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5. Doh, Taeyoung and Song, Dongho and Yang, Shu-Kuei X, Deciphering Federal Reserve Communication via Text Analysis of Alternative FOMC Statements (June 10, 2022). Federal Reserve Bank of Kansas City Working Paper Forthcoming, Available at SSRN: https://ssrn.com/abstract=4135736 or http://dx.doi.org/10.2139/ssrn.4135736
6. **The impact of announcement days on the Vix**
7. Federal Reserve Communication and the Covid-19 Pandemic. *CEPR Press*
8. **CFA Institute Machine Learning and FOMC Statements**

Source 1: Suggested approach for Fed text analysis using NLP: ***Aruoba & Dreschel, 2020***

1. Remove stop words, numbers that are not forecasts, and "erroneous words"
2. Retrieve singles, doubles, and triples (joint expressions not interrupted by stop words)

double and triple occurs for each meeting date and each document.

Figure 1: ECONOMIC CONCEPTS MENTIONED FREQUENTLY IN FOMC DOCUMENTS

Notes. Word cloud of the 75 most frequently mentioned economic concepts in documents prepared by Federal Reserve Board economists for FOMC meetings between 1982 and 2016. The size of concept reflects the frequency with which it occurs across the documents.

3. Calculate frequency of singles doubles and triples
4. Select singles doubles and triples that are economic concepts
5. Selection algorithm described in Appendix A
6. For each economic concept, capture the sentiment associated with it, following the algorithm developed by Hasan, Volander, van Lent (2020), where each of the 10 words mentioned before and after each economic term are associated with positive or negative sentiment
    a. Can check robustness by completing analysis within a 5 word window instead of a 10 word window
7. Sentiment dictionary used: Loughran-McDonald :https://sraf.nd.edu/loughranmcdonald-master-dictionary/

8. Each positive word adds +1 to the sentiment, each negative word adds -1 to the sentiment of each concept

Figure 2: SELECTED SENTIMENT INDICATORS

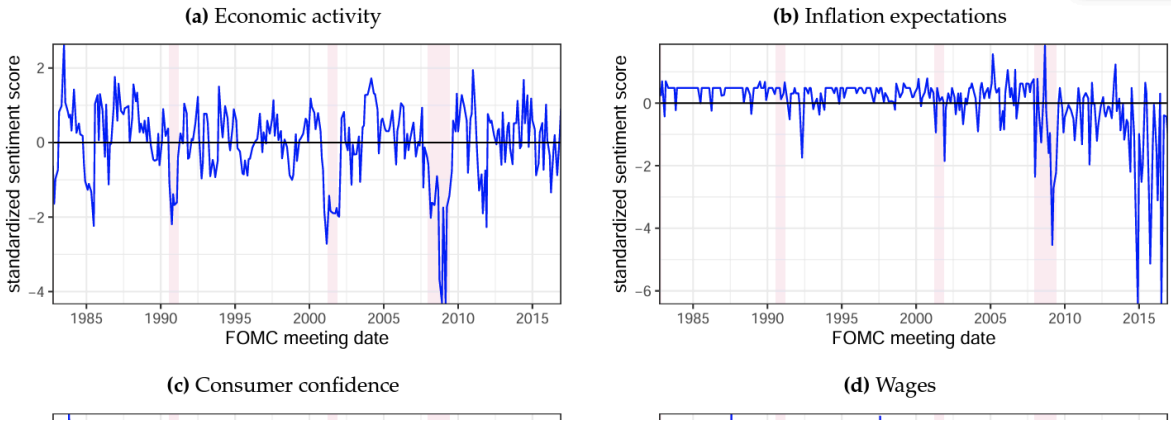


Table 1: EXAMPLES OF WORDS ASSOCIATED WITH POSITIVE AND NEGATIVE SENTIMENT

Positive sentiment	Negative sentiment
adequate	adversely
advantage	aggravate
benefit	bad
boost	burdensome
confident	collapse
conducive	concerning
desirable	decline
diligent	deficient
encouraging	eroded
excellent	exacerbate
...	...

Notes. Selected examples of words that are classified as expressing positive or negative sentiments in our improved version of the dictionary of Loughran and McDonald (2011). The total number of classified words is 2,882.

Source 2:

Source 6: [The impact of announcement days on the Vix]

- Analyzes variation in the VIX scores and macroeconomic announcement
- On days where the FOMC and employment announcements are published, the change in the VIX is on average negative
- Decreasing effect on the VIX for PPI and CPI announcements
- The impact of FOMC and employment is independent of good and bad announcements

- Overall, findings are in line with the definition of Vix as measure for uncertainty

  Empirical Strategy: 2 step model specification

  Specification 1
    - Control for confounding effects by including seasonal dummy variables to consider weekday and holiday effect

  Specification 2
- Regress remaining variation on the VIX changes on different macroeconomic announcement days
- Overall days where there is FOMC announcement, changes in VIX on average negative

The VIX is calculated as the following:

$$\sigma^2 = \frac{2}{T}\sum_i \frac{\Delta K_i}{K_i^2} e^{RT} Q(K_i) - \frac{1}{T}\left[\frac{F}{K_o} - 1\right]^2 \quad (1)$$

Econometric Approach

$$ln(VIX_t/VIX_{t-1}) = \beta_1 ln(RETURN_t) + \beta_2 ln(\Delta VOL_t) + \beta_3 D_t + \beta_4 Q_t + \epsilon_t \quad (2)$$

Results: Summary Stats

10% confidence level.

