
Machine Learning Engineer Nano degree Program

Federal Reserve Interest Rates

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Capstone proposal

- Domain Background

As a current student of a Master in Economics, I know how important is the Federal Reserve for the economy of the country, any decision by the Fed directly affects mortgage, credit card, or prices rising in the product that we buy. Therefore the Federal Reserve sets interest rates to promote conditions that achieve high employment, low and stable inflation, sustainable economic growth, and moderate long-term interest rates. The Fed monitors inflation indicators to manage inflation¹. When indicators rise more than 3% a year, the Fed raises the federal funds rate to keep rising prices under control.

Higher interest rates mean higher borrowing costs, so consumers and businesses borrow less and spend less. Demand for goods and services drop, and inflation falls. On the other hand, falling interest rates result when the Fed lowers the federal funds rate. Borrowing becomes cheaper and people spend more. This can end a recession².

Knowing the interest rate could help companies to decide if they invest or not, help people to get a new mortgage or help people to manage better their money.

- Problem Statement

¹ What are the Federal Reserve's objectives in conducting monetary policy?, Board of Governors of the Federal Reserve System. 15 March 2017.

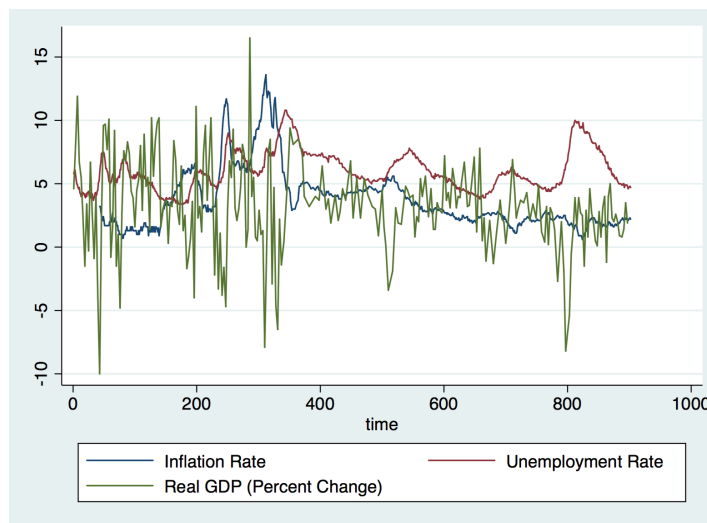
² How does monetary policy influence inflation and employment?, Board of Governors of the Federal Reserve System. 16 December 2015.

Looking at the country's unemployment data as well as gross domestic product and inflation rates you may try to predict the following Fed changes in the interest rate. This is a clear example of a regression problem, making a regression along of the variables we can try to predict the expecting interest rate.

Trying to predict the next interest rate can be beneficial for both a company and a person. This can help you make a better decision on their finances, they can invest their money or save it for a future.

- ## Datasets and Inputs

The data set for this project will be obtained from the Federal Reserve Bank of St. Louis' economic data portal. The consumer price index³ and unemployment⁴ data were provided by the US Bureau of Labor Statistics. The gross domestic product⁵ data was provided by the US Bureau of Economic Analysis. This dataset includes data on the economic conditions in the United States on a monthly basis since 1954.



³ https://fred.stlouisfed.org/graph/?g=8dGq&utm_campaign=graph&utm_content=&utm_medium=Referral&utm_source=fred.stlouisfed.org&utm_term=related_resources

⁴ <https://fred.stlouisfed.org/series/UNRATE>

⁵ <https://fred.stlouisfed.org/series/A191RL1Q225SBEA>

My predicted variable will be the interest rate, and the independent variables will be the unemployment rate, gross domestic product and the consumer price index.

	year	month	day	effectivefe	realgdpper	unemploye	inflationr	time
886	2015	12	1	.24	.	5	2.1	886
887	2015	12	16	.	.	.	.	887
888	2016	1	1	.34	.8	4.9	2.2	888
889	2016	2	1	.38	.	4.9	2.3	889
890	2016	3	1	.36	.	5	2.2	890
891	2016	4	1	.37	1.4	5	2.1	891
892	2016	5	1	.37	.	4.7	2.2	892
893	2016	6	1	.38	.	4.9	2.2	893
894	2016	7	1	.39	3.5	4.9	2.2	894
895	2016	8	1	.4	.	4.9	2.3	895
896	2016	9	1	.4	.	4.9	2.2	896
897	2016	10	1	.4	1.9	4.8	2.1	897
898	2016	11	1	.41	.	4.6	2.1	898
899	2016	12	1	.54	.	4.7	2.2	899
900	2016	12	14	.	.	.	.	900
901	2017	1	1	.65	.	4.8	2.3	901
902	2017	2	1	.66	.	4.7	2.2	902
903	2017	3	1	.	.	.	.	903
904	2017	3	16	.	.	.	.	904

$$Y_{\text{interest rate}} = B_0 + B_1 X_{\text{unemployment}} + B_2 X_{\text{consumer price index}} + B_3 X_{\text{gross domestic product}} + U_i$$

• Solution Statement

To construct the model I will use a supervised learning algorithm, a regression is the best option to predict the next interest rate. Using the consumer price index, gross domestic product and the unemployment rate as independent variables the model will predict the interest rate.

Using different supervised algorithms will be evaluated to see which one make a better prediction, the algorithms that I will test will be KNeighborsRegressor, LinearRegression, Ridge Regression and Lasso.

- **Benchmark Model**

I will use a linear regression as a benchmark, I try to beat its performance with other algorithms like lasso, Nearest Neighbors Regression, Ridge Regression and Bayesian Regression.

- **Evaluation Metrics**

To evaluate the performance of the model, I will use the r-squared to check how well the model is getting, since the highest value of the r-squared is 1 and the lowest is 0, if we got a value close to 1 that means our model is well defined and we have enough variables to predict our dependent variable.

- **Project Design**

1. Get the information from the Federal Reserve Bank of St. Louis' economic data portal.
2. Analyze the data if there are outliers or if the information needs any transformation (logarithm or exponential).
3. Split the data (features and its correspondent labels) into training data and testing data.
4. Create the model using the different algorithms (KNeighborsRegressor, LinearRegression, Ridge Regression and Lasso) and compare each one and see which one is better.
5. Check the model for multicollinearity and heteroskedasticity using F-stat and t-test.
6. Once an algorithm has been identified to has the best accuracy, use Grid Search to improved to try to make it even better.