

A Measure of deliberation quality of FOMC meetings

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ABSTRACT

Since 1993, transcripts of the *Federal Open Market Committee* (FOMC) meetings are published for deliberation transparency by the US Federal Reserve. These meetings have a direct influence on monetary policies in the US, as well as they are key in the decision process of interest rates. The Federal Reserve has leverage on the financial market and on US economy, its objective is to maintain stable prices and sustain economic growth.

In this context, we explore decision process through the analysis of the meetings' transcripts using Natural Language Processing methods such as Latent Dirichlet Allocation (LDA). Using statistical tools, we break out the process of decision-making and seek to quantify the role and influence each interlocutor has in these meetings.

Keywords

Latent Dirichlet Allocation, Speech analysis, Natural Language Processing, FOMC

1. LDA FOR TOPIC MODELLING

In this paper, we mainly use a statistical approach called Latent Dirichlet Allocation for topic modelling which consists in discovering the underlying "topics" occurring during the speeches of every meetings. Those topics are generally semantically linked and give us a way to synthesize information as well as discover underlying links between subject that come into discussion.

1.1 Processing transcripts

Transcripts are published online every year by the Federal Reserve at `FOMC_historical_year`. We continued the work of Etienne Lenaour, proposing a `Python` script that automatically webscraps the newest published transcripts given a start date and computing a selection of sentiment analysis scores based on Loughran, MacDonald, and Harvard's dictionaries. We process textual data using classical meth-

ods of tokenization, lemmatization, and cleaning, removing stopwords, symbols and punctuation.

Utterance	Date	interlocutor_name	statement	statement_number	chair_in_charge	score_pos	score_ne	score_neg	score_aff	score_his	score_a	score_v	score_hu
0		CHAIR YELLEN	738 Good morning everybody. As you know, statement 0	CHAIR YELLEN	0.5	-0.0037	0.0272	1.0	0.0	0.0	0.0140	0.0028	0.0
1		MRS. FISCHER	4 So moved Madam Chair, statement 1	CHAIR YELLEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2		CHAIR YELLEN	17 Thank you. Without objection, I am going to statement 2	CHAIR YELLEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3		MRS. POTTER	1467 I thank you Madam Chair. We will be statement 3	CHAIR YELLEN	-0.5652	0.0234	0.0441	-1.0	0.0	0.0	0.0078	0.0134	0.0
4		CHAIR YELLEN	3 Questions? President Kocherlakota, statement 4	CHAIR YELLEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5		MRS. KOCHERLAKOTA	60 Yes. Actually it is more of a comment, statement 5	CHAIR YELLEN	0.0	0.0	0.1	0.0	0.0	0.0	0.0666	0.0	0.0
6		MRS. POTTER	50 In the past week that is true. The TIPS, statement 6	CHAIR YELLEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7		CHAIR YELLEN	6 Other questions for Simon? President statement 7	CHAIR YELLEN	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8		MRS. EVANS	145 In a table exhibit 3 you have expected, statement 8	CHAIR YELLEN	1.0	0.0	0.0579	0.0	0.0	0.0	0.0386	0.0	0.0
9		MRS. POTTER	25 If the Committee released details on a statement 9	CHAIR YELLEN	0.0	0.0	0.0769	0.0	0.0	0.0	0.0769	0.0	0.0
10		MRS. EVANS	7 Yes, in terms of the informational con statement 10	CHAIR YELLEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11		MRS. POTTER	94 I do think that the core inflation number statement 11	CHAIR YELLEN	0.0	0.0232	0.0697	0.0	0.0	0.0	0.0	0.0	0.0
12		MRS. EVANS	40 Another question I had in looking at y statement 12	CHAIR YELLEN	-1.0	-0.0555	0.0555	0.0	0.0	0.0	0.0	0.0	0.0
13		MRS. POTTER	35 Market participants freely give you a statement 13	CHAIR YELLEN	0.0	0.0	0.0586	0.0	0.0	0.0	0.0	0.0	0.0
14		MRS. EVANS	15 Well guess I am wondering about the statement 14	CHAIR YELLEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15		MRS. POTTER	130 When we just ask them for the point a statement 15	CHAIR YELLEN	0.0	-0.0169	0.0381	0.0	0.0	0.0	0.0169	0.0	0.0
16		MRS. EVANS	2 Thank you, statement 16	CHAIR YELLEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17		CHAIR YELLEN	18 Further questions for Simon? No resp statement 17	CHAIR YELLEN	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18		MRS. LOGAN	1954 I B discuss testing of tools for norms statement 18	CHAIR YELLEN	-0.0476	-0.0161	0.0271	-1.0	0.0	0.0	0.0101	0.0025	0.0
19		CHAIR YELLEN	7 Thank you. Are there questions? Pres statement 19	CHAIR YELLEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20		MRS. LACKER	101 I just have a comment. I have argued a statement 20	CHAIR YELLEN	-1.0	-0.0204	0.0	0.0	0.0	0.0	0.0204	0.0	0.0
21		MRS. LOGAN	65 Doing it now in advance versus April a statement 21	CHAIR YELLEN	0.0	0.0	0.0600	0.0	0.0	0.0	0.0300	0.0	0.0
22		MRS. LACKER	9 So you are appealing to some technical statement 22	CHAIR YELLEN	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
23		MRS. LOGAN	10 For it to be perceived as a technical as statement 23	CHAIR YELLEN	0.0	0.0	0.25	0.0	0.0	0.0	0.0	0.0	0.0
24		MRS. LACKER	38 No sure thinks we are going to raise it statement 24	CHAIR YELLEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Figure 1: Excerpt of the processed dataset

