure 8 in Appendix A illustrates these principles through changes in the federal funds target rate between 2000 and 2010, providing a practical example of how central bank stances evolve over time.

3.2.1 Text Preprocessing and N-gram Identification

To apply the dictionary method effectively, the datasets containing announcements and minutes are preprocessed using a systematic cleaning procedure. First, all documents are segmented into individual sentences. Subsequently, punctuation marks and numerical values are removed and all words are converted to lowercase. This standardization ensures consistency across the dataset and facilitates efficient text analysis.

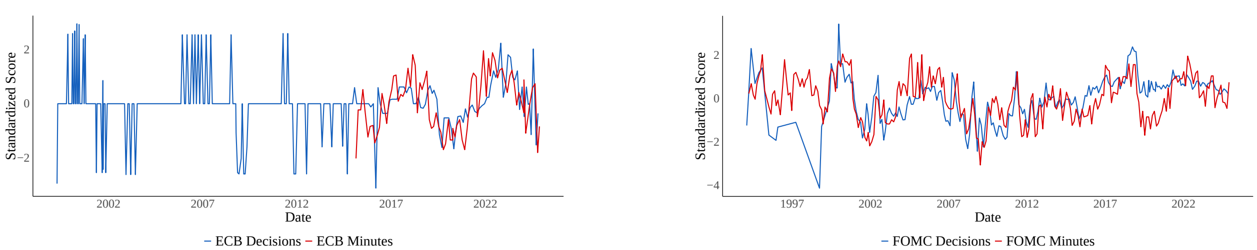
Once the text is cleaned, a stepwise process is followed to identify n-grams of decreasing lengths. In this context, n-grams refer to sequences of words separated by spaces. For example, "european central bank" is a 3-gram, while "european_central_bank," treated as a single unit, is a 1-gram. The analysis begins with 4-grams, followed by 3-grams, 2-grams, and finally single words. Only terms that match those in the predefined dictionary are recognized. To ensure that words included in identified 4-, 3-, and 2-grams are not counted multiple times, once a dictionary terms is recognized, spaces within these n-grams are replaced with underscores. This transforms them into single units, allowing them to be treated as individual "words" in subsequent analyses. Once all matching n-grams are identified, keywords are paired with their closest corresponding modifiers, and scores are assigned to each keyword-modifier combination based on the dictionary's predefined rules. An example of the cleaning process and n-gram identification is displayed in Figure 9 in Appendix A.

Table 1: Dictionary rules

Modifier Category	Keyword Category	Topic Condition	Score
Positive Modifier	Hawkish Keyword	Any but Prices and Policy	1
Positive Modifier	Dovish Keyword	Any but Prices and Policy	-1
Positive Modifier	Dovish Keyword	Prices	1
Positive Modifier	Any Keyword	Policy	-1
Positive Modifier	Hawkish Keyword	Prices	-1
Negative Modifier	Hawkish Keyword	Any but Prices and Policy	-1
Negative Modifier	Dovish Keyword	Any but Prices and Policy	1
Negative Modifier	Dovish Keyword	Prices	-1
Negative Modifier	Hawkish Keyword	Prices	1
Negative Modifier	Any Keyword	Policy	1
Neutral Phrase	Hawkish Keyword	Any	0
Neutral Phrase	Dovish Keyword	Any	0
High Modifier	Hawkish Keyword	Any	1
High Modifier	Dovish Keyword	Any	-1
Low Modifier	Hawkish Keyword	Any	-1
Low Modifier	Dovish Keyword	Any	1

3.2.2 Scoring Methodology

The methodology for scoring involves quantifying the tone of central bank communication by assigning values to n-gram combinations of modifiers and keywords. This approach is based on the observation that individual words, such as "*rates*" or "*inflation*," do not inherently indicate the tone of the communication, whereas combinations like "*decrease interest rates*" or "*increased inflation*" clearly convey a dovish or hawkish sentiment. Dovish phrase combinations are assigned a score of -1, while hawkish combinations receive a score of 1. The specific rules governing these combinations are detailed in Table 1.



(a) Standardized Hawk-score for ECB documents

(b) Standardized Hawk-score for FOMC documents

Figure 2: Policy Rate Changes Hawk-Score for ECB and FOMC Decisions

To prevent incorrect scoring, neutral phrases are incorporated. For example, the word "*least*" is categorized as a negative modifier, but the phrase "*at least*" does not carry a negative tone. In such cases, neutral phrases ensure a score of 0 is assigned. Similarly, negating phrases such as "*does not*" reverse the score of the modifier and keyword combination when detected preceding the phrase.

After assigning scores to all keyword-modifier combinations, sentence-level scores are calculated by summing the scores within each sentence and dividing by the total number of words in that sentence. These sentence scores are then aggregated across the document, with the sum divided by the number of sentences containing recognized n-grams. This ensures that sentences unrelated to economic and policy developments, such as those listing member voting outcomes or attendance details, are excluded from the scoring process. Finally, for easier interpretation, the document scores are standardized. The formal derivation follows:

$$H_t = \frac{1}{m}\sum_{i=1}^{m}\left(\frac{1}{n_i}\sum_{j=1}^{n_i} s_{ij}\right) \qquad SH_t = \frac{H_t - \overline{H}}{SD(H)}$$

Where s_{ij} denotes the score of the j-th word in the i-th sentence, n_i denotes the number of words in the i-th sentence, m indicates the total number of sentences with recognized words in the document. H_D is the Hawk-score calculated for a document released at a time t and SH_t is the resulting Standardized Hawk-score. An example of the scoring process is presented in Figure 3.

The topic-specific scores are derived from the aggregate score through a systematic process. First, the scores of individual words within each sentence are aggregated at the sentence level, grouped by topic. These sentence-level scores are then used to calculate topic fractions, which represent the proportion of the total sentence score attributable to each topic. At the document level, these topic fractions are combined with the aggregate score by multiplying the fraction for each topic by the overall document score. This approach ensures that the topic-specific scores capture both the relative importance of each topic within a document and the overall tone reflected in the aggregate score.

Raw Text

The Federal Open Market Committee at its meeting today decided to lower its target for the federal **funds rate** by 25 basis points to 3-3/4 percent. In a related action, the Board of Governors approved a 25 basis point reduction in the **discount rate** to 3-1/4 percent. Today's action by the FOMC brings the decline in the target federal **funds rate** since the beginning of the year to 275 basis points. The patterns evident in recent months–declining profitability and business **capital spending**, and slowing **growth** abroad–continue to weigh on the economy. In taking the **discount rate** action, the Federal Reserve Board approved requests submitted by the Boards of Directors of the Federal Reserve Banks of Boston, New York, Philadelphia, Atlanta, Chicago, Dallas and San Francisco.

Notes: Keywords are noted in bold a modifiers are underlined

Hawk-score Calculation

Sentence 1:	lower	+	**funds rate**	=	-1
	(Low Modifier)	+	(Hawkish Keyword, Policy)		
Sentence 2:	reduction	+	**discount rate**	=	-1
	(Low Modifier)	+	(Hawkish Keyword, Policy)		
Sentence 3:	decline	+	**funds rate**	=	-1
	(Low Modifier)	+	(Hawkish Keyword, Policy)		
Sentence 4:	declining	+	**capital spending**	=	-1
	(Low Modifier)	+	(Hawkish Keyword, Growth)		
Sentence 5:	slowing	+	**growth**	=	-1
	(Low Modifier)	+	(Hawkish Keyword, Growth)		
Sentence 6:	*omitted*				

Hawk-score:

$$H_{27/06/2001} = \frac{\frac{-1}{23} + \frac{-1}{18} + \frac{-1}{22} + \frac{-1}{21} + \frac{-1}{21}}{5} = -0.048$$

Figure 3: An example of Hawk-score calculation, paragraph from FOMC decisions for meeting on 27th June 2001

3.3 Modeling Control Variables

Although the primary focus of this analysis is the relationship between the Hawk-score and stock market volatility, I incorporate several control variables to ensure more robust and reliable results. These variables aim to help isolate the effects of Hawk-score by accounting for potential confounding factors. They include language sentiment and uncertainty, market uncertainty, text readability, and document length. First, language sentiment and uncertainty offer additional insights into market reactions by providing a comparative measure of tone, potentially enhancing the explanatory power of the model. Second, market uncertainty is closely linked to stock market volatility, as varying forecasts among market participants often lead to fluctuations. By controlling for market uncertainty, this analysis mitigates potential omitted variable bias and ensures that the relationship between volatility and central bank communication is not solely driven by periods of heightened uncertainty. Additionally, text readability plays a critical role in shaping market reactions. Complex or difficult-to-read text may confuse market participants, delaying their responses to the conveyed information. Finally, document length, measured as the word count of a document, strengthens the robustness of the analysis by accounting for the volume of information released. Longer documents may increase the likelihood of identifying dictionary-based n-grams, potentially improving the accuracy of the Hawk-score. However, they may also include information that is too lengthy or less relevant to prompt significant market reactions. Among these controls, the first three, language sentiment, uncertainty, and readability, require individual modeling before they can be utilized in the regression analysis presented in Section 3.4.

3.3.1 Language Sentiment and Uncertainty

The first control variables, language sentiment and uncertainty, have been extensively studied in academic literature. Following the approach of many researchers, I utilize the Loughran-McDonald dictionary, which classifies words into seven categories: positive, negative, uncertainty, litigious, strong modal, weak modal, and constraining. For the purposes of this analysis, I focus exclusively on the sentiment, being positive and negative language, and uncertainty in the communication. The objective of this additional textual analysis is to assess whether sentiment and uncertainty provide greater explanatory power in understanding volatility changes when combined with the Hawk-score.

To model sentiment and uncertainty, I apply the Loughran-McDonald dictionary to the cleaned datasets of announcements and minutes, generating two key measures: language sentiment and language uncertainty. First, for the language sentiment, I calculate the difference between the total positive and negative words in a document. Second, for language uncertainty I sum all the uncertain words. Both of these measures are then divided by the total number of words in a document. In addition, to simplify the interpretation and ensure comparability, both measures are standardized. The calculations are expressed formally as follows:

$$S_t = \frac{p_t - n_t}{W_t} \qquad SS_t = \frac{S_t - \overline{S}}{SD(S)}$$

$$U_t = \frac{u_t}{W_t} \qquad SU_t = \frac{U_t - \overline{U}}{SD(U)}$$

Here, p_t, n_t and u_t represent the number of positive, negative and uncertain words in a document, respectively. W_t denotes the total word count in each document. S_t and U_t are the raw sentiment and uncertainty scores, while SS_t and SU_t are their standardized versions.

3.3.2 Market Uncertainty

The second control variable incorporated in the analysis is market uncertainty. It is widely acknowledged that higher levels of market uncertainty are often associated with increased stock market volatility (Jiang et al., 2023). To account for periods of elevated uncertainty within the business cycle, I include two measures of macroeconomic uncertainty. These measures are derived from the Survey of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia and the European Central Bank, serving as proxies for market uncertainty in the US and the EU, respectively (Croushore, 1993).

The primary indicators used to approximate uncertainty are forecasts of real GDP growth and inflation, represented through the Consumer Price Index (CPI). For the US, uncertainty is calculated as the difference between the 75th and 25th percentile of the forecast distribution, while for the EU, it is measured using the variance of individual forecasts. The CPI datasets begin in December 2000 for the EU and June 1981 for the US. The GDP datasets start in September 1999 for the EU and January 1969 for the US. All datasets are reported on a quarterly basis. To align the dates of central bank communication releases with macroeconomic uncertainty measures and to address any missing data points, the last-observation-carried-forward method is employed. This approach assumes that uncertainty remains stable between quarterly releases. This approach ensures a complete dataset and facilitates accurate alignment with central bank release dates. The calculation is expressed formally as follows:

$$U_{CPI_{t,EU}} = 100 \times \text{Var}(F_t) \qquad U_{CPI_{t,US}} = P_t(75) - P_t(25)$$

$$U_{GDP_{t,EU}} = 100 \times \text{Var}(F_t) \qquad U_{GDP_{t,US}} = P_t(75) - P_t(25)$$

Here, F_t denotes the individual forecasts at a released quarter and $P_t(75)$ with $P_t(25)$ indicate the percentiles of the forecast distribution. The resulting U_{CPI_t} and U_{GDP_t} represent the modeled real GDP growth and inflation uncertainty at a specific document release date.

3.3.3 Text Readability

The final variable requiring modeling is the readability of the released documents. This measure is included to account for the observation that complex or difficult-to-comprehend texts may lead to misinterpretation among market participants or delay the market reaction. This accounts for the issue that readers may require additional time to process and understand the key implications. To quantify readability and thus estimate textual clarity, I employ the Flesch-Kincaid Grade Level measure, which provides a standardized readability score for each document (Papadamou et al., 2014; Solnyshkina et al., 2017). This score accounts for the document's sentence structure and word complexity.
The score can be computed using the following formula:

$$R_t = 0.39\left(\frac{W_t}{Se_t}\right) + 11.8\left(\frac{W_t}{Sy_t}\right) - 15.59$$

Here, W_t represents the total number of words, Se_t denotes the total number of sentences and Sy_t indicates a total number of syllables in each document. The resulting R_t value reflects the minimum U.S. school grade level required to comprehend the text. Higher scores imply greater complexity and reduced readability.

