A Natural Language Processing Approach to Analyzing Federal Reserve's Transcripts and Minutes

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Abstract

The purpose of this paper is to examine whether the Federal Reserve minutes are an accurate reflection of Federal Reserve transcripts. Using Natural Language Processing techniques such as LDA, we have generated the most important topics for transcripts and corresponding minutes to observe how similar these documents (minutes and transcripts) are. We have also calculated sentiment scores of transcripts and minutes and compared the difference in sentiment to several economic indicators. We were able to show that there exist fundamental differences between transcripts and minutes that are strongly correlated to major economic indicators. We also discovered the persistent cautious net tone of minutes even after the recovery from the Great Recession. We have concluded that Federal Reserve minutes are not an accurate summary of what was discussed during the meetings but are adjusted to make investors and the general public think how Federal Reserve wants them to.

Executive summary

Initially, we have computed the sentiment score of the minute corpus and the transcript corpus (for every document in the selected time period). We have also compared sentiment scores of transcripts and minutes corpus. We have shown that minutes tend to overstate the economic situation when the economy is strong when compared to transcripts but tend to become much more negative when the United States enters a period of an economic slowdown. The sentiment of the minutes was significantly more positive in the period preceding the Great Recession but has turned negative in 2006 and remained so since when compared to transcripts.

We have used Latent Dirichlet Allocation (LDA) to generate 7 most frequent topics for minutes and transcripts separately. We have then computed each topic proportion for every document in the minutes as well as transcripts. We were able to show that the amount of time the Federal Reserve allocates to individual topic changes significantly across time in minutes, however, in transcripts, the amount of time spent on each topic varies insignificantly.

Finally, we calculated the sentiment score of each topic generated by LDA. Moreover, we determined correlations between topics of transcript and minutes corpora finding relationships between them.

Background

The Federal Open Market Committee (FOMC) has 8 scheduled meetings per year, and the number can be larger if required. At these meetings, FOMC analyzes economic and financial data, reviews the economic conditions, and sets the monetary policy.

Minutes of regularly scheduled meetings "provide a timely summary of significant policy issues addressed by meeting participants" according to the Federal Reserve. From February 1993 to December 2004 the minutes were released 3 days after the next Committee's meeting. After December 2004, the minutes are available 3 weeks after each regularly scheduled meeting.

Transcripts are the most detailed record of the FOMC meeting available. Since 1994, the transcripts are produced from "audio recording of the proceedings". They are released to the public with a five-year lag; therefore, we do not have access to transcripts after 2013.

In this paper, we challenge the assumption that the minutes are just a "timely summary of significant policy issues addressed by meeting participants". We believe that the Federal Reserve may be using minutes to focus public attention on specific topics and to make the sentiment more positive or negative. We test our hypothesis by applying Natural Language Processing (NLP) techniques to the corpora of transcripts and minutes.

Data

We have created 2 corpora, one for transcripts and one for minutes. We obtained minutes from 1967 to 2019. However, Federal Reserve Minutes had undergone a major change in 1993.

The number of words in minutes (after removing stop words) increased from 557 in 12/22/1992 to 5730 in 2/3/1993. Therefore, we will only consider minutes from 2/3/1993 to 7/31/2019 (a total of 208 files) during this paper.

Number of Words in Minutes
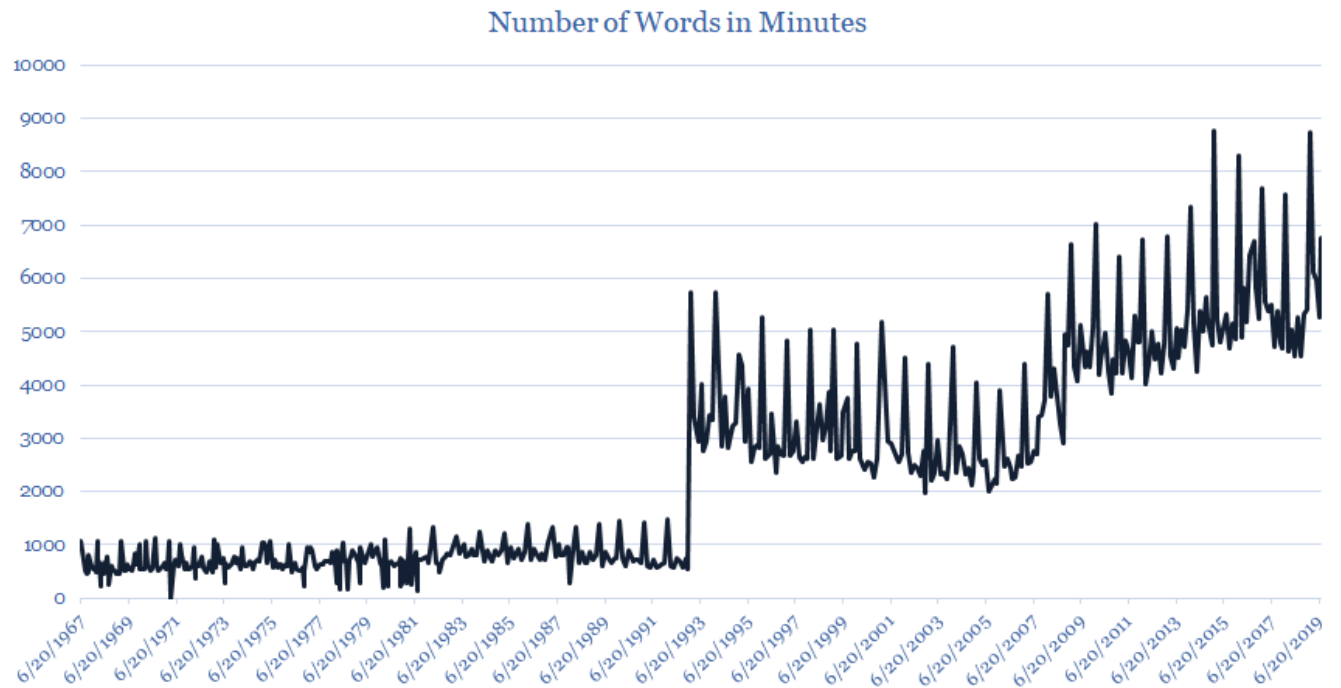
We obtained transcripts from 1982 to 2013 (For a total of 252 files). Since we need to have all documents in text format for Natural language processing, and transcripts before 1982 were images rather than text documents, hence the selected time period. From the graph below we can see that the number of words per transcripts increases gradually through the period and doesn't have the large spike that the minutes have.

Number of words in Transcripts
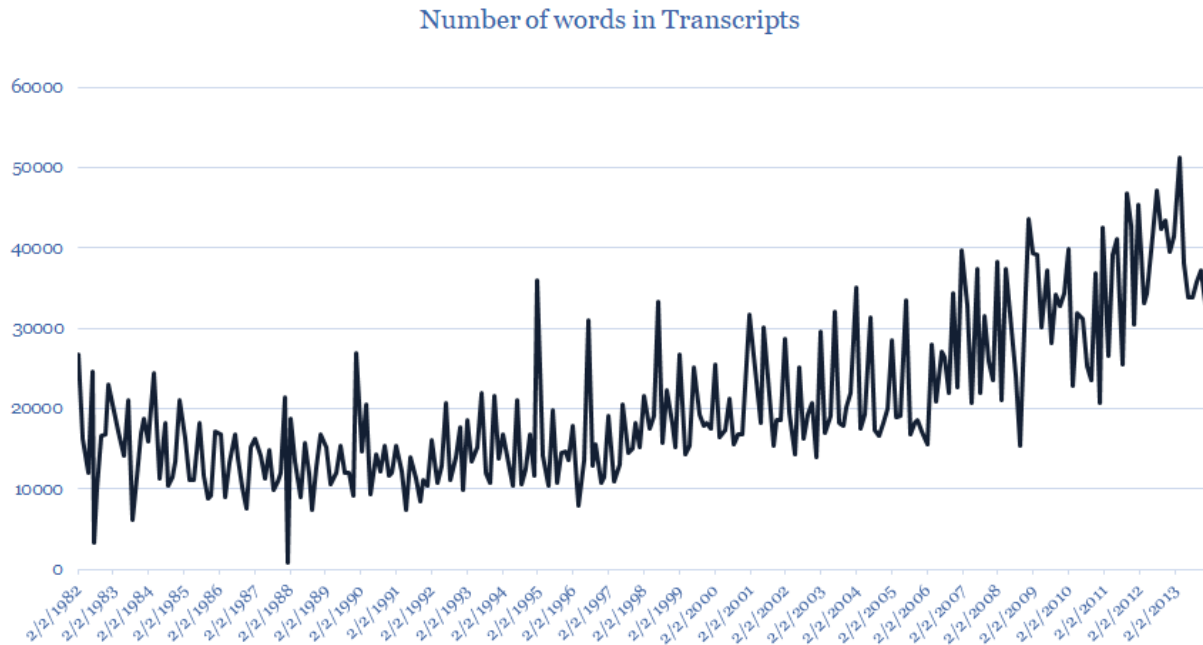
Additionally, we made sure that every transcript in the sample has a corresponding minute, and every minute has a corresponding transcript so we can do a side by side comparison. Therefore, we have 163 transcripts and 163 minutes from 1993 to 2013.

Preprocessing and Lemmatization

Now that we have collected data, we need to prepare it for machine learning algorithms. The first step is to crop our minutes and transcripts. FOMC Minutes generally begin with a list of meeting participants. These names do not add anything to the sentiment or content of minutes and only confuse the algorithms. Therefore, we will remove all the content that comes before one of the following phrases: "Staff Review of the Economic Situation" or "The Committee then turned to a discussion of the economic", or "On the recommendation of the Manager", or "The information (reviewed|received|provided)". We performed similar truncations for transcripts removing all the content before "Federal Open Market Committee Meeting" phrase.

The second step is to convert all words to lowercase and to remove all the numbers. This is done to ensure that words like "Inflation" and "inflation" are the same for the algorithm.

The third step is to remove the stop words. The stop words are commonly used words such as 'the' 'a' 'but' that do not add any meaning to the text, but take up valuable space, and prevent the formation of meaningful bigrams. We have also expanded on the list of common stop words by removing words such as: 'committee', 'bank', 'reserve', 'federal', 'board', 'governor', 'system', names of months, and other words that are very common, and do not add much meaning.

Next, we lemmatize our text. Lemmatization algorithm reduces words to their dictionary form. For example, words such as 'good', 'best', 'better' are converted to just 'good'. Lemmatization also takes into account the meaning of words in a sentence. For example, the word 'beautiful' is lemmatized to 'beautiful', and the word 'beautifully' is lemmatized to 'beautifully'. This technique is much better than stemming which would convert both words to 'beauti' which is not even an English word. Lemmatization allows us to achieve a much more accurate sentiment analysis.

Now after we cleaned up our data, we can check the most frequent words for a corpus. Below is a graph that shows the most frequent words in minutes (the larger the word, the more frequent it is):

The below graph shows the most frequent words in transcripts:

We can observe that words such as 'inflation', 'rate', 'market', 'growth' are very common in both minutes and transcripts, which is not a surprise. However, there are notable differences between these 2 plots. For example, the word 'price' is very common in minutes and less so in transcripts. Word 'percent' on the other hand is very common in transcripts and less so in minutes.

