Predicting Federal Interest Rates Based on Economic Factors

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Data Science Capstone Project - Springboard
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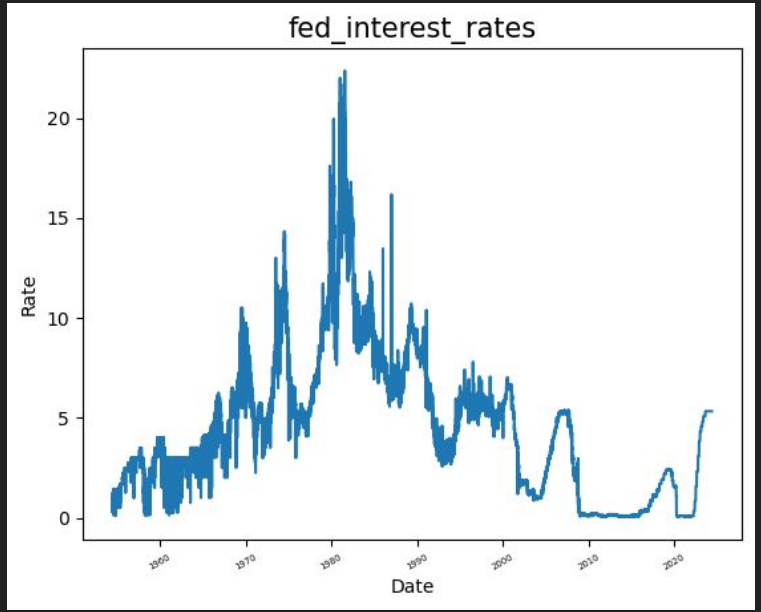
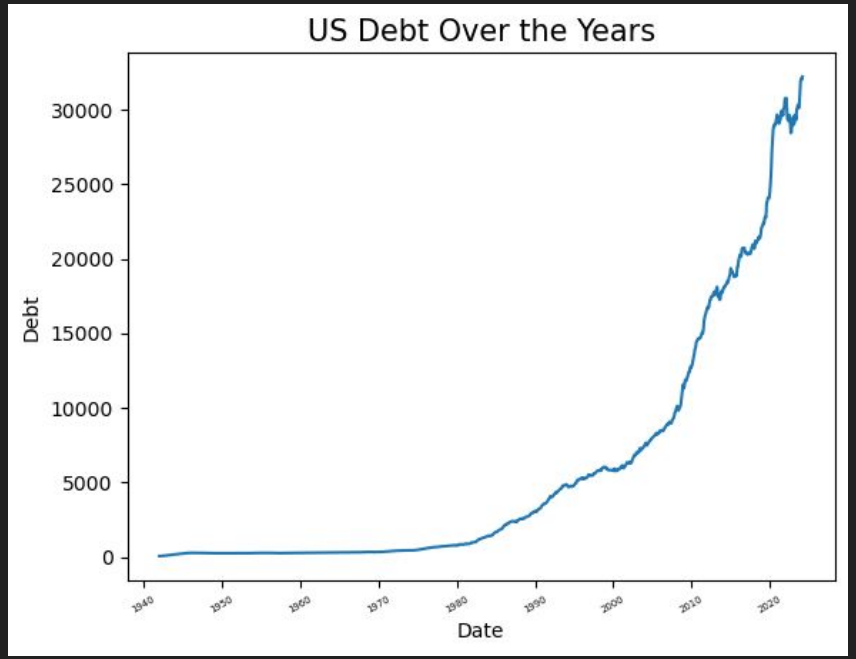
The problem

Can we predict the federal interest rates using macroeconomic factors?



What factors might affect the interest rates?

- Unemployment
- CPI
- US debt to GDP ratio
- S&P500
- Bond yield, etc



Data sources

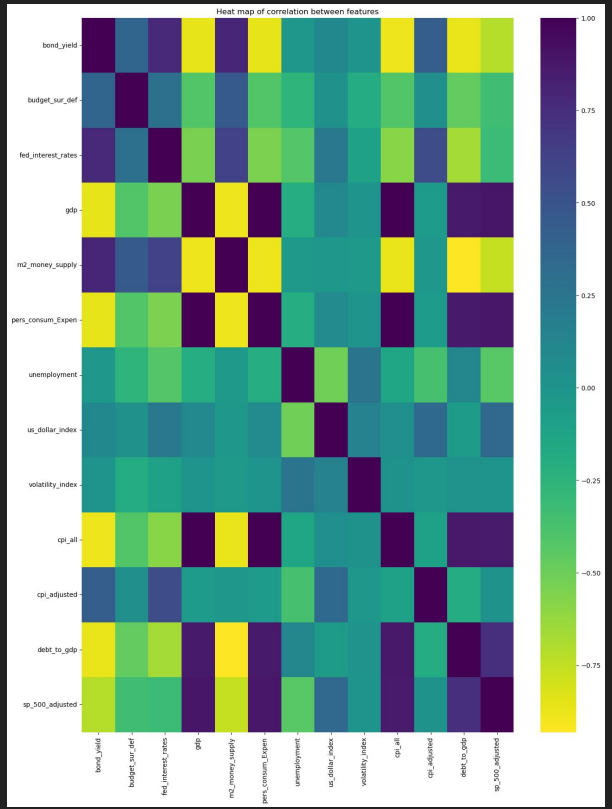
Federal Reserve Economic Data (FRED)

