How Do Federal Reserve Speech Topics Affect the Federal Funds Rate?

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Background, Theoretical Assumptions

- The Fed controls administered rates which influence market rates, most directly in the Federal Funds Market where banks borrow reserves.
- As such, it is assumed officials leave hints regarding the future path of their policy rate.
- Market participants may speculate on these hints and change their behavior accordingly.

How can this be useful?

- The Federal Reserve often emphasizes its commitment to transparency.
- As such, it is suggested that clear communication can facilitate the effective transmission of monetary policy.
- This project can serve as preliminary research testing the efficacy and effects of Fed communication with the public.

Important Notes

- Many other factors can affect the Federal Funds Rate (FFR). I anticipate a small coefficient on the effect of speech topics on the FFR.

- In order to control for these stronger factors, we will include them in the regression. Such variables include the headline PCE reading for each month, and the average amount of bank reserves in US Dollars on a monthly basis.

Pre-Estimation Predictions

- A focus will be placed on inflation-related speeches as I expect them to have the highest impact on the FFR. As such, I anticipate the regression to predict the FFR to increase for each additional inflation-related speech for the month.

- I am assuming that officials discuss inflation when it is viewed as a concern with upside risk, leading to increases in their policy rate.

- When inflation is an issue, banks will also likely anticipate the Fed to tighten, adjusting their behavior accordingly.

Data Collection

- This data will be web-scraped from the Board of Governors archive with speeches from 1996 to present day.
- The dataset can be expanded by gathering information from Federal Reserve Bank District Presidents as well.
- We will stick to speeches in the Board of Governors archive for the sake of time. Also, market participants may place more weight on these speeches as Governors are permanent FOMC voting members whereas Bank Presidents serve rotating terms.

Variables

Speeches will search for mentions of:

- “Inflation”, “Expectation”, “Resolve”, “Optimism”, “Recession”, “Employment”, “Unemployment”, “Wage”, “Instability”, “Crisis”, “Rate”, “Spread”, “Easing”, “Tightening”, “Uncertainty”, “Output”, “Declining”, “Rising”, “Concern”, “Labor”, and “Interest”.

We will also gather information on speech word count, speaker, the date and location in which the speech was given, and its website link for future reference.

Variables (cont.)

We will include the following external variables as controls:

- The Effective Federal Funds Rate
- Personal Consumption Expenditures year-over-year inflation rate

This data will be obtained in CSV format from The Federal Reserve Bank of New York and the Bureau of Economic Analysis. Which has been aggregated into the FRED Database maintained by the Federal Reserve Bank of St. Louis.

Let the games begin

Selenium will grab the variables using each item's XPATH before clicking the speech link and reading for keywords.

//*[@id="article"]/div[1]/**div[1]**/div[1]/time	5/5/2023
	Commencement Address
	Watch Live
//*[@id="article"]/div[1]/**div[1]**/div[2]/p[3]	Governor Lisa D. Cook
//*[@id="article"]/div[1]/**div[1]**/div[2]/p[4]	At the 2023 Spring Convocation, Michigan State University, East Lansing, Michigan

Portions colored in darker shade change based on the speech. We will utilize this to automate the scraping

The scraper has four main loops.

- The outermost loop will keep track of our page number.
- The second loop will keep track of a speech's location on the page we are gathering from.
- The innermost loop will tell Selenium how many times to click the "Next" button in order to arrive at the specific page and speech needed.

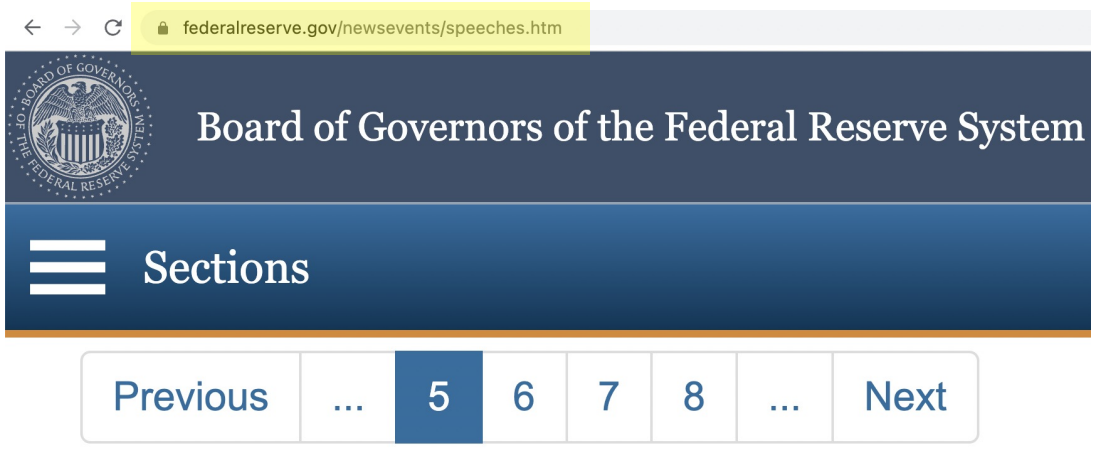
```
for page in range(1,51):

    try:
        for i in range(1,21):
            driver.get(gov)

            if page>1:
                if page<=9:

                    for pages in range(page-1):
                        driver.find_element(By.XPATH, '//*[@id="article"]/ul[1]/li[11]/a').click()

                if page>9:

                    for pages in range(1,9):
                        driver.find_element(By.XPATH, '//*[@id="article"]/ul[1]/li[11]/a').click()

                    for pages in range(page-9):
                        try:
                            driver.find_element(By.XPATH, '//*[@id="article"]/ul[1]/li[12]/a').click()

                        except: #For only page 50
                            driver.find_element(By.XPATH, '//*[@id="article"]/ul[1]/li[5]/a').click()
```