3.4 The Linear Regression model

The central research question of this paper is twofold. First, it investigates the impact of central bank communication on stock market volatility, focusing on how the hawkish or dovish tone channels this influence. Second, it examines which specific communication topics drive these effects, offering a detailed understanding of the relationship between central bank communication and market behavior. The primary objective is to assess whether the Hawk-score has explanatory power regarding the direction of daily volatility changes and magnitude. Similar to the approach of Astuti et al. (2022), this analysis assumes that a narrow window of one trading day is sufficient to capture the market's reaction to the information conveyed in central bank communications. A longer time-frame could introduce unrelated information in the market and potentially bias the results. To explore this relationship, the analysis begins with a simple (OLS) regression, modeled as follows:

$$\Delta\sigma^2{}_t = \beta_0 + \beta_1 SH_t + \epsilon_t \tag{1}$$

To enhance the robustness of the OLS estimation, the model incorporates the lagged volatility (σ^2_{t-1}), which refers to the volatility from the day preceding the central bank meeting rather than the volatility from the previous central bank release. Subsequently, language sentiment and uncertainty measures are introduced in Model (3) for comparison of tone importance . In Model (4), these measures are replaced by market uncertainty variables. This decision is justified in Section 5 with robustness check. Model (5) extends the linear model by incorporating a readability score to account for the complexity of the text. Model (6) incorporates document length, quantified as the total number of words, to account for the volume of information conveyed to market participants. Model (7) introduces a structural break, B_t, to examine potential shifts in the relationship between central bank communication and market volatility. This structural break is motivated by the observation that central banks modified their communication strategies following the global financial crisis of 2008–2009. During this period, both the Federal Reserve (FED) and the European Central Bank (ECB) adopted more transparent approaches and implemented forward guidance as a tool to manage expectations. The FED initiated this strategy following its December 2008 announcement, while the ECB implemented forward guidance more gradually, achieving full adoption by

2013 (Abreu & Lopes, 2021; Campbell et al., 2012; Gavin et al., 2014). Therefore, the implemented break uses a split point of 2009 and 2013 for the US and the EU, respectively. Finally, Models (8) and (9) focus on analyzing the pre- and post-structural break periods to explore potential relationships between central bank communication and changes in daily stock market volatility. These models are applied to all volatility-document combinations with respect to geographic region. However, the structural break model for ECB minutes is excluded, as the first minutes document was released in 2015 (two years after the structural break). The complete models with aggregated standardized Hawk-score are formally defined as follows:

$$ {\sigma^2}_t = \beta_0 + \beta_1 SH_t + \beta_2 {\sigma^2}_{t-1} + \epsilon_t \tag{2} $$

$$ {\sigma^2}_t = \beta_0 + \beta_1 SH_t + \beta_2 {\sigma^2}_{t-1} + \beta_3 SU_t + \beta_4 SS_t + \epsilon_t \tag{3} $$

$$ {\sigma^2}_t = \beta_0 + \beta_1 SH_t + \beta_2 {\sigma^2}_{t-1} + \beta_5 U_{GDP_t} + \beta_6 U_{CPI_t} + \epsilon_t \tag{4} $$

$$ {\sigma^2}_t = \beta_0 + \beta_1 SH_t + \beta_2 {\sigma^2}_{t-1} + \beta_5 U_{GDP_t} + \beta_6 U_{CPI_t} + \beta_7 R_t + \epsilon_t \tag{5} $$

$$ {\sigma^2}_t = \beta_0 + \beta_1 SH_t + \beta_2 {\sigma^2}_{t-1} + \beta_5 U_{GDP_t} + \beta_6 U_{CPI_t} + \beta_7 R_t + \beta_8 W_t + \epsilon_t \tag{6} $$

$$ {\sigma^2}_t = \beta_0 + \beta_1 (B_t * SH_t) + \beta_2 {\sigma^2}_{t-1} + \beta_5 U_{GDP_t} + \beta_6 U_{CPI_t} + \beta_7 R_t + \beta_8 W_t + \epsilon_t \tag{7} $$

$$ {\sigma^2}_t = \beta_0 + \beta_1 SH_t + \beta_2 {\sigma^2}_{t-1} + \beta_5 U_{GDP_t} + \beta_6 U_{CPI_t} + \beta_7 R_t + \beta_8 W_t + \epsilon_t \quad \text{for} \quad B_t = 0 \tag{8} $$

$$ {\sigma^2}_t = \beta_0 + \beta_1 SH_t + \beta_2 {\sigma^2}_{t-1} + \beta_5 U_{GDP_t} + \beta_6 U_{CPI_t} + \beta_7 R_t + \beta_8 W_t + \epsilon_t \quad \text{for} \quad B_t = 1 \tag{9} $$

Crucially, all the models specified above refer to realized volatility. To test the relationship with implied volatility, the model structure is repeated, replacing σ_t^2 and σ_{t-1}^2 with $\Delta\upsilon_t$ and $\Delta\upsilon_{t-1}$, respectively.

To further explore the effects of the Hawk-score and identify which topics contribute most significantly to the impact on stock market volatility, I incorporate the topic classification embedded within the dictionary. This allows for a deeper analysis of the directional influence of specific topics on volatility changes. To achieve this, I re-estimate all models while replacing the aggregate standardized Hawk-score with topic-specific scores. The subdivided scores provide a detailed perspective on whether certain topics exert a stronger influence on volatility and the direction of that influence. These topic specific scores include the following categories: global, growth, finance, prices, policy and other. The revised models are formally specified in Appendix C.

Before conducting formal tests, certain expectations about the relationship between communication tone and market volatility are considered. As discussed in Section 3.2, hawkish language emphasizes raising interest rates and controlling inflation, even at the cost of potentially slower economic growth. Such communication may signal deteriorating economic and financial conditions, potentially causing heightened uncertainty and panic among market participants. This panic could amplify stock market volatility. Thus, the first hypothesis is as follows:

Hypothesis 1: *"Hawkish language increases stock market volatility while dovish language decreases it."*

$$H_0 : \beta_1 > 0 \qquad H_1 : \beta_1 < 0$$

Conversely, dovish language aims to boost the economic growth, even at the risk of temporarily higher inflation. This tone may indicate a favorable financial environment, encouraging investment and trading activity, which can result in increased volatility. This leads to the second hypothesis:

Hypothesis 2: *"Dovish language increases stock market volatility while hawkish language decreases it"*

$$H_0 : \beta_1 < 0 \qquad H_1 : \beta_1 > 0$$

These opposing hypotheses suggest that central bank communication could influence stock market volatility in either direction. This divergence may result in an overall insignificant effect, either because the opposing impacts cancel each other out or because there is no true relationship between the variables. To address this possibility and provide a unified framework applicable to all models, the following hypothesis is proposed and applied to all models:

Hypothesis 3: *"The effects of hawkish and dovish language on stock market volatility offset each other, resulting in no significant net impact."*

$$H_0 : \beta_1 = 0 \qquad H_1 : \beta_1 \neq 0$$

4 Results

This section presents the findings from the investigation of the relationship between central bank communication and market volatility. The results focus on inference from the OLS estimations, highlighting comparisons across geographic regions as well as between aggregate and topic-specific scoring.

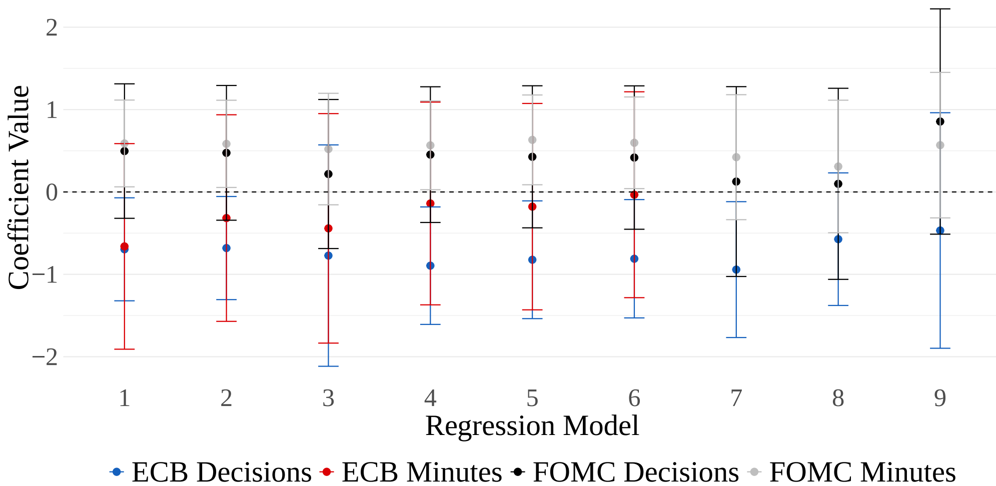
4.1 Geographic Variations in Volatility Response

The regression results of aggregate standardized Hawk-score, presented in Tables 6 to 13, predominantly yield insignificant findings at 5% significance level. However, several models achieve significance at the 10%, providing some but not strong support for rejecting the null hypothesis presented by Hypothesis 3. Namely, ECB decisions decrease daily realized volatility with the strongest significance in model 1 with 2% p-value. Conversely, FOMC minutes increase implied volatility with the strongest significance in model 5 and p-value of 6%. These results show a content-dependent but not definitive relationship between central bank communication and stock market volatility. In addition, the findings reveal geographic differences and varying effects on realized and implied volatility.

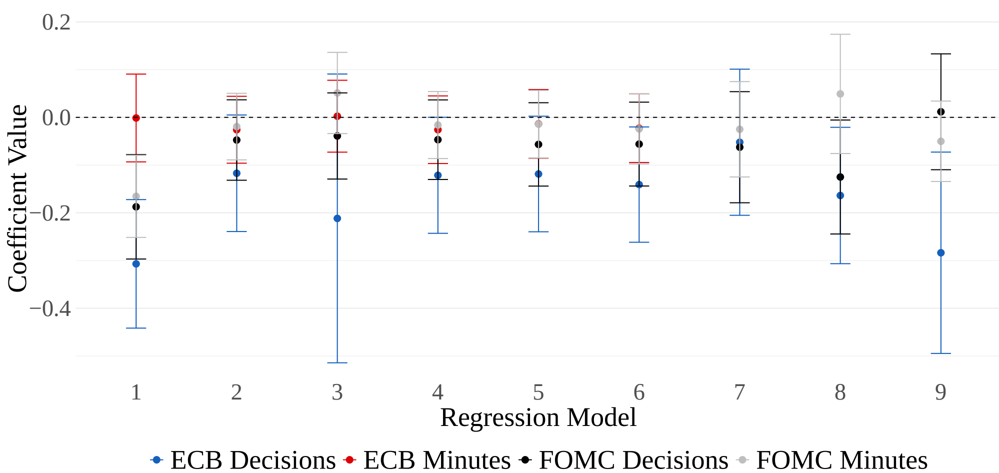
The results suggest an interesting distinction between the roles of central bank policy decisions and their accompanying minutes. The weakly significant relationship between FOMC minutes and implied volatility hints that the Federal Reserve's forward guidance in its minutes shapes investor expectations and influences the market. This finding signals that it is not the policy decision itself, but rather the additional information contained in the minutes, that drives market reactions. Conversely, in the EU, the ECB Minutes seem to have no aggregate influence on the market the ECB decisions do. However, the relationship between ECB decisions and realized volatility suggests a different dynamic.

Figure 4 compares all the coefficients with 90% confidence intervals for realized and implied volatility, analyzed separately. The realized volatility results clearly indicate a negative association between central bank communication and market volatility. This suggests that a hawkish tone from central banks tends to reassure market participants, thereby calming the markets. In contrast, the findings for implied volatility are more complex. While the association appears to be negative in the EU market, it turns positive in the US market.

This suggests that, unlike in the EU, a hawkish tone in the US market may contribute to increased market volatility. For the insignificant results, it is plausible that the opposing effects of hawkish and dovish language cancel each other out, resulting in no apparent relationship. However, this claim cannot be definitively proven within the framework of the current model, leaving open the possibility that no true association exists between some forms of central bank communication and volatility.



(a) Implied volatility



(b) Realized volatility

Figure 4: Regression Coefficients with 90% Confidence Intervals for Implied and Realized Volatility

4.2 Topic-Specific Dynamics in Central Bank Communication

Figure 5 illustrates the average topic frequency in different document types, providing further insights into the content of central bank communication. The ECB's decisions primarily focus on policy-related topics, whereas its minutes exhibit a more balanced distribution across various topics. In contrast, FOMC decisions are more evenly distributed across topics, similar to its minutes. Policy, growth, and finance emerge as the most dominant topics. Interestingly, despite both central banks emphasizing inflation control, the discussion of price-related topics does not exceed 22% in any document type. Figure 20 in Appendix A further highlights the most frequently used words across documents for each topic.

Using the Hawk-score disaggregated into topics reveals that individual topics influence market volatility even when the overall Hawk-score does not show a strong association. Topic-specific effects vary across models. For ECB decisions, global, prices, and growth topics exhibit the strongest impact, predominantly affecting implied volatility. While hawkish tone in global and growth topics reduce volatility, the prices topic moves the market in the opposite direction. For FOMC decisions, the growth and policy topics have the most significant influence, primarily on realized volatility. Notably, growth increases volatility in the U.S. market, which contrasts with its volatility-reducing association in the European market. Interestingly, the aggregated Hawk-score for FOMC minutes and ECB decisions shows significant relationships with implied and realized volatility, respectively, but these relationships do not persist when topics are analyzed individually.

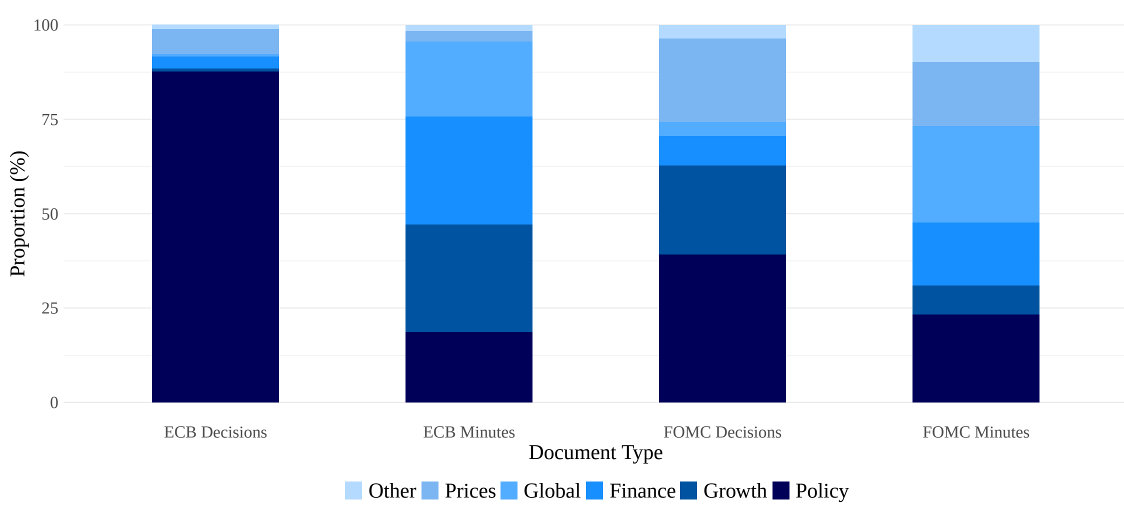


Figure 5: Topic Frequency per Document Type

4.3 Variability in Central Bank Communication Effects

The aggregate score results are not fully conclusive, as they vary across geographic regions, volatility measures, and model specifications. The behavior of variables appears sensitive to the inclusion of control variables, which further complicates the interpretation. The strongest and most consistent associations are observed with ECB decisions and realized volatility, where the effects are negative, and FOMC minutes and implied volatility, where the response is positive. While the findings provide partial evidence of a relationship between central bank communication and market volatility, they also highlight the complexity of this relationship.

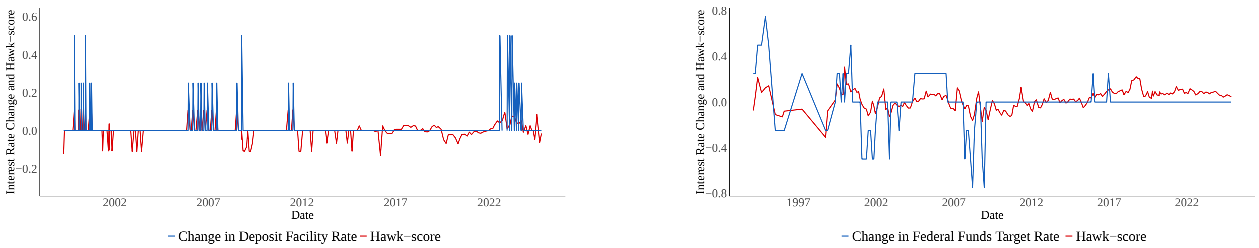
The topic-specific results show more definitive association and suggest that central bank communication seems to affect historical and forward-looking volatility measures differently, with notable geographic variations. For the European market, global, growth, and price topics are the most significant, whereas policy and growth dominate in the U.S. These differences suggest that the impact of central bank communication is context-dependent and influenced by both the nature of the communication and the structure of the respective markets.

