Central Bank Communication on Social Media: What, To Whom, How?

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Outline

Central bank communication: Communicating with the public

What central banks say can affect markets, the economy and people's lives. Central bank communication has become a tool of policy in recent years. The ECB needs to be understood by markets and experts, but also by the wider public so that people can have trust in the institution and its policies.

As a result of the strategy review, the Governing Council agreed to modernise its monetary policy communication, to reach out to wider audiences, and to make listening a regular feature of its communication.

The objectives of the Riksbank's communication are to:

- Make it possible for the Riksdag (the Swedish parliament), the general public and the media to understand, examine and evaluate the work of the Riksbank.
- Contribute to good knowledge and thereby to a high level of confidence in the Riksbank's activities, analysis and policy decisions.
- Give the employees relevant information so that they can carry out their work, feel involved and motivated and experience job satisfaction.

CHAIRMAN POWELL. Good afternoon. Thanks very much for being here. I know that a number of you will want to talk about the details of our announcement today, and I am happy to do that in a few minutes. But because monetary policy affects everyone, I want to start with a plain-English summary of how the economy is doing, what my colleagues and I at the Federal Reserve are trying to do, and why.

Clear and transparent communication is essential to the effectiveness of monetary policy, and serves a key role in the Bank's accountability to Canadians. That is why members of the Bank's Governing Council take part in regular communication activities, such as meetings, speeches, interviews and press conferences.

Engaging in two-way communication with the public, businesses, industry associations, academia, labour and other groups is invaluable to the formulation of monetary policy and to the Bank's accountability. Discussions with external groups help Governing Council members better understand prevailing dynamics in the economy and the financial system, as well as structural issues and economic research relevant to the work of the Bank.

Communication channel

New communication channels:

Press release, press conferences

Large literature on the effectiveness of central bank communication via these channels

Social media: Twitter and Facebook

Empirical evidence is scant. The study closest to ours is Ehrmann and Wabitsch (JME 2022)

How information is perceived?

- Not all information is treated in the same way:
  - Individuals are more influenced by information that is easier to understand, e.g., supermarket prices (Cavallo et al., 2017)
  - FOMC inflation forecast $\simeq$ FOMC statement $>$ news article about FOMC meeting (Coibion et al., 2022)
  - In low inflation context, firms'/households' expectations do not respond much to monetary policy announcements (Cavallo et al., 2017; Coibion et al., 2020)
- Not all agents process information in the same way:
  - Large difference between firms'/households' vs. professional forecasters' inflation forecasts but the gap can be closed by intensive news coverage of inflation dynamics (Carroll, 2003; Dräger, 2015; Lamla and Maag, 2012)
  - Media is the main source of information for managers to form inflation expectations (Kumar et al., 2015)

What we do?

Using a unique setup: Fed's communication on social media (public accounts, public information)

- Classify the Fed's communication based on topics
- Classify users who engaged with the Fed into different groups
- Examine reactions of heterogeneous groups of users to heterogeneous "information" provided by the Fed
- Extract inflation expectation signals from the tweets and examine the effects of the Fed communication on inflation expectations

Preview of results

- Twitter users do engage with the Fed, but the degree of engagement is limited
- Among all topics discussed by the Fed, Twitter users are most interested in central banking issues
- Among all groups of users, the media and economists are most active in engaging with the Fed
- More positive Fed tweets are correlated with higher inflation expectations expressed