Data cleaning and engineering

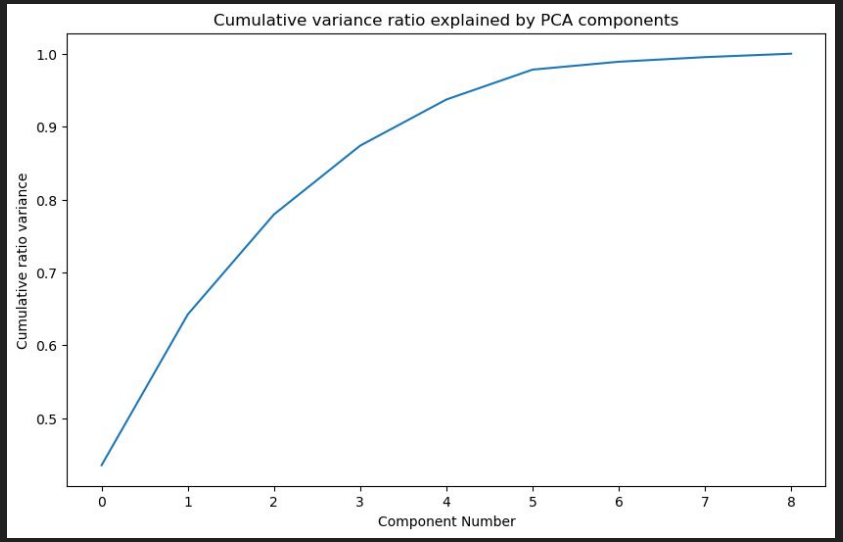
- Created new features such as US debt to GDP ratio, inflation adjusted S&P 500
- Frequency of data was different, as data was recorded weekly, monthly, or quarterly
- Imputing holiday data

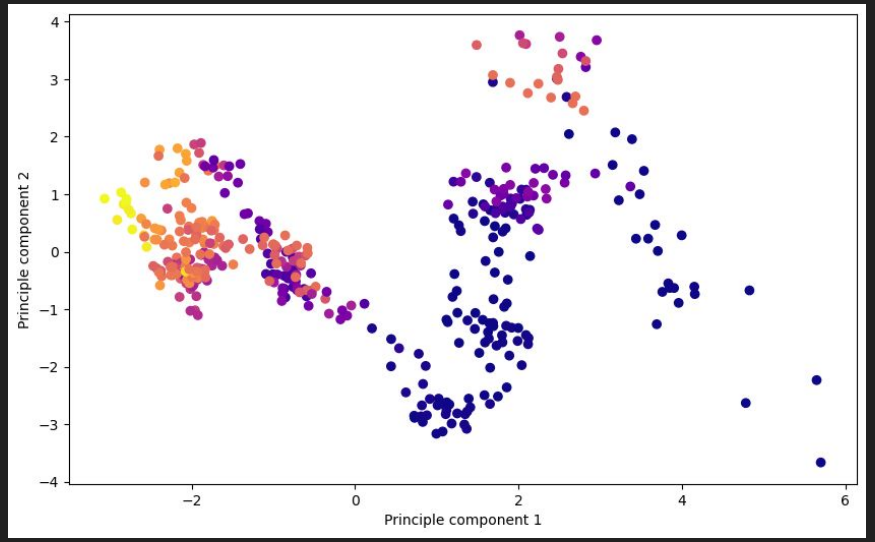
Exploratory data analysis

There were a few notable correlations. GDP, personal consumption expenditure, and S&P 500 are highly correlated with each other and also with other variables such as bond yield, m2 money supply, our debt-to-GDP ratio, and CPI.