The variable of interests and especially the cleaned statements are stored in a dataset (see fig. 1) and each statement corresponds to a speech. All meetings are concatenated and we are also interested in the influence of an eventual change of chair in the way speeches may evolve, thus we keep that information as variable of interest as well.

1.2 Motivation

Latent Dirichlet Allocation is an unsupervised statistical method for topic modelling. In our setting, we are interested in using topic modelling to analyze the content of the speeches during the meetings, the evolution of speeches and the role of people interacting during those speeches. A first general overview on all meetings available to this date shows no topic seems to appear significantly more than others overall when looking at 30 topics. However, when we break out topic frequency for each year and per chair, it seems that a shift in dominating topics is occurring (see table 1). **Should we expect more novelty in the last tenures ?**

Chair person					
CHAIRMAN BURNS	20	23	16	27	21
CHAIRMAN MILLER	16	23	20	27	18
CHAIRMAN VOLCKER	16	18	23	21	27
CHAIRMAN GREENSPAN	19	6	7	22	9
CHAIRMAN BERNANKE	13	2	5	29	26
CHAIR YELLEN	11	4	24	26	3

Table 1: Top 5 topics per chair person (chronological order): in red, topics occurring three times, in orange and in green, topics occurring twice

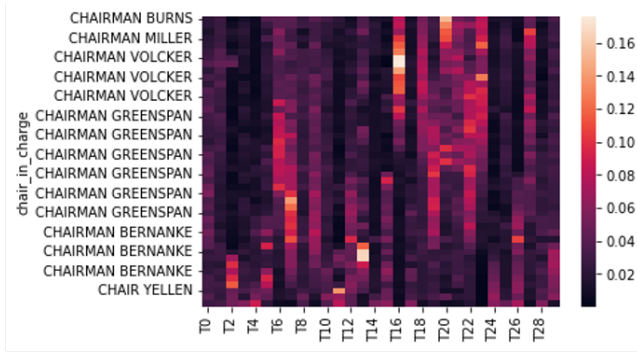


Figure 2: LDA on all meetings from 1976 to 2015 with 30 topics of 100 words: topic frequency for every chair



Figure 3: LDA with 30 topics, 100 keywords on all transcripts

2. SPEECH EVOLUTION IN FOMC MEETINGS

2.1 LDA on transcripts

We compare

We first introduce the notion of *novelty*, *transience* and *resonance* following A. Barron’s article [1].