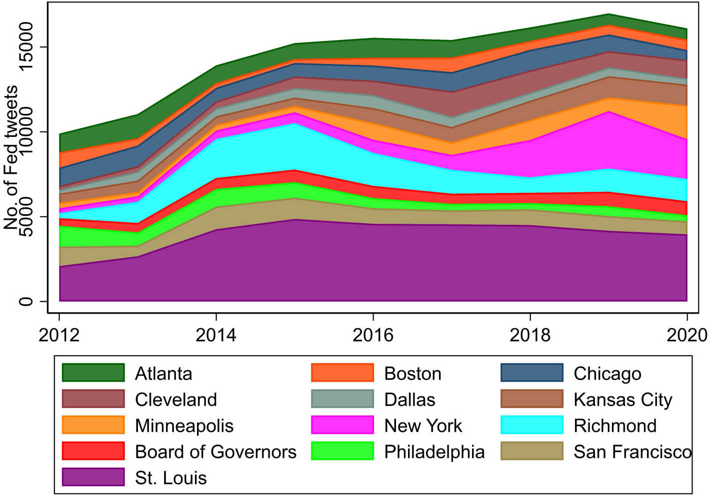
Fed tweets

- All historical (public) English tweets posted by the Twitter accounts of Federal Reserve System's Board of Governors and 12 regional Federal Reserve Banks
- 130,271 tweets (4.3% are retweets) covering the January 2012 – December 2020 period
- The data contain: user statistics, tweet statistics, and tweet analytics (i.e., number of likes, retweets, and quotes)

Tweet analytics

	Mean	SD	Min	Median	Max	N
Replies	0.60	3.55	0.00	0.00	708.00	130,271
Retweets	3.65	8.55	0.00	2.00	689.00	130,271
Likes	3.31	11.41	0.00	1.00	1517.00	130,271
Quotes	0.37	3.06	0.00	0.00	355.00	130,271

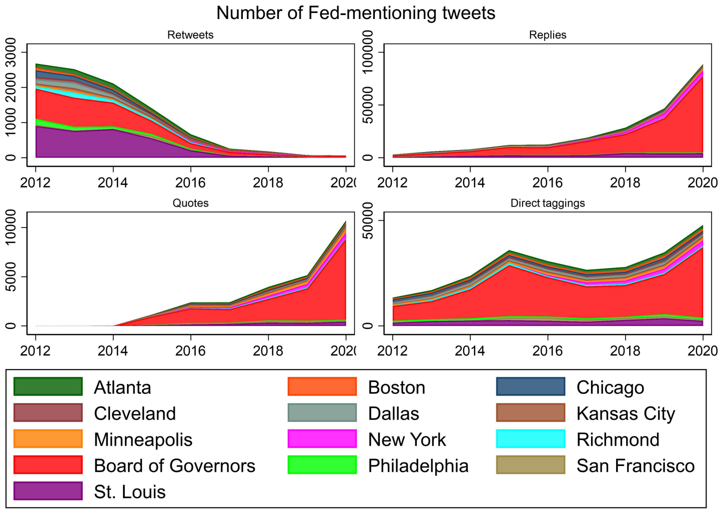
Fed tweets over time



Fed-mentioning tweets

- All public English tweets mention the Fed's Twitter handles (e.g., @federalreserve) over the 2012-2020 period
- Excluding the self-mentioning tweets gives us a sample of 495,059 tweets
- Again, we can observe all public information related to the users, the tweets, and the tweet analytics

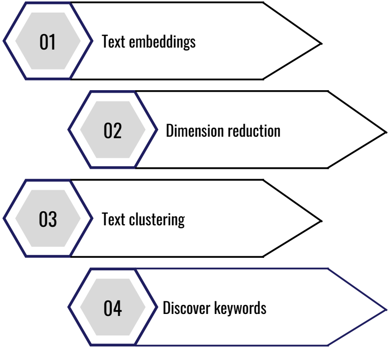
Number of Fed mentions



User/topic classification

- Aims:
  - Topics of the text
  - Twitter user classification
- Challenges:
  - No prior about **what** central banks talk about on social media
  - No prior about the **specific** groups of users who interacted with central banks on social media