5 Robustness Check

To ensure the robustness of the methodology and validate the results, two distinct robustness checks are conducted. The first evaluates the textual analysis by assessing the association, using correlation and OLS analysis, between policy changes and movements in the Hawk-score. This analysis is further applied to the Loughran-McDonald sentiment metric. The results from both textual metrics are compared to evaluate the appropriateness and effectiveness of each dictionary in analyzing central bank communication. The second robustness check involves re-estimating realized volatility using a Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. The resulting volatility estimation outcomes are then compared with those obtained using the High-Low approach. Both robustness checks validate why usage of the methods described in Section 3 are more suitable for this paper's objectives than these alternatives.

5.1 Hawk-Score Dictionary Robustness

To evaluate the accuracy of the Hawk-score, I collect the interest rate changes in the deposit facility rate and the target federal funds rate. Since hawkish policy is generally associated with an increase in interest rates, a positive change (i.e., a rise in interest rates) should positively correlate with the Hawk-score's estimation of hawkish-dovish language. The development of these time series is presented in Figure 6.



ECB Decisons Hawk-Score and Deposit Facility Rate Change

FOMC Decisons Hawk-Score and Federal Funds Target Rate Change

Figure 6: Policy Rate Changes Hawk-Score for ECB and FOMC Decisions

The visual inspection suggests a positive association that is further supported by the correlation analysis. The results reveal significant positive relationships of 41.7% and 46.2% for the ECB and FOMC decisions, respectively. These findings suggest a strong relation between the Hawk-score and policy changes. To further test this relationship, an OLS regression model is estimated as follows:

$$\Delta \text{Interest rate}_t = \alpha_0 + \alpha_1 \text{Standardized text metric}_t + \epsilon$$

In the first test, the standardized Hawk-score is substituted into the model as the standardized text metric. The regression results reinforce the correlation findings, indicating a significant association between policy stance and the Hawk-score.

The second test repeats these steps using the Loughran-McDonald sentiment metric. However, for the ECB, the Loughran-McDonald dictionary fails to identify words in over 200 documents, reducing the number of observations from 304 to 74. Among these 74 observations, none aligns with the dates of policy changes. Consequently, as all policy changes within these documents equal zero, resulting in no variance, neither correlation analysis nor OLS estimation is feasible. For FOMC decisions, the dictionary provides sufficient coverage to perform both analyses. The correlation results indicate a 27% positive relationship, which is approximately 20% lower than the Hawk-score correlation but remains statistically significant. Even though the regression results show a significant association between the Loughran-McDonald sentiment and interest rate changes, the relationship is much smaller in magnitude.

These results are summarized in Table 2 and lead to two key conclusions. First, the Hawk-score dictionary demonstrates significant alignment with the policy stances of both the ECB and FOMC decisions. These results establish the Hawk-score as a reliable language proxy and a robust estimate for integration into further modeling, providing greater confidence in its applicability. Second, the Loughran-McDonald dictionary fails to accurately process a substantial number of ECB decisions and exhibits low or no association with interest rate changes in the United States. Due to its limited accuracy and inability to recognize all documents, the Loughran-McDonald metrics are excluded from models other than Model (3) and Model (12).

Table 2: Correlation and OLS Estimation Results for Textual Metrics and Interest Rate Changes in the US and EU

	Δ Interest rate US		Δ Interest rate EU	
	Correlation	OLS	Correlation	OLS
Hawk-score	0.462***	1.038***	0.417***	0.937***
		(0.134)		(0.112)
Loughran-McDonald	0.277***	0.050***	NA	NA
		(0.011)		(NA)
Note:				*p<0.1; **p<0.05; ***p<0.01

5.2 Realized Volatility Robustness Check

The second robustness check involves estimating realized volatility using a GARCH model. The GARCH model is a widely accepted tool in academia for modeling conditional volatility in financial markets. Unlike simpler models that often assume constant variance, the GARCH model accounts for the dynamic, heteroskedastic nature of financial asset returns, making it particularly suitable for capturing the clustering behavior of volatility (AL-Rjoub, 2016; Nikkinen & Sahlström, 2004). One key distinction of the GARCH model is that it models the volatility of returns, not prices themselves. The starting point is the calculation of daily returns and deviations of returns from the mean. These are calculated as follows:

$$r_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \qquad \epsilon_t = r_t - \mu$$

Here, r_t represents the daily return, P_t and P_{t-1} are consecutive daily prices, μ is the mean return and ϵ_t represents the deviation of returns from the mean. The GARCH model is then defined as:

$$\sigma^2_{GARCH,t} = \omega + \alpha\epsilon^2_{t-1} + \beta\sigma^2_{GARCH,t-1}$$

where $\sigma^2_{GARCH,t}$ is the modeled conditional volatility, ω represents the long-run average variance, α is the weight assigned to the previous day's squared deviation from the mean ϵ^2_{t-1} and β is the weight of the prior day's volatility $\sigma^2_{GARCH,t-1}$.

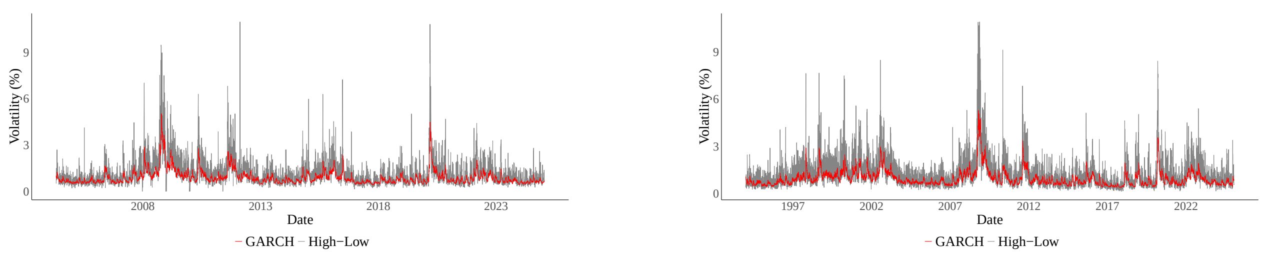
To compare the realized High-Low volatility introduced in Section 3.1 with GARCH-modeled volatility, a visual inspection and summary statistic comparisons are presented in Figure 7 and Table 3, respectively.

Table 3: Summary Statistics of Realized Volatility Estimation Methods

	S&P 500		STOXX	
Method	High-Low	GARCH	High-Low	GARCH
Mean	1.277	0.961	1.199	0.900
Standard Deviation	0.942	0.509	0.893	0.466
Minimum	0.146	0.389	0	0.412
Maximum	10.904	5.286	10.982	5.032

The comparison of High-Low and GARCH realized volatility estimation report several findings. Firstly, GARCH volatility estimates are generally less extreme and more smoothed compared to the High-Low methodology. This is due to the GARCH model's reliance on lagged observations, which reduces the impact of short-term fluctuations. Second, the summary statistics indicate that GARCH volatility exhibits a lower mean and maximum volatility compared to the High-Low methodology. Additionally, GARCH volatility has a standard deviation approximately one half lower than that of the High-Low approach, further emphasizing its less volatile nature. Thirdly, despite differences in magnitude, the overall directional trends of GARCH and High-Low volatility methods are consistent. The fluctuations align closely, suggesting that both methods effectively captures the core dynamics of volatility. Lastly, to quantitatively assess the relationship between the two methodologies, a correlation test is performed. The results indicate a statistically significant positive correlation of 70.9% for S&P 500 volatility and 68.7% for STOXX volatility between the GARCH and High-Low methods. This high correlation demonstrates that, despite methodological differences, the two approaches yield comparable insights into market volatility dynamics.

This robustness check demonstrates that both methodologies effectively capture market volatility. While GARCH provides a smoother representation, the High-Low approach is more sensitive to short-term market reactions, making it better suited for capturing volatility spikes and extreme market responses. Although GARCH is well-suited for analyzing broader trends, its smoothing effect may dampen the extreme volatility signals that are central to this study's focus on short-term fluctuations. Consequently, the High-Low methodology aligns more closely with the research objectives of this paper. Overall, these results reinforce the robustness and methodological soundness of the volatility estimates.



STOXX S&P 500

Figure 7: Realized Volatility Modeling Comparison

6 Conclusion

This paper examines the relationship between the hawkish-dovish tone of central bank communication and stock market volatility, along with its underlying topic drivers. To achieve this, the study analyzes the textual content of policy decisions and minutes issued by the FOMC and the ECB. Volatility is analyzed using both realized and implied volatility proxies, while the tone of communication is quantified through a standardized Hawk-score metric, applied in both aggregate and topic-specific forms.

The findings indicate that central bank communication influences market volatility, albeit inconsistently. A weak positive relationship is observed between FOMC minutes and implied volatility, whereas ECB decisions exhibit a negative association with realized volatility. In contrast, topic-specific models reveal different dynamics. For instance, topics like growth, global issues, and prices significantly impact implied volatility in the European market, while policy and growth topics are more influential in the U.S., primarily affecting realized volatility. An additional insight concerns the communication content of the two central banks. While the FOMC's communication is more evenly distributed across topics, the ECB predominantly focuses on policy implications. These distinctions underscore the importance of granular analyses to better understand how and which central bank communication impacts financial markets, and have practical implications for policymakers aiming to stabilize financial markets and manage investor expectations effectively.

Despite the efforts of this paper to address gaps in the literature, several limitations remain. These context-sensitive findings suggest opportunities for further research to refine the understanding of this relationship. Firstly, the future studies could improve upon the Hawk-score by developing a central-bank-specific dictionary that better captures the monetary policy communication in different geographies. Alternatively, a more automated approach could be utilized. Furthermore, the analysis could be extended by using real intraday data, rather than daily proxies. This could enhance the precision of volatility measurements. This approach would allow researchers to narrow the reaction window to hours surrounding document releases, ensuring a clearer attribution of market movements to the communication itself. Lastly, additional controls, such as major macroeconomic news released on the same day or the volume of traded securities, could also refine the analysis.

References

Abreu, A., & Lopes, D. S. (2021). *Forward guidance and the semiotic turn of the European Central Bank: Journal of Cultural Economy: Vol 15 , No 1 - Get Access*. Retrieved January 2, 2025, from https://www.tandfonline.com/doi/full/10.1080/17530350.2021.1921829

AL-Rjoub, S. (2016). Media Coverage of Central Bank Communications and stock market reactions.

Apel, M., & Grimaldi, M. (2012). The Information Content of Central Bank Minutes. *SSRN Journal*. https://doi.org/10.2139/ssrn.2092575

Ashwin, J. (2024). Financial news media and volatility: Is there more to newspapers than news? *Journal of Financial Markets*, *69*, 100896. https://doi.org/10.1016/j.finmar.2024.100896

Ashwin, J., Kalamara, E., & Saiz, L. (2024). Nowcasting Euro area GDP with news sentiment: A tale of two crises. *Journal of Applied Econometrics*, *39*(5), 887–905. https://doi.org/10.1002/jae.3057

Astuti, V., Ciarlone, A., & Coco, A. (2022). The role of central bank communication in inflation-targeting Eastern European emerging economies. *SSRN Journal*. https://doi.org/10.2139/ssrn.4295466
Very relevant paper.

Bank, E. C. (2022). Monetary policy accounts. Retrieved December 30, 2024, from https://www.ecb.europa.eu/press/accounts/html/index.en.html

Bennani, H. (2019). Does People's Bank of China communication matter? Evidence from stock market reaction. *Emerging Markets Review*, *40*, 100617. https://doi.org/10.1016/j.ememar.2019.05.002

Campbell, J. R., Evans, C. L., Fisher, J. D. M., Justiniano, A., Calomiris, C. W., & Woodford, M. (2012). Macroeconomic Effects of Federal Reserve Forward Guidance [with Comments and Discussion]. *Brookings Papers on Economic Activity*, 1–80. Retrieved January 2, 2025, from https://www.jstor.org/stable/23287215

Cboe. (2024). Retrieved 2024, from https://www.cboe.com/tradable_products/vix/

Chen, E.-T. (, & Clements, A. (2007). S&P 500 implied volatility and monetary policy announcements. *Finance Research Letters*, *4*(4), 227–232. https://doi.org/10.1016/j.frl.2007.07.002

Chou, R. Y., Chou, H.-C., & Liu, N. (2012, October 29). *Range Volatility: A Review of Models and Empirical Studiues*. 2168528. Retrieved December 31, 2024, from https://papers.ssrn.com/abstract=2168528

Cieslak, A., & Schrimpf, A. (2018). Non-Monetary News in Central Bank Communication.

Crayton, A. (2018, September). Central Bank Communication and the Yield Curve: A Semi-Automatic Approach using Non-Negative Matrix Factorization [arXiv:1809.08718 [econ]]. https://doi.org/10.48550/arXiv.1809.08718

Croushore, D. (1993). Introducing: The survey of professional forecasters. *Business Review-Federal Reserve Bank of Philadelphia 6*.

Ehrmann, M., & Talmi, J. (2020). Starting from a blank page? Semantic similarity in central bank communication and market volatility. *Journal of Monetary Economics*, *111*, 48–62. https://doi.org/10.1016/j.jmoneco.2019.01.028

Feldkircher, M., Hofmarcher, P., & Siklos, P. (2021). What do central banks talk about? A European perspective on central bank communication. https://ideas.repec.org/a/onb/oenbfi/y2021iq2-21b1.html

Gallo, G. M., Lacava, D., & Otranto, E. (2023, May). Volatility jumps and the classification of monetary policy announcements [arXiv:2305.12192 [econ]]. https://doi.org/10.48550/arXiv.2305.12192
Comment: 22 pages, 5 tables, 6 figures.

Gardner, B., Scotti, C., & Vega, C. (2022). Words speak as loudly as actions: Central bank communication and the response of equity prices to macroeconomic announcements. *Journal of Econometrics*, *231*(2), 387–409. https://doi.org/10.1016/j.jeconom.2021.07.014

Garman, M. B., & Klass, M. J. (1980). On the Estimation of Security Price Volatilities from Historical Data. *The Journal of Business*, *53*(1), 67–78. Retrieved December 31, 2024, from https://www.jstor.org/stable/2352358

Gavin, W. T., Keen, B. D., Richter, A. W., & Throckmorton, N. A. (2014). The Limitations of Forward Guidance.

Gertler, P., & Horvath, R. (2018). Central bank communication and financial markets: New high-frequency evidence. *Journal of Financial Stability*, *36*, 336–345. https://doi.org/10.1016/j.jfs.2018.03.002

Gonzalez, M., & Tadle, R. C. (2021). DOCUMENTOS DE TRABAJO.

