

The goal of this project is to train a natural language processor using AutoML techniques to predict the actions of the Federal Reserve following FOMC (Federal Open Market Committee) meetings. The available data for training consists of Meeting Minutes, which can be freely accessed on the FOMC website at the Federal Reserve Website². To classify each data set, the central bank policy change following the minutes needs to be added, which can be categorized as either a raise, hold, or decrease in policy. Additional variables can be incorporated to provide context to the Fed chair's discussion, including the inflation rate, unemployment rate, Federal Reserve Funds rate, expected Federal Reserve Funds movement (short-term Treasury Yields), stock trends, relative wages, and retail home sales. These variables are easily obtainable from the Federal Reserve of St. Louis Website³. To ensure consistency in the data and account for variations in the speaking manner of different Fed Chairs, the focus will be on the current Fed Chair, Jerome Powell. With Powell's tenure starting in 2018, there is a substantial amount of data available for analysis. The project also aims to build a model and assess its accuracy in predicting the Federal Reserve's actions in the upcoming FOMC meetings on June 13th and July 25th. With the current expectation for the Fed to pause rate increases in the coming meeting⁶, a model that could predict an alternate result would be greatly beneficial.

As the Federal Funds Rate is such a large driver of macroeconomic movement, it is difficult to quantify the enormity of its effect. To start, the Federal Funds Rate (FFR) is the main monetary policy tool of the Federal Reserve, and is how they influence the money supply through altering the interest paid between depository institutions overnight on an uncollateralized basis. The primary effect is on FFR futures, which are also known as 30-day interest rate futures. The current size of the Effective Federal Funds Volume is roughly \$132 billion, according to the Federal Reserve of St. Louis³. The Fed's ability to affect the interest on these futures loans affects the downstream interest rates of almost all facets of the economy. For example, when the FFR increases, credit card APRs also increase, which can cause more people to default on their various loans. The Fed choosing to increase their FFR also has an adverse effect on the stock market, as the higher cost to invest is thought to slow the growth potential and earnings of certain companies. Accurately predicting the next Federal Funds Target Rate would be a huge boon to any sort of investor, from institutional banks who trade for reserves, companies intending to make long-term investments, and homeowners predicting if they should put a second mortgage down on a home. In a more direct sense, predicting surprise rate increases or decreases following an FOMC meeting could lead to 8.04% alpha every FOMC meeting.

Work by Cynthia Royal Tori¹ cites that while the FOMC meeting dates account for only 4.42% of the trading days in a year, they make up over 13% of the cumulative returns over the same period. It concludes that the mean market return on the trading days contemporaneous with FOMC meetings was 5.7 times higher than non-FOMC meeting trading days during the span of 1980-2000. It also concludes that not investing on these given days results in an investor missing out on 16% of the cumulative returns between 1980 and 2000. Gospodinov and Jamali (2012)⁴ also show a surprising correlation between the FOMC and stock market returns. Namely, while the change in Federal funds target rates has a positive, albeit statistically insignificant effect on implied volatility, decomposed target rate movement has a statistically significant effect on volatility. That is, the unexpected, surprise component of rate change has a large effect on volatility. Gospodinov and Jamali attribute this to the Efficient Market Hypothesis, clarified by Rajesh Kumar⁵, who describes share prices as reflecting all new information accurately. The correlation between the surprise component in the rate change and the volatility metric indicate that investors adjust their portfolios when there is news that updates their previous thinking.

Specifically, a surprise percentage point increase in the Federal Funds rate increased the change in realized volatility by 2.80% to 8.04% depending on the surprise measure by Gospodinov and Jamali. This shows that accurately predicting a surprise movement in the FFR following an FOMC meeting could correlate to high portfolio rates of return. There is surprisingly little research to say how often markets incorrectly estimate the FOMC monetary policy action, especially given the well-known correlation between market alpha and the FOMC meeting dates. One common proxy for predicting the Federal Funds Target Rate are short term Treasury bond rates, which could theoretically be used to predict how often the market has priced the Federal Funds Target Rate incorrectly. But without more detailed hourly data provided by a stock trading API, this research will have to wait for another paper.