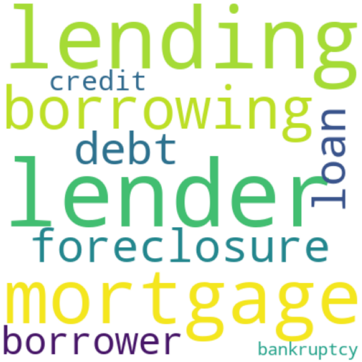
Keyword discovery approach



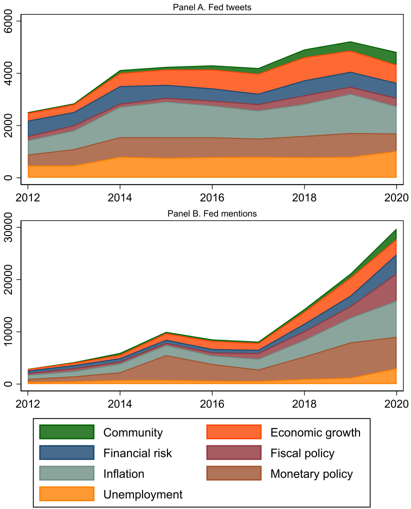
- Topics in central bank communications:
  - Pre-defined keywords (Cieslak and Vissing-Jorgensen, 2020) → limited (only keywords about the economy/financial market)
  - Apply LDA to FOMC statements (Hansen and McMahon, 2016) → LDA does not work well with short texts, issues with topics' interpretability
- Classify users based on the tweets' content: experts. vs non-experts (Ehrmann and Wabitsch, 2022)

Text clustering examples

Topic 2

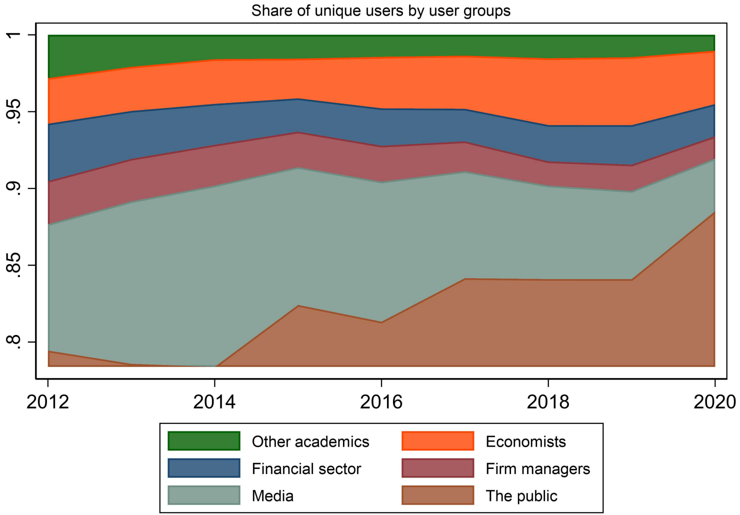


Topics



Panel A. Fed tweets
0
2000
4000
6000
2012
2014
2016
2018
2020
Panel B. Fed mentions
0
10000
20000
30000
2012
2014
2016
2018
2020
Community
Economic growth
Financial risk
Fiscal policy
Inflation
Monetary policy
Unemployment