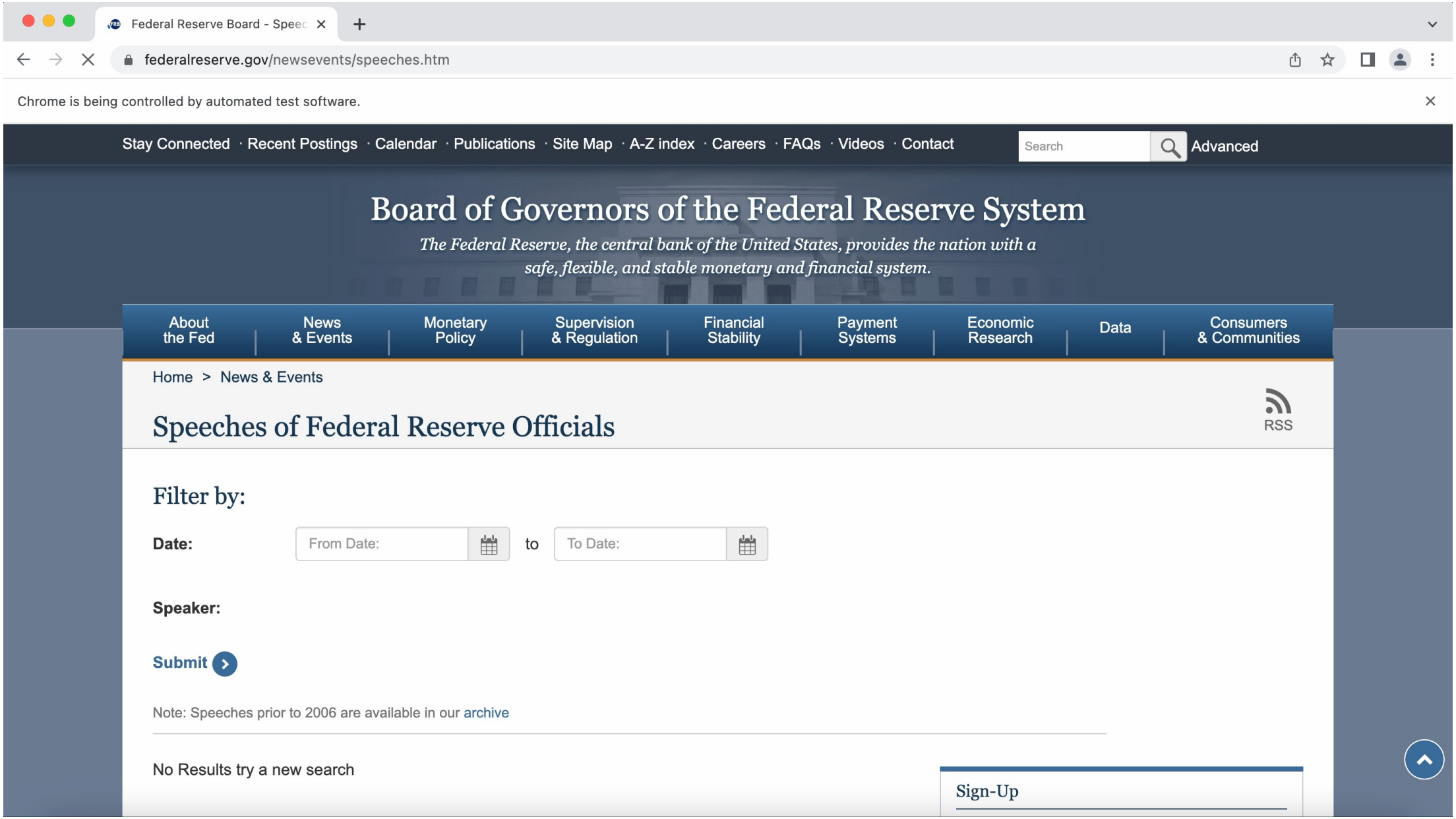
Since the archive has more than 50 pages, we will paginate.

However,

- The page URL remains constant, regardless of the page clicked.

- Instead, we will ask Selenium to click the “Next” button until we arrive on our desired page.




Federal Reserve Board - Spee
federalreserve.gov/newsevents/speeches.htm
Chrome is being controlled by automated test software.
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The Federal Reserve, the central bank of the United States, provides the nation with a safe, flexible, and stable monetary and financial system.
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Economic Research
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Home > News & Events
Speeches of Federal Reserve Officials
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Filter by:
Date:
From Date:
to
To Date:
Speaker:
Submit
Note: Speeches prior to 2006 are available in our archive
No Results try a new search
Sign-Up

Once we have arrived on the desired page…

- Selenium will use the information from the second loop, which holds the speech number within its page, to gather our variables.
- The speech will be temporarily saved as a list in which each word has its own index.
- This is done so we can record any mentions of our keywords.

```
link=driver.current_url


text=driver.find_element(By.XPATH, '//*[@id="article"]/div[3]').text
text=text.split()



keywordsearch={'inflation':0, 'expectation':0, 'resolve':0, 'optimism':0, 'recession':0,
                        'employment':0,'unemployment':0, 'wage':0, 'instability':0,
                        'crisis':0, 'rate':0, 'spread':0, 'easing':0, 'tightening':0,
                        'uncertainty':0, 'output':0, 'declining':0, 'rising':0,
                        'concern':0, 'labor':0, 'interest':0}


for keyword in keywordsearch.keys():
    for word in text:
        if keyword in word.lower():
            keywordsearch[keyword]+=1
```

Saving the captured data.

- Finally, all recorded data will be input into a dictionary. Each speech's group of variables will be stored under an reference number.