Sentiment analysis

Sentiment analysis is used to identify positive, negative and neutral words in a text. We have carried out the process by comparing the text with the selected dictionaries to calculate the sentiment score. We have used the following different dictionaries:

1. Opinion Lexicon dictionary (not tailored to financial documents, has around 8000 words that are labeled as positive, neutral, or negative)
2. Combinations of manually built Dictionary + Loughran/McDonald dictionary contains 451 positive and 2651 negative words. Both these dictionaries have been specifically tailored for financial documents and companies' earnings announcements.

	A	B	C	D	E
1	Positive	Negative			
2	able	abnormally			
3	absorb	abrupt			
4	absorbed	abundant			
5	absorbing	adverse			
6	acceptable	adversely			
7	achieveme	aggravate			
8	adequately	aggravated			
9	alleviated	aggravating			
10	alleviating	aggravation			
11	beneficial	ailing			
12	benefit	alarming			
13	benefiting	anxiety			
14	benign	arrears			
15	better	bad			
16	brighter	burdened			
17	broaden	challenge			
18	buoyancy	challenges			
19	calm	challenging			
20	calmed	closure			
21	calming	clouded			
22	comfortab	compromised			
23	confident	concern			
24	confined	concerns			
25	contained	confronted			

3. Combination of manually built, Loughran/McDonald, and Opinion Lexicon dictionaries. We believe this to be the best dictionary as it has the optimal level of commonly used English words as well as Financial terms.

To compute the sentiment of each document, we start from the beginning of each document, and then for every word we check if it is in the positive list, or if it is in the negative list. Next, we count the total number of positive, negative and all words.

```
num_of_positive = 0
num_of_negative = 0
num_of_words = 0
for item in new_list:
    num_of_words+=1
    if item == 1 :
        num_of_positive+=1
    elif item == -1:
        num_of_negative+=1
```

Then we calculate the sentiment of the document using the following formula. This formula allows us to compare the sentiment of transcripts and the corresponding minutes, even if they have a different number of words. This gives a standard sentiment score for each document regardless of a number of words.

$$Sentiment\ Score = \frac{\#\ of\ Positive\ Words\ -\ \#\ of\ Negative\ Words}{\#\ of\ Positive\ Words\ +\ \#\ of\ Negative\ Words}$$

Below is the sentiment of transcript corpus graph:
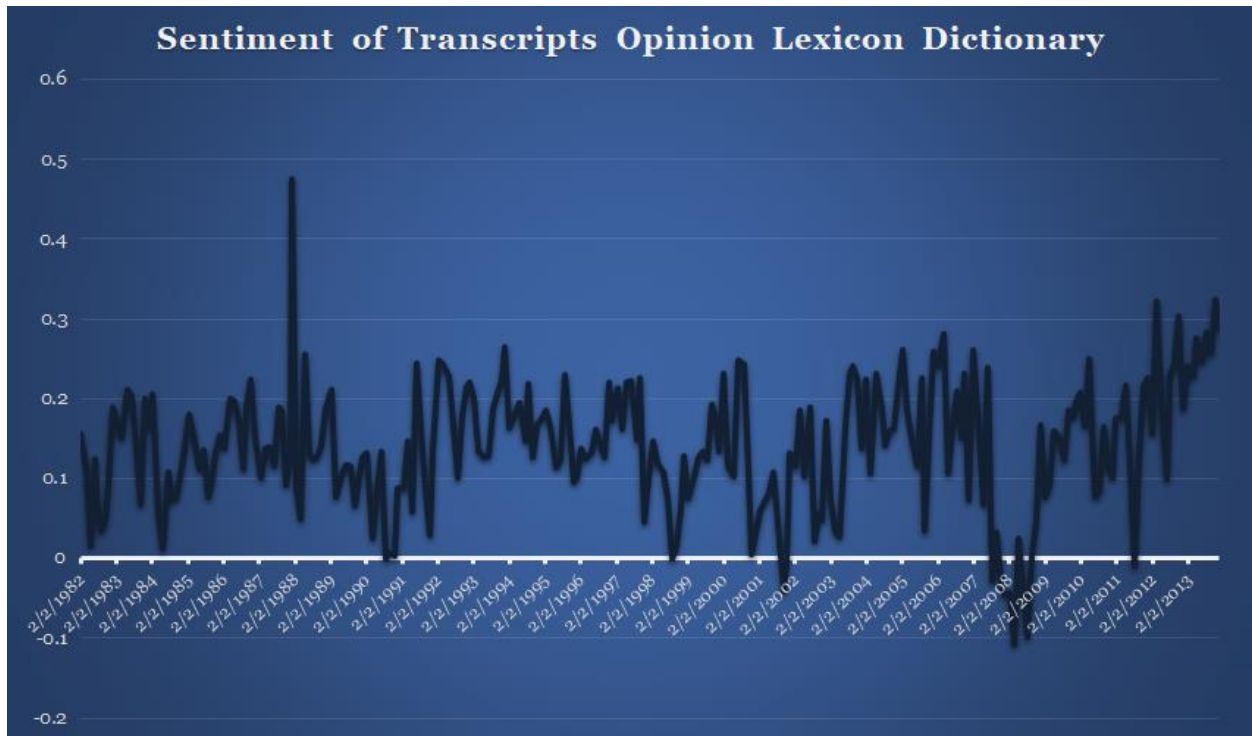
As we can see transcripts have positive sentiment for most of the period. This is expected as the opinion lexicon dictionary is more positive in nature.

Below we will plot the transcripts moving average to eliminate some noise and make graphs smoother.

Sentiment Transcripts MA(4) Opinion Lexicon Dictionary
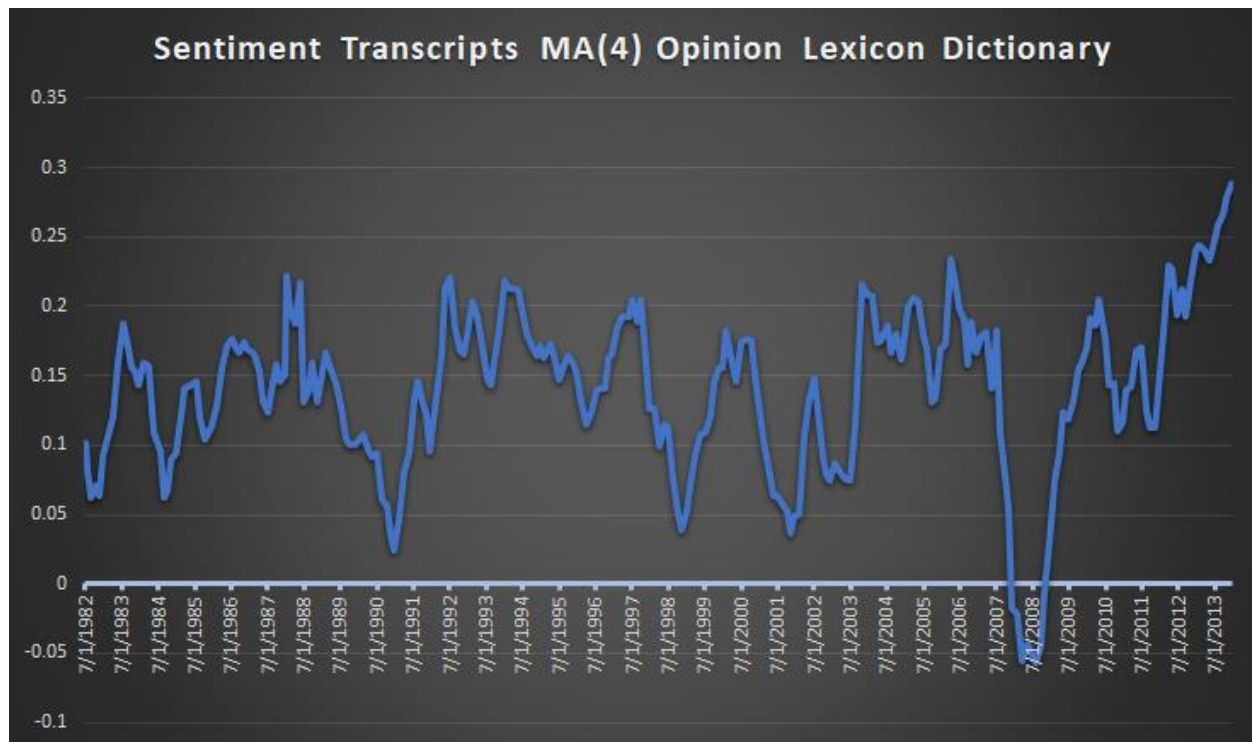
As expected with Opinion Lexicon Dictionary sentiment of transcripts is positive for most of the sample with the Great Recession period being an exception.

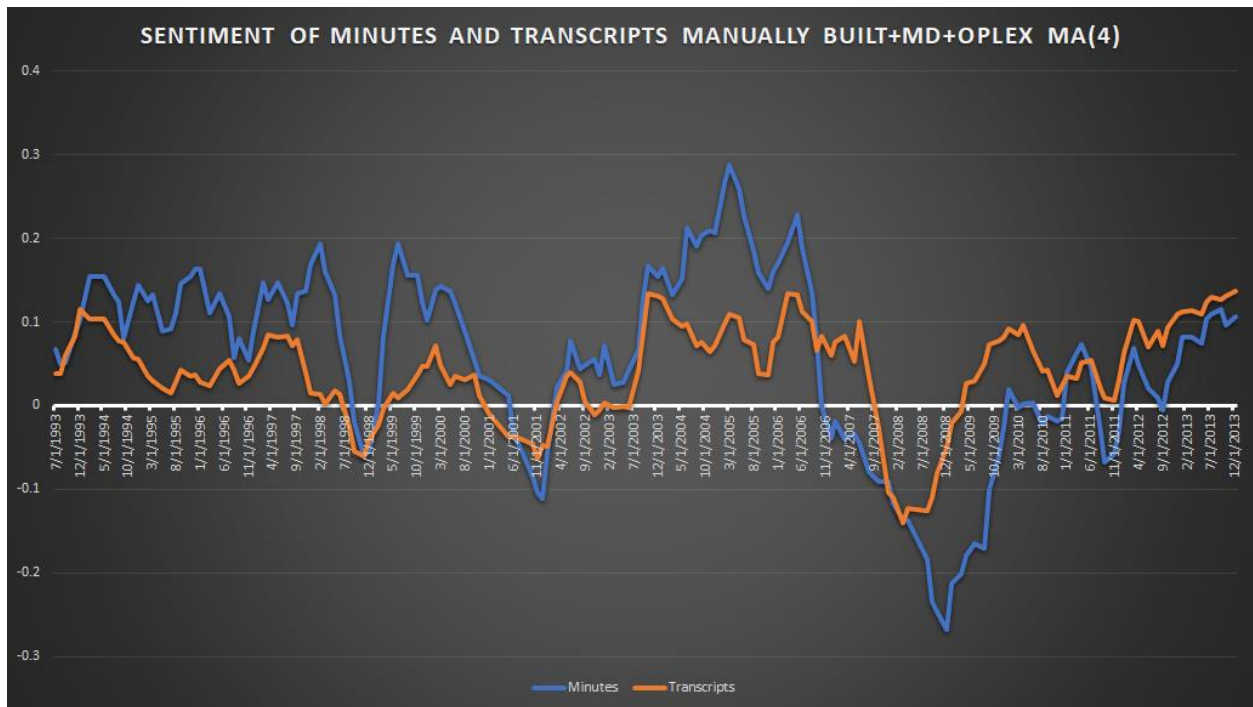Now we will plot Minutes Sentiment Moving average:

Sentiment Minutes MA(4) Opinion Lexicon Dictionary
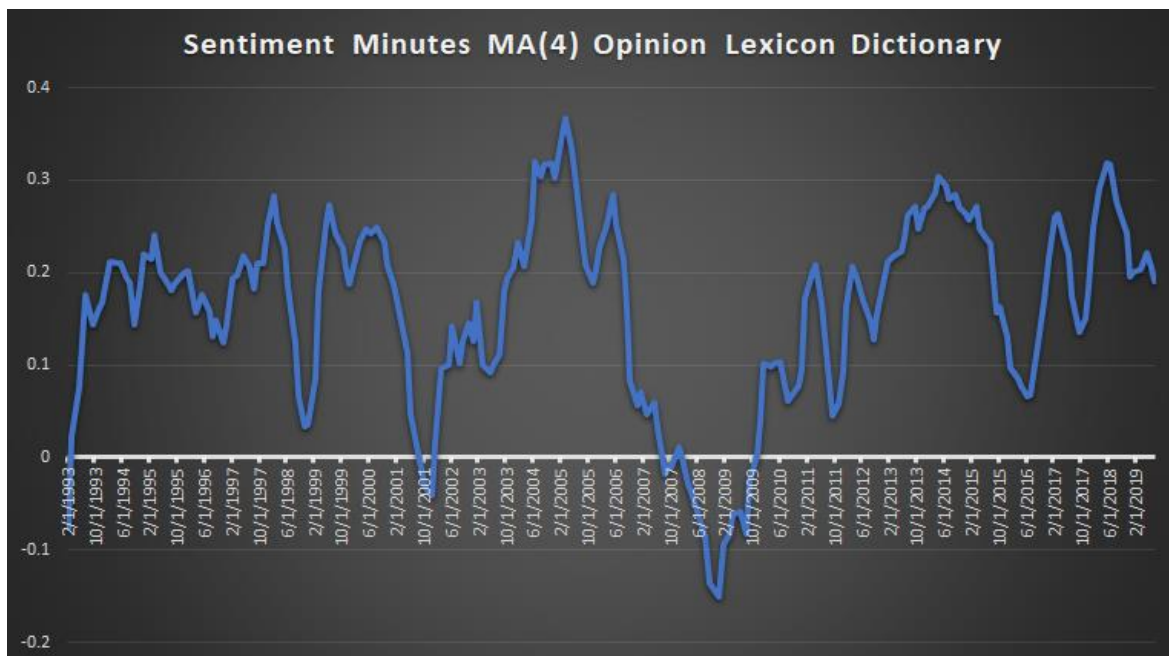
Below we plot the difference between the sentiment of Minutes and Transcripts. We can see that minutes tend to be more positive than transcripts during periods of strong economic conditions and tend to be more negative during periods of an economic slowdown.
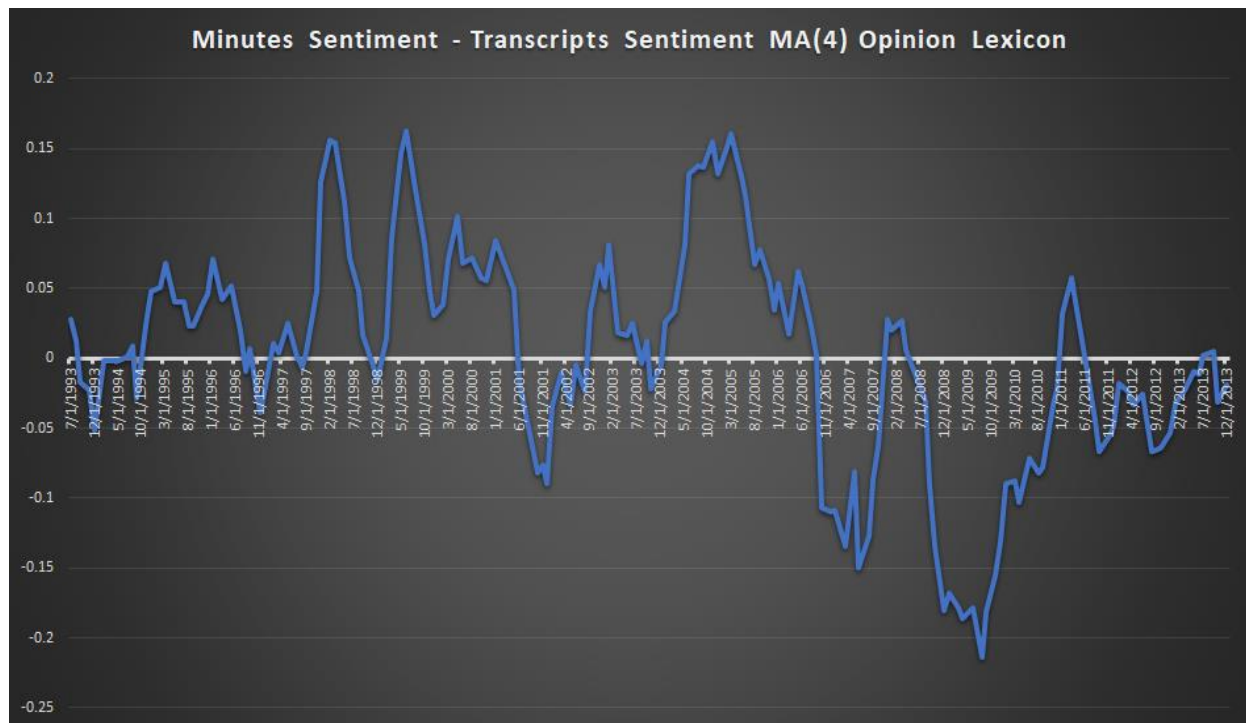
Below we show the sentiment of Transcripts and Minutes for combinations of manually built Dictionary and Loughran/McDonald dictionary:

Sentiment MINUTES Manually Built+MD MA(4)

Sentiment Transcripts Manually Built+MD MA(4)
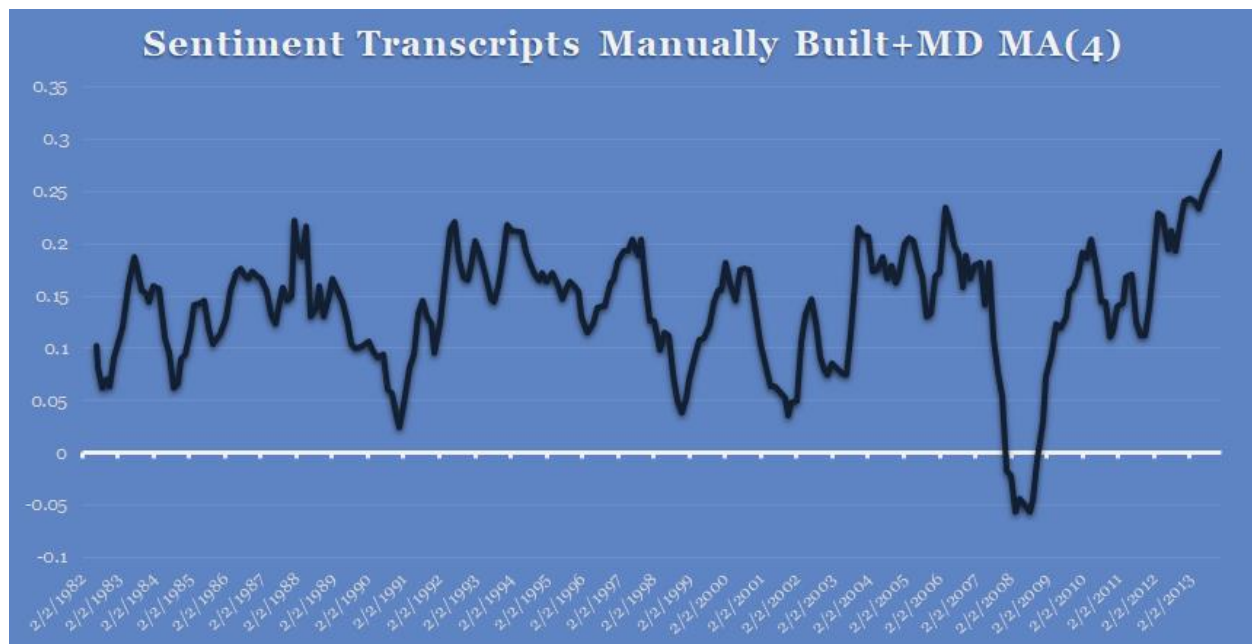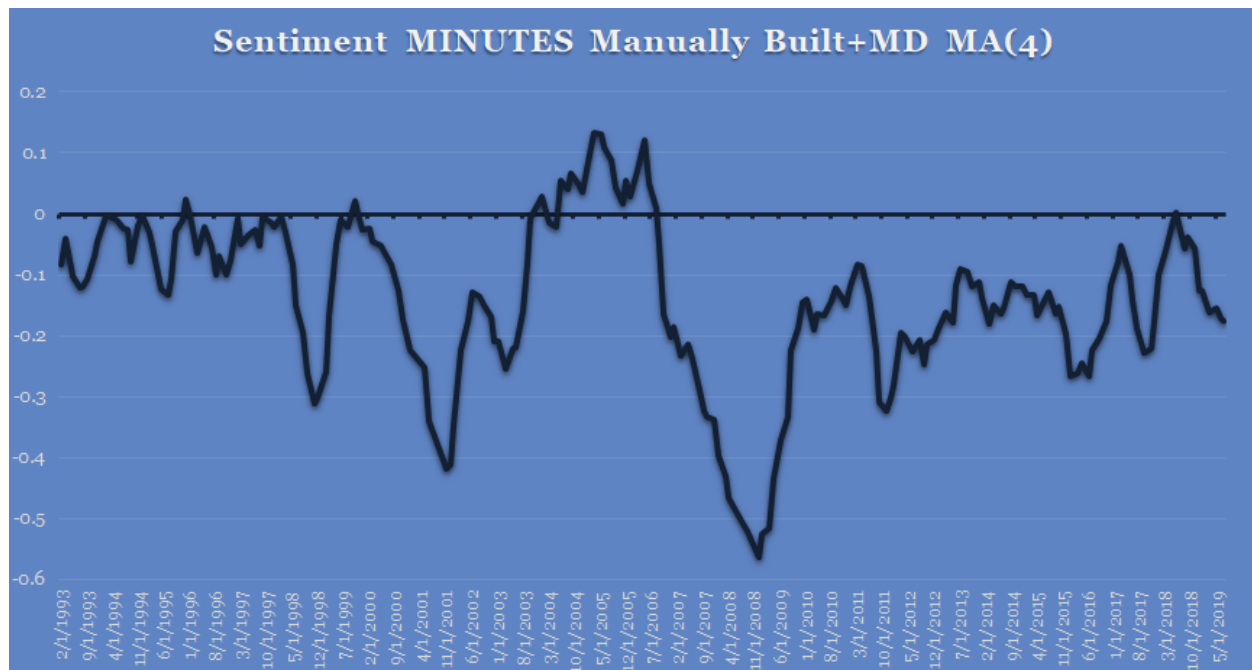
Finally, we produce the plots of the sentiment of transcripts and minutes using a combination of all 3 dictionaries.