User classification

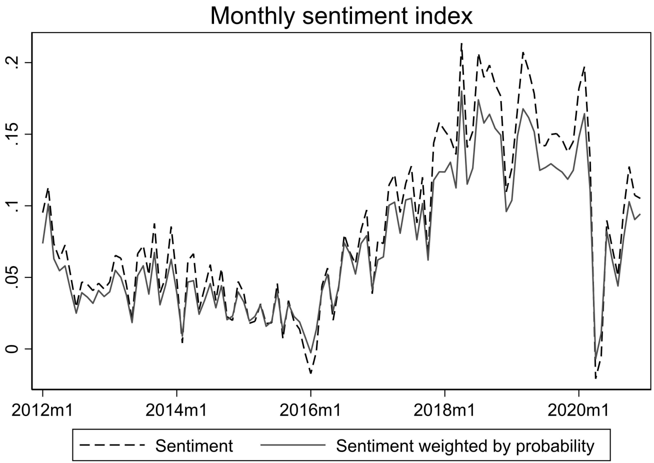


Tweet sentiment

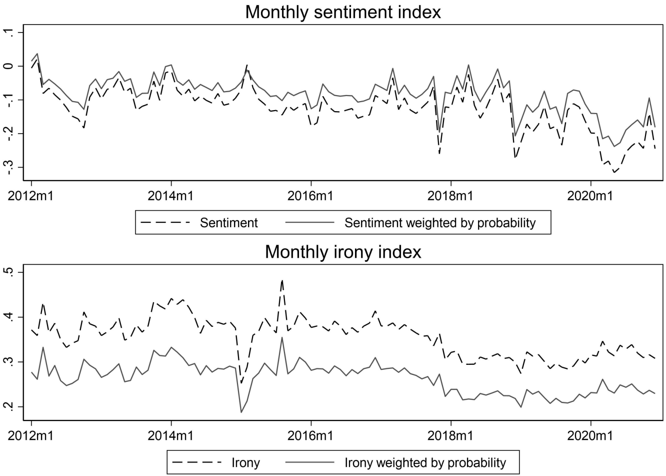
We use TweetNLP (Camacho-Collados et al., 2022) to predict:

- Sentiment (negative, neutral, or positive) and its probability
- Irony (ironic or not) and its probability

Sentiment - Fed tweets



Sentiment - Fed mentions



Inflation expectation signals - Fed mentions

- We are not able to measure inflation expectations per se (e.g., the 1-year ahead inflation rate is X%)
- But we could extract inflation expectation **signals** (e.g., inflation is expected to increase)
- Typical approach: **Labeled data** $\Rightarrow$ Language model (e.g., GPT) $\Rightarrow$ Classifier (e.g., neural net)

Few shot learning

- Construct a small corpus of sentences referring to inflation expectations. Each sentence is assigned 1 of 3 labels: 0 (lower inflation), 1 (no change in inflation), and 2 (higher inflation)
- Contrastive learning:
  - Generate sentence pairs from the small corpus
  - Using a SBERT (sentence BERT) transformer model to embed sentences and labels into a latent space
  - Fine-tuning the transformer model to minimize the distance between 2 sentences with the same label or maximize the distance between 2 sentences with different labels
- Train a classifier using embeddings from the fine-tuned transformer model
- Apply the classifier on the Fed mentions data

Reactions to the Fed tweets

$$Reaction^{D}_{i,j,d} = \alpha + \beta_1 FOMC^{Unchange}_{d} + \beta_2 FOMC^{Change}_{d} + \beta_3 ln(EPU)_d + Fedtweet_{i,j,d}\gamma + \epsilon_{i,j,d} \quad (1)$$

$$ln(Reaction_{i,j,d}) = \alpha + \beta_1 FOMC^{Unchange}_{d} + \beta_2 FOMC^{Change}_{d} + \beta_3 ln(EPU)_d + Fedtweet_{i,j,d}\gamma + \epsilon_{i,j,d} \quad (2)$$

- *i*, *j*, and *d* refer to tweet *i* posted by Fed account *j* on date *d*
- $Reaction^D$ is a dummy indicating where tweet *i* received any likes, retweets, quotes, or replies; $ln(Reaction)$ is the natural log of the number of likes/retweets/quotes/replies
- *Fed tweet* is a vector of dummies indicating the post's characteristics (order of the post, topics mentioned, whether or not photos/videos/external links are included)

Extensive margin

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Like		Retweet		Reply		Quote	
Unconditional prob.	0.69		0.77		0.27		0.16	
		(0.003)		(0.003)		(0.003)		(0.003)
ln(EPU)		-0.001		0.005		-0.001		0.019***
		(0.003)		(0.003)		(0.003)		(0.003)
$FOMC^{Unchange}$		-0.007		0.014		0.007		0.004
		(0.011)		(0.011)		(0.008)		(0.010)
$FOMC^{Change}$		0.006		-0.020		-0.000		0.050**
		(0.017)		(0.020)		(0.021)		(0.021)
Growth	0.072***	0.073***	0.066***	0.065***	0.076***	0.077***	0.099***	0.098***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
Unemployment	-0.002	-0.001	0.020***	0.022***	0.010*	0.010**	-0.006	-0.006
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)
Monetary	0.058***	0.060***	0.042***	0.044***	0.030***	0.031***	0.026***	0.022***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Inflation	0.026***	0.026***	0.035***	0.037***	0.008*	0.009**	-0.002	-0.004
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Community	0.053***	0.051***	0.033***	0.032***	0.044***	0.042***	0.021**	0.013
	(0.009)	(0.009)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
FinRisk	0.005	0.004	0.012**	0.008	-0.001	0.000	0.016***	0.015***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)
Fiscal	0.011	0.011	0.040***	0.039***	0.031***	0.028***	0.032***	0.031***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Sentiment	0.034***	0.035***	-0.042***	-0.044***	-0.022***	-0.021***	-0.031***	-0.029***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	130,254	130,271	130,254	130,271	130,254	130,271	130,254	130,271
R-squared	0.289	0.262	0.202	0.169	0.321	0.290	0.229	0.190

