Central bank communication on social media: What, to whom, and how?

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Motivation

- Various strategies are adopted to improve monetary policy **transparency**.
  - Communication via social media become a popular tool in U.S. and U.K.
  - Understanding how this tool utilized and its effectiveness still limited.
- Twitter provides a good platform to study social media communication.
  - Reliable mapping between Fed, mentioners and followers.
  - Prior studies focus on the Fed's **tweeting activities**, but do not involve how Fed's tweets **attract public's attention**.

Research Questions

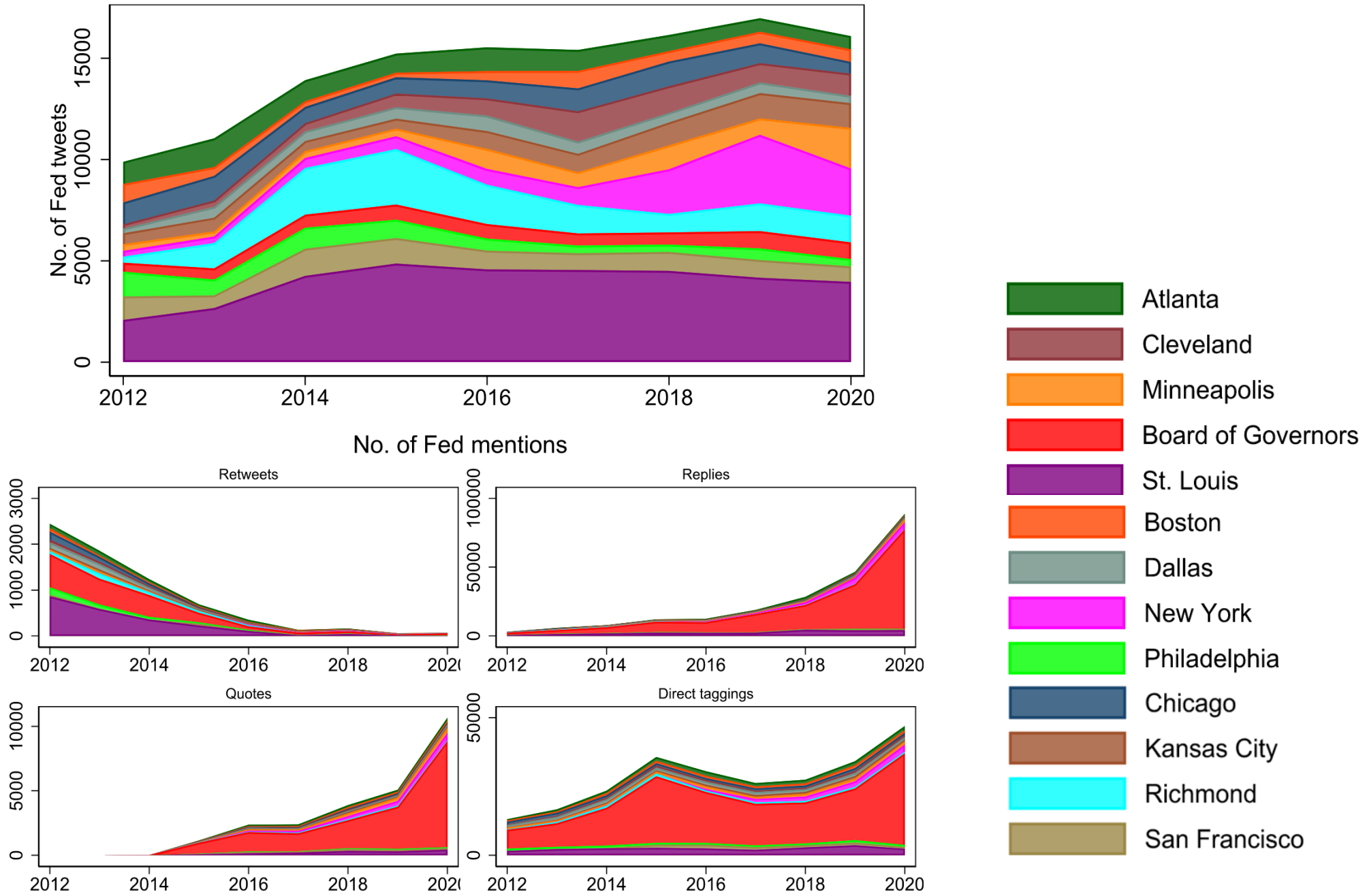
- (1) What is communicated on Twitter?
- (2) Who engages with Fed on Twitter?
- (3) Whether Fed’s Twitter has influence on inflation expectations?