González, M., & Tadle, R. C. (2020). Signaling and Financial Market Impact of Chile's Central Bank Communication: A Content Analysis Approach [Publisher: Brookings Institution Press]. *Economía*, *20*(2), 127–178. Retrieved December 18, 2024, from https://www.jstor.org/stable/27007015

Gorodnichenko, Y., Pham, T., & Talavera, O. (2021). The Voice of Monetary Policy. https://www.nber.org/system/files/working_papers/w28592/w28592.pdf

Gu, C., Chen, D., Stan, R., & Shen, A. (2022). It is not just What you say, but How you say it: Why tonality matters in central bank communication. *Journal of Empirical Finance*, *68*, 216–231. https://doi.org/10.1016/j.jempfin.2022.07.008

Hansen, S., & McMahon, M. (2016). Shocking language: Understanding the macroeconomic effects of central bank communication. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2717790

Haugen, R. A., Talmor, E., & Torous, W. N. (1991). The Effect of Volatility Changes on the Level of Stock Prices and Subsequent Expected Returns. *The Journal of Finance*, *46*(3), 985–1007. https://doi.org/10.2307/2328551

Hoang, D. H. (2020, September). Central Bank Communication and Asset Correlation. https://doi.org/10.2139/ssrn.3744800

Hubert, P., & Labondance, F. (2019). Central bank tone and the dispersion of views within monetary policy committees. https://sciencespo.hal.science/hal-03403256/file/2019-hubert-central-bank-tone-and-the-dispersion-of-views-within-monetary-policy-committees.pdf

Istrefi, K., Odendahl, F., & Sestieri, G. (2024, October). *ECB communication and its impact on financial markets* (Documentos de Trabajo No. 2431) (Series: Documentos de Trabajo). Banco de España. Madrid. https://doi.org/10.53479/37792

Jiang, Y., Liu, X., & Lu, Z. (2023). Financial uncertainty and stock market volatility.

Kaminskas, R., & Jurkšas, L. (2024). ECB communication sentiments: How do they relate to the economic environment and financial markets? *Journal of Economics and Business*, *131*, 106198. https://doi.org/10.1016/j.jeconbus.2024.106198

Kryvtsov, O., & Petersen, L. (2021). Central bank communication that works: Lessons from lab experiments. *Journal of Monetary Economics*, *117*, 760–780. https://doi.org/10.1016/j.jmoneco.2020.05.001

Loughran, T., & McDonald, B. (2010, March). When is a Liability not a Liability? Textual Analysis, Dictionaries, and 10-Ks. Retrieved December 22, 2024, from https://papers.ssrn.com/abstract=1331573

Loughran, T., & McDonald, B. (2015, February). The Use of Word Lists in Textual Analysis. https://doi.org/10.2139/ssrn.2467519

Lucca, D. O., & Trebbi, F. (2009). NBER WORKING PAPER SERIES.

Marozzi, A. (2022, September). *Essays on the European Central Bank's communication* [phd]. London School of Economics and Political Science. Retrieved December 18, 2024, from https://etheses.lse.ac.uk/4453/

Nikkinen, J., & Sahlström, P. (2004). Impact of the federal open market committee's meetings and scheduled macroeconomic news on stock market uncertainty. *International Review of Financial Analysis*, *13*(1), 1–12. https://doi.org/10.1016/j.irfa.2004.01.001

Papadamou, S., Sidiropoulos, M., & Spyromitros, E. (2014). Does central bank transparency affect stock market volatility? *Journal of International Financial Markets, Institutions and Money*, *31*, 362–377. https://doi.org/10.1016/j.intfin.2014.05.002

Picault, M., & Renault, T. (2017). Words are not all created equal: A new measure of ECB communication. *Journal of International Money and Finance*, *79*, 136–156. https://doi.org/10.1016/j.jimonfin.2017.09.005

Rosa, C. (2011). Words that shake traders: The stock market's reaction to central bank communication in real time. *Journal of Empirical Finance*, *18*(5), 915–934. https://doi.org/10.1016/j.jempfin.2011.07.005

Rosa, C. (2013). The Financial Market Effect of FOMC Minutes. https://www.newyorkfed.org/medialibrary/media/research/epr/2013/0913rosa.pdf

Schmeling, M., & Wagner, C. (2023, July). Does Central Bank Tone Move Asset Prices? https://doi.org/10.2139/ssrn.2629978

Solnyshkina, M., Zamaletdinov, R., Gorodetskaya, L., & Gabitov, A. (2017). Evaluating text complexity and flesch-kincaid grade level. *Journal of Social Studies Education Research*, *8*(3), 238–248.

Tobback, E., Nardelli, S., & Martens, D. (2017). Between Hawks and Doves: Measuring Central Bank Communication. *SSRN Journal*. https://doi.org/10.2139/ssrn.2997481

Uwatt, U. B., Itodo, I., & Odu, A. T. (2023, November). Central Bank Communications and Financial Market Reactions: A Text Mining Approach. https://doi.org/10.2139/ssrn.4634704

very close to my analysis.

Vähämaa, S., & Äijö, J. (n.d.). THE FED'S POLICY DECISIONS AND IMPLIED VOLATILITY.

7 Appendix

A Textual Analysis

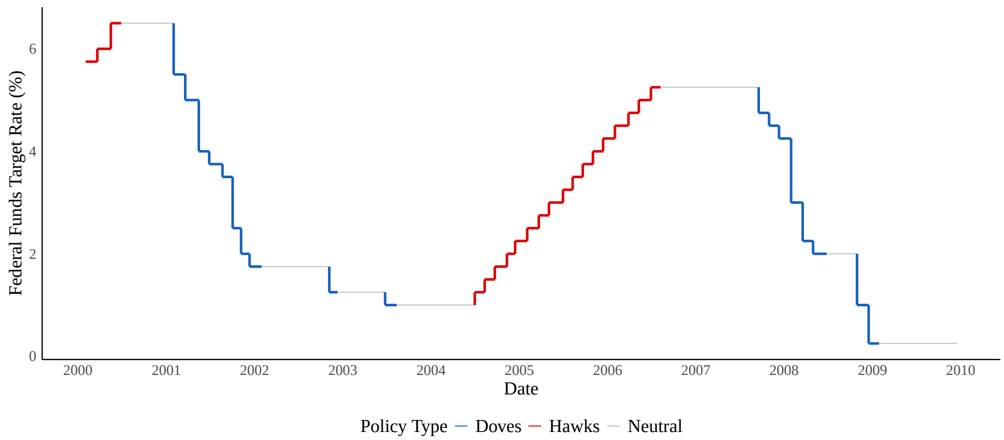


Figure 8: Federal Funds Target Rate, visualization of hawkish and dovish policy stance

Raw Text

At today's meeting the Governing Council of the ECB decided that the interest rate on the main refinancing operations and the interest rates on the marginal lending facility and the deposit facility will remain unchanged at 1.00.

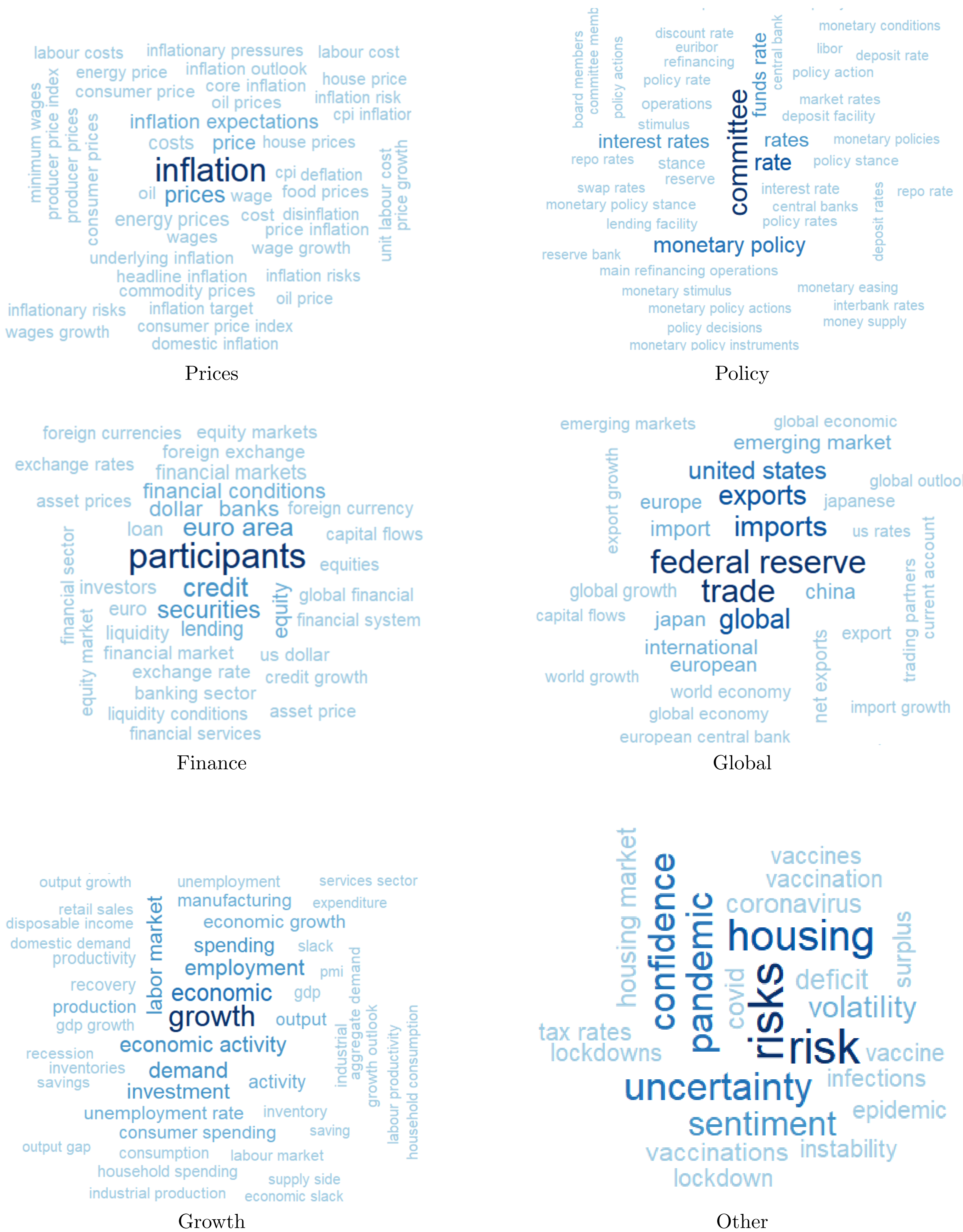
The President of the ECB will comment on the considerations underlying these decisions at a press conference starting at 2.30 p.m. CET today.

Clean Text with Identified N-grams

at today s meeting the governing council of the ecb decided that the interest_rate on the main_refinancing_operations and the interest_rates on the marginal lending_facility and the deposit_facility will remain_unchanged at and respectively

the president of the ecb will comment on the considerations underlying these decisions at a press conference starting at p m cet today

Figure 9: An example of the text cleaning process, paragraph from ECB decisions for meeting on 5th November 2009



Prices

Policy

Finance

Global

Growth

Other

Figure 10: Word clouds of Most Common Keywords per Topic

Table 4: Dictionary Terms by Category

High Modifiers:
above, accelerate, accelerated, accelerates, accelerating, added, augment, augmented, augmenting, augments, big, bigger, bigger than estimated, bigger than expected, bigger than usual, biggest, boost, boosted, boosting, boosts, brighter, buoy, buoyant, buoyed, buoying, buoys, climb, climbed, climbing, climbs, elevate, elevated, elevates, elevating, escalate, escalated, escalates, escalating, exceed, exceeded, exceeding, exceeds, excessive, expand, expanded, expanding, expands, expansionary, fast, faster, faster than estimated, faster than expected, faster than usual, fastest, further, further than estimated, further than expected, further than usual, furthering, gain, gaining, gained, grew, grow, growing, grown, grows, hawk, hawkish, high, higher, higher than estimated, higher than expected, higher than usual, highest, hike, hikes, hiking, impulse, impulsed, impulses, impulsing, increase, increased, increases, increasing, inflationary, large, larger, larger than estimated, larger than expected, larger than usual, largest, lift, lifted, lifting, lifts, maintain, maximum, more, more than estimated, more than expected, more than usual, mount, mounted, mounting, mounts, peak, peaked, peaking, peaks, pick up, picked up, picking up, picks up, raise, raised, raises, raising, ramp, ramped, ramping, ramps, rapid, rise, risen, rises, rising, rose, show growth, showed growth, showing growth, shows growth, skyrocket, skyrocketed, skyrocketing, skyrockets, spike, spiked, spikes, spiking, spur, spurred, spurring, spurs, strengthen, strengthened, strengthening, strengthens, strong, stronger, stronger than estimated, stronger than expected, stronger than usual, strongest, surge, surged, surges, surging, swifter, tighten, tightened, tightening, tightens, tighter, upper, upside, upside risk, upside risks, upswing, upswinging, upswings, upswung, uptrend, upturn, upturned, upturning, upturns, upward, upwards, upward risk, upward risks, upward trend, upward trends, upwards trend, upwards trends, vigor, vigorous, widen, widened, widening, widens, wider
Positive Modifiers:
accommodate, accommodated, accommodates, accommodating, benign, best, better, better than estimated, better than expected, better than usual, calm, calmed, calmer, calmer than estimated, calmer than expected, calmer than usual, calming, calms, depreciation, depreciate, depreciated, depreciating, depreciates, dynamic, ease, eases, eased, easing, encouraging, excellent, expansion, expansionary, greater than expected, greater than usual, greatest, healthier, healthier than estimated, healthier than expected, healthier than usual, improve, improved, improves, improving, loose, loosen, loosened, loosening, loosens, looser, looser than estimated, looser than expected, looser than usual, mitigate, mitigated, mitigates, mitigating, optimistic, outperform, outperformed, outperforming, outperforms, positive, recover, recovered, recovering, recovers, reinforce, reinforced, reinforces, reinforcing, restore, restored, restores, restoring, satisfactory, stabilise, stabilised, stabilises, stabilising, stabilize, stabilized, stabilizes, stabilizing, stable, stimulate, stimulated, stimulates, stimulating, stimulative, stimulatory, steady, successful
Negative Modifiers:
adverse, aggravate, aggravated, aggravates, aggravating, appreciate, appreciation, appreciated, appreciating, appreciates, bad, badly, challenging, concern, concerned, concerning, concerns, conservative, constrain, constrained, constraining, constrains, deepen, deepened, deepening, deepens, deeper, deeper than estimated, deeper than expected, deeper than usual, destabilizing, deteriorate, deteriorated, deteriorates, deteriorating, difficult, difficulty, disappoint, disappointed, disappointing, disappoints, fail, failed, failing, fails, fluctuate, fluctuated, fluctuates, fluctuating, fragile, harm, harmed, harmful, harming, harms, inconsistent, jeopardise, jeopardised, jeopardises, jeopardising, jeopardize, jeopardized, jeopardizes, jeopardizing, lackluster, pessimistic, poor, restrictive, require support, requiring support, requires support, riskier, risky, stagnating, stagnation, stress, stressed, stresses, stressful, stressing, stringent, subprime, tepid, terrible, threaten, threatened, threatening, threatens, torrid, tougher, troubling, troubled, turbulent, uncertain, unclear, undermine, unfavorable, unfavourable, unstable, volatile, vulnerable, weak, weaken, weakened, weakening, weakens, weakness, weaknesses, weakest, weaker, weaker than estimated, weaker than expected, weaker than usual, worrying, worse, worse than estimated, worse than expected, worse than usual, worsen, worsened, worsening, worsens, worst