The speech index is formatted as:

- <page number>_<location on page>

- The index 1_20 will refer to the 20th speech on the first page.

```
data[str(page)+'_'+str(i)]={'Speaker': speaker,
                            'Date': date,
                            'Article_Link': link,
                            'Location': location,
                            'Word_Count': len(text),
                            'Inflation_Mentions':keywordsearch['inflation'],
                            'Expectation_Mentions': keywordsearch['expectation'],
                             …For all keywords }
```

A	B	C	D	E	F	G	H	I	J	K	L	M	N
	Speaker	Date	Article_Link	Location	Word_Count	Inflation_Me	Expectation_	Resolve_Mei	Optimism_M	Recession_M	Employment	Unemployme	Wage_Menti
1_1	Governor Lis	5/5/23	https://www	At the 2023 S	1509	0	0	0	0	0	0	0	0
1_2	Governor Lis	4/21/23	https://www	At the Carrol	2279	29	0	0	0	0	6	4	6
1_3	Governor Mi	4/20/23	https://www	At the Fed Li	569	3	0	0	0	0	0	0	0
1_4	Governor Chi	4/20/23	https://www	At the Crypto	1923	0	0	0	0	0	0	0	0
1_5	Governor Mi	4/18/23	https://www	At the Georg	4087	0	0	0	0	0	0	0	0
1_6	Governor Mi	4/14/23	https://www	At the Whart	4950	0	8	0	0	0	0	0	0
1_7	Governor Chi	4/14/23	https://www	At the Grayb	1951	20	0	0	0	0	3	1	1
1_8	Governor Lis	4/4/23	https://www	At "Exploring	474	0	0	0	0	0	0	0	0
1_9	Governor Chi	3/31/23	https://www	At the Macro	2610	62	29	0	0	1	20	18	8
1_10	Governor Lis	3/31/23	https://www	At the 2023 I	2225	30	3	0	0	3	5	1	8
1_11	Vice Chair fo	3/29/23	https://www	At the Nation	686	0	0	0	0	0	0	0	0
1_12	Governor Phi	3/27/23	https://www	At the H. Par	5350	18	5	0	0	0	6	1	0
1_13	Governor Mi	3/14/23	https://www	At the Indepe	4949	0	21	0	0	0	0	0	0

Source: The Federal Reserve Board of Governors, Author's Calculations

This process will iterate for 50 pages. Then, move to a new site for pre-2006 speeches.

- The second portion of the scraper will do many of the same processes as before, with small changes due to the format of the new website.

Hitches that left me nightmares.

Main Concern:

- I noticed that the pagination appears to work quickly until around a page of speeches have been scraped.

- After some time, it stops on every fifth page and waits 2-3 seconds before moving on.

- This pattern concerns me, and I begin to wonder if the Fed's website is intentionally slowing my requests. This drastically reduced the speed of the scraper.

Hitches that left me nightmares (cont.)

- When first beginning to build the program, I had trouble navigating to the “Next” button.
- I later learned that after the 9th page, the button’s XPATH location changes as the bar gets wider.
- This took a time to be made apparent but was luckily able to be smoothened out.