SENTIMENT OF MINUTES AND TRANSCRIPTS MANUALLY BUILT+MD+OPLEX MA(4)

MINUTES SENTIMENT - TRANSCRIPTS SENTIMENT MANUALLY BUILT+MD+OPLEX

MINUTES SENTIMENT - TRANSCRIPTS SENTIMENT MANUALLY BUILT+MD+OPLEX MA(4)
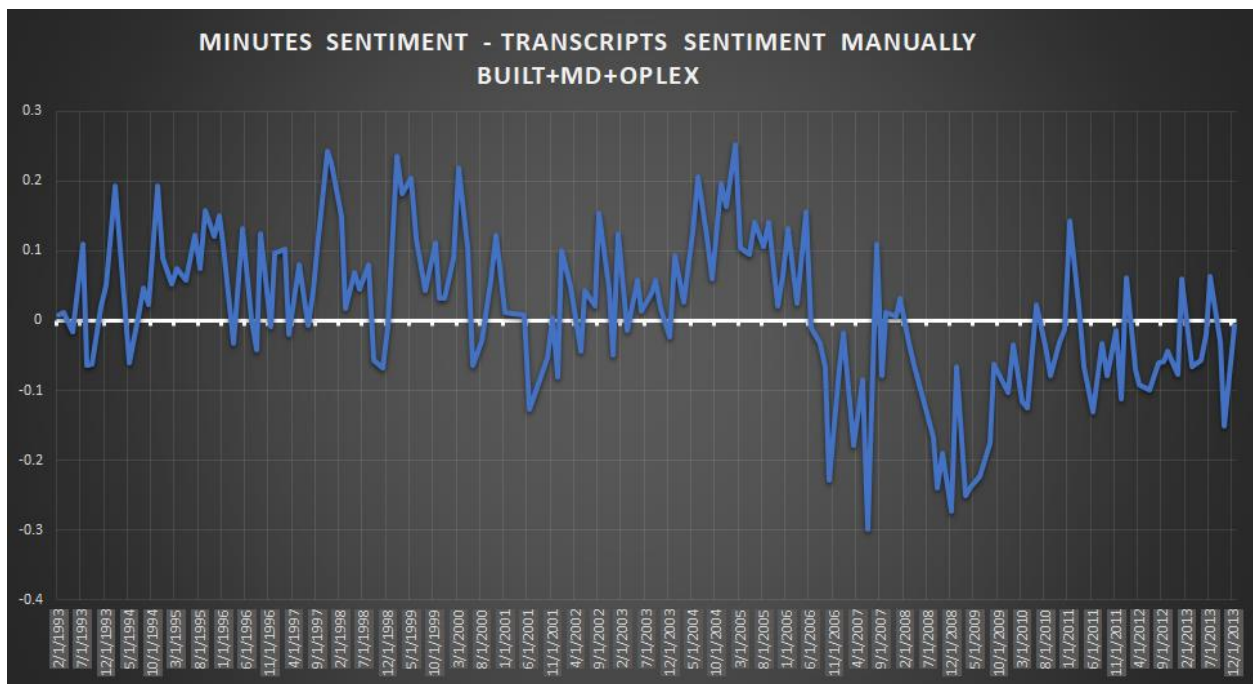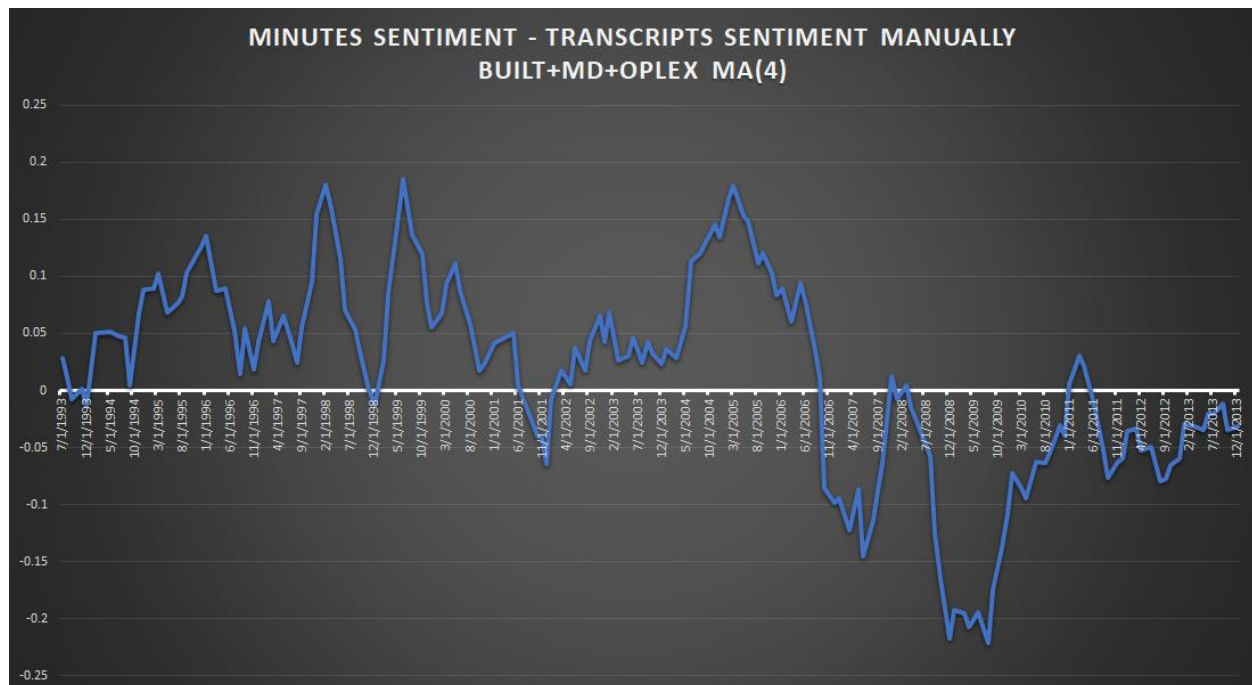
Using the combination of all 3 dictionaries makes the most sense as we get the more balanced dictionary that also includes financial terms. We will only refer to the combined dictionary from now on.

In all three cases, we can notice that the sentiment of minutes tends to be more positive than the sentiment of transcripts when economic conditions are strong. To examine this assumption, we plot the difference in net tone against major economic indicators to see if we can confirm our observation. We chose GDP, unemployment rate, inflation, and stock market returns as our economic indicators as they tend to be the data Federal Reserve considers most important when determining monetary policy.

Below we plot the difference in the sentiment of minutes and transcripts (blue bars) vs Preliminary GDP. The reason we use Preliminary GDP because it is available to Federal Reserve participants during the meeting.

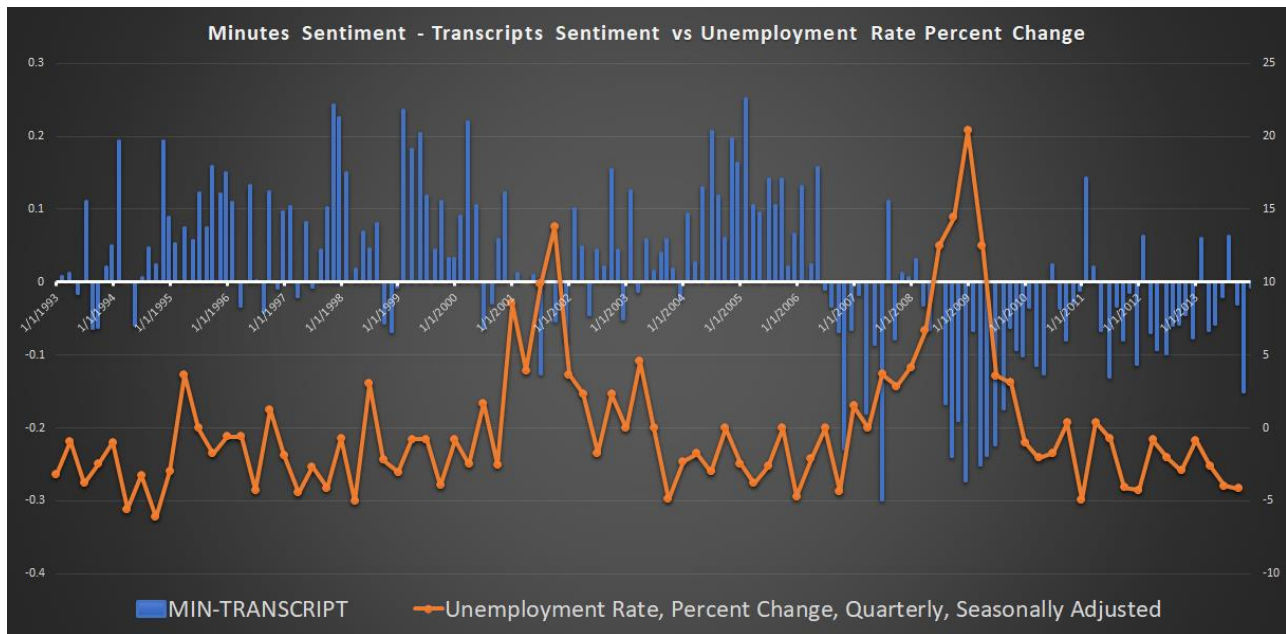Minutes Sentiment - Transcripts Sentiment vs. Preliminary Gdp
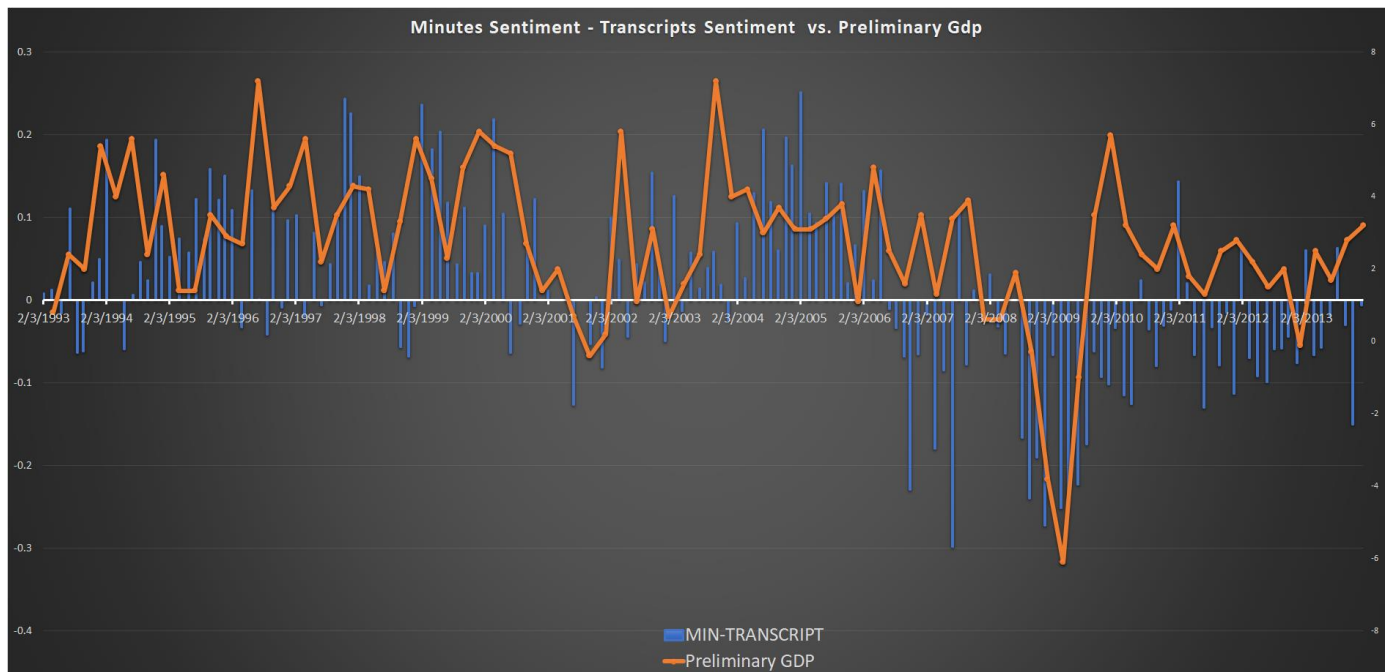
We can easily spot that there appears to be a strong positive correlation between Preliminary GDP and the net sentiment. Prior to 2001 GDP growth is above 0, and so is the net sentiment. Both go below 0 in 2001 and recover quickly. We can see that growth begins to slow down starting at the end of 2005, and then into 2006-2009, and minutes turn much more negative than the transcripts. It is also important to note that GDP growth recovers in mid-2009 and onwards, but minutes remain more negative than transcripts.

