Parsing the FED: A new approach for content analysis

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Outline

- Brief overview of text mining methods for FOMC statements
- Introducing 'Edit Distance'
- Empirical results
- Key takeaways

Measuring the FOMC statements: 'Multi-dimensional nature of text'

- 1. Word counts: Amount of information
- 2. Readability: Clarity of the statement
- 3. Topics: e.g. Growth vs Inflation vs Forward guidance
- 4. Tone: Sentiment (Hawking vs Dovish)

However, FOMC statements are not crafted from a blank page but relied heavily from previous statement. This has led to...

- 5. Statement comparison [t-1 vs t]: Semantic similarity.
- 6. Our proposed method: Edit distance

FOMC BLUE BOOK [2010]

March FOMC Statement—Alternative A

- 1. Information received since the Federal Open Market Committee met in January suggests that economic activity has continued to strengthen and that the deterioration in the labor market is abating. Household spending is expanding at a moderate rate but remains constrained by high unemployment, modest income growth, lower housing wealth, and tight credit. Business spending on equipment and software has risen significantly. However, investment in nonresidential structures is still contracting, housing activity continues to be sluggish, and employers remain reluctant to add to payrolls. In light of the weakness in labor markets and prospects for a subpar economic recovery, the Committee judges that further monetary stimulus is warranted.
- With substantial resource slack continuing to restrain cost pressures and with longer-term inflation expectations stable, inflation is likely to be subdued for some time.
- 3. To provide <u>further</u> support to mortgage lending and housing markets and to <u>promote a more</u> robust economic recovery in a context of price stability, the Committee decided to extend its program for purchasing agency mortgage-backed securities. The previously announced purchases of \$1.25 trillion of those securities will be executed by the end of this month, and the Committee now anticipates that an additional \$150 billion of such securities will be purchased during the second quarter. The Federal Reserve has been purchasing about \$175 billion of agency debt, and those transactions will be executed by the end of this month. The Committee will continue to evaluate its purchases of securities in light of the evolving economic outlook and conditions in financial markets. The Committee will maintain the target range for the federal funds rate at 0 to ¼ percent and continues to anticipate that economic conditions, including low rates of resource utilization, subdued inflation trends, and stable inflation expectations, are likely to warrant exceptionally low levels of the federal funds rate for an extended period.
- 4. In light of improved functioning of financial markets, the Federal Reserve has been closing the special liquidity facilities that it created to support markets during the crisis. The only remaining such program, the Term Asset-Backed Securities Loan Facility, is scheduled to close on June 30 for loans backed by new-issue commercial mortgage-backed securities and on March 31 for loans backed by all other types of collateral.

March FOMC Statement—Alternative B

- 1. Information received since the Federal Open Market Committee met in January suggests that economic activity has continued to strengthen and that the labor market is stabilizing. Household spending is expanding at a moderate rate but remains constrained by high unemployment, modest income growth, lower housing wealth, and tight credit. Business spending on equipment and software has risen significantly. However, investment in nonresidential structures is declining, and housing starts have been flat at a depressed level. While bank lending continues to contract, financial market conditions remain supportive of economic growth. Although the pace of economic recovery is likely to be moderate for a time, the Committee anticipates a gradual return to higher levels of resource utilization in a context of price stability.
- With substantial resource slack continuing to restrain cost pressures and longer-term inflation expectations stable, inflation is likely to be subdued for some time. [The Committee expects that over time and with appropriate monetary policy, inflation will run at rates consistent with price stability.]
- 3. The Committee will maintain the target range for the federal funds rate at 0 to ¼ percent and continues to anticipate that economic conditions, including low rates of resource utilization, subdued inflation trends, and stable inflation expectations, are likely to warrant exceptionally low levels of the federal funds rate for an extended period. To provide support to mortgage lending and housing markets and to improve overall conditions in private credit markets, the Federal Reserve has been purchasing \$1.25 trillion of agency mortgage-backed securities and about \$175 billion of agency debt; those purchases are nearing completion, and the remaining transactions will be executed by the end of this month. The Committee will continue to monitor the economic outlook and financial developments and will employ its policy tools as necessary to promote economic recovery and price stability.
- 4. In light of improved functioning of financial markets, the Federal Reserve <u>has been closing</u> the special liquidity facilities that it created to support markets during the crisis. The only remaining such program, the Term Asset-Backed Securities Loan Facility, is scheduled to close on June 30 for loans backed by new-issue commercial mortgage-backed securities and on March 31 for loans backed by all other types of collateral.