Intensive margin

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ln(Likes)		ln(Retweets)		ln(Replies)		ln(Quotes)	
Mean (raw number)	4.82		4.71		2.19		2.34	
ln(EPU)		0.024***		0.021***		0.022***		0.024**
		(0.007)		(0.006)		(0.008)		(0.009)
$FOMC^{Unchange}$		0.121***		0.145***		0.124***		0.281***
		(0.024)		(0.022)		(0.033)		(0.038)
$FOMC^{Change}$		0.221***		0.348***		0.291***		0.461***
		(0.050)		(0.066)		(0.081)		(0.071)
Growth	0.310***	0.308***	0.415***	0.407***	0.094***	0.083***	0.275***	0.264***
	(0.014)	(0.013)	(0.013)	(0.013)	(0.014)	(0.013)	(0.020)	(0.019)
Unemployment	-0.035***	-0.032***	0.044***	0.047***	-0.001	0.000	-0.019	-0.016
	(0.011)	(0.011)	(0.010)	(0.010)	(0.012)	(0.012)	(0.018)	(0.017)
Monetary	0.106***	0.092***	0.200***	0.197***	0.086***	0.072***	0.041**	0.029
	(0.012)	(0.012)	(0.011)	(0.011)	(0.014)	(0.014)	(0.020)	(0.019)
Inflation	-0.029***	-0.032***	0.045***	0.047***	-0.001	-0.007	-0.040***	-0.046***
	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)	(0.015)	(0.015)
Community	0.124***	0.097***	0.020	0.007	0.037	0.008	0.073**	0.050*
	(0.023)	(0.024)	(0.022)	(0.022)	(0.028)	(0.027)	(0.031)	(0.029)
FinRisk	0.001	0.001	0.045***	0.046***	-0.017	-0.039***	0.002	-0.015
	(0.014)	(0.014)	(0.012)	(0.012)	(0.015)	(0.014)	(0.024)	(0.023)
Fiscal	0.035	0.028	0.053***	0.051***	-0.003	0.001	0.075**	0.069**
	(0.021)	(0.021)	(0.020)	(0.020)	(0.021)	(0.020)	(0.033)	(0.031)
Sentiment	0.091***	0.098***	-0.108***	-0.109***	-0.024**	-0.015	-0.032**	-0.031**
	(0.009)	(0.010)	(0.008)	(0.008)	(0.010)	(0.010)	(0.014)	(0.014)
Observations	89,412	89,476	100,767	100,802	35,413	35,576	20,678	20,726
R-squared	0.384	0.350	0.370	0.335	0.400	0.324	0.230	0.166

Conversing with the Fed

$$\begin{aligned} Outcome_d^{Mentions} = \alpha &+ \beta_1 FOMC_d^{Change} + \beta_2 FOMC_d^{Unchange} + \beta_3 ln(EPU)_d \\ &+ \gamma_1 ln(CentralBanking)_d + \gamma_2 ln(FedTweets)_d \\ &+ \gamma_3 ln(FedAccounts)_d + \gamma_4 Sentiment_d^{Fedtweets} + \varepsilon_d \end{aligned} \tag{3}$$

- Number of Fed mentions, number of Fed mentions discussing central banking, sentiment, irony, HHI based on topics
- Number of unique users who mentioned the Fed, number of users by each user group, HHI based on users

