Central Bank Mandates and the Financial Cycle: through the Lens of Federal Reserve Speeches*

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Abstract

The Federal Reserve has an institutional mandate to pursue price stability and maximum sustainable employment; however, it remains unclear whether it can also pursue secondary objectives, such as financial stability, economic equality, or climate risk mitigation. The academic literature has largely argued that it should not. We characterize the Fed's interpretation of its mandate using state-of-the-art methods from natural language processing, including a collection of large language models (LLMs) that we modify for enhanced performance on central bank texts. We apply these methods and models to a comprehensive corpus of Fed speeches delivered between 1960 and 2021. We find that the Fed perceives financial stability to be the most important policy concern that is not directly enumerated in its mandate, especially in times when the debt-to-GDP ratio is high, but does not generally treat it as a separate policy objective. From a policy perspective, it has, in fact, frequently discussed the use of monetary policy to achieve financial stability and this discussion appears to have consequences. In particular, its discussion of both financial stability and financial crises predicts both monetary policy decisions and movements in asset prices, even after rigorously controlling for macroeconomic and financial variables.

1. Introduction

We characterize the Fed's interpretation of its mandate using state-of-the-art methods from natural language processing, including large language models (LLMs) modified for enhanced performance on central bank texts.

- Measure the extent to which the Fed has:
  – Advocated for the use of banking regulation / monetary policy to achieve financial stability.
  – Past, present, or future focus. Academic focus.
- Most comprehensive collection of speeches to date. Extract text features that capture Fed's perception of its own mandate:
  – Use state-of-the-art NLP tools to extract the most significant policy concerns.
  – Identify semantic similarities, identify states of the economy and discussion topics that are closely associated with FS concerns.
  – Semantic variables predict broad range of asset returns

Finding: the Fed perceives financial stability to be the most important non-dual mandate concern.

- During tightening periods, more likely to be discussion about use of MP to achieve FS, and non-dual mandate topics.
- During easing periods, discussion more likely to focus on MP and inflation/employment.

2. Data

- Federal Reserve speeches
  – 1914-2021, most comprehensive from 1960-2021.
  – Voting and non-voting FOMC members.
- Journal articles and working papers related to central banks.
  – Semantic Scholar Open Corpus (S2ORC), generated by Lo et al. (2020).
  – Articles from economics related to macro, monetary, and financial markets. Must have abstract available.
  – Publication outlet has at least 500 entries in overall database.
  – 328,370 articles (29,781 reference CBs).
- Macro and financial variables
  – Jordà et al. (2016) macrohistory database.
  – Output gap data from FRED, measured annually.

3. Methodologies: LLMs and Methods

1. **Transformer model. (BERT ((Devlin et al., 2019)) and RoBERTa ((Liu et al., 2019))**
   - Maps sequence of embeddings to sequence of contextualized embeddings.
2. **Sentence transformer model.**
   - Maps sequence of embeddings to single embedding.
3. **Feature extraction methods.**
   - Zero shot classification (ZSC), extractive question answering (EQA), and semantic textual similarity (STS).

Example: Classification with Zero-shot Learning

- **Sequence:** "Banks continue to play this role but it has become more challenging today to do so because some lenders find themselves capital constrained as a result of recent losses and/or sizable unanticipated additions to their balance sheets of formerly off balance sheet instruments." (Gary Stern 2009 speech)
- **Candidate Classes:** ['financial stability', 'output', 'inflation', 'labor market'].
- **Scores:** [0.718, 0.203, 0.048, 0.031].

Example: Extractive Question Answering

- Consider two passages from a February 1972 speech by then-President of FRB St. Louis Darryl Francis:
- **Query:** What is the most significant concern in this passage?
  – **Context 1:** "The suspension of the convertibility of the dollar into gold and the imposition of a 10 percent import surcharge last summer ran the risk of mass foreign retaliation in the form of destructive trade barriers."
  – **Output 1:** mass foreign retaliation.
  – **Context 2:** "Another significant aspect of the President's new policies announced August 15 are the measures taken to reverse the deteriorating US balance of payments."
  – **Output 1:** deteriorating US balance of payments.

Example: Semantic Textual Similarity

- Use contextualized sentence embeddings and semantic textual similarity.
- Compare sequences from speeches with descriptions of policy objectives or preferences.
  – *"Monetary policy should be used to achieve financial stability."*
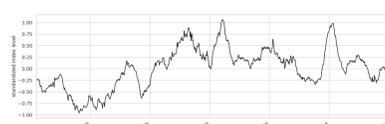 – *"Banking regulation should be used to achieve financial stability."*

Figure 1: *Cosine similarity: Banking Regulation and Financial Stability*

4. Extracted Text Features

- Use zero-shot classification with BERT at the paragraph level.
- Get probabilities that paragraph discusses specific contents: financial stability (FS), financial crisis, banking regulation (BR), monetary policy (MP), etc..
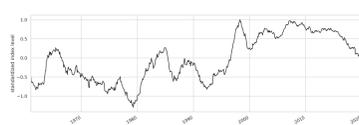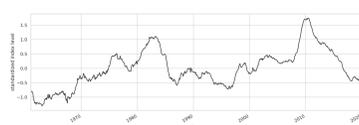

Figure 2: *Financial Stability Content Index*

Figure 3: *Financial Crisis Content Index*
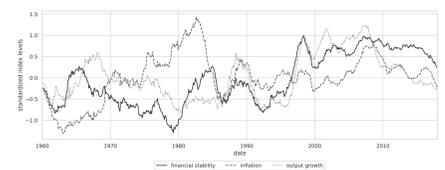
- Create indices for inflation and output growth.