Low Modifiers:
accommodate, accommodating, accommodative, below, bottom, bottomed, bottoming, bottoms, collapse, collapsing, collapsed, compress, compressed, compression, contract, contracted, contracting, contraction, contractions, contractionary, contracts, cut, cutting, cuts, dampen, dampened, dampening, dampens, decelerate, decelerated, decelerates, decelerating, decline, declined, declines, declining, decrease, decreased, decreases, decreasing, deflationary, depress, depressed, depresses, depressing, descend, descended, descending, descends, diminish, diminished, diminishes, diminishing, disinflationary, dove, dovish, down, downside, downside risk, downside risks, downsides, downsize, downsized, downsizes, downsizing, downward, downwards, downward trend, downwards trend, downward trends, downwards trends, downward risk, downwards risk, downward risks, downwards risks, drop, dropped, dropping, drops, erode, eroded, erodes, eroding, fade, faded, fades, fading, fall, fallen, falling, falls, fell, fewer, fewer than estimated, fewer than expected, fewer than usual, flatten, flattened, flattening, flattens, hopeful, lagged, lagging, lagged behind, lagging behind, least, less, less than estimated, less than expected, less than usual, lost, losing, slowdown, low, lower, lower than estimated, lower than expected, lower than usual, lowered, lowering, lowers, lowest, mild, minimal, minor, moderate, moderated, moderates, moderating, modest, negative, recede, receding, recedes, recessionary, reduce, reduced, reduces, reducing, reduction, reductions, reversal of increases, reversed increases, sank, shorten, shortened, shortening, shortens, shrink, shrinking, shrinks, shrunk, shrunken, sink, sinking, slow, slowed, slower, slowest, slowing, slows, sluggish, slump, slumping, small, smaller, smaller than estimated, smaller than expected, smaller than usual, smallest, soften, softened, softening, softens, subside, subsides, subsiding, subdued, sunk, suppress, suppressed, suppresses, suppressing, temper, tempered, tempering, wane, waned, wanes, waning
Hawkish Keywords: Policy
bank rate, board member, board members, central bank, central banks, committee, committee member, committee members, core rates, deposit rates, deposit rate, discount rate, deposit facility, euribor, interbank interest rate, lending facility, funds rate, interbank rate, interbank rates, interest rate, interest rates, libor, lombard rate, main refinancing operations, market rates, monetary conditions, monetary policy, monetary policy action, monetary policy actions, monetary policy instrument, monetary policy instruments, monetary policy stance, monetary policy stances, monetary policies, monetary stance, monetary stances, money demand, money supply, policy action, policy actions, policy decision, policy decisions, policy instrument, policy instruments, policy stance, policy stances, policy repo rate, policy rate, policy rates, pribor, operations, rate, rates, refinancing, repo rate, repo rates, reserve, reserve bank, reserve positions, reverse repo rate, reverse repo rates, selic rate, swap rates, stance
Hawkish Keywords: Growth
activity, aggregate demand, capacity utilisation, capacity utilization, capital expenditure, capital formation, capital investment, capital spending, consumption, consumption expenditure, consumer spending, demand, demand side, disposable income, domestic demand, domestic economy, domestic growth, economic, economic activity, economic conditions, economic development, economic expansion, economic growth, economic output, economic recovery, employment, employment growth, expenditure, expenditure growth, growth, growth outlook, growth expectations, growth forecast, growth forecasts, growth prospects, gdp, gdp growth, household consumption, household income, household spending, industrial, industrial production, investment, inventory, inventories, labor market, labour market, labour productivity, manufacturing, output, output gap, output growth, pmi, private consumption, production, productivity, recovery, retail sales, services sector, spending, supply side
Hawkish Keywords: Prices
commodity price, commodity prices, consumer price, consumer prices, core inflation, cost, costs, consumer price index, cpi, cpi inflation, domestic inflation, energy price, energy prices, expected inflation, food inflation, food price, food prices, headline inflation, house price, house prices, inflation, inflation expectation, inflation expectations, inflation outlook, inflationary pressures, inflationary pressure, inflation projection, inflation projections, inflation report, inflation risk, inflation risks, inflation target, inflationary expectation, inflationary expectations, inflation data, inflation prediction, inflation forecast, inflation forecasts, inflationary pressure, inflationary pressures, inflationary risk, inflationary risks, labour cost, labour costs, minimum wage, minimum wages, oil, oil price, oil prices, price, price growth, price inflation, prices, prices growth, producer price, producer prices, producer price index, underlying inflation, unit labour cost, unit labour costs, wage, wage growth, wages, wages growth

Hawkish Keywords: Finance
asset price, asset prices, banks, banking system, banking sector, banking sector, capital flows, credit, credit growth, commercial paper, dollar, euro, euro area, exchange rate, exchange rates, equity, equities, equity market, equity markets, financial conditions, financial market, financial markets, financial sector, financial services, financial system, financial systems, foreign currency, foreign currencies, foreign exchange, global financial, investors, lending, liquidity, liquidity conditions, loan, participants, securities, us dollar
Hawkish Keywords: Global
advanced country, advanced countries, advanced economy, advanced economies, capital flows, current account, china, developed markets, developed economies, exports, emerging economy, emerging economies, emerging market, emerging markets, emerging country, emerging countries, europe, european, european central bank, export, exports, net exports, export growth, exports growth, federal reserve, global, global economic, global economic growth, global economic activity, global economy, global growth, global outlook, global recovery, international, international growth, japan, japanese, trade, trading partners, united states, usa, us rates, world economic activity, world economic growth, world economy, world growth
Hawkish Keywords: Other
confidence, housing, housing market, sentiment, surplus, vaccine, vaccines, vaccination, vaccinations
Dovish Keywords: Policy
monetary easing, monetary easing cycle, monetary stimulus, stimulus
Dovish Keywords: Growth
economic activity contraction, economic contraction, economic slack, economic uncertainty, gdp decline, household saving, household savings, idleness, precautionary saving, precautionary savings, recession, saving, savings, slack, spare capacity, uncertainty about economic growth, unemployed, unemployment, unemployment rate, unemployment rates
Dovish Keywords: Prices
expected deflation, expected disinflation, deflation, disinflation, deflationary risk, deflationary risks, disinflationary risk, disinflationary risks
Dovish Keywords: Finance
financial crisis, financial instability, financial uncertainty, financial volatility, market volatility
Dovish Keywords: Global
geopolitical risks, import, imports, import growth, imports growth, net imports
Dovish Keywords: Other
coronavirus, covid, covid19, covid 19, deficit, epidemic, infections, instability, lockdown, lockdowns, pandemic, risk, risks, tax rates, uncertainty, vat rates, variance, volatility
Neutral Terms:
all of above, at least, best practice, best practices, committee stresses that, forward contracts, greater transparency, greater focus, remain unchanged, high frequency, higher frequency, high quality, high yield, increasing weight, more detail, more timely, more or less, rate of change, rates of change
Negators:
anti, aren t, by no means, can t, cannot, cannot be, cannot but be, halt, halt a, halt an, halt the, halted, halted the, halting, halting the, halts, halts the, nt, not, not a, not an, not the, not expected to, not allow, not allow a, not allow an, not allow the, not be, not permit, not permit a, not permit an, not permit the, prevent, prevent a, prevent an, prevent the, preventing, preventing a, preventing an, preventing the, prevents, prevents a, prevents an, prevents the, not permit a, not permit an, not permit the, no reason to, no reason to expect, not rule out, not rule out a, not rule out an, not rule out the, reverse, reverse the, reverse a, reverse an, reversed, reversed the, reversed a, reversed an, reverses, reverses the, reverses a, reverses an, reversing, reversing the, reversing a, reversing an, reversal of, reversal of the, unlikely to

B Justifying Regression Assumptions

In regression analysis, the validity of statistical inference heavily depends on the assumptions underlying the OLS method. Two critical assumptions are homoskedasticity and the absence of autocorrelation in the residuals. Violations of these assumptions can lead to inefficient estimates and invalid hypothesis testing. I test for homoskedasticity and autocorrelation using the Breusch-Pagan (BP) and Durbin-Watson (DW) tests. If either assumption is violated, standard errors in the regression tables are adjusted accordingly to ensure valid inference.

Table 5: Heteroskedasticity and Autocorrelation Test Results

Model	BP Statistic	BP p-value	BP Result	DW Statistic	DW p-value	DW Result
Model 1 ECB Decisions and Realized Volatility	3.376	0.066	N	1.498	0.000	Y
Model 1 ECB Decisions and Implied Volatility	3.064	0.080	N	1.843	0.086	N
Model 1 ECB Minutes and Implied Volatility	3.496	0.062	N	2.119	0.666	N
Model 1 ECB Minutes and Realized Volatility	0.002	0.964	N	1.499	0.009	Y
Model 1 FOMC Decisions and Implied Volatility	0.277	0.599	N	2.059	0.651	N
Model 1 FOMC Decisions and Realized Volatility	1.156	0.282	N	1.100	0.000	Y
Model 1 FOMC Minutes and Implied Volatility	1.301	0.254	N	1.948	0.322	N
Model 1 FOMC Minutes and Realized Volatility	7.277	0.007	Y	1.469	0.000	Y
Model 2 ECB Decisions and Realized Volatility	23.076	0.000	Y	1.695	0.012	Y
Model 2 ECB Decisions and Implied Volatility	6.878	0.032	Y	1.844	0.088	N
Model 2 ECB Minutes and Realized Volatility	14.059	0.001	Y	2.098	0.628	N
Model 2 ECB Minutes and Implied Volatility	4.349	0.114	N	2.076	0.548	N
Model 2 FOMC Decisions and Implied Volatility	0.247	0.884	N	2.046	0.612	N
Model 2 FOMC Decisions and Realized Volatility	46.778	0.000	Y	1.783	0.045	Y
Model 2 FOMC Minutes and Implied Volatility	1.295	0.523	N	1.951	0.331	N
Model 2 FOMC Minutes and Realized Volatility	48.704	0.000	Y	2.076	0.703	N
Model 3 ECB Decisions and Realized Volatility	18.612	0.001	Y	1.769	0.126	N
Model 3 ECB Decisions and Implied Volatility	6.220	0.183	N	2.243	0.800	N
Model 3 ECB Minutes and Realized Volatility	10.539	0.032	Y	2.105	0.593	N
Model 3 ECB Minutes and Implied Volatility	7.648	0.105	N	2.116	0.617	N
Model 3 FOMC Decisions and Implied Volatility	5.976	0.201	N	2.082	0.680	N
Model 3 FOMC Decisions and Realized Volatility	50.570	0.000	Y	1.848	0.099	N
Model 3 FOMC Minutes and Implied Volatility	2.389	0.665	N	1.951	0.310	N
Model 3 FOMC Minutes and Realized Volatility	49.600	0.000	Y	2.099	0.749	N
Model 4 ECB Decisions and Realized Volatility	23.223	0.000	Y	1.733	0.018	Y
Model 4 ECB Decisions and Implied Volatility	6.271	0.180	N	1.856	0.100	N
Model 4 ECB Minutes and Realized Volatility	14.127	0.007	Y	2.096	0.548	N
Model 4 ECB Minutes and Implied Volatility	8.219	0.084	N	2.154	0.632	N
Model 4 FOMC Decisions and Realized Volatility	52.506	0.000	Y	1.855	0.105	N
Model 4 FOMC Decisions and Implied Volatility	0.354	0.986	N	2.054	0.595	N
Model 4 FOMC Minutes and Realized Volatility	50.398	0.000	Y	2.094	0.719	N
Model 4 FOMC Minutes and Implied Volatility	5.984	0.200	N	1.955	0.306	N
Model 5 ECB Decisions and Realized Volatility	23.884	0.000	Y	1.704	0.009	Y
Model 5 ECB Decisions and Implied Volatility	7.418	0.191	N	1.844	0.078	N
Model 5 ECB Minutes and Realized Volatility	13.567	0.019	Y	2.191	0.698	N
Model 5 ECB Minutes and Implied Volatility	9.302	0.098	N	2.130	0.594	N
Model 5 FOMC Decisions and Realized Volatility	51.689	0.000	Y	1.866	0.109	N
Model 5 FOMC Decisions and Implied Volatility	4.207	0.520	N	2.056	0.578	N
Model 5 FOMC Minutes and Realized Volatility	51.460	0.000	Y	2.102	0.729	N
Model 5 FOMC Minutes and Implied Volatility	5.806	0.326	N	1.953	0.287	N
Model 6 ECB Decisions and Realized Volatility	27.158	0.000	Y	1.705	0.008	Y
Model 6 ECB Decisions and Implied Volatility	14.530	0.024	Y	1.842	0.069	N
Model 6 ECB Minutes and Realized Volatility	13.680	0.033	Y	2.184	0.666	N
Model 6 ECB Minutes and Implied Volatility	14.464	0.025	Y	2.157	0.620	N
Model 6 FOMC Decisions and Realized Volatility	51.898	0.000	Y	1.867	0.100	N
Model 6 FOMC Decisions and Implied Volatility	4.297	0.637	N	2.056	0.554	N
Model 6 FOMC Minutes and Realized Volatility	51.860	0.000	Y	2.101	0.715	N
Model 6 FOMC Minutes and Implied Volatility	8.408	0.210	N	1.963	0.303	N