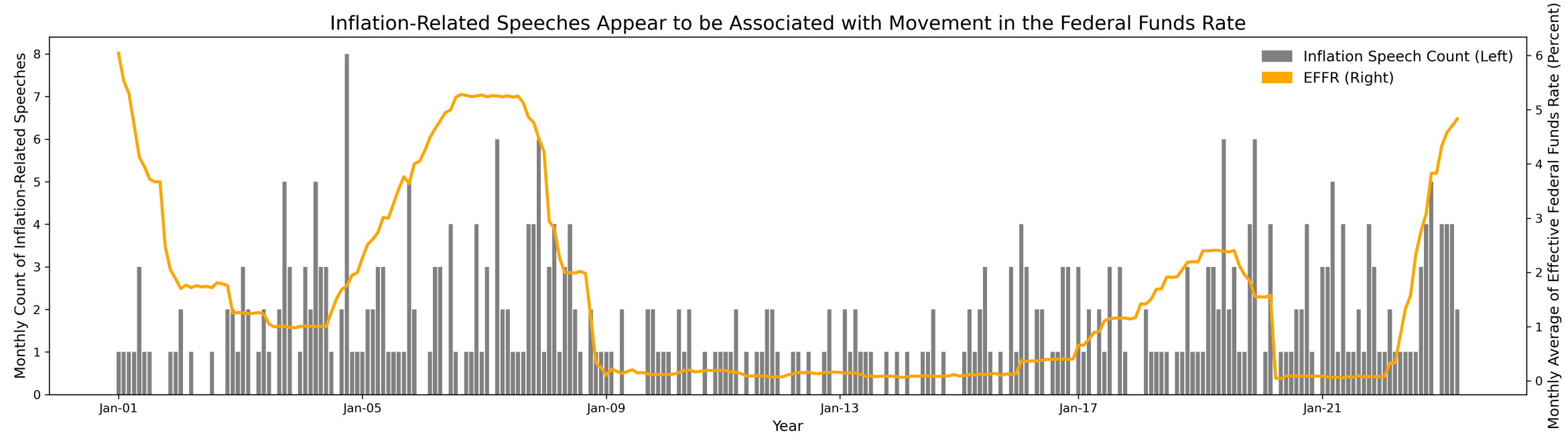
Data Preparation Using Python's Pandas

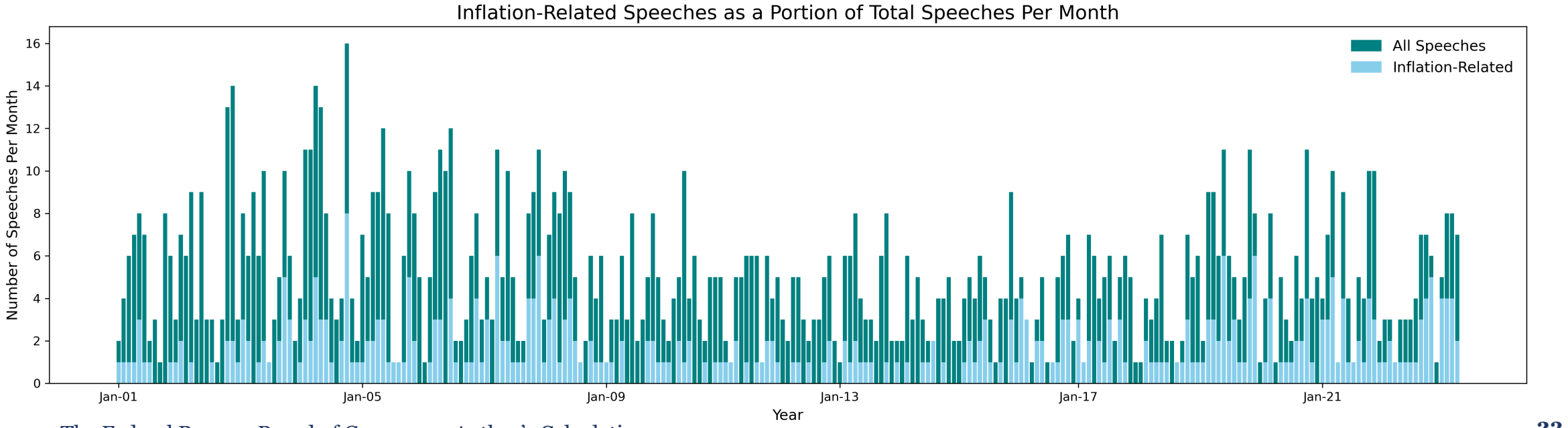
- After all data is collected it condensed into monthly format using a "groupby()" function.
- It was assumed that if a speech has five or more mentions of a keyword, it has a topic that is related to said word.
- Binary variables are created based on this information. The "groupby()" function is then used to sum all observations to return the monthly count of keyword related speeches.
- The Scraped data is merged with the control variables, EFFR, PCE, and Reserves, to create the final dataset.

Euphoria.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
	Reserves	PCE_YOY	EFFR	Month	Day	Year	Date	Total	Inflation_Rel	Expectation_	Resolve_Rel	Optimism_R	Recession_R	Employment	Unemploym	Wage_Relat	Instability_R	Crisis_Relate	Rate_Relate
0			4.83	4	1	2023	4/1/23	7	2	1	0	0	0	1	0	1	0	1	3
1	3258400	4.16416	4.70125	3	1	2023	3/1/23	8	4	3	0	0	0	3	1	2	0	0	6
2	3021800	5.07497	4.57875	2	1	2023	2/1/23	8	4	2	0	0	0	0	0	1	0	0	6
3	3029900	5.38131	4.33	1	1	2023	1/1/23	5	4	2	0	0	0	2	0	2	0	0	4
4	3107300	5.3012	3.83	12	1	2022	12/1/22	1	0	0	0	0	0	0	0	0	0	1	1
5	3126200	5.65905	3.83	11	1	2022	11/1/22	6	5	1	0	0	0	1	0	2	0	0	5
6	3055700	6.1262	3.08	10	1	2022	10/1/22	7	4	0	0	0	0	2	0	0	0	1	3
7	3131400	6.28895	2.75857143	9	1	2022	9/1/22	7	3	1	0	0	0	1	0	1	0	2	6
8	3305900	6.25537	2.33	8	1	2022	8/1/22	4	1	2	0	0	0	0	0	0	0	0	1
9	3258700	6.38956	1.58	7	1	2022	7/1/22	3	1	1	0	0	1	1	1	0	0	0	2
10	3228400	6.9757	1.33	6	1	2022	6/1/22	3	1	1	0	0	0	0	0	0	0	0	1
11	3317900	6.51547	0.83	5	1	2022	5/1/22	3	1	0	0	0	0	2	0	0	0	1	1
12	3615400	6.41205	0.33	4	1	2022	4/1/22	1	1	0	0	0	0	1	0	0	0	0	1
13	3874700	6.76658	0.33	3	1	2022	3/1/22	3	2	1	0	0	1	1	1	0	0	0	2
14	3804500	6.38893	0.08	2	1	2022	2/1/22	3	1	1	0	0	0	1	0	0	0	0	1
15	4187900	5.96612	0.08	12	1	2021	12/1/21	2	1	0	0	0	0	1	1	0	0	2	2
16	4180600	5.85138	0.079	11	1	2021	11/1/21	10	3	2	0	0	0	4	1	0	0	1	6
17	4128100	5.22266	0.08	10	1	2021	10/1/21	10	4	4	0	0	0	5	3	1	0	1	6
18	4193200	4.65448	0.08	9	1	2021	9/1/21	4	1	2	0	0	0	1	1	0	0	0	3
19	4140100	4.51751	0.096	8	1	2021	8/1/21	5	2	2	0	0	1	2	2	1	0	0	3
20	3943900	4.42416	0.07	7	1	2021	7/1/21	1	1	1	0	0	0	1	0	0	0	0	1
21	3848100	4.25478	0.08	6	1	2021	6/1/21	4	1	1	0	0	0	2	0	0	0	1	2
22	3872400	4.04701	0.06	5	1	2021	5/1/21	9	4	3	0	0	0	5	1	2	0	0	5
23	3887300	3.62945	0.07	4	1	2021	4/1/21	1	1	1	0	0	0	1	1	0	0	0	1
24	3721300	2.53375	0.07	3	1	2021	3/1/21	10	5	2	0	0	0	5	1	0	0	2	9
25	3345900	1.70253	0.07285714	2	1	2021	2/1/21	7	3	0	0	0	1	3	2	2	0	1	5
26	3153800	1.47732	0.09	1	1	2021	1/1/21	4	3	3	0	0	0	3	2	0	0	0	4
27	3135000	1.27691	0.09	12	1	2020	12/1/20	5	0	0	0	0	0	0	0	0	0	0	2
28	3034700	1.08356	0.0875	11	1	2020	11/1/20	4	1	1	0	0	0	1	1	0	0	1	3
29	2876600	1.10937	0.09	10	1	2020	10/1/20	11	4	1	0	0	0	5	2	0	0	2	8
30	2852800	1.27578	0.09	9	1	2020	9/1/20	4	2	2	0	0	0	2	2	0	0	0	3
31	2799700	1.16133	0.09166667	8	1	2020	8/1/20	6	2	2	0	0	0	3	2	0	0	2	2
32	2718500	0.88833	0.09	7	1	2020	7/1/20	2	1	1	0	0	0	1	1	0	0	1	1