Degree of engagement

	(1)	(2)	(3)	(4)	(5)
	ln(Mentions)	Sentiment	Irony	ln($Mentions^{CentralBanking}$)	HHI^{topics}
$FOMC^{Unchange}$	0.695***	-0.018*	-0.009	1.183***	0.021***
	(0.056)	(0.010)	(0.015)	(0.074)	(0.004)
$FOMC^{Change}$	1.385***	-0.052**	-0.062***	2.325***	0.107***
	(0.107)	(0.026)	(0.016)	(0.109)	(0.009)
ln(EPU)	0.038**	-0.011***	0.004	0.073***	-0.000
	(0.017)	(0.004)	(0.007)	(0.026)	(0.003)
ln(CentralBanking)	0.005	-0.000	-0.000	0.152***	0.004***
	(0.021)	(0.005)	(0.008)	(0.030)	(0.002)
ln(FedTweets)	0.515***	0.027**	-0.020	0.395***	-0.009***
	(0.042)	(0.011)	(0.015)	(0.057)	(0.003)
$Sentiment^{Fedtweets}$	-0.123	0.123***	0.058*	-0.336***	0.004
	(0.085)	(0.024)	(0.035)	(0.125)	(0.008)
ln(FedAccounts)	0.446***	0.012	0.019	0.393***	-0.006
	(0.044)	(0.011)	(0.017)	(0.062)	(0.004)
Observations	3,164	3,164	3,164	3,035	3,164
R-squared	0.713	0.178	0.132	0.566	0.125

Who engaged with the Fed?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ln(Users)	ln(Public)	ln(Media)	ln(Ecomomists)	ln(Financial sector)	ln(Managers)	$HHI^{Usergroups}$
$FOMC^{Unchange}$	0.661***	0.631***	1.160***	0.674***	0.353***	0.577***	-0.063***
	(0.053)	(0.057)	(0.070)	(0.093)	(0.092)	(0.095)	(0.011)
$FOMC^{Change}$	1.329***	1.313***	2.007***	1.220***	0.993***	1.052***	-0.070***
	(0.103)	(0.108)	(0.097)	(0.120)	(0.208)	(0.204)	(0.015)
ln(EPU)	0.047***	0.042**	0.090***	0.043	0.020	0.019	0.003
	(0.016)	(0.018)	(0.026)	(0.026)	(0.026)	(0.027)	(0.005)
$\ln(Fed^{CentralBanking})$	-0.003	-0.002	0.033	0.005	-0.006	-0.061*	-0.004
	(0.019)	(0.022)	(0.031)	(0.033)	(0.029)	(0.033)	(0.005)
ln(FedTweets)	0.464***	0.467***	0.708***	0.299***	0.175***	0.470***	-0.052***
	(0.038)	(0.044)	(0.063)	(0.062)	(0.054)	(0.066)	(0.010)
$Sentiment^{Fedtweets}$	-0.111	-0.135	-0.324**	-0.097	-0.393***	-0.244	-0.004
	(0.079)	(0.089)	(0.135)	(0.136)	(0.136)	(0.153)	(0.025)
ln(FedAccounts)	0.443***	0.446***	0.247***	0.117*	0.149**	-0.121*	-0.020*
	(0.040)	(0.046)	(0.067)	(0.065)	(0.064)	(0.071)	(0.012)
Observations	3,164	3,164	2,765	2,165	1,915	1,774	3,164
R-squared	0.735	0.669	0.501	0.329	0.300	0.176	0.181

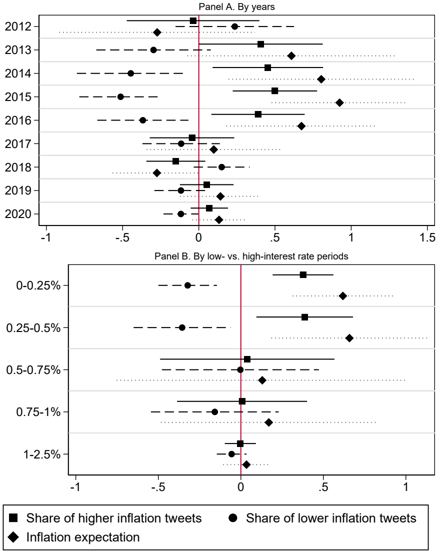
Who engaged with the Fed about central banking issues?