Continued on next page

Model	BP Statistic	BP p-value	BP Result	DW Statistic	DW p-value	DW Result
Model 7 ECB Decisions and Realized Volatility	33.253	0.000	Y	1.723	0.009	Y
Model 7 ECB Decisions and Implied Volatility	18.107	0.020	Y	1.926	0.189	N
Model 7 FOMC Decisions and Realized Volatility	56.739	0.000	Y	1.870	0.084	N
Model 7 FOMC Decisions and Implied Volatility	7.273	0.507	N	2.071	0.554	N
Model 7 FOMC Minutes and Realized Volatility	57.446	0.000	Y	2.133	0.766	N
Model 7 FOMC Minutes and Implied Volatility	9.184	0.327	N	1.956	0.253	N
Model 8 ECB Decisions and Realized Volatility	9.178	0.164	N	1.847	0.137	N
Model 8 ECB Decisions and Implied Volatility	3.162	0.788	N	2.117	0.705	N
Model 8 FOMC Decisions and Realized Volatility	8.185	0.225	N	2.068	0.476	N
Model 8 FOMC Decisions and Implied Volatility	6.675	0.352	N	1.615	0.013	Y
Model 8 FOMC Minutes and Realized Volatility	32.521	0.000	Y	2.041	0.472	N
Model 8 FOMC Minutes and Implied Volatility	1.850	0.933	N	2.104	0.614	N
Model 9 ECB Decisions and Realized Volatility	17.921	0.006	Y	1.932	0.240	N
Model 9 ECB Decisions and Implied Volatility	6.802	0.340	N	1.856	0.138	N
Model 9 FOMC Decisions and Realized Volatility	9.117	0.167	N	1.792	0.059	N
Model 9 FOMC Decisions and Implied Volatility	4.611	0.595	N	2.349	0.950	N
Model 9 FOMC Minutes and Realized Volatility	22.723	0.001	Y	2.073	0.562	N
Model 9 FOMC Minutes and Implied Volatility	6.934	0.327	N	1.901	0.201	N
Model 10 ECB Decisions and Realized Volatility	36.067	0.000	Y	1.469	0.000	Y
Model 10 ECB Decisions and Implied Volatility	8.137	0.228	N	1.846	0.083	N
Model 10 ECB Minutes and Implied Volatility	2.194	0.822	N	2.031	0.000	Y
Model 10 ECB Minutes and Realized Volatility	0.708	0.983	N	1.547	0.000	Y
Model 10 FOMC Decisions and Implied Volatility	7.187	0.304	N	2.058	0.622	N
Model 10 FOMC Decisions and Realized Volatility	2.912	0.820	N	1.081	0.000	Y
Model 10 FOMC Minutes and Implied Volatility	0.924	0.968	N	1.990	0.765	N
Model 10 FOMC Minutes and Realized Volatility	0.196	0.999	N	1.390	0.000	Y
Model 11 ECB Decisions and Realized Volatility	52.734	0.000	Y	1.688	0.009	Y
Model 11 ECB Decisions and Implied Volatility	9.122	0.244	N	1.850	0.089	N
Model 11 ECB Minutes and Realized Volatility	14.036	0.029	Y	1.990	0.765	N
Model 11 ECB Minutes and Implied Volatility	3.364	0.762	N	2.019	0.765	N
Model 11 FOMC Decisions and Implied Volatility	6.986	0.430	N	2.047	0.584	N
Model 11 FOMC Decisions and Realized Volatility	44.933	0.000	Y	1.710	0.010	Y
Model 11 FOMC Minutes and Implied Volatility	0.965	0.987	N	1.983	0.762	N
Model 11 FOMC Minutes and Realized Volatility	50.292	0.000	Y	2.083	0.762	N
Model 12 ECB Decisions and Realized Volatility	30.305	0.000	Y	2.054	0.433	N
Model 12 ECB Decisions and Implied Volatility	8.827	0.453	N	2.186	0.713	N
Model 12 ECB Minutes and Realized Volatility	10.890	0.208	N	2.038	0.765	N
Model 12 ECB Minutes and Implied Volatility	5.848	0.664	N	2.069	0.000	Y
Model 12 FOMC Decisions and Implied Volatility	10.921	0.281	N	2.060	0.583	N
Model 12 FOMC Decisions and Realized Volatility	48.970	0.000	Y	1.749	0.017	Y
Model 12 FOMC Minutes and Implied Volatility	3.453	0.903	N	1.992	0.762	N
Model 12 FOMC Minutes and Realized Volatility	52.064	0.000	Y	2.085	0.762	N
Model 13 ECB Decisions and Realized Volatility	53.680	0.000	Y	1.705	0.009	Y
Model 13 ECB Decisions and Implied Volatility	16.632	0.055	N	1.825	0.056	N
Model 13 ECB Minutes and Realized Volatility	14.173	0.077	N	1.989	0.765	N
Model 13 ECB Minutes and Implied Volatility	8.694	0.369	N	2.125	0.000	Y
Model 13 FOMC Decisions and Realized Volatility	52.331	0.000	Y	1.814	0.051	N
Model 13 FOMC Decisions and Implied Volatility	7.019	0.635	N	2.057	0.574	N
Model 13 FOMC Minutes and Realized Volatility	52.182	0.000	Y	2.093	0.762	N
Model 13 FOMC Minutes and Implied Volatility	4.751	0.784	N	1.992	0.762	N
Model 14 ECB Decisions and Realized Volatility	53.988	0.000	Y	1.676	0.004	Y
Model 14 ECB Decisions and Implied Volatility	16.995	0.074	N	1.798	0.033	Y
Model 14 ECB Minutes and Realized Volatility	13.771	0.131	N	2.144	0.765	N
Model 14 ECB Minutes and Implied Volatility	9.980	0.352	N	2.070	0.766	N
Model 14 FOMC Decisions and Realized Volatility	50.541	0.000	Y	1.845	0.071	N
Model 14 FOMC Decisions and Implied Volatility	10.302	0.414	N	2.059	0.559	N
Model 14 FOMC Minutes and Realized Volatility	53.298	0.000	Y	2.101	0.762	N
Model 14 FOMC Minutes and Implied Volatility	5.026	0.832	N	1.988	0.762	N
Model 15 ECB Decisions and Realized Volatility	56.008	0.000	Y	1.681	0.004	Y
Model 15 ECB Decisions and Implied Volatility	20.926	0.034	Y	1.796	0.029	Y
Model 15 ECB Minutes and Realized Volatility	14.832	0.138	N	2.125	0.000	Y

Continued on next page

Model	BP Statistic	BP p-value	BP Result	DW Statistic	DW p-value	DW Result
Model 15 ECB Minutes and Implied Volatility	13.782	0.183	N	2.111	0.766	N
Model 15 FOMC Decisions and Realized Volatility	49.311	0.000	Y	1.842	0.061	N
Model 15 FOMC Decisions and Implied Volatility	10.342	0.500	N	2.059	0.535	N
Model 15 FOMC Minutes and Realized Volatility	53.888	0.000	Y	2.098	0.762	N
Model 15 FOMC Minutes and Implied Volatility	7.471	0.680	N	2.003	0.762	N
Model 16 ECB Decisions and Realized Volatility	59.217	0.000	Y	1.802	0.777	N
Model 16 ECB Decisions and Implied Volatility	23.959	0.066	N	1.930	0.762	N
Model 16 FOMC Decisions and Realized Volatility	72.794	0.000	Y	1.936	0.141	N
Model 16 FOMC Decisions and Implied Volatility	17.646	0.479	N	2.108	0.590	N
Model 16 FOMC Minutes and Realized Volatility	61.532	0.000	Y	2.133	0.769	N
Model 16 FOMC Minutes and Implied Volatility	11.367	0.726	N	2.004	0.769	N
Model 17 ECB Decisions and Realized Volatility	7.415	0.387	N	1.974	0.764	N
Model 17 ECB Decisions and Implied Volatility	2.611	0.956	N	2.101	0.763	N
Model 17 FOMC Decisions and Realized Volatility	17.929	0.083	N	2.036	0.395	N
Model 17 FOMC Decisions and Implied Volatility	12.226	0.347	N	1.593	0.008	Y
Model 17 FOMC Minutes and Realized Volatility	35.226	0.000	Y	2.017	0.771	N
Model 17 FOMC Minutes and Implied Volatility	3.199	0.956	N	2.154	0.771	N
Model 18 ECB Decisions and Realized Volatility	35.354	0.000	Y	1.821	0.089	N
Model 18 ECB Decisions and Implied Volatility	23.331	0.016	Y	1.758	0.048	Y
Model 18 FOMC Decisions and Realized Volatility	15.690	0.153	N	1.981	0.249	N
Model 18 FOMC Decisions and Implied Volatility	9.775	0.551	N	2.467	0.984	N
Model 18 FOMC Minutes and Realized Volatility	23.899	0.008	Y	2.056	0.763	N
Model 18 FOMC Minutes and Implied Volatility	8.926	0.539	N	1.969	0.763	N

Notes: Y indicates the presence of heteroskedasticity or autocorrelation, while N denotes homoskedasticity or no autocorrelation.

C Specification of Topic Regression Models

$$\sigma^2{}_t = \gamma_0 + \gamma_1 \text{Global}_t + \gamma_2 \text{Growth}_t + \gamma_3 \text{Finance}_t + \gamma_4 \text{Prices}_t + \gamma_5 \text{Policy}_t + \gamma_6 \text{Other}_t + \epsilon_t \tag{10}$$

$$\begin{aligned}\sigma^2{}_t = {} & \gamma_0 + \gamma_1 \text{Global}_t + \gamma_2 \text{Growth}_t + \gamma_3 \text{Finance}_t + \gamma_4 \text{Prices}_t + \gamma_5 \text{Policy}_t + \gamma_6 \text{Other}_t \\ & + \gamma_7 \sigma^2{}_{t-1} + \epsilon_t \end{aligned} \tag{11}$$

$$\begin{aligned}\sigma^2{}_t = {} & \gamma_0 + \gamma_1 \text{Global}_t + \gamma_2 \text{Growth}_t + \gamma_3 \text{Finance}_t + \gamma_4 \text{Prices}_t + \gamma_5 \text{Policy}_t + \gamma_6 \text{Other}_t \\ & + \gamma_7 \sigma^2{}_{t-1} + \gamma_8 SU_t + \gamma_9 SS_t + \epsilon_t \end{aligned} \tag{12}$$

$$\begin{aligned}\sigma^2{}_t = {} & \gamma_0 + \gamma_1 \text{Global}_t + \gamma_2 \text{Growth}_t + \gamma_3 \text{Finance}_t + \gamma_4 \text{Prices}_t + \gamma_5 \text{Policy}_t + \gamma_6 \text{Other}_t \\ & + \gamma_7 \sigma^2{}_{t-1} + \gamma_8 U_{GDP_t} + \gamma_9 U_{CPI_t} + \epsilon_t \end{aligned} \tag{13}$$

$$\begin{aligned}\sigma^2{}_t = {} & \gamma_0 + \gamma_1 \text{Global}_t + \gamma_2 \text{Growth}_t + \gamma_3 \text{Finance}_t + \gamma_4 \text{Prices}_t + \gamma_5 \text{Policy}_t + \gamma_6 \text{Other}_t \\ & + \gamma_7 \sigma^2{}_{t-1} + \gamma_8 U_{GDP_t} + \gamma_9 U_{CPI_t} + \gamma_{10} R_t + \epsilon_t \end{aligned} \tag{14}$$

$$\begin{aligned}\sigma^2{}_t = {} & \gamma_0 + \gamma_1 \text{Global}_t + \gamma_2 \text{Growth}_t + \gamma_3 \text{Finance}_t + \gamma_4 \text{Prices}_t + \gamma_5 \text{Policy}_t + \gamma_6 \text{Other}_t \\ & + \gamma_7 \sigma^2{}_{t-1} + \gamma_8 U_{GDP_t} + \gamma_9 U_{CPI_t} + \gamma_{10} R_t + \gamma_{11} W_t + \epsilon_t \end{aligned} \tag{15}$$

$$\begin{aligned}\sigma^2{}_t = {} & \gamma_0 + \gamma_1 (B_t * \text{Global}_t) + \gamma_2 (B_t * \text{Growth}_t) + \gamma_3 (B_t * \text{Finance}_t) + \gamma_4 (B_t * \text{Prices}_t) \\ & + \gamma_5 (B_t * \text{Policy}_t) + \gamma_6 (B_t * \text{Other}_t) + \gamma_7 \sigma^2{}_{t-1} + \gamma_8 U_{GDP_t} + \gamma_9 U_{CPI_t} \\ & + \gamma_{10} R_t + \gamma_{11} W_t + \epsilon_t \end{aligned} \tag{16}$$

$$\begin{aligned}\sigma^2{}_t = {} & \gamma_0 + \gamma_1 \text{Global}_t + \gamma_2 \text{Growth}_t + \gamma_3 \text{Finance}_t + \gamma_4 \text{Prices}_t + \gamma_5 \text{Policy}_t + \gamma_6 \text{Other}_t \\ & + \gamma_7 \sigma^2{}_{t-1} + \gamma_8 U_{GDP_t} + \gamma_9 U_{CPI_t} + \gamma_{10} R_t + \gamma_{11} W_t + \epsilon_t \qquad \text{for} \quad B_t = 0 \end{aligned} \tag{17}$$

$$\begin{aligned}\sigma^2{}_t = {} & \gamma_0 + \gamma_1 \text{Global}_t + \gamma_2 \text{Growth}_t + \gamma_3 \text{Finance}_t + \gamma_4 \text{Prices}_t + \gamma_5 \text{Policy}_t + \gamma_6 \text{Other}_t \\ & + \gamma_7 \sigma^2{}_{t-1} + \gamma_8 U_{GDP_t} + \gamma_9 U_{CPI_t} + \gamma_{10} R_t + \gamma_{11} W_t + \epsilon_t \qquad \text{for} \quad B_t = 1 \end{aligned} \tag{18}$$

D Regression Tables

Table 6: Results for ECB Decisions and Realized Volatility

	Dependent variable: Realized Volatility								
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SH_t	-0.307^{**}	-0.117	-0.212^{*}	-0.121^{*}	-0.119^{*}	-0.141^{*}	-0.052	-0.164^{*}	-0.284^{*}
	(0.139)	(0.079)	(0.123)	(0.075)	(0.073)	(0.074)	(0.089)	(0.087)	(0.153)
${\sigma^2}_{t-1}$		0.750^{***}	1.163^{**}	0.741^{***}	0.724^{***}	0.689^{***}	0.720^{***}	0.387^{***}	0.848^{**}
		(0.153)	(0.473)	(0.158)	(0.160)	(0.127)	(0.123)	(0.117)	(0.408)
SS_t			-0.247						
			(0.173)						
SU_t			-0.074						
			(0.293)						
U_{CPI_t}				-0.004^{***}	-0.004^{***}	-0.006^{***}	-0.006^{***}	-0.021	-0.004
				(0.001)	(0.001)	(0.002)	(0.002)	(0.014)	(0.003)
U_{GDP_t}				-0.001^{***}	-0.001^{***}	-0.002^{***}	-0.002^{***}	0.001	-0.001^{**}
				(0.0002)	(0.0002)	(0.0004)	(0.0004)	(0.003)	(0.001)
R_t					-0.031	-0.060^{***}	-0.054^{***}	-0.053	-0.027
					(0.019)	(0.015)	(0.017)	(0.036)	(0.020)
W_t						0.001^{*}	0.001^{**}	0.019^{***}	0.001
						(0.0005)	(0.0005)	(0.004)	(0.0004)
SH_tB_t							-0.240		
							(0.169)		
Observations	207	207	61	207	206	206	206	104	102
R-squared	0.064	0.305	0.439	0.318	0.329	0.347	0.355	0.521	0.311
Adjusted R^2	0.060	0.298	0.399	0.305	0.312	0.327	0.329	0.492	0.268
F-statistic	14.058	1.000	205.000	44.827	2.000	204.000	10.944	4.000	56.000
F-test p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for ECB Decisions and Realized Volatility. Note that the subscript t-1 refers to the volatility of the preceding day rather than the volatility of the previous meeting day. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (1–9). Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 7: Results for ECB Decisions and Implied Volatility

