### Interest Rate Impact on Stock Prices

Impact of US Federal Interest Rate Policy on Forward-Looking Valuations of Large Businesses

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GitHub repo: <a href="https://github.com/ryanmcr17/project1">https://github.com/ryanmcr17/project1</a>

### Project Plan/Details

#### Project Description and Background

Analysis of US interest rate policy relative to large US company valuations. Interest rate policy is represented by effective federal funds rates, set by the Federal Open Market Committee (FOMC) within the Federal Reserve central bank of the US. Forward-looking valuations of large companies are represented by S&P 500 Price-to-Earnings (PE) Ratio data.

Anecdotally, and very generally, businesses typically see stronger revenue/earnings growth when interest rates are lower, at least when other economic conditions are equivalent (employment rates / labor market conditions and inflation rates especially). When the Fed/FOMC 'tightens' interest rate policy by raising their Fed Funds target rate range (i.e. 'raising interest rates') that often negatively impacts future business growth/profits and therefore current forward-looking valuations (in the form of stock prices). However, forward-looking valuations of large US businesses are dependent upon many factors beyond just interest rates, and many of those factors likely impact both valuations as well as federal interest rates themselves (confounding factors). I'm curious to explore the direct relationship mathematically to see how strong it may be, while understanding that a much more thorough analysis would be necessary to truly understand the complex relationship between these two variables and that an especially strong negative correlation (r-value close to -1) is highly unlikely.

#### **Key Questions Considered**

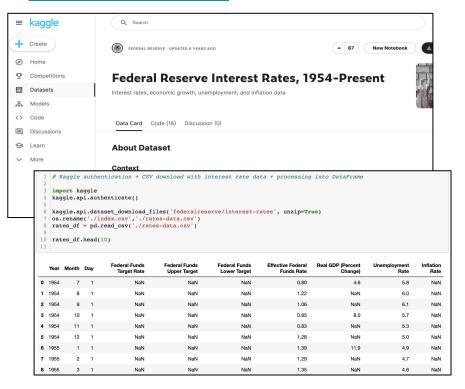
- What do the distributions of values look like from each individual dataset?
- What values/periods from each dataset could be considered outliers?
- Is there a consistent (negative) correlation between Effective Fed Funds Rates and S&P 500 PE ratios/valuations?
- Do potential outlier data points (whether included or removed) have a significant impact on the level of correlation between the two datasets?

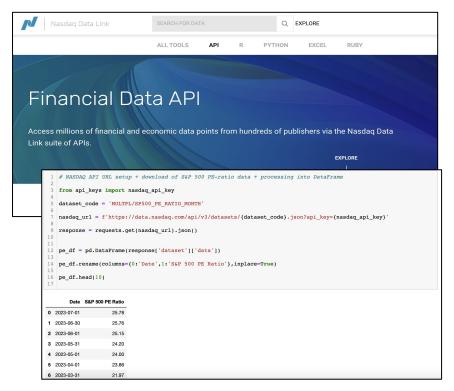
### Process Taken

## **Data Cleansing**

#### **Data Sources**

US federal interest rate data by month obtained from <u>Kaggle</u>, S&P 500 PE ratios by month obtained from <u>NASDAQ Data Link API</u>





#### Merged Data

Matched formatting of date data between dataframes, used inner merge to combine while dropping duplicative end-of-month datapoints, created new clean dataframe with only necessary columns/data

	Date	S&P 500 PE Ratio	Year	Month	Day	Federal Funds Target Rate	Federal Funds Upper Target	Federal Funds Lower Target	Effective Federal Funds Rate	Real GDP (Percent Change)	Unemployment Rate	Inflation Rate	Month2	Day2	
0	2017- 03-01	23.60	2017	3	1	NaN	0.75	1 # Reduc	e to primary column	s for analysis,	using Effective Fede	ral Funds Ra	ite to repi	resent rat	tes
1	2017- 02-01	23.68	2017	2	1	NaN	0.75	4	f = combined_df[['Date of count())	ate','S&P 500 PE	Ratio','Effective F	ederal Funds	Rate']].c	lropna().s	sort_values('Date',igno
2	2017- 01-01	23.59	2017	1	1	NaN	0.75	7 clean_d	f.head(50)	752					
3	2016- 12-01	23.76	2016	12	1	NaN	0.50	S&P 500 PE	ederal Funds Rate	752 752 752					
4	2016- 11-01	23.35	2016	11	1	NaN	0.50	<b>Date 0</b> 1954-07-01	S&P 500 PE Ratio Effecti	ive Federal Funds Rate 0.80					
								<b>1</b> 1954-08-01	11.70	1.22					
								<b>2</b> 1954-09-01	11.96	1.06					
								<b>3</b> 1954-10-01	12.02	0.85					
								<b>4</b> 1954-11-01	12.28	0.83					
								<b>5</b> 1954-12-01	12.62	1.28					
								<b>6</b> 1955-01-01		1.39					
								<b>7</b> 1955-02-01		1.29					
								<b>8</b> 1955-03-01		1.35					
								<b>9</b> 1955-04-01	12.39	1.43					

#### Merged Data

Matched format of date data in rate dataframe with that in PE dataframe, used inner merge to combine while dropping end-of-month datapoints from rate dataframe leaving only start-of-month rows

	Date	S&P 500 PE Ratio	Year	Month	Day	Federal Funds Target Rate	Federal Funds Upper Target	Federal Funds Lower Target	Effective Federal Funds Rate	Real GDP (Percent Change)	Unemployment Rate	Inflation Rate	Month2	Day2
0	2017- 03-01	23.60	2017	3	1	NaN	0.75	0.50	NaN	NaN	NaN	NaN	03	01
1	2017- 02-01	23.68	2017	2	1	NaN	0.75	0.50	0.66	NaN	4.7	2.2	02	01
2	2017- 01-01	23.59	2017	1	1	NaN	0.75	0.50	0.65	NaN	4.8	2.3	01	01
3	2016- 12-01	23.76	2016	12	1	NaN	0.50	0.25	0.54	NaN	4.7	2.2	12	01
4	2016- 11-01	23.35	2016	11	1	NaN	0.50	0.25	0.41	NaN	4.6	2.1	11	01

# Appendix

#### Additional Interesting Questions for Future Analysis

- Considering the potential time-lag in impact of interest rates on PE ratios, is there a stronger correlation between the two variables if accounting for that time-lag by shifting the x-axis for one of the variables relative to the other?
- What other factors/variables likely impact US company valuations / PE ratios that should be considered through additional analyses? Which of those may also have an impact on interest rate policy / future rates themselves?

#### Additional Notes on Original Plan/Datasets

Originally considered looking at tech company valuations specifically, via NASDAQ index PE ratios and because interest rates anecdotally seem to have a greater impact on tech company valuations due to longer average time-to-value industry-wide. Went with broader S&P 500 index data because it's available across a much longer time period, and Fed interest rates move quite slowly over years and differently over decades.

#### Acknowledgements and Data Sources

- pulling code from week-06/module-06 'WeatherPy' challenge as starting point for data loading
- federal interest rate data by month obtained from Kaggle (<a href="https://www.kaggle.com/datasets/federalreserve/interest-rates">https://www.kaggle.com/datasets/federalreserve/interest-rates</a>)
- S&P 500 PE ratios by month obtained from NASDAQ Data Link API (<a href="https://docs.data.nasdaq.com/docs/python-time-series">https://docs.data.nasdaq.com/docs/python-time-series</a>)