March FOMC Statement—Alternative C

- Information received since the Federal Open Market Committee met in January indicates
 that economic activity has continued to advance and that the labor market is beginning to
 stabilize. Consumer spending is expanding, business spending on equipment and software
 has risen appreciably, and firms have brought inventory stocks into better alignment with
 sales. While bank lending continues to contract, financial market conditions remain supportive
 of economic growth. With a sustainable economic recovery now under way, the Committee
 anticipates a gradual return to higher levels of resource utilization.
- Higher energy prices have been reflected in a recent modest pickup in inflation, but underlying inflation pressures remain muted. The Committee will adjust the stance of monetary policy as necessary over time to ensure that longer-term inflation expectations remain well anchored and that inflation outcomes are consistent with price stability.
- 3. The Committee will maintain the target range for the federal funds rate at 0 to ¼ percent and continues to anticipate that economic conditions, including low rates of resource utilization, subdued inflation trends, and stable inflation expectations, are likely to warrant exceptionally low levels of the federal funds rate for some time [, at least through the end of the second quarter]. The Federal Reserve has been purchasing \$1.25 trillion of agency mortgage-backed securities and about \$175 billion of agency debt; those purchases are nearing completion, and the remaining transactions will be executed by the end of this month.
- 4. Although the federal funds rate is likely to remain exceptionally low for some time, the Federal Reserve will need to begin to tighten monetary conditions at the appropriate time to prevent the development of inflationary pressures. Over coming months, the Federal Reserve will continue to test its tools for draining reserves. In due course, those operations will be scaled up to drain more significant volumes of reserve balances, and then the Federal Reserve will increase the interest rate paid on reserves and its target for the federal funds rate. The Committee anticipates that any sales of the Federal Reserve's securities holdings would be gradual and would not occur until after policy tightening is under way and the economic recovery is sufficiently advanced. The Committee will monitor the economic outlook and financial developments in determining the timing and sequence of its measures for policy firming and will employ its tools as necessary to promote economic recovery and price stability.
- 5. In light of improved functioning of financial markets, the Federal Reserve has been closing the special liquidity facilities that it created to support markets during the crisis. The only remaining such program, the Term Asset-Backed Securities Loan Facility, is scheduled to close on June 30 for loans backed by new-issue commercial mortgage-backed securities and on March 31 for loans backed by all other types of collateral.

What is 'EDIT DISTANCE'?

Edit Distance: Word Level

- Edit distance is a standard measurement of dissimilarity of two words.
- Edit distance between *kitten* and *sitting*. Count minimum operation required for changing kitten to sitting
 - **1. k**itten → itten (delete "k" at O
 - 2. itten \rightarrow sitten [insert "s" at O]
 - 3. sitten \rightarrow sittn [delete "e" at 4]
 - 4. sittn \rightarrow sittin [insert "i" at 4]
 - 5. sittin \rightarrow sitting [insert "g" at 6]
 - 6. Resule:
 - a. Edit script: delete k, e, insert s, i, g
 - b. Total distance: 5

Edit Distance: Sentence Level

john goes to school. => *they go to class.*

1) john go to school. => they go to class. [stem]

- 2) Edit distance calculation
 - a) Edit script:
 - i] Delete: john, school
 - ii) Insert: *they*, *class*
 - b) Edit distance: 4

Comparing 2 Statements Using Edit Distance

- Goal: comparing FOMC statement_t-1 and statement_t
- Stemming: remove s, es, ing
- Pairing sentences
 - Each sentence s in statment_t-1 will be paired with the most similar sentence in statment_t.
- Classifying sentences
 - Deleted sentences
 - \circ New sentences
 - Edited sentences

Comparing 2 Statement

Statement at t-1

Business fixed investment and exports have weakened. The Committee contemplates the future target for the federal funds rate.

Statement at t

Business fixed investment and exports remain weak. It assesses the appropriate path of the target inflation.

Comparing 2 Statement: Stemming

Statement_t-1

business fix invest and export have weak.

the committee contemplate the future target for the federal fund rate.

Statement_t business fix invest and export remain weak. it assess the appropriate path of the target inflat.

Comparing 2 Statement: Pairing

Pair 1

business fix invest and export have weak. => business fix invest and export remain weak.

Edit script: delete *have*, insert *remain* Edit distance: 2

Pair 2

the committee contemplate the future target for the federal fund rate => it assess the appropriate path of the target inflat

Edit script: delete *committee*, *contemplate*, ... insert *access*, Edit distance: 16

Comparing 2 Statement: Classifying Sentences

- Deleted sentences:
 - sentences in statement_t-1
 - distance from its pair in statement_t > [# of the sentence's words]/2
- New sentences:
 - sentences in statement_t
 - distance from its pair in statement_t-1 > [# of the sentence's words]/2
- Edited sentences:
 - \circ other sentences in statement_t

Comparing 2 Statement: Classifying Sentences

Statement at t

Business fixed investment and exports have weakened. The Committee contemplates the future target for the federal funds rate. [deleted]

Statement at t+1	
Business fixed investment and exports remain weak.	(edited)
It assesses the appropriate path of the target inflation.	(new)

Comparing 2 Statement: Classifying Sentences

Statement at t-1

Business fixed investment and exports have weakened. _The Committee contemplates the future target for the federal funds rate. [deleted]_

Statement at t	
Business fixed investment and exports remain weak.	(edited)
It assesses the appropriate path of the target inflation.	(new)

Comparing 2 Statement

Sentence	Туре	Deleted Words	Inserted Words
Business fixed investment and exports remain weak.	edited	have	remain
The Committee contemplates the future target for the federal funds rate.	deleted	-	-
It assesses the appropriate path of the target inflation.	new	-	-
Total		have	remain