	Dependent variable: Implied Volatility								
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SH_t	-0.696^{*}	-0.681	-0.772	-0.895^{**}	-0.823^{*}	-0.811	-0.942	-0.573	-0.468
	(0.380)	(0.446)	(0.817)	(0.434)	(0.434)	(0.529)	(0.579)	(0.489)	(0.869)
Δv_{t-1}		-0.070	-0.238	-0.085	-0.067	-0.068	-0.057	-0.017	-0.159
		(0.093)	(0.156)	(0.080)	(0.080)	(0.094)	(0.097)	(0.109)	(0.114)
SS_t			0.204						
			(0.990)						
SU_t			0.515						
			(0.971)						
U_{CPI_t}				-0.015	-0.010	-0.007	-0.007	-0.153	0.010
				(0.025)	(0.025)	(0.036)	(0.038)	(0.105)	(0.026)
U_{GDP_t}				-0.003	-0.003	-0.002	-0.003	-0.013	0.0004
				(0.004)	(0.004)	(0.004)	(0.004)	(0.024)	(0.005)
R_t					-0.241^{*}	-0.225^{*}	-0.183	0.018	-0.068
					(0.135)	(0.134)	(0.130)	(0.185)	(0.245)
W_t						-0.001	0.004	0.078^{***}	0.0004
						(0.003)	(0.004)	(0.020)	(0.003)
SH_tB_t							0.233		
							(1.169)		
Observations	295	295	71	258	258	258	258	157	101
R-squared	0.011	0.014	0.055	0.025	0.038	0.038	0.074	0.149	0.031
Adjusted R^2	0.008	0.007	-0.002	0.010	0.019	0.015	0.045	0.115	-0.031
F-statistic	3.355	1.000	293.000	2.109	2.000	292.000	0.963	4.000	66.000
F-test p-value	0.068	0.123	0.434	0.162	0.083	0.131	0.012	0.000	0.805

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for ECB Decisions and Implied Volatility. Note that the subscript t-1 refers to the volatility of the preceding day rather than the volatility of the previous meeting day. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (1–9). Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 8: Results for ECB Minutes and Realized Volatility

	Dependent variable: Realized Volatility					
Model	(1)	(2)	(3)	(4)	(5)	(6)
SH_t	-0.001	-0.026	0.002	-0.026	-0.014	-0.023
	(0.080)	(0.047)	(0.055)	(0.048)	(0.043)	(0.042)
${\sigma^2}_{t-1}$		0.571^{***}	0.553^{***}	0.559^{***}	0.566^{***}	0.534^{***}
		(0.100)	(0.094)	(0.104)	(0.103)	(0.097)
SS_t			-0.094^{*}			
			(0.052)			
SU_t			-0.033			
			(0.051)			
U_{CPI_t}				-0.001	-0.0004	-0.001
				(0.001)	(0.001)	(0.001)
U_{GDP_t}				-0.00003	-0.00000	-0.0001
				(0.0002)	(0.0002)	(0.0002)
R_t					0.085	0.079
					(0.063)	(0.063)
W_t						0.00004^{**}
						(0.00002)
Observations	80	80	80	80	80	80
R-squared	0.000	0.430	0.457	0.433	0.447	0.465
Adjusted R^2	-0.013	0.415	0.428	0.403	0.409	0.421
F-statistic	0.001	1.000	78.000	29.065	2.000	77.000
F-test p-value	0.981	0.000	0.000	0.000	0.000	0.000

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for ECB Minutes and Realized Volatility. Note that the subscript t-1 refers to the volatility of the preceding day rather than the volatility of the previous meeting day. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (1–9). Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 9: Results for ECB Minutes and Implied Volatility

	Dependent variable: Implied Volatility					
Model	(1)	(2)	(3)	(4)	(5)	(6)
SH_t	-0.661	-0.317	-0.442	-0.140	-0.178	-0.033
	(0.759)	(0.762)	(0.847)	(0.748)	(0.761)	(0.676)
Δv_{t-1}		-0.224^{**}	-0.231^{**}	-0.248^{**}	-0.246^{**}	-0.259^{**}
		(0.112)	(0.113)	(0.110)	(0.111)	(0.109)
SS_t			0.587			
			(0.876)			
SU_t			-0.088			
			(0.856)			
U_{CPI_t}				-0.011	-0.014	-0.006
				(0.029)	(0.030)	(0.022)
U_{GDP_t}				-0.010^{**}	-0.010^{**}	-0.009
				(0.004)	(0.004)	(0.005)
R_t					-0.351	-0.246
					(1.019)	(0.878)
W_t						-0.001
						(0.0004)
Observations	72	72	72	72	72	72
R-squared	0.011	0.065	0.075	0.135	0.137	0.167
Adjusted R^2	-0.003	0.038	0.020	0.083	0.071	0.090
F-statistic	0.759	1.000	70.000	2.404	2.000	69.000
F-test p-value	0.387	0.098	0.259	0.043	0.078	0.057

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for ECB Minutes and Implied Volatility. Note that the subscript t-1 refers to the volatility of the preceding day rather than the volatility of the previous meeting day. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (1–9). Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed Table 5 in Appendix B.

Table 10: Results for FOMC Decisions and Realized Volatility

	Dependent variable: Realized Volatility								
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SH_t	−0.187	−0.048	−0.039	−0.047	−0.057	−0.056	−0.063	−0.125*	0.012
	(0.129)	(0.065)	(0.062)	(0.055)	(0.057)	(0.057)	(0.071)	(0.073)	(0.074)
${\sigma^2}_{t-1}$		0.585***	0.554***	0.567***	0.566***	0.565***	0.565***	0.325***	0.762***
		(0.078)	(0.086)	(0.091)	(0.091)	(0.092)	(0.094)	(0.073)	(0.061)
SS_t			−0.166***						
			(0.054)						
SU_t			−0.090*						
			(0.050)						
U_{CPI_t}				0.321**	0.329***	0.334***	0.332***	0.079	0.438***
				(0.124)	(0.125)	(0.125)	(0.125)	(0.229)	(0.121)
U_{GDP_t}				−0.009	−0.021	−0.020	−0.028	0.582**	−0.036
				(0.029)	(0.031)	(0.032)	(0.032)	(0.268)	(0.052)
R_t					0.013	0.015	0.013	0.019	−0.045
					(0.019)	(0.023)	(0.023)	(0.031)	(0.057)
W_t						−0.00004	0.0002	0.002	0.001
						(0.0002)	(0.0004)	(0.002)	(0.001)
SH_tB_t							0.016		
							(0.118)		
Observations	219	219	217	219	219	219	219	90	129
R-squared	0.035	0.456	0.487	0.477	0.478	0.479	0.480	0.443	0.606
Adjusted R^2	0.031	0.451	0.477	0.468	0.466	0.464	0.460	0.403	0.586
F-statistic	7.937	1.000	217.000	90.473	2.000	216.000	50.216	4.000	212.000
F-test p-value	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for FOMC Decisions and Realized Volatility. Note that the subscript t-1 refers to the volatility of the preceding day rather than the volatility of the previous meeting day. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (1–9). Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 11: Results for FOMC Decisions and Implied Volatility

	Dependent variable: Implied Volatility								
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SH_t	0.496	0.475	0.218	0.453	0.427	0.418	0.126	0.099	0.855
	(0.496)	(0.497)	(0.550)	(0.501)	(0.524)	(0.529)	(0.700)	(0.726)	(0.831)
Δv_{t-1}		-0.070	-0.062	-0.070	-0.069	-0.068	-0.071	-0.070	-0.090
		(0.080)	(0.081)	(0.081)	(0.081)	(0.082)	(0.082)	(0.131)	(0.111)
SS_t			0.732						
			(0.526)						
SU_t			-0.324						
			(0.519)						
U_{CPI_t}				-0.710	-0.687	-0.728	-0.591	0.030	-0.702
				(1.088)	(1.099)	(1.136)	(1.146)	(1.475)	(1.374)
U_{GDP_t}				0.161	0.126	0.122	0.207	0.408	0.344
				(0.483)	(0.524)	(0.526)	(0.533)	(2.547)	(0.594)
R_t					0.035	0.015	0.052	0.114	-0.384
					(0.203)	(0.247)	(0.248)	(0.282)	(0.657)
W_t						0.0004	-0.004	-0.010	0.0004
						(0.003)	(0.004)	(0.016)	(0.007)
SH_tB_t							0.666		
							(1.059)		
Observations	219	219	217	219	219	219	219	90	129
R-squared	0.005	0.008	0.020	0.010	0.010	0.011	0.018	0.012	0.020
Adjusted R^2	0.000	-0.001	0.001	-0.008	-0.013	-0.017	-0.019	-0.059	-0.028
F-statistic	1.000	1.000	217.000	0.882	2.000	216.000	1.077	4.000	212.000
F-test p-value	0.318	0.415	0.369	0.695	0.814	0.894	0.862	0.983	0.871

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for FOMC Decisions and Implied Volatility. Note that the subscript t-1 refers to the volatility of the preceding day rather than the volatility of the previous meeting day. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (1–9). Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 12: Results for FOMC Minutes and Realized Volatility

	Dependent variable: Realized Volatility								
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SH_t	−0.166	−0.019	0.051	−0.016	−0.014	−0.024	−0.025	0.049	−0.050
	(0.102)	(0.044)	(0.050)	(0.044)	(0.044)	(0.045)	(0.072)	(0.072)	(0.046)
$\sigma^2{}_{t-1}$		0.593^{***}	0.558^{***}	0.584^{***}	0.580^{***}	0.567^{***}	0.555^{***}	0.616^{***}	0.332^{***}
		(0.104)	(0.099)	(0.104)	(0.110)	(0.115)	(0.107)	(0.120)	(0.087)
SS_t			-0.119^{**}						
			(0.054)						
SU_t			−0.040						
			(0.041)						
U_{CPI_t}				0.108	0.119	0.128	0.157^{*}	0.137	0.155
				(0.093)	(0.096)	(0.096)	(0.094)	(0.245)	(0.104)
U_{GDP_t}				0.002	0.003	0.010	0.022	0.451	0.044
				(0.049)	(0.050)	(0.051)	(0.050)	(0.287)	(0.062)
R_t					0.025	0.014	−0.041	−0.121	0.093
					(0.060)	(0.060)	(0.066)	(0.112)	(0.081)
W_t						−0.00002	0.00002	0.00004	−0.00003
						(0.00002)	(0.00002)	(0.00003)	(0.00003)
SH_tB_t							−0.023		
							(0.090)		
Observations	249	249	249	249	249	249	249	121	128
R-squared	0.039	0.418	0.432	0.422	0.422	0.424	0.443	0.501	0.305
Adjusted R^2	0.035	0.414	0.423	0.412	0.410	0.410	0.425	0.474	0.271
F-statistic	10.007	1.000	247.000	88.425	2.000	246.000	46.388	4.000	244.000
F-test p-value	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for FOMC Minutes and Realized Volatility. Note that the subscript t-1 refers to the volatility of the preceding day rather than the volatility of the previous meeting day. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (1–9). Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 13: Results for FOMC Minutes and Implied Volatility

	Dependent variable: Implied Volatility								
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SH_t	0.589*	0.584*	0.521	0.566*	0.633*	0.597*	0.422	0.309	0.568
	(0.320)	(0.322)	(0.411)	(0.328)	(0.331)	(0.338)	(0.461)	(0.489)	(0.537)
Δv_{t-1}		−0.013	−0.013	−0.011	−0.008	−0.007	−0.004	−0.028	0.044
		(0.062)	(0.062)	(0.062)	(0.062)	(0.062)	(0.063)	(0.088)	(0.090)
SS_t			0.144						
			(0.407)						
SU_t			−0.210						
			(0.325)						
U_{CPI_t}				−0.367	−0.131	−0.105	−0.089	−3.124**	1.547
				(0.702)	(0.725)	(0.728)	(0.734)	(1.319)	(0.942)
U_{GDP_t}				−0.008	−0.009	0.013	0.038	1.086	−0.147
				(0.334)	(0.333)	(0.336)	(0.338)	(1.564)	(0.361)
R_t					0.607	0.539	0.470	−0.158	−0.409
					(0.478)	(0.495)	(0.522)	(0.712)	(0.992)
W_t						−0.0001	−0.00003	−0.00001	0.00002
						(0.0001)	(0.0002)	(0.0002)	(0.0003)
SH_tB_t							0.341		
							(0.669)		
Observations	249	249	249	249	249	249	249	121	128
R-squared	0.014	0.014	0.016	0.015	0.021	0.023	0.025	0.069	0.038
Adjusted R^2	0.010	0.006	-0.000	-0.001	0.001	-0.002	-0.007	0.020	-0.010
F-statistic	3.383	1.000	247.000	1.708	2.000	246.000	0.982	4.000	244.000
F-test p-value	0.067	0.183	0.418	0.453	0.384	0.475	0.623	0.218	0.580

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for FOMC Minutes and Implied Volatility. Note that the subscript t-1 refers to the volatility of the preceding day rather than the volatility of the previous meeting day. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (1–9). Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 14: Results for ECB Decisions and Realized Volatility

	Dependent variable: Realized Volatility								
Model	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Finance	−1.190	−1.565	0.967	−1.854	−2.103	−1.791	−40.271***	−35.118***	−1.744
	(4.367)	(3.355)	(1.996)	(3.675)	(3.430)	(3.118)	(7.211)	(12.263)	(2.895)
Global	−11.524	−10.616	−17.503***	−10.086	−9.958	−9.748	−0.719	-	−3.173
	(12.891)	(7.898)	(5.186)	(7.445)	(7.108)	(7.871)	(4.485)	-	(3.675)
Growth	4.051	3.484	3.200*	3.005	2.990	1.831	2.193	-	2.867
	(2.694)	(2.204)	(1.899)	(2.158)	(2.281)	(1.608)	(2.113)	-	(2.037)
Policy	−0.313**	−0.103	−1.397*	−0.107	−0.109	−0.111	−0.031	−0.130	−0.588**
	(0.147)	(0.092)	(0.710)	(0.083)	(0.083)	(0.084)	(0.095)	(0.085)	(0.228)
Other	8.210	8.964	12.588*	9.585	9.450	8.738	9.708	-	10.521
	(5.898)	(5.608)	(7.084)	(5.951)	(6.979)	(5.918)	(7.036)	-	(6.880)
Prices	−0.768	−0.528	0.698	−0.416	−0.240	−0.295	0.152	-	0.092
	(0.643)	(0.425)	(0.697)	(0.463)	(0.428)	(0.520)	(0.516)	-	(0.483)
FinanceB_t							38.181***		
							(6.020)		
PolicyB_t							−0.511*		
							(0.277)		
GlobalB_t							-		
							-		
GrowthB_t							-		
							-		
OtherB_t							-		
							-		
PricesB_t							-		
							-		
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	207	207	61	207	206	206	206	104	102
R-squared	0.145	0.386	0.672	0.400	0.410	0.416	0.474	0.557	0.440
Adjusted R^2	0.120	0.365	0.614	0.372	0.380	0.383	0.435	0.525	0.371
F-statistic	5.660	6.000	200.000	17.896	7.000	199.000	11.597	9.000	51.000
F-test p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for ECB Decisions and Realized Volatility. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (10–18). Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 15: Results for ECB Decisions and Implied Volatility