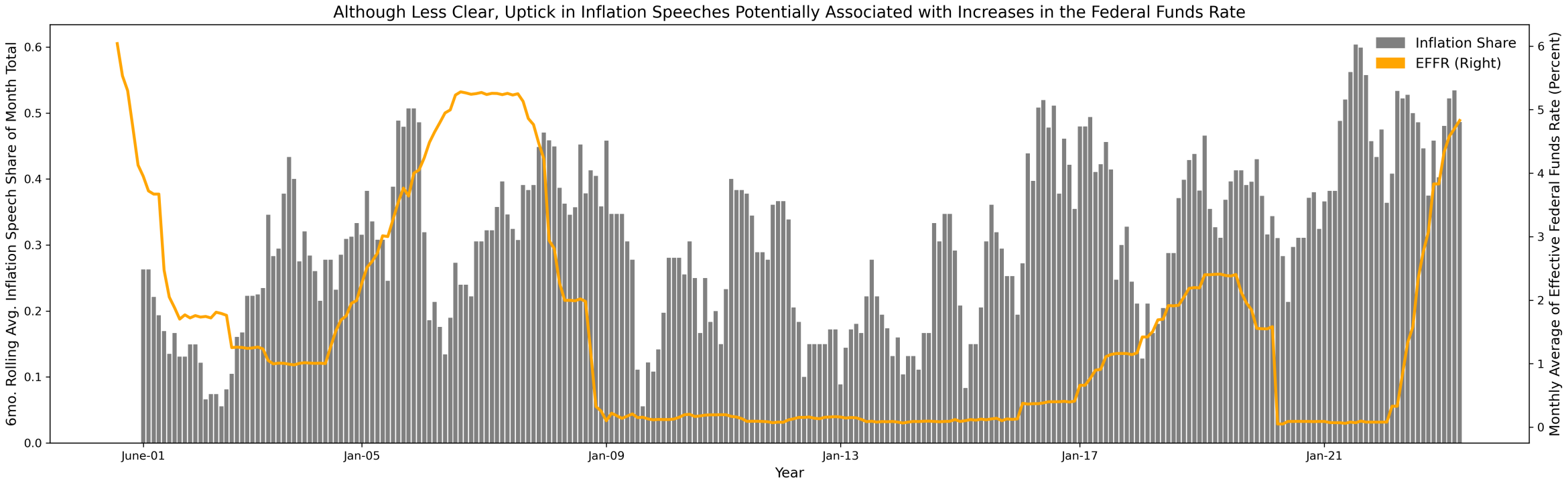
Source: The Federal Reserve Board of Governors, Author's Calculations