Contribution

- Contribute to literature on monetary policy affect economic agents' expectations.
  - Prior literature: **result of change** are mixed (Binder, 2017; Claus and Nguyen, 2020); different **agents** respond to monetary policy varies (Coibion et al., 2022).
  - Extend: examine influence of Fed's tweets on inflation expectations.
- Contribute to literature on using social media as central bank communication tool.
  - Prior literature: twitter **activities** (Korhonen and Newby, 2019); **similarity** between tweets and press releases (Masciandaro et al., 2020); Fed's **engagement** on twitter (Conti-Brown and Feinstein, 2020).
  - Extend: analyze twitter users' discussion of Fed, find tweets can shape expectations.

Social media data

- Fed timeline
  - Tweets posted by the accounts of Fed Board of Governors and 12 regional Fed Banks
  - New York Fed created in 2008.06; Kansas City Fed created in 2011.04
  - Historical tweets from 2012.01 to 2020.12
  - Observation: user description, tweet statistics, tweet analytics
- Tweets mentioning Fed's Twitter accounts
  - All public tweets that mention Fed's Twitter handles (e.g., @federalreserve)
  - Four types: retweets(1.45%); quotes(44.08%); replies(4.96%); direct tagging(49.51%)

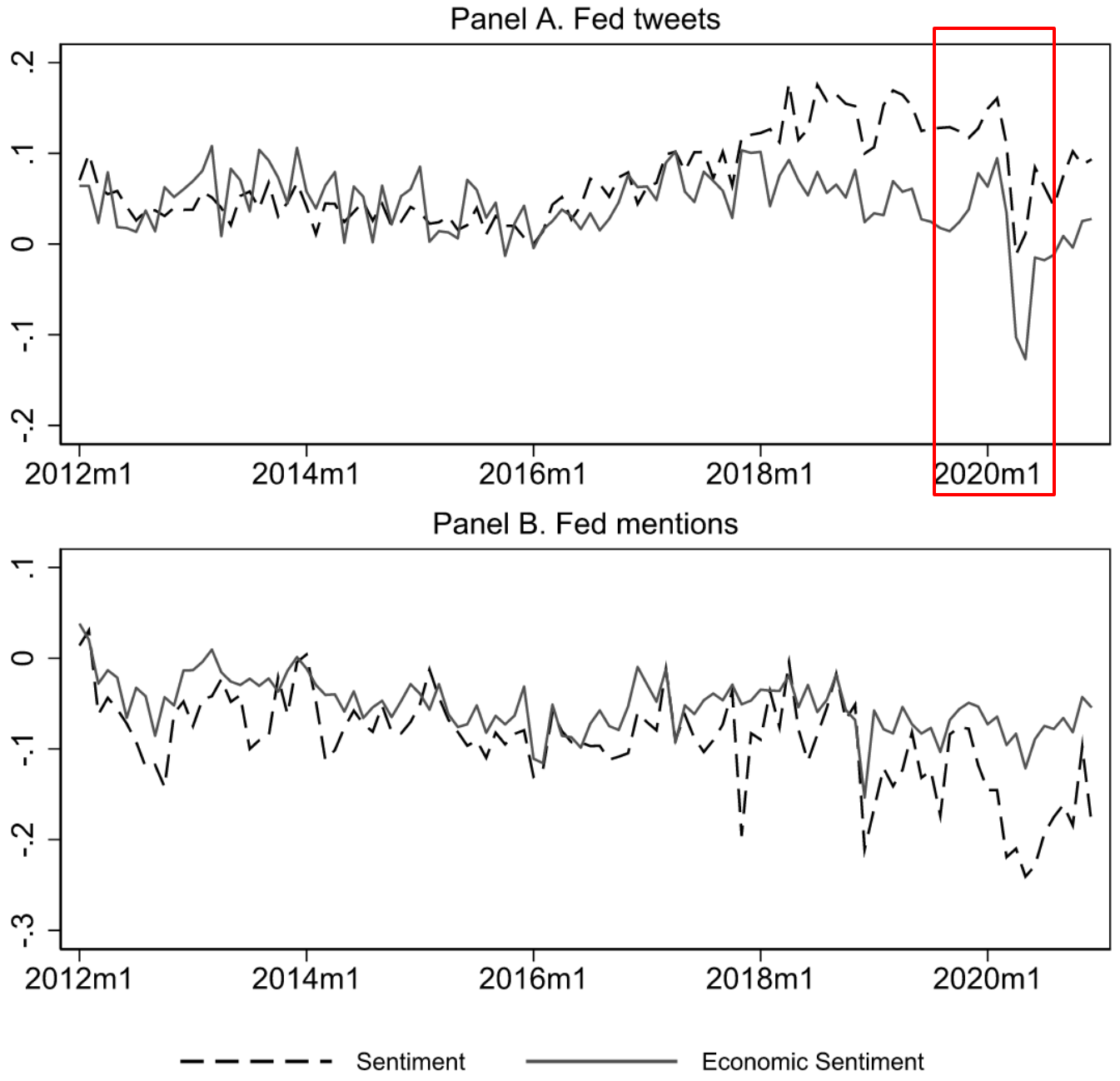

No. of Fed tweets
0
5000
10000
15000
2012
2014
2016
2018
2020
No. of Fed mentions
Retweets
0
1000
2000
3000
Replies
0
50000
100000
Quotes
0
5000
10000
Direct taggings
0
50000
Atlanta
Cleveland
Minneapolis
Board of Governors
St. Louis
Boston
Dallas
New York
Philadelphia
Chicago
Kansas City
Richmond
San Francisco

Text analysis

- Text sentiment
  - General sentiment: TweetNLP (Camacho et al., 2022)
  - Economic sentiment: Sentiment-xDistil

Text	Sentiment	Economic sentiment
After 15 years of growth, loans to small businesses by banks fell last year #banking	Neutral	Negative
St. Louis Fed President Bullard was on CNBC's squawk box this morning. Watch the video at urls	Neutral	Neutral
School improvements boost house prices more in better school districts than in other districts #stl	Positive	Positive
Unemployment rate declines to 9.5 percent from 9.7 percent	Negative	Positive
Sales of new homes fall to lowest level since at least 1963	Negative	Negative

- Sentiment monthly index
  - $$\frac{\sum Probability^{Positive} - \sum Probability^{Negative}}{Number\ of\ tweets}$$


Panel A. Fed tweets
.2
.1
0
-.1
-.2
2012m1
2014m1
2016m1
2018m1
2020m1
Panel B. Fed mentions
.1
0
-.1
-.2
-.3
2012m1
2014m1
2016m1
2018m1
2020m1
Sentiment
Economic Sentiment