	(1)	(2)	(3)	(4)	(5)
	ln(Public)	ln(Media)	ln(Economists)	ln(Financial sector)	ln(Managers)
$FOMC^{Unchange}$	1.061***	**1.162*** **	0.420***	0.339***	0.197**
	(0.077)	(0.090)	(0.115)	(0.114)	(0.093)
$FOMC^{Change}$	2.252***	**2.421*** **	0.970***	0.964***	0.916***
	(0.112)	(0.103)	(0.166)	(0.217)	(0.156)
ln(EPU)	0.080***	0.077***	0.003	-0.009	0.011
	(0.028)	(0.030)	(0.029)	(0.031)	(0.034)
$\ln(Fed^{CentralBanking})$	0.114***	**0.135*** **	0.073*	0.056	0.004
	(0.030)	(0.035)	(0.038)	(0.034)	(0.038)
ln(FedTweets)	0.310***	0.237***	-0.016	0.025	0.050
	(0.061)	(0.069)	(0.069)	(0.074)	(0.078)
$Sentiment^{Fedtweets}$	-0.306**	-0.006	-0.154	0.085	0.001
	(0.128)	(0.158)	(0.148)	(0.186)	(0.176)
ln(FedAccounts)	0.372***	0.102	0.200***	0.025	-0.014
	(0.067)	(0.074)	(0.071)	(0.079)	(0.092)
Observations	2,952	1,798	1,164	705	500
R-squared	0.498	0.307	0.202	0.199	0.220

What message was spread further?

	(1)	(2)	(3)	(4)	(5)
	$\ln(Spread^{Public})$	$\ln(Spread^{Media})$	$\ln(Spread^{Economists})$	$\ln(Spread^{Financialsector})$	$\ln(Spread^{Managers})$
$FOMC^{Unchange}$	0.847***	**0.845*** **	0.795***	0.269	0.144
	(0.175)	(0.171)	(0.235)	(0.297)	(0.254)
$FOMC^{Change}$	2.451***	**2.508*** **	1.263***	1.028**	0.977***
	(0.233)	(0.298)	(0.440)	(0.486)	(0.340)
ln(EPU)	0.008	0.120	0.064	-0.116	0.227
	(0.052)	(0.075)	(0.089)	(0.131)	(0.155)
$\ln(Fed^{CentralBanking})$	0.039	0.160*	0.000	0.066	0.215
	(0.061)	(0.094)	(0.114)	(0.159)	(0.174)
ln(FedTweets)	0.266**	-0.137	0.040	-0.017	-0.608
	(0.120)	(0.174)	(0.215)	(0.313)	(0.395)
$Sentiment^{Fedtweets}$	-0.636**	-0.866**	0.078	0.921	-0.984
	(0.283)	(0.437)	(0.511)	(0.708)	(0.958)
ln(FedAccounts)	0.240*	0.292	-0.153	-0.462	0.589
	(0.131)	(0.193)	(0.243)	(0.344)	(0.489)
Observations	2,208	1,468	840	389	319
R-squared	0.400	0.282	0.222	0.284	0.229

Fed tweets' sentiment and inflation expectations



Conclusions

- The Fed's attempt to communicate with the wider public is not "a road to nowhere", but...
- The degree of public outreach is limited
- Instead of trying to communicate with the general public, perhaps central bankers should take advantage of intermediated channels like media (Blinder et al., 2022)

User classification - Keywords

Back

Academic	Economist	Journalist	News outlet	Firm director	Public with financial knowledge	Finance
adjunct professor	economist	anchor	abacusnews	ceo	cfa	altcoin trader
assistant prof	economista	correspondent	bbc	cfo	msc economics	asset management
assistant professor		host podcast	bloomberg	chairman	msc finance	asset manager
assoc professor		journalist	business insider	chairman board		bond trader
associate professor		commentator	businessinsider	chief operate		commodity trader
asst prof		podcast host	cbsnews	founder chairman		community banker
asst professor		radio host	channel	president ceo		currency trader
distinguish fellow		reporter	cnbc			derivative trader
distinguish professor		show host	cnn			economic analyst
doctoral candidate		contributor	financial times			equity trader
doctoral student		columnist	fox news			financial advisor
economics phd			foxnews			financial analyst
economist phd			ft			forex trader
economista			media			fund manager
economista profesor			news			fx trader
environmental economist			newyork times			hedgefund manager
labor economist			nyt			intraday trader
phd candidate			techcrunch			investment banker
phd econ			the economist			management firm
phd student			wall street journal			mortgage banker
postdoc phd			wsj			option trader
postdoctoral fellow						portfolio management
profesor universidad						portfolio manager
profesor universitario						portfolio mgr