Source: The Federal Reserve Board of Governors, Author's Calculations

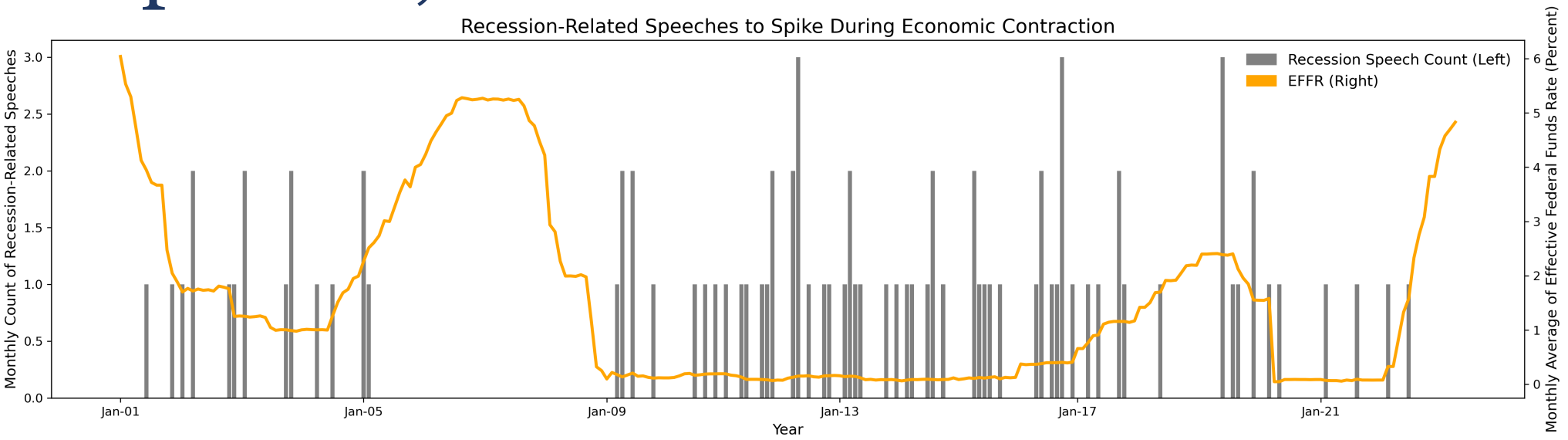
However,

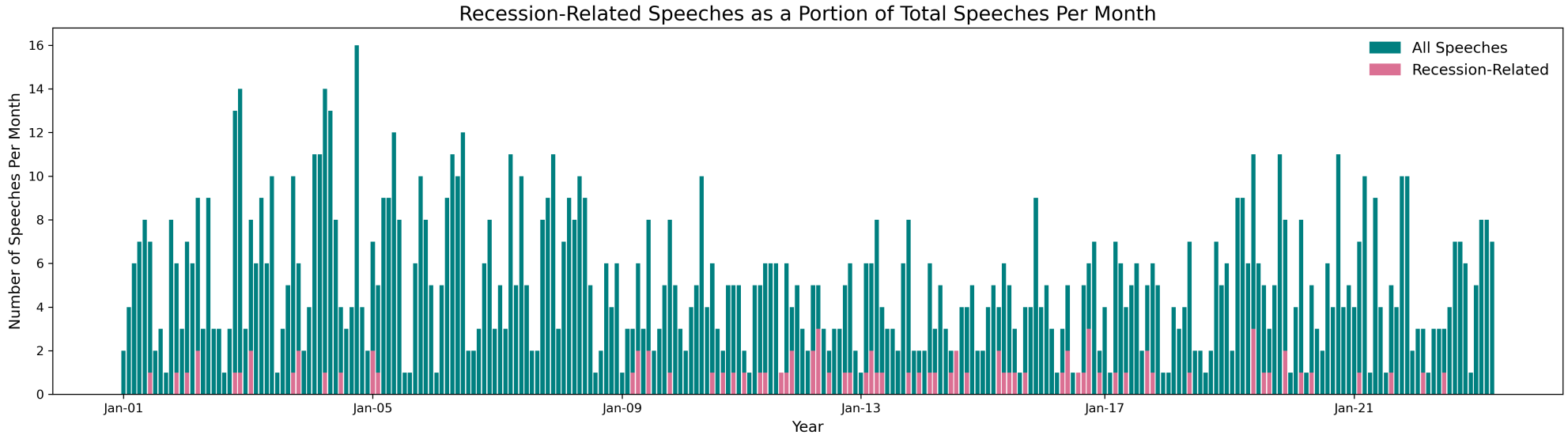



```
final['InflationShare_Average']=final.rolling(window=6)['Inflation_Share'].mean()
```

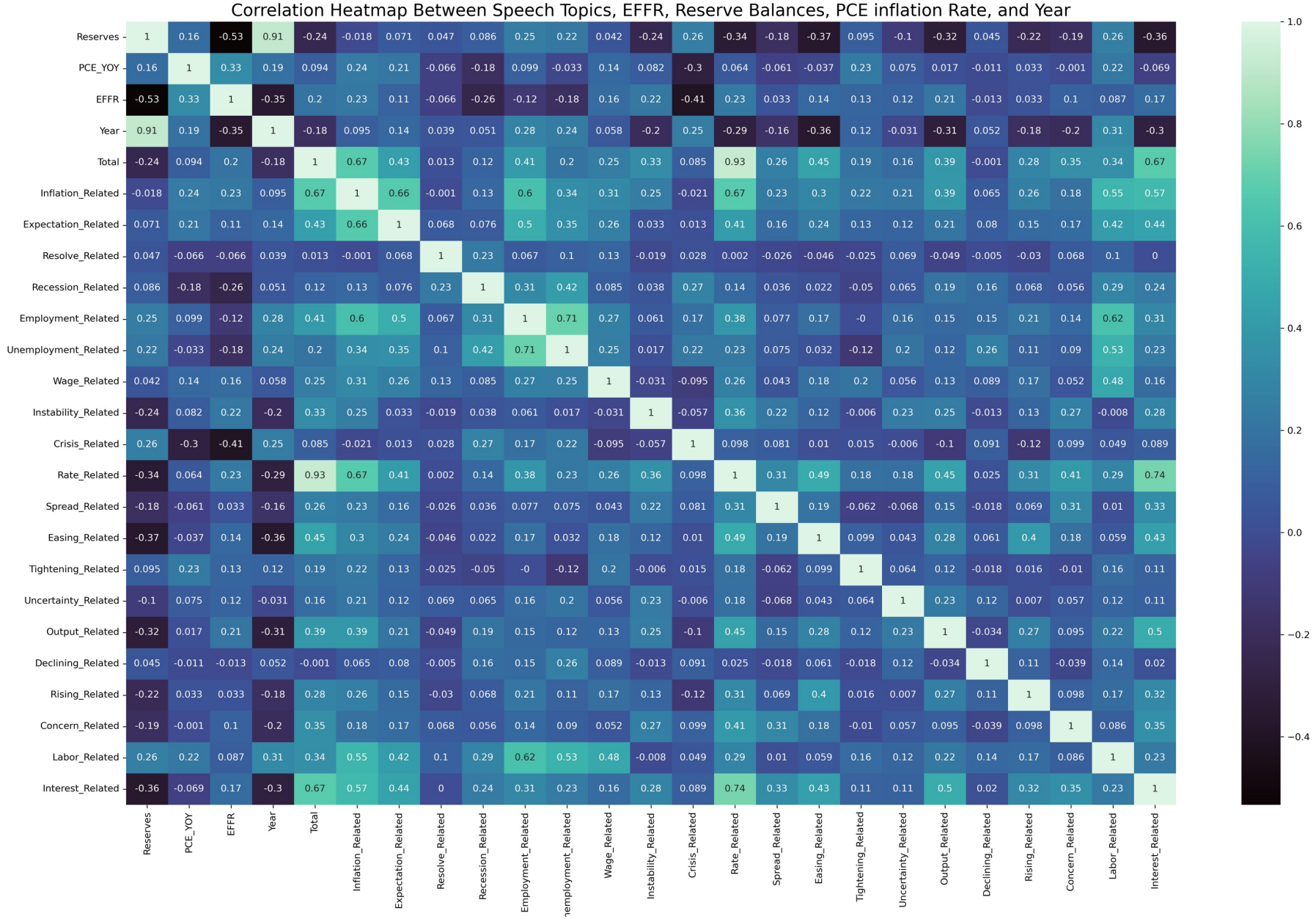
Source: The Federal Reserve Board of Governors, Author's Calculations

