**Federal Open Market Committee’s Linguistic Indicators: From Recession to Expansion**

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3/23/2021

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**ABSTRACT**

Previous research has criticized the United States Federal Reserve Open Market Committee (FOMC) for slow and ineffective monetary responses to economic crises using the FOMC’s vague language as evidence of faulty economic research. Using sentiment analysis and text classification, this paper finds that the Federal Reserve Open Market Committee’s language effectively identifies macroeconomic trends, but their language remains relatively vague and non-committal.

**KEYWORDS:** Federal Reserve, Macroeconomics, Textual Analysis

**INTRODUCTION**

The United States Federal Reserve Open Market Committee (FOMC) meets every six weeks to discuss the monetary supply of the economy, inflationary trends and potential decisions to stabilize the economy, releasing “minutes” of their meeting that summarize their discussion. However, with the Federal Funds Rate remaining at nearly zero for the majority of the past decade and inflation below their declared annual 2% goal (Sims & Wu, 2020) the FOMC has increasingly become a target for criticism due to the FOMC’s slow and ineffective responses to economic pressures (Powell & Wessel, 2020). Additionally, critics of the FOMC use the FOMC minutes’ language and word choice as evidence of their inefficient and mislocated policy focus as they claim the minutes typically reinforce and restate what every observer already knows (Murray, 2019).

This study attempts to identify whether this criticism is justified by determining the extent to which the FOMC’s minutes mirror macroeconomic trends. Additionally, we wish to ascertain the FOMC’s language that distinguishes pre- and post-crisis FOMC minutes. A difference in language following a recession would indicate new priorities and responsibilities for the FOMC. This analysis enables us to measure the ability of the FOMC to identify and research the United States’ economic reality. Additionally, if the FOMC’s linguistic sentiment in their minutes does not match United States’ macroeconomic trends, the FOMC may not respond sufficiently to a crisis or an expansion.

**DATA**

The data for this analysis consists of United States macroeconomic data publicly available from the Federal Reserve Bank of St. Louis and the plain text of the FOMC’s meeting minutes which are also publicly available on the Federal Reserve’s website. The macroeconomic data includes the United States’ gross domestic product, unemployment, gross investment, consumer price index, and federal funds rate. All of this data is collected in six week increments from January 1993 to January 2021 in order to match economic data with each FOMC meeting.

**Fig. 1. Summary Statistics of Macroeconomic Data**

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Fig. 1. N=338. All data is measured in six-week increments. Inflation, GDP, and Gross Investment are all measured in percent change compared to a year prior. Interest rate is the Federal Funds Rate set by the FOMC. UNRATE refers to the unemployment rate of the United States’ labor force.

The plain text of the FOMC’s minutes consists of 225 text files spanning 28 years of FOMC meetings. Additionally, stop words such as names, numbers or common lexical language like “the”, “and”, or “of” are removed from the data in order to increase the unique information stored in each line of data. The average length of each text is around 8,000-9,000 words providing nearly 2,000,000 words in total with 2,697 distinct words.

All of the data used for this project can be obtained for replication purposes on our GitHub repo located in the appendix of this project.

**METHODS**

We isolate two methods that will be used to analyze the FOMC’s language and compare it to the macroeconomic environment to which they are reacting.

First, we use a classification model through the Sklearn python package that identifies the language which distinguishes pre- and post-2008 financial crisis FOMC minutes (Boisberranger et al., 2021). To accomplish this task, the classification model selects training and testing sets of texts, creates a document-term matrix, counting the use of each word in every single text, and then, uses logistic regression to predict which texts are or are not from after the 2008 Financial Crisis. Therefore, words that are highly weighted in the logistic regression indicate that a text comes from before the 2008 Financial Crisis while words that have a low weighting would indicate the opposite. Using the classification model’s weighting, we can identify how the FOMC’s language changed during the 2008 financial crisis and the United States’ recovery from recession. For example, if words pertaining to inflationary policy have a lower weighting in the classification model’s logistic regression, then language pertaining to inflationary policy would be comparatively more likely to occur after the 2008 Financial Crisis.

Second, we use sentiment analysis to provide a score to each line of the Fed Minutes, and using an ordinary least squares linear model, we compare how the FOMC’s sentiment is affected by macroeconomic conditions. We use two dictionary-based sentiment analysis libraries, specifically made for analyzing financial and economic language. These are the Harvard IV-4 (HIV-4) Dictionary and the Loughran and McDonald Dictionary. The HIV-4 Dictionary began in the mid 1990s using United States National Science Foundation grants to accelerate natural language processing studies, but today, their sentiment analysis tools focus on categorization of texts into topics with unique domain language such as economics, politics or biology (Harvard General Inquirer, n.d.). In each domain, words have different sentiment scoring based on how they are likely used. Additionally, while some sentiment analysis tools analyze each word independently, the HIV-4 focuses on distinguishing meaning based on multiple word phrases that are domain specific. For example, single word sentiment analysis dictionaries may score a phrase such as “increasing gross domestic product” as negative due to the presence of the word “gross” while HIV-4 scores this phrase as overwhelmingly positive because of its domain-based dictionary and multiple word capacity. Similarly, the Loughran and Macdonald sentiment dictionary also focuses on multiple word statements, but unlike the HIV-4, Tim Loughran and Bill McDonald, while researching finance and textual analysis at Notre Dame University, created this dictionary to focus primarily on financial and economic words and phrases. Figure 2 shows the summary statistics of both dictionaries’ scoring. It is important to note that while both dictionaries have the same range from -1 to 1, they have significantly different means and standard deviations. 75% of HIV-4 scores remain above 0.33 with much lower variance than Loughran-McDonald scores.