Next, we will compare the difference in the sentiment of minutes and transcripts against inflation. We use percent change in PCE as our measure of inflation since Federal Reserve tends to focus more PCE than CPI.

Minutes Sentiment – Transcripts Sentiment vs. PCE

Legend: MIN-TRANSCRIPT — Personal Consumption Expenditures, Percent Change, Quarterly, Seasonally Adjusted Annual Rate
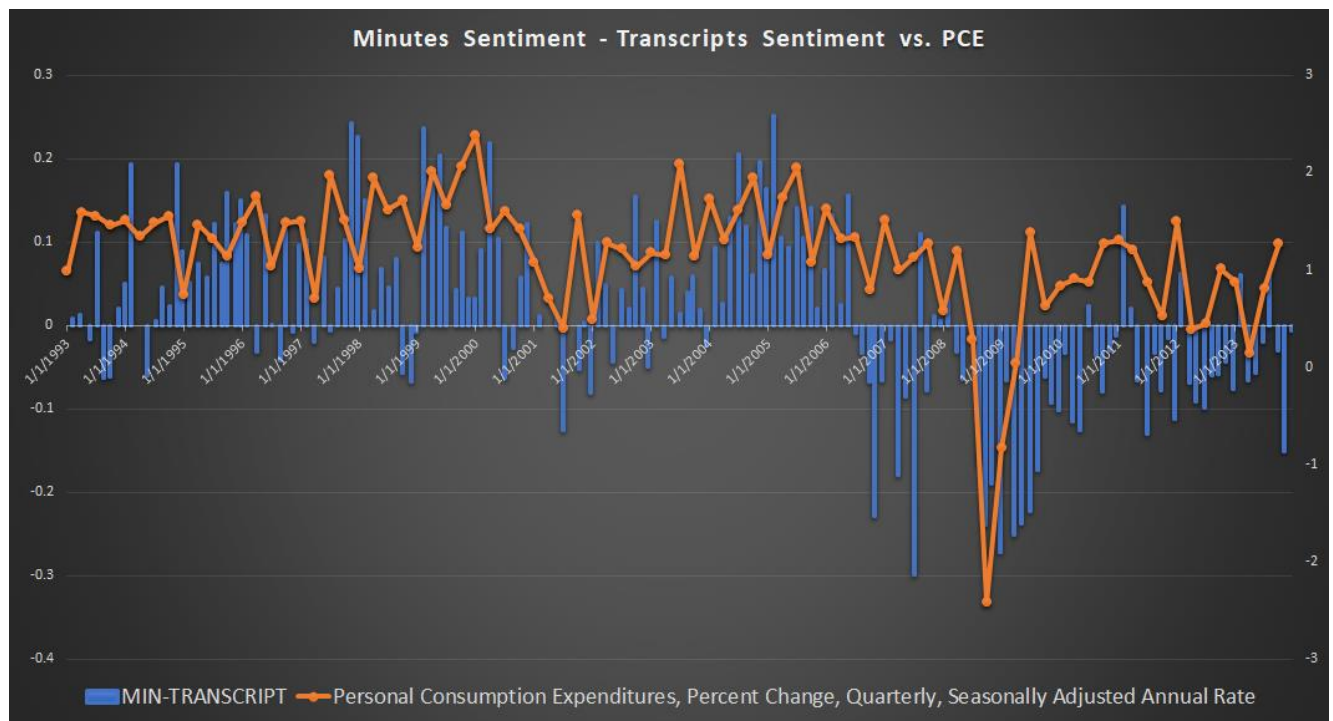
We can observe a similar pattern when we used Preliminary GDP. Both the net tone difference and inflation are positive before 2001-2002, where they head lower. We can, however, note that the sentiment turns negative in late 2006-early 2007, while inflation is still above 0. Note that once again inflation recovers in late 2009, while net sentiment remains negative.

Next, we compared the difference in the sentiment of minutes and transcripts against a percent change in the unemployment rate.

Minutes Sentiment - Transcripts Sentiment vs Unemployment Rate Percent Change

We can observe the strong negative correlations between these variables, as the unemployment rate increased, the minutes tend to be more negative than transcripts.

We also plot the difference in the sentiment of minutes and transcripts against S&P 500 log returns.

MIN-TRANSCRIPT NETTONE vs SNP 500 Log Returns
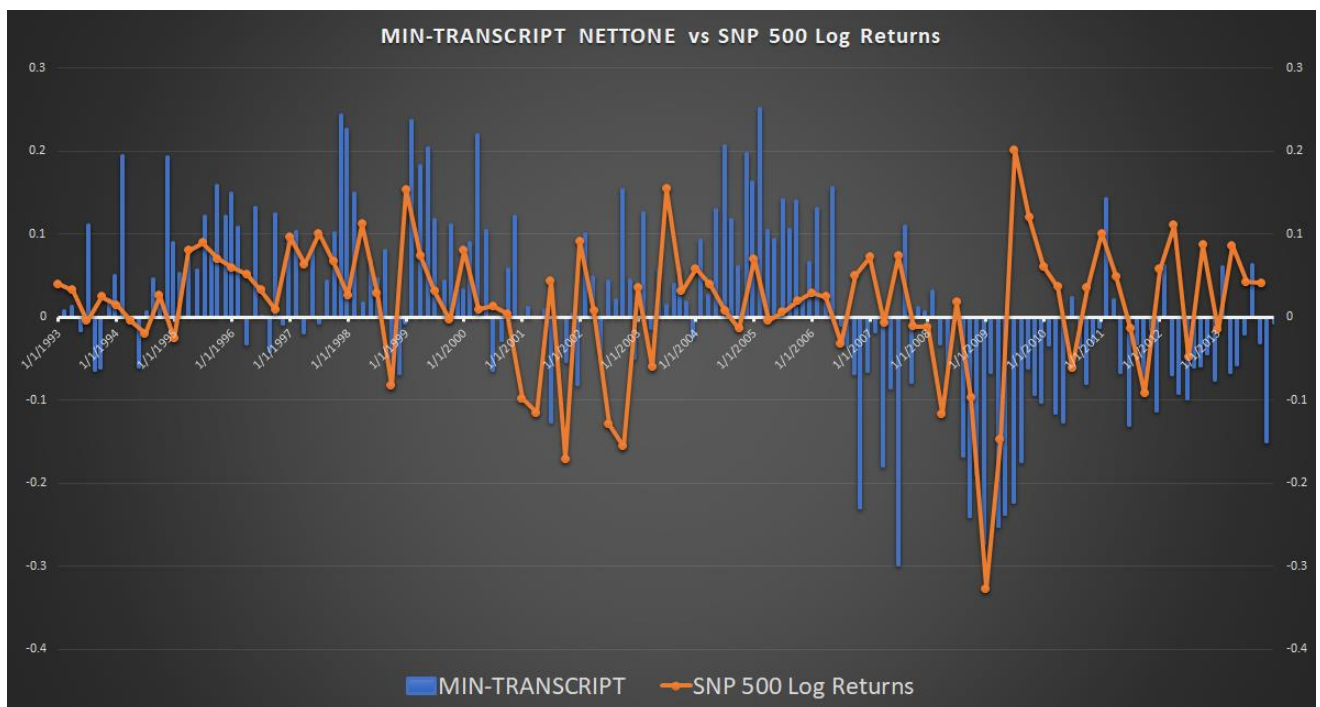
This graph gives us a couple of new insights. First S&P 500 returns turn negative in late 1998, and so does the difference in tone. And note that once again the US stock market recovers after the Great Recession, while the sentiment does not.

Sentiment Analysis Findings

By comparing the difference in sentiment between minutes and transcripts and economic indicators, we can make 3 key observations:

1. When Economic conditions are strong (positive GDP growth, moderate inflation, low/falling unemployment, booming stock market) Federal Reserve minutes are more positive than transcripts. Federal Reserve sends a message of confidence to public/investors.
2. When Economic conditions are weakening (slowing GDP growth, low inflation, rising unemployment, weak stock market) Federal Reserve minutes are more negative than transcripts. Federal Reserve sends a message of uncertainty/weakness to the public/investors.
3. There has been a fundamental shift in the sentiment of minutes following the financial crash of 2007-2008. While the economic data recovered by the mid-2009 and further, minutes have remained significantly more pessimistic than transcripts. It appears that the Federal Reserve wants to emphasize the future risks to the economy and does not want public/investors to once again become overconfident as they did before the Great Recession.

To explain the last observation, we analyze the most frequent topics in transcripts and minutes and see how their proportion changes over time.

Topic Modeling

To Generate the most frequent topics we use our lemmatized data. We first must convert our text documents to a matrix of token counts. This is done by using **sklearn.feature_extraction.text**.**CountVectorizer** function. "This implementation produces a sparse representation of the counts using scipy.sparse.csr_matrix."

One of the most important details is whether to include single words or to include bigrams, trigrams and so on. Upon running both models, it becomes very clear that using bigrams and trigrams generates significantly better and more coherent topics than using individual words. Therefore we use the ngram_range=(2, 3) parameter to build our matrix. After we have created a matrix of token counts, we can pass it to the `LatentDirichletAllocation` algorithm to generate our topics.

Model Selection

"Latent Dirichlet allocation (LDA), a generative probabilistic model for collections of discrete data such as text corpora. LDA is a three-level hierarchical Bayesian model, in which each item of a collection is modeled as a finite mixture over an underlying set of topics".

There are several parameters that need to be specified to LDA. The most important of which is the number of topics. If the number of topics is too low, topics will be too general. If the number of topics is too high, topics will be too broad and unrecognizable. Previous studies that used LDA algorithms usually used between 5 to 12 topics.

We have implemented the following approach to figure out the best model:

Search Parameters:

•Number of components [7, 8, 10, 12, 15]
•Learning decay [.5, .7, .9]
•Used GridSearchCV package

```
Best Model's Params:  {'learning_decay': 0.9, 'n_components': 7}
Best Log Likelihood Score:  -2640034.979685259
Model Perplexity:  71161.85382727075
```

According to the Log-Likelihood method, and Model Perplexity method the best model has 7 topics and learning decay of 0.9. Learning decay is the "parameter that controls the learning rate in the online learning method". It is also known as "Kappa". We were satisfied with the topics generated by this model and applied it to both minutes and transcripts.

Topic Analysis

LDA model has produced 7 topics for transcripts and 7 topics for minutes. We have looked at the top 100 words in each topic and named each topic accordingly. It is important to note that LDA will not name the topics, they must be named manually. Some topics are very easily recognizable, such as Inflation, Economic Outlook, and some are not. The naming is subjective, and the reader may disagree on the naming of some of the topics.