To emphasize,





Source: The Federal Reserve Board of Governors, Author's Calculations



Source: The Federal Reserve Board of Governors, Authors Calculations

Regression Models

$$EFFR_i = \beta_0 + \beta_1 Reserves_i + \beta_2 PCE\_YOY_i + \beta_3 Total_i + \beta_4 Inflation_i + \beta_5 Recession_i + \beta_6 Instability_i + \beta_7 Crisis_i + \beta_8 Rising_i + \beta_9 Labor_i + u_i$$

$$EFFR_i = \beta_0 + \beta_1 Reserves_i + \beta_2 PCE\_YOY_i + \beta_3 Total_i + \beta_4 Inflation_i + \beta_5 Recession_i + \beta_6 Instability_i + \beta_7 Crisis_i + \beta_8 Rising_i + \beta_9 Labor_i + \beta_{10} RecessionXInstability_i + u_i$$

Initial Regression

studentized Breusch-Pagan test

```
data:  m1
BP = 75.871, df = 22, p-value = 7.644e-08
```

Effect of Fed Speech Topic on the Effective Federal Funds Rate

	Dependent variable:
	EFFR (Percent)
Bank Reserves (Trillions USD)	-0.818***
	(0.082)
% Change in PCE YoY Inflation Rate	0.272***
	(0.057)
Total Monthly Speeches	0.063
	(0.065)
"Inflation" Related Speeches	0.264***
	(0.096)
"Expectation" Related Speeches	0.087
	(0.103)
"Resolve" Related Speeches	-0.184
	(0.832)
"Recession" Related Speeches	-0.339***
	(0.131)
"Employment" Related Speeches	-0.158*
	(0.094)
"Wage" Related Speeches	0.159
	(0.161)
"Instability" Related Speeches	1.048***
	(0.397)
"Crisis" Related Speeches	-0.138**
	(0.065)
"Rate" Related Speeches	-0.098
	(0.085)
"Spread" Related Speeches	-0.166
	(0.166)
"Easing" Related Speeches	0.016
	(0.132)
"Tightening" Related Speeches	0.125
	(0.223)
"Uncertainty" Related Speeches	-0.058
	(0.184)
"Output" Related Speeches	-0.034
	(0.130)
"Declining" Related Speeches	1.350
	(1.166)
"Rising" Related Speeches	-0.568***
	(0.166)
"Concern" Related Speeches	-0.001
	(0.113)
"Labor" Related Speeches	0.243**
	(0.111)
"Interest" Related Speeches	-0.041
	(0.074)
Constant	1.931***
	(0.214)
Observations	257
Residual Std. Error	1.042 (df = 234)

Note: Standard Deviations in Parentheses *p<0.1; **p<0.05; ***p<0.01

Keyword speeches refer to the monthly sum of speeches in which the keyword is mentioned five or more times

Regression Output

- After running an initial regression to test which categories are statistically significant, the final two models include:
- Reserves, PCE YoY, and Speech topics, along with a control for total monthly speeches.
- The second model interacts "Recession"- and "Instability"-related speeches.

Effect of Fed Speech Topic on the Effective Federal Funds Rate

	Dependent variable:	
	EFFR (Percent)	
	OLS	OLS Interaction
	(1)	(2)
Bank Reserves (Trillions USD)	-0.791***	-0.787***
	(0.070)	(0.068)
% Change in PCE YoY Inflation Rate	0.305***	0.308***
	(0.055)	(0.054)
Total Monthly Speeches	-0.017	-0.014
	(0.034)	(0.034)
"Inflation" Related Speeches	0.192**	0.168**
	(0.075)	(0.075)
"Recession" Related Speeches	-0.393***	-0.341***
	(0.121)	(0.123)
"Instability" Related Speeches	0.775**	1.203***
	(0.373)	(0.421)
"Crisis" Related Speeches	-0.165***	-0.168***
	(0.062)	(0.061)
"Rising" Related Speeches	-0.587***	-0.558***
	(0.155)	(0.153)
"Labor" Related Speeches	0.269***	0.273***
	(0.096)	(0.095)
"Recession" X "Instability Speeches		-0.731*
		(0.444)
Constant	1.838***	1.819***
	(0.204)	(0.200)
Observations	257	257
Residual Std. Error	1.116 (df = 247)	1.097 (df = 246)
Note: Standard Deviations in Parentheses		*p<0.1; **p<0.05; ***p<0.01

Keyword speeches refer to the monthly sum of speeches in which the keyword is mentioned five or more times