VIX change:	Full sample	FOMC	Employm.	CPI	PPI
Observations	3024	104	140	142	144
Negative changes	1380	69	98	79	75
Positive changes	1626	34	41	61	68
Negative changes(%)	0.4600	0.6700	0.7050	0.5640	0.5244
Absolute changes					
Mean	0.0022	-0.6670***	-0.2630**	-0.1179	-0.0072
Std. dev.	1.8006	2.0550	1.5697	1.7820	1.8774
Max	16.54	4.46	8.15	11.09	14.12
Min	-17.36	-12.94	-7.58	-4.89	-6.45
Percentage changes					
Mean	0.0001	-0.0320***	-0.0170***	-0.0075	-0.0033
Std. dev.	0.0690	0.0807	0.0631	0.0696	0.0699
Max	0.49	0.17	0.23	0.30	0.23
Min	-0.35	-0.31	-0.20	-0.21	-0.26

Source 7: Market Responses to Central Bank Speeches

- Findings: News in central bank speeches can help explain volatility and tail risk
- Use fed official's public speeches
- Researchers have paid only limited attention to speeches
    - Central banker speeches occur at much higher frequency compared to FOMC statements
    -

Text analysis for monetary policy

- Utilizing word count methods
- To identify news content of a speech, control for market expectations
- **Define news shock as:** difference between a speech implied forecast revision and the most recent Survey of Professional Forecasters forecast measure available at time of speech

Multimodal NLP Framework

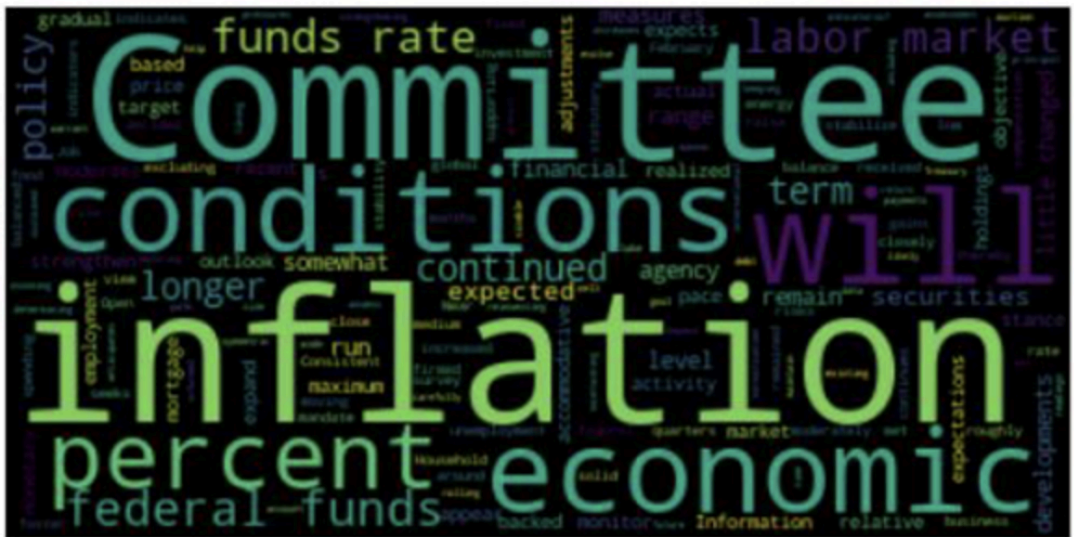
- Use word cloud
- Represent word clouds as term-document matrix
- Vector representation of tokens

Source 8 : CFA Institute Machine Learning and FOMC Statements

Loughran McDonaled Sentimet lexicon for financial documents

- Shortcoming: sentiment scores only assess words, not sentences
    - To address issues, train BERT and XLNet models to analyze statements on sentence by sentence basis
- Before sentiment scores, construct word clouds to visualize frequency/importance of particular words in FOMC statements

Word Cloud: March 2017 FOMC Statement



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Sentiment Score = (Positive Sentences – Negative Sentences) / (Positive Sentences + Negative Sentences)

Literature Review

Through the extraction and textual analysis from FOMC statements by Jerome Powell and analyzing their sentiment, we can hope to better understand the underlying dynamics between the changes in the sentiment of speeches of federal reserve officials and stock market volatility.

Expand and extend pre-existing literature on the impact of a announcement days on the VIX

Stock markets around macroeconomic announcements

- **-**

Text Analysis for Monetary Policy

file:///Users/inesperezalvarez-pallete/Downloads/SSRN-id4471242.pdf

- Burgeoning field of research

Federal Reserve Speech and Forecast Data