Below we will show the top 25 bigrams and trigrams for minutes and transcripts.

First, we will display the top 25 terms for minutes:

Top 100 Words per Topic, Minutes, ngram = 2-3, learning_decay =0.9 #of topics =7

Topic 0:	Topic 1:	Topic 2:	Topic 3:	Topic 4:	Topic 5:	Topic 6:
energy price	fund rate	economic activity	motor vehicle	monetary policy	consumer price	economic growth
financial market	consumer spending	price inflation	labor market	labor market	inflation expectation	recent month
inflation expectation	price index	real gdp	high level	interest rate	financial condition	intermeeting period
term inflation	remain low	gdp growth	economic outlook	long run	unemployment rate	near term
economic condition	month end	real gdp growth	unemployment rate	market condition	low level	treasury security
long term inflation	business contact	core inflation	open market	long term	moderate pace	equity price
food energy	foreign exchange	first half	capital good	labor market condition	labor cost	long term
measure inflation	oil price	fix investment	industrial production	target range	inflation remain	fomc meeting
base measure	value dollar	business fix	balance sheet	range fund	united states	market participant
inflation pressure	continue expand	business fix investment	single family	range fund rate	aggregate demand	corporate bond
two month	twelve month	consumer price inflation	payroll employment	target range fund	consumer sentiment	second half
foreign economy	express concern	housing market	emerge market	price stability	policy accommodation	policy action
labor force	trade deficit	coming month	resource utilization	downside risk	high tech	retail sale
pce price	exchange value	home sale	business spending	medium term	expand moderate	little change
housing sector	business equipment	inventory sale	mortgage rate	intermeeting period	outlook inflation	inflation compensation
term inflation expectation	slow pace	longer run	low level	economic outlook	market economy	economic expansion
economic situation	exchange value dollar	house price	nonfarm payroll	run objective	core consumer	economic data
labor compensation	information review	rate percent	meeting participant	asset purchase	housing activity	basis point
force participation	review meeting	outlook economic	anecdotal report	short term	nonresidential construction	staff forecast
labor force participation	information review meeting	average hourly	nondefense capital	real estate	core consumer price	recent data
decline energy	growth consumer	average hourly earnings	participation rate	back security	state local	euro area
little change	price increase	policy directive	new home	economic financial	rate remain	forecast prepare
intermeeting period	foreign exchange value	sale ratio	nondefense capital good	period ahead	condition market	speculative grade
price rise	credit condition	inventory investment	economic recovery	percent objective	expand moderate pace	treasury yield
couple participant	participant note	inventory sale ratio	exist home	mortgage back	agency mortgage	net export

We examined the top 100 words for each topic and named them the following way:

| Topic 0	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
Inflation	Foreign Policy/Trade	Economic Activity/Outlook	Labor Condtions/Unemployment	Monetary Policy	Consumption	Financial Markets

Now that we have generated and defined our topics, we can see how their proportion changed throughout the time frame.

Topic Proportions For Minutes, Trained on Minutes, ngram = 2-3, learning_decay =0.9, #oftopics =7
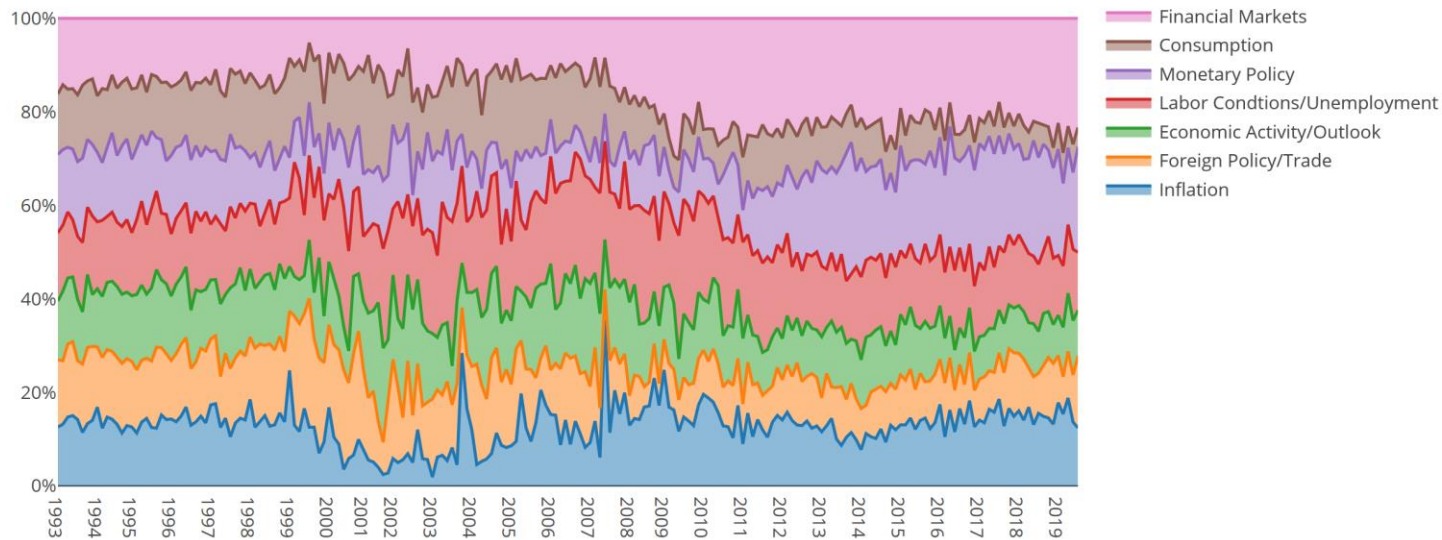
It is important to note that there is a lot of variabilities as time goes by. To make it clearer we will plot a proportion of a couple of individual topics.

Topic Proportions For Minutes, Trained on Minutes, ngram = 2-3, learning_decay =0.9, #oftopics =7
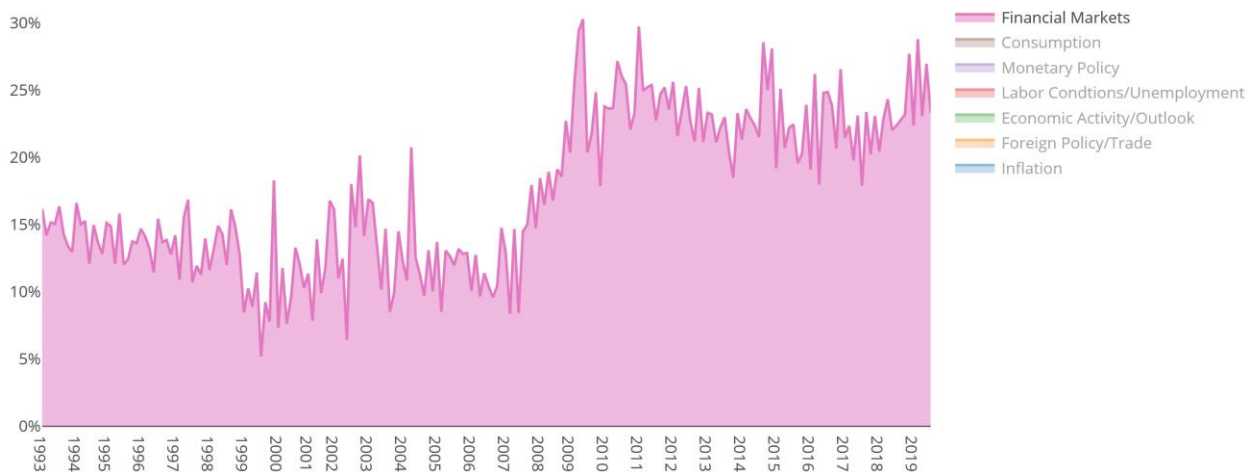
The Topic Financial Markets in minutes was discussed generally in the 10-15% range prior to the Great Recession but has increased substantially since. Now it is discussed for 20-30% of the time. This might explain why the minutes have remained more negative than transcripts despite the economy recovering. When we plot the sentiment of Financial Markets topics for minutes, we can see that sentiment remains predominantly negative. Federal Reserve is now dedicating

more time to discussing Financial Markets in minutes than it used to prior to 2007, and the sentiment for this topic is very negative from 2007 to late 2013.
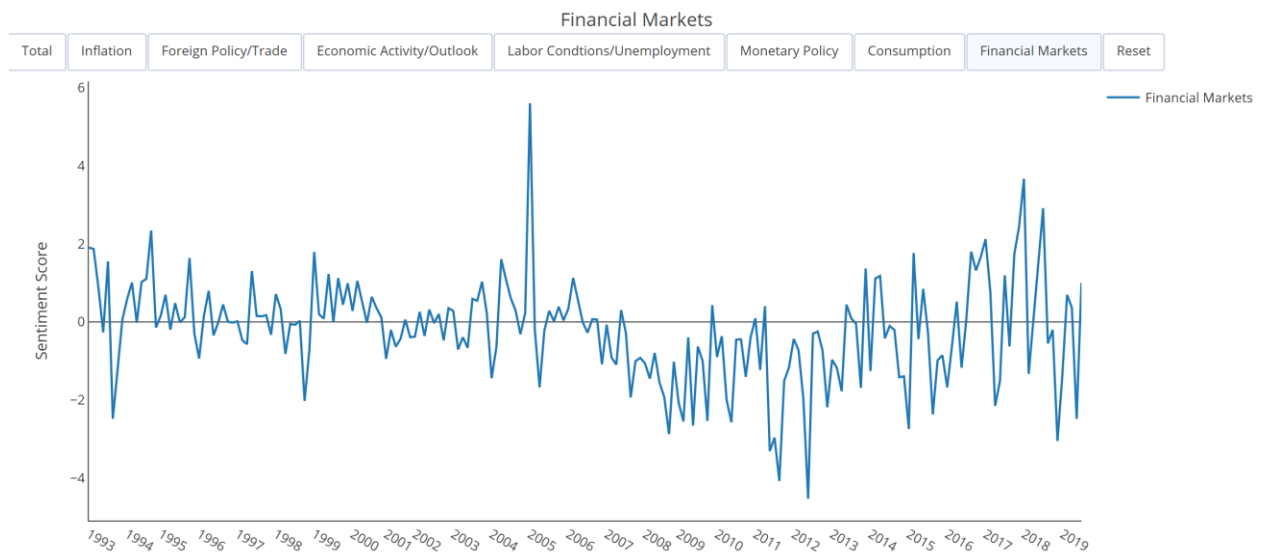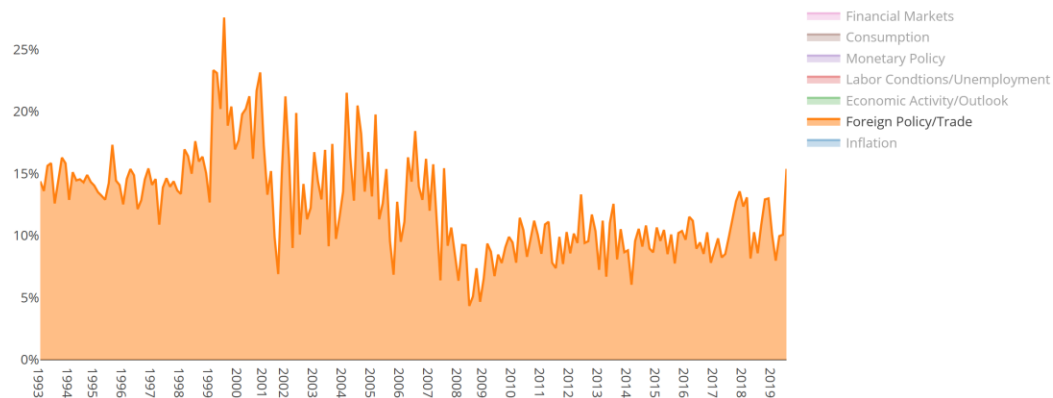