**Figure 2. Summary Statistics of Sentiment Scores**

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Fig. 2. N = 9828. The interquartile range of Loughran-McDonald scores is about 3 times larger than the HIV-4 scores, representing a much wider distribution.

Using both of these scoring methods, we will use the sentiment scores as the dependent variable in a ordinary least squares linear regression model with the macroeconomic variables outlined in the data section acting as the independent variables. We choose to use an OLS model due to largely constant variance of the residual across varying sentiment scores.

**RESULTS**

The classification model yields statistically significant results in identifying words that distinguish pre- and post-2008 financial crisis FOMC minutes. Figures 1 and 2 show which words had the highest and lowest weighting, respectively, in the logistic regression of the classification model. As is shown, the presence of words such as “securities”, “liquidity”, and “credit” all indicate that a text is coming from a post-2008 FOMC minutes due to their low weighting in the logistic regression while the presence of words such as “gains”, “output”, “pace” and “expansion” are all indicative of a pre-2008 FOMC minutes due to their high logistic regression. This drastic difference in language shows the FOMC’s shifting priorities from the management of traditional business cycle volatility in pre-2008 FOMC minutes to the stability of asset prices and injection of liquidity into financial institutions.

Additionally, the only texts that are consistently misidentified by the classification model come from 2007 or 2008 which indicates the FOMC’s shifting rhetoric as the reality of the financial crisis became clear. Because the FOMC had to quickly react to a changing financial landscape, their language in minutes from 2007 may be similar to language that the FOMC used to describe the post-2008 macroeconomic trends.

**Fig. 3. LR’s Highest Weighted Words Fig. 4. LR’s Lowest Weighted Words**

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Fig. 4. A low weighting indicates that the presence of a words is more likely in a post-2008 FOMC minutes.

Fig. 3. “FEAT” is the word that is receiving a weighting. A high weighting indicates that the presence of a word is more likely in a pre-2008 FOMC minutes.

The regressions using sentiment scoring and macroeconomic data also yield significant results, but the magnitude of the associations are interesting. Figures 4 and 5 show the regression tables using Loughran-McDonald scores as the dependent variable and HIV-4 scores as the dependent variable, respectively.

**Fig. 5. Regression Results using Loughran-McDonald Dictionary**

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Signif. Codes:0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ‘ 1

Fig. 5. Each “coef” is the coefficient in OLS regression pertaining to a specific variable. The final two columns provide the 95% confidence interval centered on the “coef” value with the given “std err” provided in column 2.

**Fig. 6. Regression Results using HIV-4 Dictionary**

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Fig. 6. The standard errors when using HIV-4 scores as the dependent variables are much smaller than when scoring with the LM dictionary. As fig. 2. Showed above, the variance of the LM scores is much larger than the variance of the HIV-4 scores, so this is likely the cause of this change.

The Loughran-McDonald scores have a few interesting results. First, unemployment rate is not significantly associated with a higher or lower L.-M. score. Additionally, GDP is negatively associated with L.-M. score which is definitively the most surprising result from this analysis. GDP is strongly positively associated with inflation (Appendix 1.), which only reinforces the negative sentiment pressures as the economy is in an expansionary period. Nevertheless, it shows the FOMC’s focus which is primarily on monetary issues such as inflation and interest rates rather than gross output. The regression results with Loughran-McDonald scores as the dependent variable do have similarities with the regression using HIV-4 scores as the dependent variable, with variables such as interest rates and gross investment having similar coefficients in the regression results.

The results using the HIV-4 scores are all significant except for GDP, again reinforcing the unimportance of gross output to the FOMC’s decision making. Instead, inflation is a major focus of the FOMC, using the Federal Funds Rate to keep it under control. Accordingly, in the HIV-4 model, inflation is negatively associated with HIV-4 sentiment scores, but interest rates are positively associated with HIV-4 sentiment scores because the FOMC will raise interest rates when they feel the economy is fundamentally strong enough to manage a higher Federal Funds Rate (Powell & Wessel, 2020).

It is important to note that while many of these coefficients are statistically significant, their magnitude is not practically significant. For example, figure 1 shows interest rates have remained between 0.050 and 6.550 in the last 30 years, yet moving from the minimum to the maximum interest rate, holding all other variables constant, would only represent a sentiment change of +0.054 in the Loughran-McDonald scoring and +0.072 in the HIV-4 scoring. Both of these sentiment changes would represent less than 25% of a single standard deviation for the score distributions.

**CONCLUSION**

This study aims to highlight the changing language of the FOMC amidst a volatile macroeconomic climate, finding that the FOMC’s language has statistically changed in the aftermath of the 2008 Financial Crisis to include words pertaining to asset pricing and credit rates rather than expansionary, output-based language. Additionally, this study uses two sentiment analysis dictionaries, Loughran-McDonald and HIV-4, to compare the sentiment of FOMC minutes to United States’ macroeconomic data. We find that the FOMC’s language generally follows the direction of macroeconomic trends, but its language does not reflect the magnitude of macroeconomic trends, with the sentiment, on average, only changing slightly between recessions and expansionary periods. This indicates that, while the FOMC effectively identifies the direction of macroeconomic trends, their language does not reflect the extent of these trends with clear, emotional valence. This lack of intensity linguistically is likely why criticism has been levied on the FOMC following the 2008 Financial Crisis because their language remains largely constant with only subtle changes occurring as macroeconomic indicators change.

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**APPENDIX**

**A.1. Regression Variables Correlation Table**

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**A.2.**

**A.3. Work Division**