Project plan:

1. Aggregate useable data, clarify the desired output from the model
2. Perform EDA on dataset, split data into training, testing, and validation sets. Pre-process or clean data as needed
3. Clean up data for pre-processing across data sets and get it ready for running through a model
4. Clarify the training, evaluation, and testing sets and perform a test run of model generation to choose highest correlation variables
5. Run AutoML for NLP models, identifying strengths and weaknesses of each chosen model type. Tune hyperparameters and identify best evaluation metrics.
6. Test specific NLP models to capture best hyperparameters and model. Record evaluations and strengths of new model. Ingest most recent FOMC meeting minutes
7. Repeat process for another chosen NLP model and validate against previous models. Attempt to predict July 25th action
8. Model selection and evaluation
9. Identify weakness and strength of chosen model and fine-tune data and output.
10. Verbalize the strengths and weaknesses of chosen model as well as how it works. Explain model bias and potential overcorrection. Run prediction on newest FOMC minutes to predict Federal Reserve action
11. Save model and deploy monitoring plan for next week.
12. Review July 25th action after Powell statement. Begin writing paper explaining model process and math.
13. Finish writing Github paper and publish.

The dataset is fairly standard, in that it is available widely to the public. The Federal Reserve Open Market Committee minutes that follow the meetings are available three weeks after every meeting and policy action as a downloadable pdf or html file. This will act as my primary variable for prediction in the NLP model. Given that FOMC meetings occur (generally) every 6 weeks, this gives me three weeks after the release of the last FOMC minutes to retrain the model to predict the next FOMC action. Over

the course of these three weeks and up to the day before the FOMC, further macroeconomic data can be collected. Reworking this into a file for data ingestion will not be difficult. As for the other macroeconomic variables, they are available for wide use by the Federal Reserve Bank of St. Louis. Finally, for more financial terms such as the expected inflation rate and expected federal funds rate action, I can look at the Treasury Yields also provided by the Federal Reserve Bank of St. Louis.

I will be using a supervised, regression model to predict the outcome of FOMC meeting actions. To do this, a net sentiment score will be applied to each of the FOMC minutes, which will act as a predictor variable for a numeric response variable, representing the amount of basis points up or down or sideways the FOMC will raise or decrease the FFR.

1. Tori, C. "Federal Open Market Committee Meetings and Stock Market Performance." *Financial Services Review*, vol. 10, no. 1–4, 2001, pp. 163–171, [https://doi.org/10.1016/s1057-0810\(01\)00087-7](https://doi.org/10.1016/s1057-0810(01)00087-7).
2. "Meeting Calendars and Information." *The Fed - Meeting Calendars and Information*, www.federalreserve.gov/monetarypolicy/fomccalendars.htm. Accessed 23 May 2023.
3. "Federal Reserve Economic Data: Fred: St. Louis Fed." *FRED*, fred.stlouisfed.org/. Accessed 23 May 2023.
4. Gospodinov, Nikolay, and Ibrahim Jamali. "The Effects of Federal Funds Rate Surprises on S&P 500 Volatility and Volatility Risk Premium." *Journal of Empirical Finance*, vol. 19, no. 4, Sept. 2012, pp. 497–510, <https://doi.org/10.1016/j.jempfin.2012.04.009>.
5. Kumar, Rajesh. "Efficient Capital Markets and Its Implications." *Valuation*, 2016, pp. 73–91, <https://doi.org/10.1016/b978-0-12-802303-7.00003-6>.
6. Duggan, Wayne. "June Fed Meeting Preview: And on the Seventh Day, the FOMC Rested." *Forbes*, 23 May 2023, www.forbes.com/advisor/investing/fed-meeting-preview/.