Exploratory data analysis - Principal component analysis



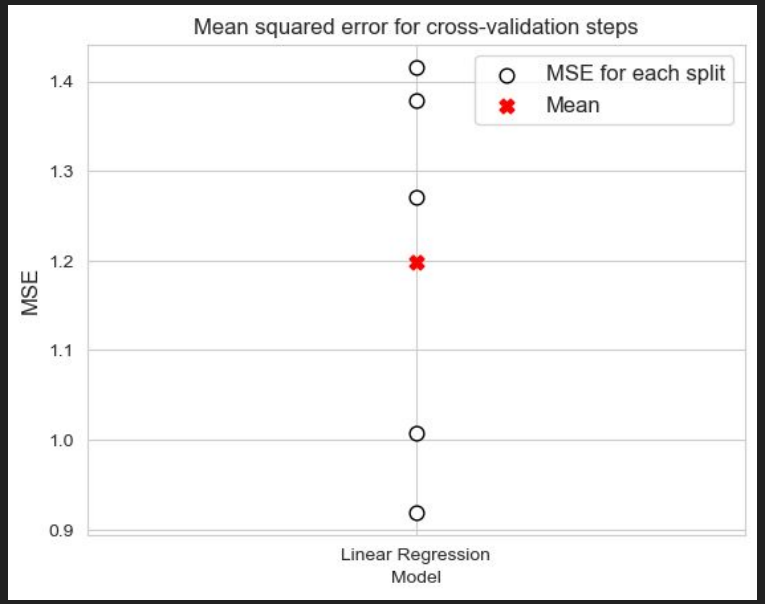


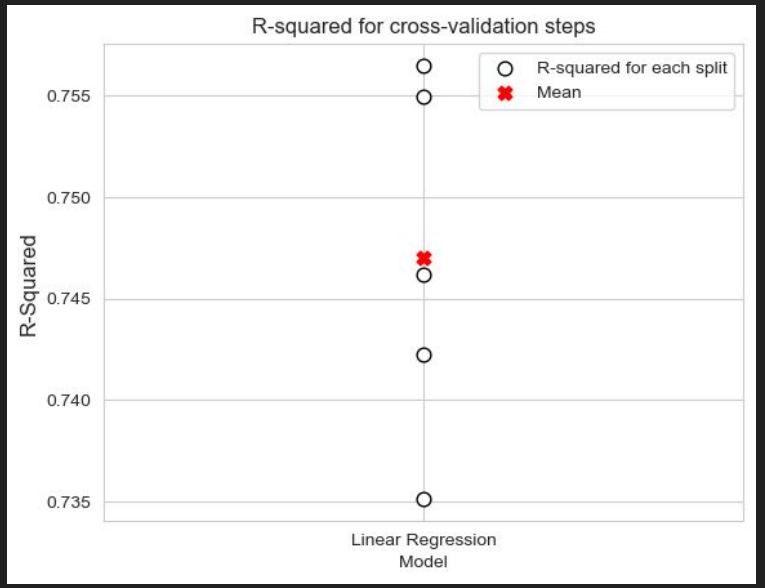
The first three components accounts for 78% of variance. There are about clear 4 clusters.

Modeling

- The dataset was split into 80-20 split
- Two models were used - Linear Regression and XGBoost
- GridsearchCV was used for hyperparameter tuning for XGBoost
- Mean squared error and R-squared were used as metrics

Model 1 - Linear Regression





The mean MSE is around 1.2, and the smallest MSE during cross-validation is 0.92.The mean R-squared is around 0.745, and the smallest R-squared during cross-validation is 0.735.

Model 2 - XGBoost

Hyperparameter tuning results

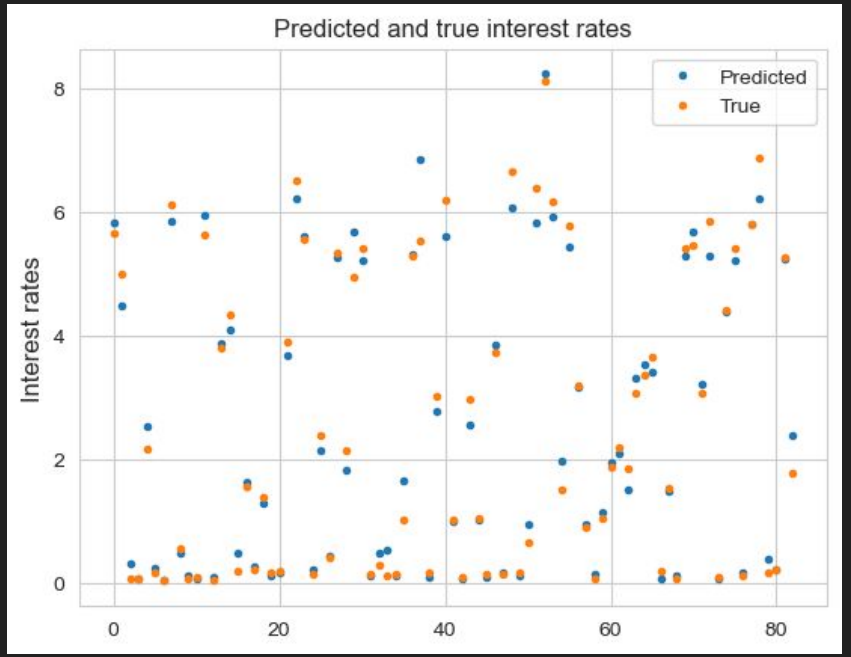
- Best MSE was 0.40
- Max depth = 5
- Colsample by tree = 0.45
- Eta = 0.1

XGBoost is the best model!

Model 2 - XGBoost

The model was tested on the test set

- MSE was 0.08
- R-squared was 0.98



Metrics table

Method	Mean Squared Error	R-Squared
LInear Regression	0.40	0.735
XGBoost	0.08	0.98

Future work

- Incorporate social media news - linguistic data
- Explore additional macroeconomic factors