Text embeddings Back

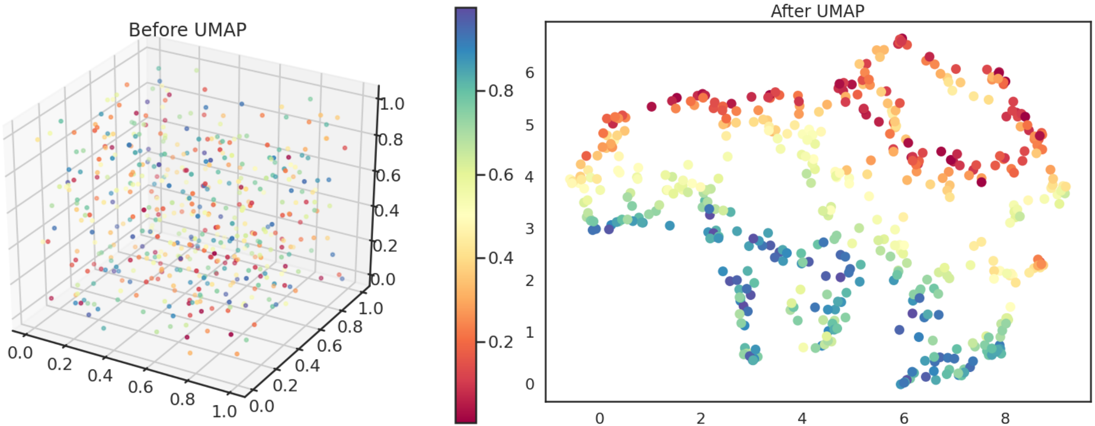
- Numerical representations of the texts
- Previously: rely on global document counts to generate vectors representing a word $\rightarrow$ ignoring the semantic meaning
- Now:
  - Take into account the local context (Example)
  - Not only word embeddings but also sentence/paragraph embeddings
  - Texts with similar semantic meanings will be closer in the vector space
- We use Google's Universal Sentence Encoder model to convert each text (a Facebook post, a tweet, or a user's self-description) into a 512-dimensional vector

Dimensionality reduction

We use Uniform Manifold Approximation and Projection (UMAP) to lower the dimensionality of the text embeddings

- UMAP vs PCA: PCA is linear, natural language is not
- UMAP vs t-SNE (t-distributed Stochastic Neighbor Embedding): UMAP captures global structure better; t-SNE is mostly used for data visualization

Dimensionality reduction



Text clustering

We apply the Hierarchical *Density-Based* Spatial Clustering of Applications with *Noise* (HDBSCAN) algorithm on the reduced dimensionality embeddings to cluster tweets/users' description into groups. HDBSCAN vs K-means:

- HDBSCAN can work well for data where clusters have arbitrary shapes, different sizes, different densities
- HBDSCAN can deal with outliners
- K-means requires a pre-defined number of clusters, HDBSCAN does not

Interpretable clusters

$$TFIDF = \frac{n_{t,d}}{\sum_{t'} n_{t',d}} \times \log(\frac{|D|}{|\{d \in D : t \in d\}|}) \quad (4)$$

where $n_{t,d}$ is the freq. of word t in document d; $\sum_{t'} n_{t',d}$ is the total word freq. in the document; $|D|$ is the number of documents in the data

$$TFIDF \times IDF_i = TFIDF \times \log(\frac{|K|}{|\{t \in K\}|}) \quad (5)$$

where $|K|$ is the number of clusters and $|\{t \in K\}|$ is the number of clusters that word t appears in