	Dependent variable: Implied Volatility								
Model	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Finance	−0.809	−0.914	−14.325	−13.296	−14.673	−15.124	−39.634	−42.626	−20.124**
	(8.093)	(8.097)	(10.999)	(10.625)	(9.773)	(10.655)	(44.585)	(34.865)	(10.095)
Global	−86.811***	−86.829***	−122.821***	−68.786***	−66.563**	−67.303**	−88.832	−39.376	−17.617
	(19.626)	(19.633)	(27.487)	(23.616)	(26.722)	(28.166)	(62.173)	(70.476)	(15.393)
Growth	−15.589	−15.038	−2.942	−30.366**	−30.328***	−29.210**	−20.108	-	−15.434**
	(11.107)	(11.129)	(13.155)	(12.649)	(8.954)	(11.939)	(14.774)	-	(6.531)
Policy	−0.452	−0.457	0.271	−0.505	−0.457	−0.461	−0.513	−0.482	−0.650
	(0.421)	(0.421)	(1.452)	(0.463)	(0.467)	(0.491)	(0.485)	(0.485)	(1.306)
Other	−0.152	−0.992	1.982	8.783	9.121	9.310	23.565	-	24.256
	(14.630)	(14.666)	(17.182)	(15.711)	(16.171)	(15.876)	(18.959)	-	(17.929)
Prices	4.812	5.092	8.937*	9.301**	10.238***	10.470**	9.396*	-	9.294**
	(3.846)	(3.860)	(4.711)	(4.336)	(3.827)	(4.431)	(4.952)	-	(4.664)
FinanceB_t							19.472		
							(44.812)		
GlobalB_t							71.225		
							(68.132)		
GrowthB_t							-		
							-		
PolicyB_t							−0.074		
							(1.368)		
OtherB_t							-		
							-		
PricesB_t							-		
							-		
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	295	295	71	259	258	258	258	157	101
R-squared	0.084	0.086	0.323	0.123	0.136	0.136	0.187	0.183	0.130
Adjusted R^2	0.065	0.064	0.223	0.091	0.101	0.098	0.137	0.138	0.022
F-statistic	4.388	6.000	288.000	3.872	7.000	287.000	3.227	9.000	61.000
F-test p-value	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.294

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for ECB Decisions and Implied Volatility. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (10–18). Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 16: Results for ECB Minutes and Realized Volatility

	Dependent variable: Realized Volatility					
Model	(10)	(11)	(12)	(13)	(14)	(15)
Finance	−0.430	0.435	0.536	0.674	0.148	−0.323
	(1.842)	(1.420)	(1.439)	(1.523)	(1.547)	(1.591)
Global	−2.470	−0.923	−0.945	−0.650	−1.203	−1.634
	(2.276)	(1.762)	(1.751)	(1.889)	(1.905)	(1.932)
Growth	0.188	0.272	0.301	0.372	0.211	−0.056
	(1.093)	(0.840)	(0.841)	(0.894)	(0.892)	(0.916)
Policy	−1.522	−0.262	−0.111	0.027	−0.552	−1.005
	(2.123)	(1.640)	(1.645)	(1.770)	(1.794)	(1.827)
Other	−0.330	0.233	0.275	0.411	−0.033	−0.413
	(1.431)	(1.102)	(1.116)	(1.168)	(1.193)	(1.230)
Controls	No	Yes	Yes	Yes	Yes	Yes
Observations	80	80	80	80	80	80
R-squared	0.091	0.471	0.502	0.473	0.490	0.501
Adjusted R^2	0.030	0.427	0.446	0.414	0.425	0.429
F-statistic	1.482	5.000	74.000	10.825	6.000	73.000
F-test p-value	0.206	0.000	0.000	0.000	0.000	0.000

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for ECB Minutes and Realized Volatility. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (10–18). The topic 'Prices' is omitted due to an insufficient number of observations. Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 17: Results for ECB Minutes and Implied Volatility

	Dependent variable: Implied Volatility					
Model	(10)	(11)	(12)	(13)	(14)	(15)
Finance	19.985	15.037	20.146	11.297	13.970	29.439
	(37.797)	(36.633)	(37.280)	(35.798)	(36.477)	(37.604)
Global	20.333	12.199	16.230	5.903	8.816	23.768
	(44.936)	(43.618)	(44.105)	(42.572)	(43.293)	(44.050)
Growth	3.379	0.043	1.959	−12.025	−12.306	3.449
	(33.477)	(32.424)	(32.711)	(34.917)	(35.141)	(36.391)
Policy	18.187	12.053	16.425	7.652	10.710	26.205
	(43.366)	(42.043)	(42.598)	(40.973)	(41.749)	(42.650)
Other	7.959	3.129	6.915	−0.160	1.941	14.564
	(27.566)	(26.753)	(27.253)	(26.243)	(26.789)	(27.865)
Controls	No	Yes	Yes	Yes	Yes	Yes
N	72	72	72	72	72	72
R-squared	0.049	0.123	0.138	0.206	0.209	0.236
Adjusted R^2	-0.023	0.042	0.028	0.105	0.094	0.111
F-statistic	0.681	5.000	66.000	1.522	6.000	65.000
F-test p-value	0.640	0.185	0.281	0.056	0.083	0.065

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for ECB Minutes and Implied Volatility. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (10–18). The topic 'Prices' is omitted due to an insufficient number of observations. Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 18: Results for FOMC Decisions and Realized Volatility

	Dependent variable: Realized Volatility								
Model	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Finance	−1.165	−0.710	−0.839	−0.872*	−0.989**	−1.038**	−0.807	−1.302*	−2.299*
	(0.956)	(0.456)	(0.572)	(0.449)	(0.464)	(0.485)	(0.643)	(0.731)	(1.239)
Global	1.108	0.624	0.027	0.676	0.618	0.618	−0.096	0.220	3.801**
	(1.390)	(1.012)	(1.240)	(0.708)	(0.713)	(0.712)	(0.866)	(1.025)	(1.874)
Growth	0.043	0.423**	0.420**	0.521***	0.550***	0.562***	0.578**	0.468**	1.514***
	(0.224)	(0.171)	(0.179)	(0.169)	(0.177)	(0.178)	(0.229)	(0.211)	(0.381)
Policy	−0.356*	−0.369**	−0.244	−0.384**	−0.420**	−0.422**	−0.379**	−0.450***	−1.845**
	(0.202)	(0.173)	(0.184)	(0.168)	(0.177)	(0.177)	(0.186)	(0.154)	(0.772)
Other	0.041	0.879	0.517	0.950	0.898	0.908	1.071	1.261	−0.591
	(1.073)	(0.770)	(0.713)	(0.709)	(0.736)	(0.731)	(0.851)	(0.827)	(1.725)
FinanceB_t							−1.352		
							(1.393)		
GlobalB_t							3.760		
							(2.588)		
GrowthB_t							0.925*		
							(0.494)		
PolicyB_t							−1.411*		
							(0.731)		
OtherB_t							−2.116		
							(2.077)		
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	219	219	217	219	219	219	219	90	129
R-squared	0.048	0.481	0.511	0.512	0.517	0.518	0.543	0.519	0.658
Adjusted R^2	0.021	0.464	0.490	0.491	0.494	0.492	0.502	0.451	0.626
F-statistic	1.781	6.000	212.000	27.970	7.000	211.000	24.058	9.000	207.000
F-test p-value	0.104	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for FOMC Decisions and Implied Volatility. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (10–18). The topic 'Prices' is omitted due to an insufficient number of observations. Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 19: Results for FOMC Decisions and Implied Volatility

	Dependent variable: Implied Volatility								
Model	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Finance	1.912	1.947	3.635	1.893	1.669	1.576	−0.923	−0.054	19.675
	(5.906)	(5.908)	(6.406)	(6.006)	(6.069)	(6.170)	(7.637)	(4.958)	(14.730)
Global	−1.808	−2.088	−3.090	−2.065	−2.182	−2.173	9.253	8.603	−32.736
	(9.074)	(9.082)	(9.824)	(9.117)	(9.146)	(9.169)	(10.849)	(5.966)	(22.284)
Growth	0.424	0.494	0.417	0.349	0.408	0.425	−1.386	−1.590	6.327
	(1.653)	(1.656)	(1.663)	(1.698)	(1.714)	(1.729)	(2.139)	(1.720)	(4.616)
Policy	−0.677	−0.760	−1.075	−0.773	−0.842	−0.845	−0.926	−0.799	−6.126
	(1.500)	(1.503)	(1.556)	(1.514)	(1.536)	(1.540)	(1.598)	(2.316)	(9.116)
Other	−4.422	−4.408	−4.009	−4.344	−4.440	−4.433	−6.188	−6.631	−29.046
	(7.031)	(7.033)	(7.161)	(7.097)	(7.120)	(7.137)	(8.426)	(10.732)	(20.527)
FinanceB_t							20.284		
							(15.884)		
GlobalB_t							-40.779^{*}		
							(24.134)		
GrowthB_t							7.104		
							(4.843)		
PolicyB_t							−3.974		
							(8.728)		
OtherB_t							−20.398		
							(21.159)		
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	219	219	217	219	219	219	219	90	129
R-squared	0.016	0.020	0.031	0.022	0.022	0.022	0.061	0.047	0.067
Adjusted R^2	-0.012	-0.013	-0.011	-0.020	-0.025	-0.029	-0.023	-0.087	-0.020
F-statistic	0.564	6.000	212.000	0.609	7.000	211.000	0.734	9.000	207.000
F-test p-value	0.759	0.748	0.677	0.856	0.903	0.940	0.785	0.970	0.673

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for FOMC Decisions and Implied Volatility. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (10–18). The topic 'Prices' is omitted due to an insufficient number of observations. Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 20: Results for FOMC Minutes and Realized Volatility

	Dependent variable: Realized Volatility								
Model	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Finance	−0.544	0.159	0.139	0.174	0.190	0.111	14.826	4.610	4.077**
	(1.359)	(1.042)	(1.034)	(1.044)	(1.046)	(1.051)	(11.900)	(11.293)	(2.050)
Global	−0.253	−0.382	−0.319	−0.353	−0.350	−0.335	16.040*	0.865	−10.221**
	(0.757)	(0.579)	(0.576)	(0.581)	(0.582)	(0.582)	(8.915)	(1.729)	(4.034)
Growth	0.020	−0.777	−1.056	−0.835	−0.857	−0.788	−29.318	−8.018	−30.217**
	(1.865)	(1.429)	(1.423)	(1.432)	(1.436)	(1.439)	(20.214)	(17.080)	(12.080)
Policy	−0.813	−0.695	−0.763	−0.685	−0.698	−0.692	−14.944	−4.131	−5.703
	(1.285)	(0.984)	(0.985)	(0.985)	(0.987)	(0.988)	(9.602)	(7.688)	(4.456)
FinanceB_t							−9.646		
							(12.322)		
GlobalB_t							−27.816		
							(21.070)		
GrowthB_t							−5.583		
							(10.092)		
PolicyB_t							10.128		
							(108.912)		
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	249	249	249	249	249	249	249	121	128
R-squared	0.011	0.422	0.436	0.426	0.426	0.428	0.461	0.507	0.353
Adjusted R^2	-0.010	0.408	0.417	0.407	0.405	0.404	0.426	0.467	0.298
F-statistic	0.529	5.000	243.000	29.482	6.000	242.000	23.171	8.000	240.000
F-test p-value	0.754	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for FOMC Minutes and Realized Volatility. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (10–18). The topics 'Prices' and 'Other' are omitted due to an insufficient number of observations. Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

Table 21: Results for FOMC Minutes and Implied Volatility

	Dependent variable: Implied Volatility								
Model	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Finance	13.249	13.449	13.433	13.362	13.745*	13.282	64.278	118.032	30.725
	(8.191)	(8.219)	(8.215)	(8.249)	(8.258)	(8.291)	(95.329)	(73.991)	(22.254)
Global	−6.228	−6.323	−6.537	−6.446	−6.414	−6.333	−33.725	18.804*	−46.300
	(4.561)	(4.574)	(4.573)	(4.591)	(4.591)	(4.597)	(71.768)	(11.357)	(43.796)
Growth	−14.165	−14.440	−13.378	−14.147	−14.642	−14.233	−75.576	−176.269	−135.198
	(11.242)	(11.280)	(11.323)	(11.327)	(11.337)	(11.363)	(162.117)	(111.990)	(131.140)
Policy	−2.439	−2.622	−1.333	−2.679	−2.898	−2.824	−27.630	−77.710	36.651
	(7.746)	(7.771)	(7.834)	(7.795)	(7.798)	(7.806)	(77.061)	(50.442)	(48.483)
FinanceB_t							−36.092		
							(99.063)		
GlobalB_t							−11.475		
							(170.274)		
GrowthB_t							−55.870		
							(80.896)		
PolicyB_t							55.700		
							(872.810)		
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	249	249	249	249	249	249	249	121	128
R-squared	0.015	0.016	0.026	0.018	0.022	0.024	0.043	0.092	0.067
Adjusted R^2	-0.005	-0.009	-0.007	-0.015	-0.014	-0.016	-0.019	0.018	-0.013
F-statistic	0.748	5.000	243.000	0.651	6.000	242.000	0.789	8.000	240.000
F-test p-value	0.588	0.690	0.612	0.813	0.791	0.815	0.792	0.272	0.595

Notes: *p<0.1; **p<0.05; ***p<0.01

This table presents the regression results for FOMC Minutes and Implied Volatility. The progression of models across columns reflects the inclusion of additional control variables, as indicated in the "Controls" row. Columns without control variables are labeled "No," while those with added controls are labeled "Yes." The specific controls align with those outlined in Equations (10–18). The topics 'Prices' and 'Other' are omitted due to an insufficient number of observations. Standard errors, reported in parentheses, are adjusted for autocorrelation and heteroskedasticity based on the results of the respective tests, which are detailed in Table 5 in Appendix B.

APPENDIX 3: Official statement of original BACHELOR thesis

By signing this statement, I hereby acknowledge the submitted thesis (hereafter mentioned as "product"), titled:

Effects of Central Bank Communication on the Stock Market Volatility

to be produced independently by me, without external help.

Wherever I paraphrase or cite literally, a reference to the original source (journal, book, report, internet, etc.) is given.

By signing this statement, I explicitly declare that I am aware of the fraud sanctions as stated in the Education and Examination Regulations (EERs) of the SBE.

Place:	Maastricht
Date:	20/01/2025
First and last name:	Viktória Račková
Study programme:	Bachelor Economics and Business Economics
EBT Code:	2425-EBT0015
ID number:	i6306896
Signature:	Račková