Figure 4: *Inflation, Output Growth, and FS*

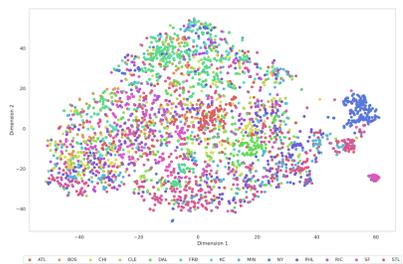- Visualize how different Federal Reserve Banks discuss FS contents in speeches (t-SNE).

Figure 5: *Clustering of FS Content Across All Speeches*

5. Regression Analysis

- Determine underlying drivers and content of FS discussions at the Fed:

$$y_t = \beta_0 + \beta_1 \tau_{jt}^{fs} + \beta_2 \tau_{jt}^{fc} + \beta_3 \tau_{jt}^{\pi} + \beta_4 \tau_{jt}^{e} + \beta_5 \tau_t^{bc} + \beta_6 \tau_t^{bl}$$
$$+ \beta_7 v^m + \beta_8 v^f + \zeta_k + \gamma_i + e_{jt}.$$

  – y_t is FS content of a particular paragraph (e.g., FS index, cosine similarity).
  – τ are text features, v are macro and financial controls.

	(1960-2021)	(1960-1983)	(1984-2021)
inflation$_{jt}$	0.0342	-0.0321	0.0639
	(0.0027)	(0.0043)	(0.0033)
employment$_{jt}$	0.1253	0.1504	0.1139
	(0.0020)	(0.0035)	(0.0023)
financial crisis$_{jt}$	0.0879	0.0736	0.0954
	(0.0027)	(0.0048)	(0.0032)
bank liquidity$_{jt}$	0.1466	0.1683	0.1351
	(0.0036)	(0.0063)	(0.0044)
bank capital$_{jt}$	0.3032	0.3346	0.2916
	(0.0039)	(0.0068)	(0.0047)
past focus$_{jt}$	-0.1185	-0.1147	-0.1194
	(0.0018)	(0.0031)	(0.0022)
present focus$_{jt}$	0.0678	0.0492	0.0781
	(0.0015)	(0.0025)	(0.0019)
future focus$_{jt}$	0.0882	0.0746	0.0917
	(0.0019)	(0.0033)	(0.0023)
academic focus$_{jt}$	0.1639	0.1726	0.1596
	(0.0019)	(0.0037)	(0.0023)
debt-to-gdp ratio$_t$	0.2198	-0.0638	0.2799
	(0.0257)	(0.1695)	(0.0365)
loan-to-deposit ratio$_t$	0.0010	0.0026	0.0032
	(0.0005)	(0.0024)	(0.0007)
Adj. R-squared	0.5256	0.5164	0.5310
No. of observations	310,425	96,702	213,723

All key coefficients are significant with $p < 0.01$.

- Financial Stability and Other Policy Objectives.
  – Academic focus tends to oppose using MP / BR for FS.
    * Opposition to use of MP has declined during the Great Moderation.
    * Opposition to use of BR has increased.
  – Statements on FS tend to be in present or future.
    * Advocacy for use of MP hinges on past examples and future hypotheticals.
    * Advocacy for use of BR is focused on present.

	Monetary Policy			Banking Regulation		
	(1960-2021)	(1960-1983)	(1984-2021)	(1960-2021)	(1960-1983)	(1984-2021)
past focus$_{jt}$	0.0351	0.0136	0.0430	0.0002	-0.0190	0.0027
	(0.0024)	(0.0042)	(0.0029)	(0.0022)	(0.0036)	(0.0028)
present focus$_{jt}$	0.0010	0.0215	-0.0114	0.0736	0.0755	0.0705
	(0.0021)	(0.0036)	(0.0026)	(0.0019)	(0.0031)	(0.0024)
future focus$_{jt}$	0.0617	0.0413	0.0696	-0.0356	-0.0396	-0.0321
	(0.0024)	(0.0043)	(0.0028)	(0.0022)	(0.0037)	(0.0027)
academic focus$_{jt}$	-0.0691	-0.0923	-0.0566	-0.0233	-0.0132	-0.0242
	(0.0025)	(0.0050)	(0.0029)	(0.0024)	(0.0043)	(0.0029)
Adj. R-squared	0.0893	0.0969	0.0962	0.1701	0.1280	0.1953

All coefficients are significant with $p < 0.01$, except where noted in red.

References

Devlin, J., M. Chang, K. Lee, and K. Toutanova (2019). BERT: pre-training of deep bidirectional transformers for language understanding. In J. Burstein, C. Doran, and T. Solorio (Eds.), *Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, NAACL-HLT 2019, Minneapolis, MN, USA, June 2-7, 2019, Volume 1 (Long and Short Papers)*, pp. 4171–4186. Association for Computational Linguistics.

Jordà, , M. Schularick, and A. M. Taylor (2016, May). *Macrofinancial History and the New Business Cycle Facts*. University of Chicago Press.

Liu, Y., M. Ott, N. Goyal, J. Du, M. Joshi, D. Chen, O. Levy, M. Lewis, L. Zettlemoyer, and V. Stoyanov (2019). Roberta: A robustly optimized BERT pretraining approach. *CoRR abs/1907.11692*.

Lo, K., L. L. Wang, M. Neumann, R. Kinney, and D. Weld (2020, July). S2ORC: The semantic scholar open research corpus. In *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics*, Online, pp. 4969–4983. Association for Computational Linguistics.