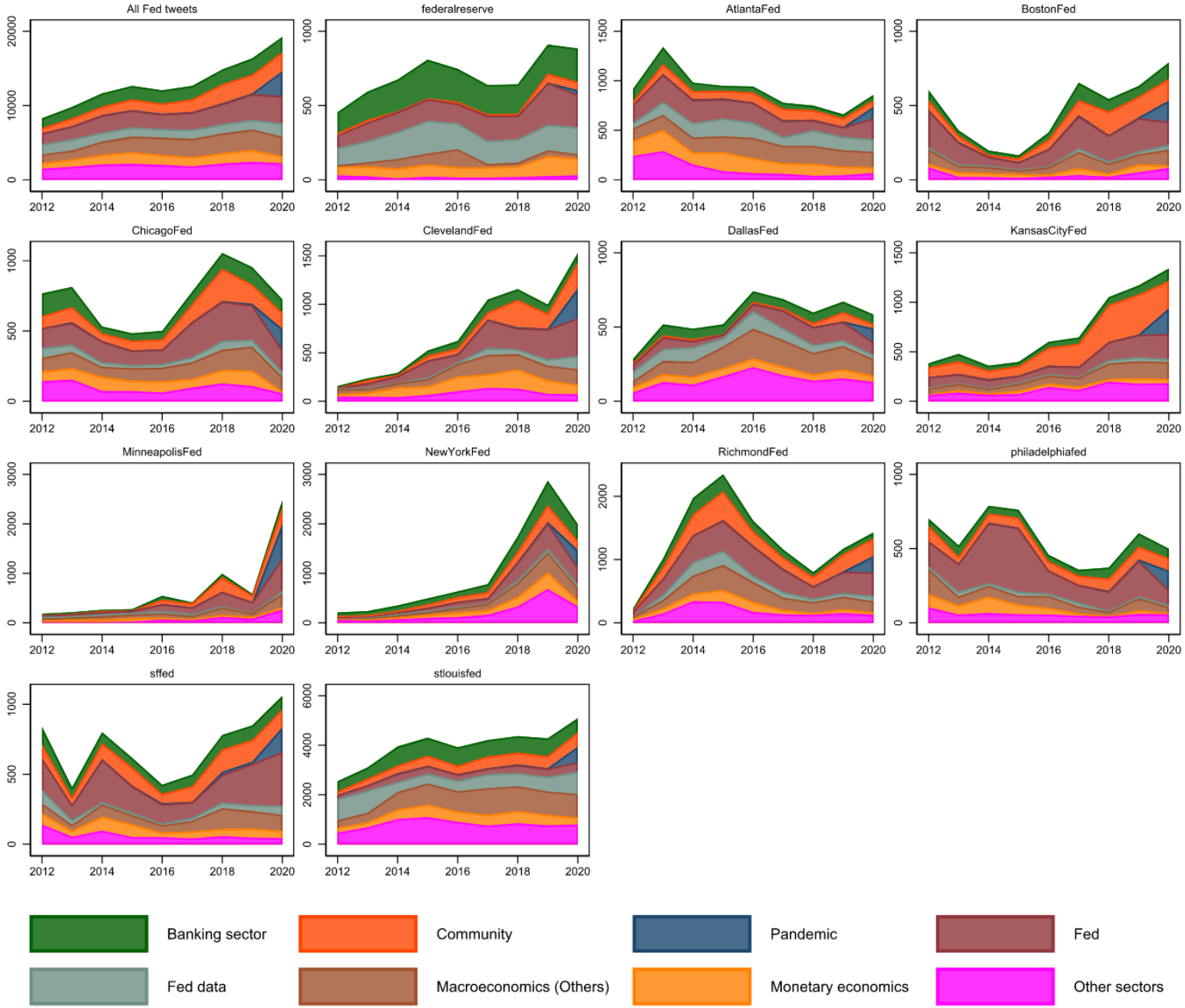
Text analysis

- Taxonomy construction
  - Topics dictionary requires prior knowledge, not scalable for diverse corpora.
  - LDA weak in interpretation of topics.
  - Propose a weakly-supervised, scalable framework:
  - **Step 1**: Clustering with text embeddings for topic modeling