Detailed Output

Effect of Fed Speech Topic on the Effective Federal Funds Rate

	Dependent variable:	
	EFFR (Percent)	
	OLS	OLS Interaction
	(1)	(2)
Bank Reserves (Trillions USD)	-0.791	-0.787
	(0.070)	(0.068)
	t = -11.364	t = -11.507
	p = 0.000	p = 0.000
% Change in PCE YoY Inflation Rate	0.305	0.308
	(0.055)	(0.054)
	t = 5.587	t = 5.728
	p = 0.00000	p = 0.000
Total Monthly Speeches	-0.017	-0.014
	(0.034)	(0.034)
	t = -0.484	t = -0.403
	p = 0.629	p = 0.687
"Inflation" Related Speeches	0.192	0.168
	(0.075)	(0.075)
	t = 2.555	t = 2.257
	p = 0.011	p = 0.025
"Recession" Related Speeches	-0.393	-0.341
	(0.121)	(0.123)
	t = -3.258	t = -2.778
	p = 0.002	p = 0.006
"Instability" Related Speeches	0.775	1.203
	(0.373)	(0.421)
	t = 2.080	t = 2.857
	p = 0.038	p = 0.005
"Crisis" Related Speeches	-0.165	-0.168
	(0.062)	(0.061)
	t = -2.652	t = -2.749
	p = 0.008	p = 0.006
"Rising" Related Speeches	-0.587	-0.558
	(0.155)	(0.153)
	t = -3.788	t = -3.643
	p = 0.0002	p = 0.0003
"Labor" Related Speeches	0.269	0.273
	(0.096)	(0.095)
	t = 2.792	t = 2.892
	p = 0.006	p = 0.004
"Recession" X "Instability Speeches		-0.731
		(0.444)
		t = -1.648
		p = 0.100
Constant	1.838	1.819
	(0.204)	(0.200)
	t = 9.017	t = 9.080
	p = 0.000	p = 0.000
Observations	257	257
Residual Std. Error	1.116 (df = 247)	1.097 (df = 246)

Note: Standard Deviations in Parentheses *p<0.1; **p<0.05; ***p<0.01

Keyword speeches refer to the monthly sum of speeches in which the keyword is mentioned five or more times

Output Interpretation

Variable	Coefficient	T-Statistic	P-Value
Bank Reserves	For every 1 trillion USD increase in reserves, the FFR is predicted to decrease by .79 percentage points.	t=-11.507 Absolute value is greater than two, suggesting statistical significance.	p=.000 Suggests that this coefficient is statistically significant at a significance level greater than 99%.
% Change in PCE YoY	For every percentage point increase in the PCE inflation rate, the FFR is predicted to increase by .31 percentage points.	t=5.728 Absolute value is greater than two, suggesting statistical significance.	p=.000 Suggests that this coefficient is statistically significant at a significance level greater than 99%.
Total Monthly Speeches (Interesting)	For each additional monthly speech, regardless of topic, the FFR is predicted to decrease by .14 percentage points.	t=-.403 Absolute value is not greater than two, suggesting little statistical significance.	p=.687 This coefficient is not statistically significant at any high significance level.
Inflation Speech	For each additional inflation speech, the FFR is predicted to increase by .17 percentage points.	t=2.257 Absolute value is greater than two, suggesting statistical significance.	p=.025 Suggests that this coefficient is statistically significant at the 95% significant level.

Output Interpretation (cont.)

Variable	Coefficient	T-Statistic	P-Value
Recession Speech	For each additional recession speech, the FFR is predicted to decrease by .34 percentage points.	t=-2.778 Absolute value is greater than two, suggesting statistical significance.	p=.006 Suggests that this coefficient is statistically significant at a significance level greater than 99%.
Instability Speech	For each additional instability speech, the FFR is predicted to increase by 1.203 percentage points.	t=2.857 Absolute value is greater than two, suggesting statistical significance.	p=.005 Suggests that this coefficient is statistically significant at a significance level greater than 99%.
Crisis Speech	For each additional crisis speech, the FFR is predicted to decrease by .17 percentage points.	t=-2.749 Absolute value is greater than two, suggesting statistical significance.	p=.006 Suggests that this coefficient is statistically significant at a significance level greater than 99%.
Rising Speech	For each additional rising speech, the FFR is predicted to decrease by .56 percentage points.	t=-3.643 Absolute value is greater than two, suggesting statistical significance.	p=.0003 Suggests that this coefficient is statistically significant at a significance level greater than 99%.

Output Interpretation (cont.)

Variable	Coefficient	T-Statistic	P-Value
Labor Speech	For each additional instability speech, the FFR is predicted to increase by .27 percentage points.	t=2.892 Absolute value is greater than two, suggesting statistical significance.	p=.004 Suggests that this coefficient is statistically significant a significance level greater than 99%.
Recession X Instability Speech	For each additional speech with both mentions of a recession and instability, the FFR is predicted to decrease by .73 percentage points.	t=-1.648 Absolute value is not greater than two, however, it is not far. This coefficient could statistically significant but at a level lower than the 95% significance level.	p=.100 Suggests that this coefficient is statistically significant at the 90% significance level.

Limitations

- My method of capturing a speech's topic is very crude. For example, mentions of inflation during a recession hold different meaning than during an expansion. We need more context to gain the topic of the speech.

- I assumed an uptick in inflation speeches showed concerns of rising inflation. However, we can also see a similar uptick when inflation is below target. This would likely have the opposite effect on the FFR.

- Additional variables should be included to yield more accurate results such as variables for financial stress or market participants' outlook on the future path of the economy. Also, since this is a timeseries, I should include lags on variables and look into other similar adjustments.

Limitations (cont.)

- Additionally, in order to make the scraper most feasible, I should find a way to speed its data collection process.
- This would mean needing to work around the potential rate slowing done by the website itself.
- Potential solutions may include running multiple scrapers simultaneously to work on different pages of the archive.
- This would require multiple Jupyter notebook files with my current scraper, or the implementation of threading to run multiple tasks which would have to be learned, if chosen.

Thank you.