This increase in the popularity of Financial Markets topics is offset by the drop in popularity of Consumption topic and Foreign Policy/Trade topic. Foreign Policy/Trade was very common during the formation of the European Union, and 9/11 attacks, but has fallen since.
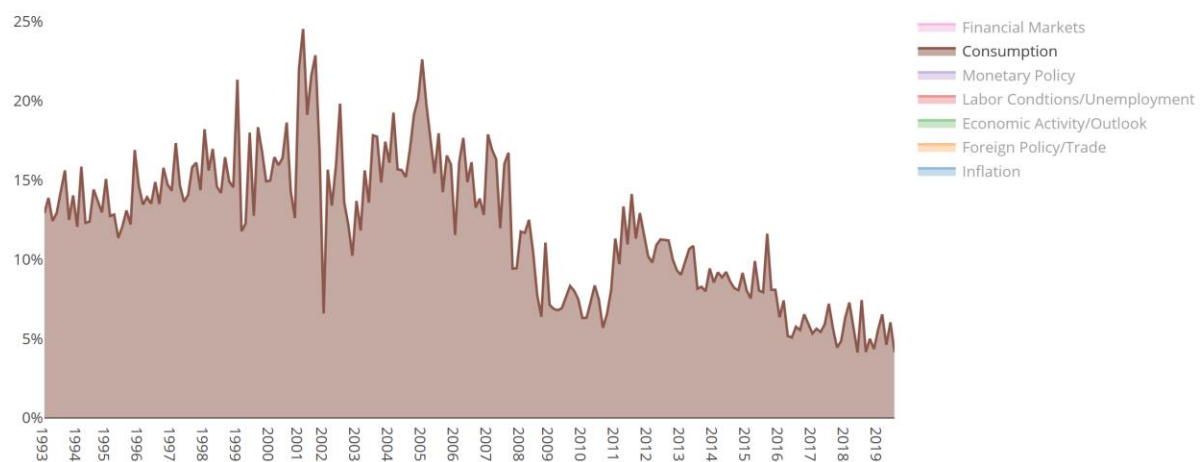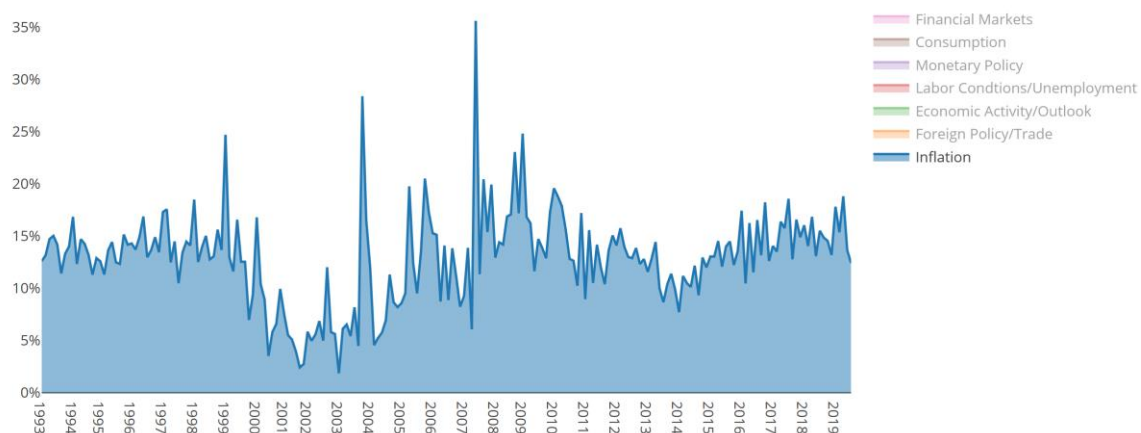
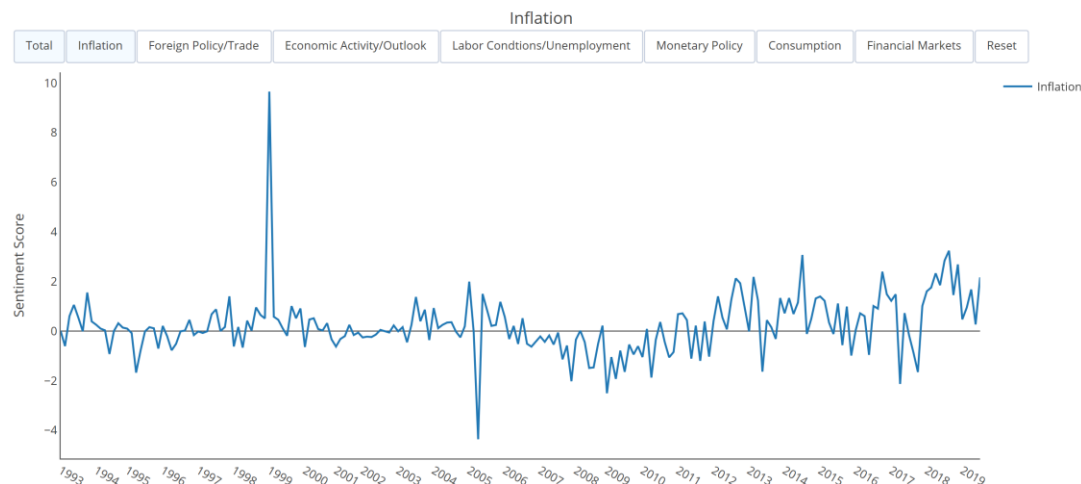Topic Proportions For Minutes, Trained on Minutes, ngram = 2-3, learning_decay =0.9, #oftopics =7

Topics Labor Conditions/Unemployment Economic Activity/Outlook remain constant thought the entire time frame, whereas topic Monetary Policy increases in popularity after 2010.

A very interesting topic is Inflation. The proportion of this topic is very volatile, falling below 5% in the early 2000s and having frequent spikes above 20% numerous times. Federal Reserve tends to focus heavily on the inflation topic when it worries that inflation is too high or too low. For example, in the October 2003 spike which corresponds to the second-largest spike, Fed States: "The Committee judged that, on balance, the risk of inflation becoming undesirably low would remain the predominant concern for the foreseeable future".

Topic Proportions For Minutes, Trained on Minutes, ngram = 2-3, learning_decay =0.9, #oftopics =7

| Total | Inflation | Foreign Policy/Trade | Economic Activity/Outlook | Labor Condtions/Unemployment | Monetary Policy | Consumption | Financial Markets | Reset |

We have performed the same analysis for Transcripts.

Below are the top 25 terms per topic for transcripts:

Top 100 Words per Topic, Transcripts ,ngram=2, 7 topics

Topic 0:	Topic 1:	Topic 2:	Topic 3:	Topic 4:	Topic 5:	Topic 6:
even though	fund rate	labor market	last meeting	balance sheet	market participant	basis point
housing market	interest rate	monetary policy	second half	little bit	real estate	percentage point
economic activity	financial market	inflation expectation	since last	united states	last week	unemployment rate
downside risk	long term	unemployment rate	consumer spending	press conference	along line	long run
growth rate	asset purchase	economic growth	open market	policy action	period time	incoming data
leave panel	monetary policy	near term	labor force	financial stability	commercial real	house price
long time	short term	gdp growth	upside risk	bernanke okay	financial institution	new york
retail sale	forward guidance	core inflation	business contact	exit strategy	foreign exchange	next two
high level	fed fund	long term	natural rate	support alternative	ask question	dual mandate
red line	term interest	intermeeting period	employment growth	next meeting	first time	around percent
private sector	left panel	real gdp	unemployment rate	append transcript	last time	central tendency
capital spending	financial condition	oil price	first half	fomc meeting	bernanke fisher	rate percent
take account	right panel	price stability	import price	transcript).	payroll employment	real economy
housing sector	term rate	energy price	around table	agency mbs	slow growth	paragraph alternative
current level	around table	commodity price	annual rate	material use	long period	bernanke question
low level	market condition	output gap	economic condition	price increase	make change	percent end
aggregate demand	market expectation	core pce	high tech	primary dealer	term outlook	bernanke lacker
consumer confidence	purchase program	fiscal policy	short run	mortgage back	large scale	rate inflation
job growth	reaction function	pce inflation	next couple	back security	support recommendation	sovereign debt
middle panel	money market	medium term	make sense	staff memo	asset sale	percent inflation
motor vehicle	yield curve	downside risk	next several	make clear	number people	price rise
past two	treasury yield	productivity growth	industrial production	take place	small business	bottom leave
middle leave	equity price	inflation rate	raise question	mortgage rate	growth real	gdp growth
get back	balance risk	economic outlook	force participation	exchange rate	policy tool	bernanke right
moderate pace	low level	stock market	two thing	economic recovery	bernanke plosser	downward revision

We have examined the top 100 words for each topic and named them the following way:

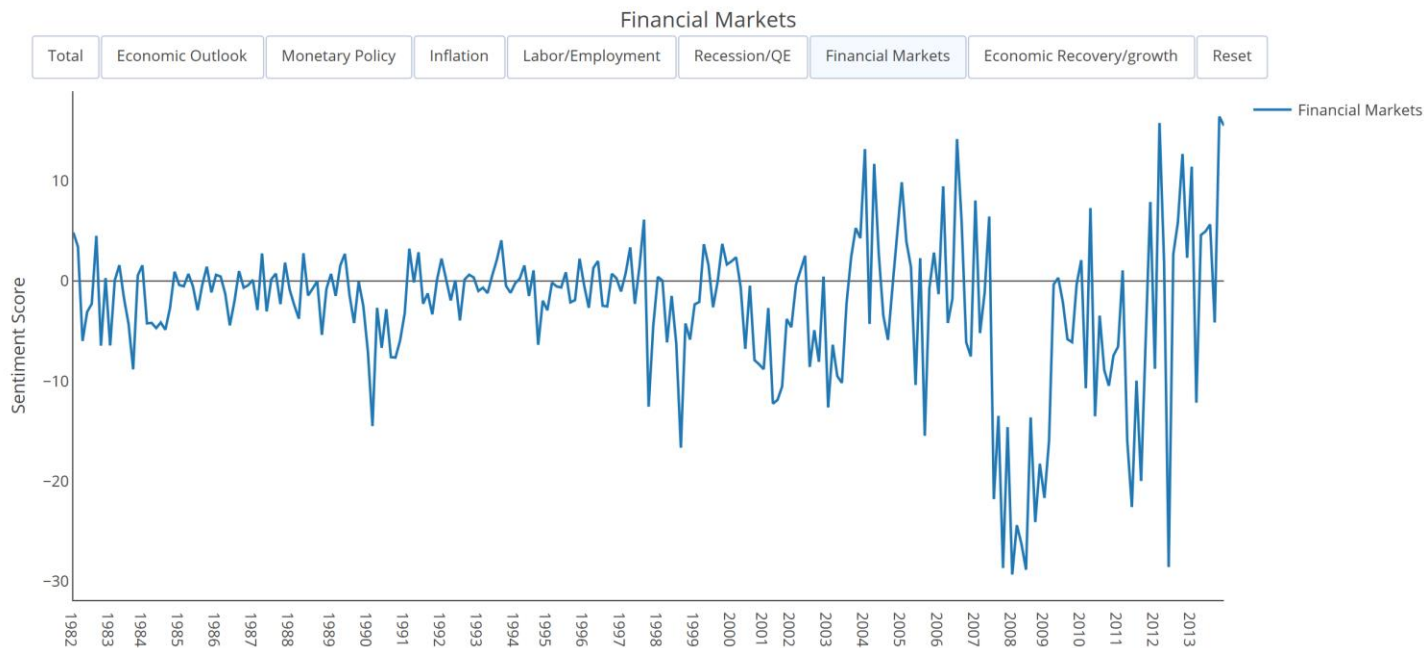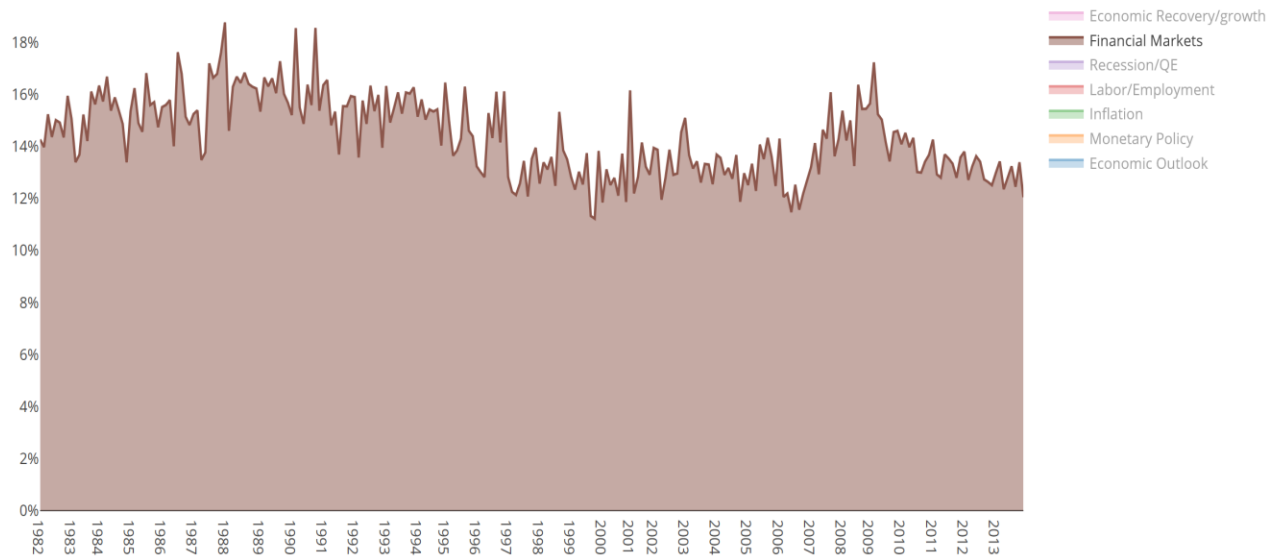| Topic 0	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
Economic Outlook	Monetary Policy	Inflation	Labor/Employment	Recession/QE	Financial Markets	Economic Recovery/growth

Now that we have generated and defined our topics, we can see how their proportion changed throughout the time frame.

Topic Proportions For Transcripts, 7 Topics, Trained on Transcripts, ngram = 2, learning_decay =0.9
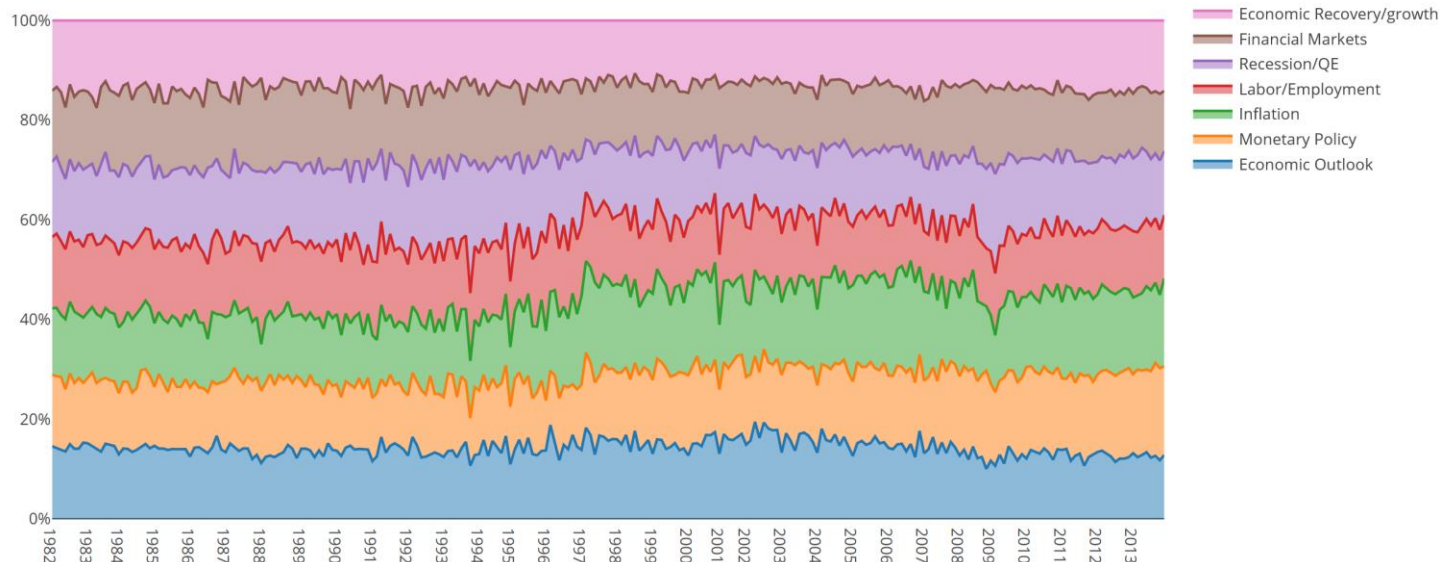
Right away we can notice that there is significantly less variability in topic proportion for transcripts than in minutes. In minutes we saw the proportion of some topics double or being cut in half from the beginning of the period to the end, while in transcripts they do not move by more than a few percentage points. For example, the topic 'Financial Markets' which more than doubled in minutes after 2007, only increased by a couple of percentage points. Although the sentiment of 'Financial Markets' in transcripts is predominantly negative since its proportion does not increase that much, the effect on the overall sentiment of transcripts is much lower.

Topic Proportions For Transcripts, 7 Topics, Trained on Transcripts, ngram = 2, learning_decay =0.9

Legend:
- Economic Recovery/growth
- Financial Markets
- Recession/QE
- Labor/Employment
- Inflation
- Monetary Policy
- Economic Outlook

Financial Markets

Tabs: Total | Economic Outlook | Monetary Policy | Inflation | Labor/Employment | Recession/QE | Financial Markets | Economic Recovery/growth | Reset

These observations lead to a very interesting point:

Since FOMC meetings are long and usually lasts 2 days, Federal Reserve spends relatively the same amount of time discussing each topic. Major economic data and topics such as unemployment rate and inflation are generally presented and discussed for relatively the same

amount of time in each meeting. There are small changes from meeting to meeting, for example, FED might spend a bit more time discussing Financial Markets in 2007-2010 but these changes are not large enough since FED still has to follow the meeting agenda and discuss Inflation, Labor/Unemployment as well as other topics**.**

Since minutes are very short compared to transcripts, the Federal Reserve has more freedom to focus on the topics it considers the most important.

Fed Minutes are not a summary of what was discussed during the meeting, rather it is a tool that FED uses to focus public attention on specific topics.

The topic analysis also explains the fundamental shift in minutes after 2007-2008, and why the difference in sentiment between minutes and transcripts did not recover, even when economic data improved. This is because FED minutes are being dominated by the Financial Markets Topic (25-30% after 2008-2009, compared to about 10% before) and the sentiment of this topic is generally negative.

Correlation Analysis

Next, we check the correlation is sentiment between topics in minutes and transcripts. Topics Inflation, Economic Activity/Outlook, Labor/Unemployment, Monetary Policy, and Financial Markets appear in both minutes and transcripts, and the sentiment correlation between identical topics vary between 0.18 and 0.43.

	Economic Outlook	Monetary Policy	Inflation	Labor/Employment	Recession/QE	Financial Markets	Economic Recovery/growth
Inflation	0.17	0.16	0.18	0.10	0.08	0.20	0.13
Foreign Policy/Trade	0.39	0.15	0.38	0.34	0.17	0.32	0.25
Economic Activity/Outlook	0.28	0.10	0.25	0.27	0.15	0.33	0.19
Labor Condtions/Unemployment	0.51	0.17	0.46	0.43	0.27	0.46	0.34
Monetary Policy	0.25	0.33	0.24	0.17	0.19	0.29	0.21
Consumption	0.17	-0.01	0.13	0.08	0.06	0.10	0.12
Financial Market	0.34	0.18	0.51	0.41	0.15	0.41	0.28

Summary

During our research, we were trying to discover whether FOMC minutes are an accurate reflection of Federal Reserve transcripts.

We have performed Sentiment Analysis of all minutes and transcripts, and on their topics. We came to the concussion that:

- When Economic conditions are strong (positive GDP growth, moderate inflation, low/falling unemployment, booming stock market) Federal Reserve minutes are more positive than transcripts. Federal Reserve sends a message of confidence to the public/investors.
- When Economic conditions are weakening (slowing GDP growth, low inflation, rising unemployment, weak stock market) Federal Reserve minutes are more negative than transcripts. Federal Reserve sends a message of uncertainty/weakness to the public/investors.
- There has been a fundamental shift in the sentiment of minutes following the financial crash of 2007-2008. While the economic data recovered by the mid-2009 and further, minutes have remained significantly more pessimistic than transcripts. It appears that the Federal Reserve wants to emphasize the future risks to the economy and does not want public/investors to once again become overconfident as they did before the Great Recession.
- Since FOMC meetings are long and usually lasts 2 days, the Federal Reserve spends a relatively equal amount of time discussing each topic. Major economic data and topics such as unemployment rate and inflation are generally presented and discussed for relatively the same amount of time in each meeting. There are small changes from meeting to meeting, for example, FED might spend a bit more time discussing Financial Markets in 2007-2010, but these changes are not large since FED still must follow the meeting agenda and discuss Inflation, Labor/Unemployment as well as other topics.
- Since minutes are very short compared to transcripts Federal Reserve has more freedom to focus on the topics it considers the most important. Fed Minutes are not a summary of what was discussed during the meeting, rather it is a tool that FED uses to focus public attention on specific topics.

- The topic analysis also explains the fundamental shift in minutes after 2007-2008, and why the difference in sentiment between minutes and transcripts did not recover, even when economic data improved. This is because FED minutes are being dominated by the Financial Markets Topic (25-30% after 2008-2009, compared to about 10% before) and the sentiment of this topic is generally negative.

Appendix

Attached are the complete graphs of Topic Modelling and Sentiment analysis of Topics:

Minutes_Topics_Sentiments.html   Minutes_TopicWords.html   Minutes_Topics_Proportions.html

Transcripts_Topics_Sentiments.html   Transcripts_TopicWords.html

Transcripts_Topics_Proportions.html

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https://github.com/JonnyFLDN/Federal-Reserve-Minutes-Topic-and-Sentiment-Modelling