    (1)text embeddings: Google’s USE; (2)dimensionality reduction: UMAP;

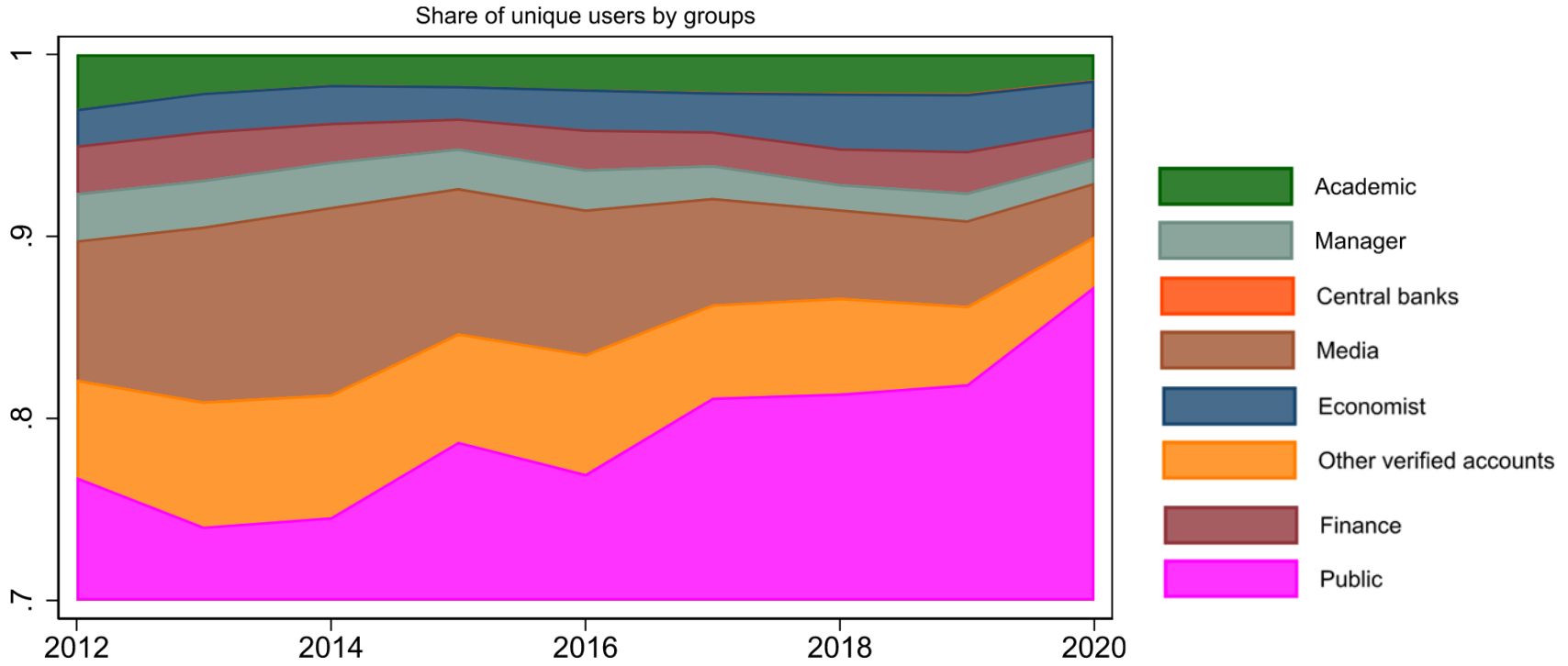
    (3)clustering: HDBSCAN; (4)keywords generation: TFIDF
  - **Step 2**: Hyperparameter finetuning
  - **Step 3**: manual taxonomy construction