2.2 Measures of Novelty, Transience and Resonance

Given speech mixtures $S = (s_i^{(t)})_{1 \leq i \leq K}^{0 \leq t \leq T}$, with t indexing the chronological order, i indexing the topic, we use Kullback-Leibler divergence to model “surprise”, meaning the appearance of a new topic in a frame of topic mixtures set with parameter w which defines a window of past speeches. The novelty of the t -th speech taken as center speech is given by :

$$\mathcal{N}_w(t) = \frac{1}{w} \sum_{d=1}^w \text{KLD}(s^{(t)} | s^{(t-d)}) \quad (1)$$

We also refer to transience as the persistence of a speech’s subject in the discussion using similar notations :

$$\mathcal{T}_w(t) = \frac{1}{w} \sum_{d=1}^w \text{KLD}(s^{(t)} | s^{(t+d)}) \quad (2)$$

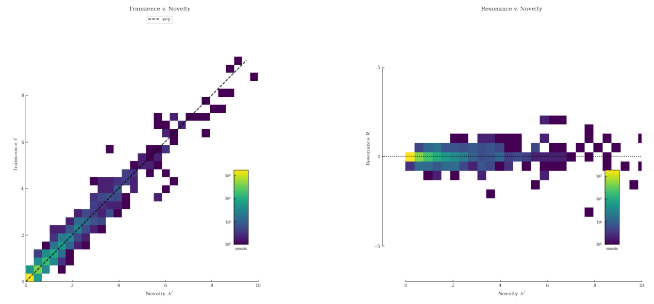


Figure 4: Transience v. Novelty and Resonance v. Novelty on 30 topics

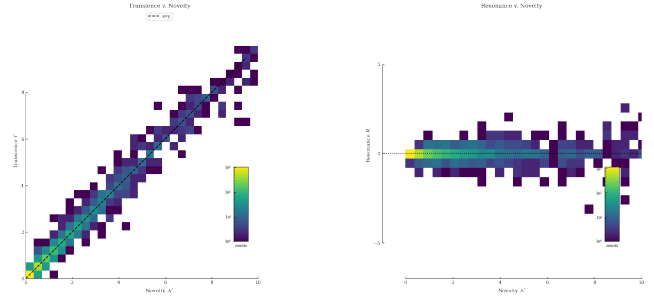


Figure 5: Transience v. Novelty and Resonance v. Novelty on 100 topics

Which allows us to introduce the notion of resonance : $\mathcal{R}_w(t) = \mathcal{N}_w(t) - \mathcal{T}_w(t)$ This metrics tell us about the quality of a speech in terms of its reception: a transience speech means the content is heavily propagated, and novelty accounts for disruption in a stream of ideas. We expect, based on Barron’s article, that novelty, transience and resonance are role reflective of the speaker.

We show in fig. 4 & 5 the density plot of transience, resonance and novelty in all statements after processing. On the left, the density plot of transience v. novelty per speech is given at scale $w = 7$.

2.3 Measuring discrepancy per speakers

3. CONCLUSIONS

This paragraph will end the body of this sample document. Remember that you might still have Acknowledgments or Appendices; brief samples of these follow. There is still the Bibliography to deal with; and we will make a disclaimer about that here: with the exception of the reference to the L^AT_EX book, the citations in this paper are to articles which have nothing to do with the present subject and are used as examples only.

4. ACKNOWLEDGMENTS

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5. REFERENCES

- [1] A. T. J. Barron and al. Individuals, institutions, and innovation in the debates of the french revolution. *Proceedings of the National Academy of Sciences*, 115 (18):4607–4612, May 2018.