Empirical results

- Data: FOMC statements
 - 155 statements from May 1999 December 2017

Edit distance measure of the FOMC statements: SENTENCE LEVEL



Edit distance measure of the FOMC statements: WORD LEVEL



New sentences [Growth vs Inflation]





Econometric analysis of equity market impacts

Our empirical setup

- Focus on FOMC's meeting day
- Dependent variable: (Open to Close) Return in Equity market (S&P500)
- Independent variables
 - Control: Monetary policy surprises [Source: Bloomberg] +1 = unexpected hike, -1 = unexpected cut; zero otherwise
 - Edit distance measures: Net edit (insert-delete) of growth and inflation;
 - Other variables including total word counts, readability
- Two methods
 - OLS
 - E-Garch

Word-power regression on S&P500 return 'Growth' and 'Inflation' are the most powerful word

Top 20 edited words	Variable	Coefficient	Std. Error	t-Statistic	Prob.
	С	0.2929	0.11	2.56	0.01
	MP_SURPRISE	-0.9088***	0.44	-2.07	0.04
1	NET_EDIT_GROWTH	0.5935***	0.22	2.64	0.01
2	NET_EDIT_INFLAT	-0.4161**	0.18	-2.31	0.02
3	NET_EDIT_HOWEV	-0.3569*	0.21	-1.70	0.09
4	NET_EDIT_SLOW	-0.4259	0.28	-1.53	0.13
5	NET_EDIT_DECLIN	-0.2920	0.26	-1.11	0.27
6	NET_EDIT_ECONOM	-0.2156	0.21	-1.02	0.31
7	NET_EDIT_PACE	0.2238	0.28	0.79	0.43
8	NET_EDIT_WILL	0.1710	0.22	0.78	0.44
9	NET_EDIT_MARKET	0.2162	0.28	0.78	0.44
10	NET_EDIT_YEAR	0.1929	0.26	0.76	0.45
11	NET_EDIT_CONTINU	-0.1058	0.15	-0.73	0.47
12	NET_EDIT_RATE	0.1020	0.24	0.43	0.67
13	NET_EDIT_MODER	-0.0896	0.21	-0.42	0.67
14	NET_EDIT_RECENT	0.0707	0.22	0.32	0.75
15	NET_EDIT_IMPROV	0.0882	0.29	0.31	0.76
16	NET_EDIT_PRICE	0.0554	0.18	0.30	0.76
17	NET_EDIT_REMAIN	-0.0481	0.19	-0.25	0.81
18	NET_EDIT_SOMEWHAT	-0.0545	0.26	-0.21	0.84
19	NET_EDIT_MONTH	-0.0419	0.22	-0.19	0.85
20	NET_EDIT_COMMITTE	-0.0257	0.25	-0.10	0.92
	R-Square	0.1525			
***/**/* denotes signification	nce at the 1%/5%/10% level				

Regression on S&P500 return: Robustness check

Specifications	(1)	(2)	(3)
С	0.2722**	0.2774**	0.8716
	(0.11)	(0.11)	(1.07)
MP_SURPRISE	-0.9372**	-0.9243**	-0.7915*
	(0.42)	(0.43)	(0.43)
NET_EDIT_GROWTH	0.3723**	0.3761**	0.3596**
	(0.17)	(0.17)	0.1709
NET_EDIT_INFLAT	-0.3054**	-0.2969*	-0.2827*
	(0.15)	(0.16)	(0.16)
NEW_SENTENCE_GROWTH		0.0241	
		(0.08)	
NEW_SENTENCE_INFLAT		-0.0024	
		(0.12)	
DLOG(TOTAL_WORD_COUNT)			0.9821
			(0.63)
FLESCH_KINCAID			-0.0366
			(0.07)
R Squared	0.0855	0.0860	0.1023

Regression on S&P500 return: EGARCH [1,1]

Mean equation	Coefficient	Std. Error	Prob.
Constant	0.2308***	0.0590	0.0001
MP_SURPRISE	-0.8850*	0.5035	0.0788
NET_EDIT_GROWTH	0.1943**	0.0823	0.0182
NET_EDIT_INFLAT	-0.2905***	0.0962	0.0025
Variance equation			
Constant	-0.5444***	0.1782	0.0023
Abs(MP_SURPRISE)	1.9803***	0.4070	0.0000
FLESCH_KINCAID	0.0414***	0.0075	0.0000
DLOG(Total_word_count)	0.6673	0.4661	0.1522
NET_EDIT_GROWTH	0.2582**	0.1272	0.0423
NET_EDIT_INFLAT	-0.3453***	0.0629	0.0000

Key takeaways

- Edit distance can be used to measure 'dis-similarity' between two consecutive FOMC statements
- Supplement to 'semantic similarity' measure used by Ehrmann and Talmi [2019, JME, 'Starting from a Blank Page?...']
- But our proposed method is helpful in identifying financial market impact especially at 'word level'
- Two most significant words affecting US equity market (both return and volatility) are 'growth and 'inflation'
- No significant relationship is found when the FOMC added new sentences or overall number of words in the statement
- Lower readability increases market volatility