    Clustering is **interrelated** and **over-classied** as outliers: manual topic reduction


All Fed tweets
federalreserve
AtlantaFed
BostonFed
ChicagoFed
ClevelandFed
DallasFed
KansasCityFed
MinneapolisFed
NewYorkFed
RichmondFed
philadelphiafed
sffed
stlouisfed
Banking sector
Community
Pandemic
Fed
Fed data
Macroeconomics (Others)
Monetary economics
Other sectors

User classification

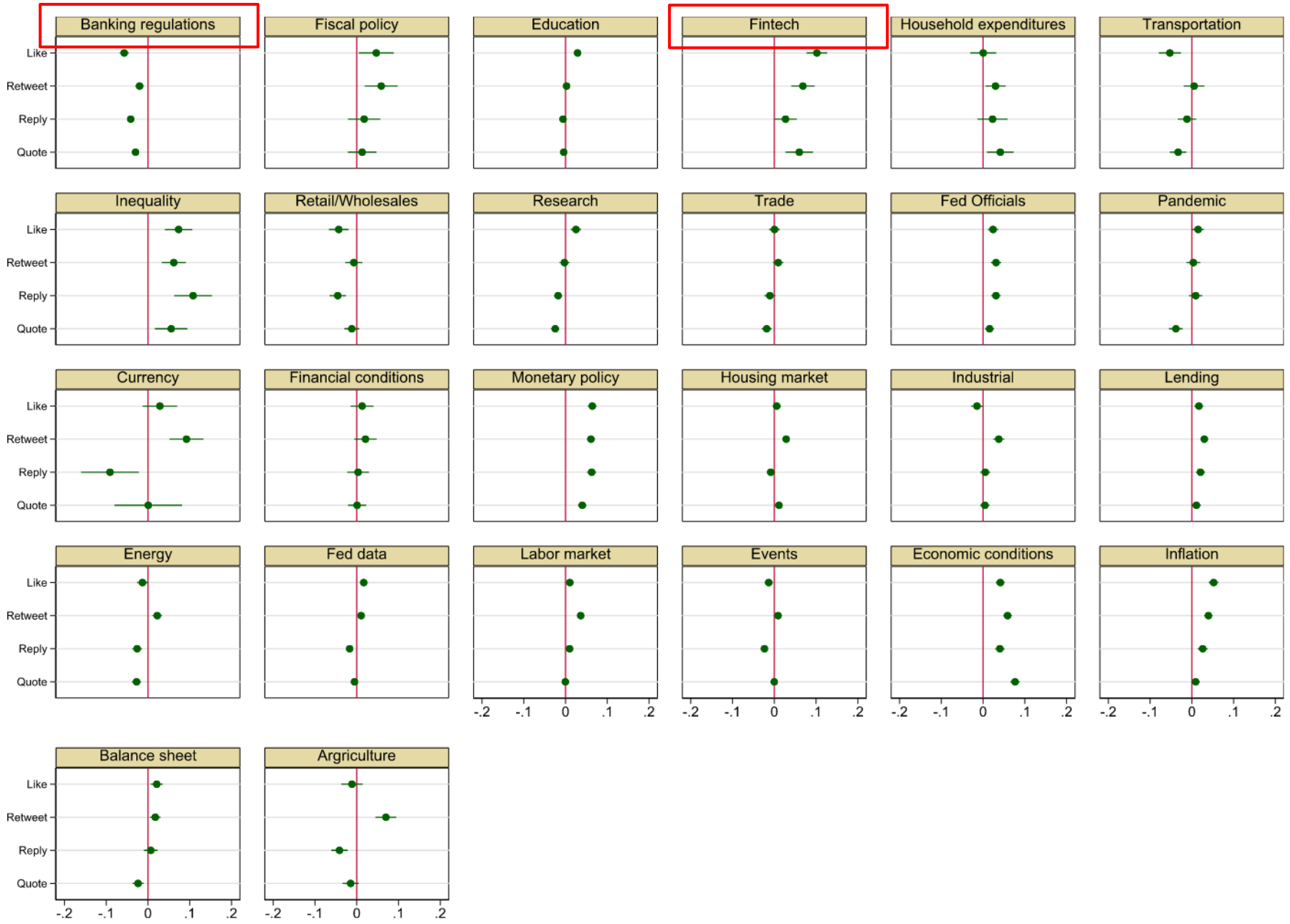
- Apply the taxonomy framework on users' **self-description**.
  - Generate dictionary of eight user groups: media, economist, non-economic-majored academics, finance, manager, central banks, public, other verified accounts.



Fed direct engagement on Twitter

- $Reaction_{i,d}^{D} = \alpha + \beta_1 FOMC_d^{Unchange} + \beta_2 FOMC_d^{Change} + \beta_3 \ln(EPU)_d + \gamma Fedtweet_{i,j,d} + \varepsilon_{i,j,d}$

	$Like^D$ (1)	$Retweet^D$ (2)	$Reply^D$ (3)	$Quote^D$ (4)
$FOMC^{Unchange}$	−0.018*	0.007	−0.001	−0.002
	(0.011)	(0.011)	(0.008)	(0.010)
$FOMC^{Change}$	−0.005	−0.027	−0.009	0.042**
	(0.017)	(0.020)	(0.021)	(0.021)
Pandemic	0.015**	0.003	0.008	−0.039***
	(0.007)	(0.008)	(0.008)	(0.008)
Fed data	0.020***	0.010***	−0.016***	−0.008**
	(0.004)	(0.003)	(0.004)	(0.003)
Monetary economics	0.060***	0.055***	0.047***	0.029***
	(0.004)	(0.004)	(0.004)	(0.004)
Macroeconomics (Others)	0.016***	0.040***	0.013***	0.018***
	(0.003)	(0.003)	(0.003)	(0.003)
Other sectors	−0.016***	0.028***	−0.018***	−0.007**
	(0.004)	(0.003)	(0.003)	(0.003)
Banking sector	−0.009**	0.010***	−0.009***	−0.011***
	(0.004)	(0.003)	(0.003)	(0.003)
Community	0.031***	0.005	−0.002	−0.003
	(0.004)	(0.004)	(0.003)	(0.003)
Fed	−0.003	0.009***	−0.007***	−0.003
	(0.003)	(0.003)	(0.003)	(0.003)


Banking regulations
Fiscal policy
Education
Fintech
Household expenditures
Transportation
Inequality
Retail/Wholesales
Research
Trade
Fed Officials
Pandemic
Currency
Financial conditions
Monetary policy
Housing market
Industrial
Lending
Energy
Fed data
Labor market
Events
Economic conditions
Inflation
Balance sheet
Argriculture
Like
Retweet
Reply
Quote
-.2
-.1
0
.1
.2

Fed indirect engagement on Twitter

Engagement with the Fed – By content.

	Dependent variable:								
	Mentions	*Sentiment*^{M}	*Economic sentiment*^{M}	*Irony*^{M}	*Monetary economics*^{M}	*Macroeconomics (Others)*^{M}	*Other sectors*^{M}	*Banking sector*^{M}	*HHI*^{Topics}
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FOMC^{Unchange}	0.636***	−0.004	−0.003	0.022***	1.422***	0.717***	0.402***	0.315***	0.011***
	(0.051)	(0.008)	(0.007)	(0.006)	(0.084)	(0.077)	(0.075)	(0.080)	(0.003)
FOMC^{Change}	1.121***	−0.020	0.025	0.029***	1.795***	1.331***	1.038***	0.951***	0.013**
	(0.122)	(0.025)	(0.029)	(0.009)	(0.113)	(0.095)	(0.131)	(0.122)	(0.005)
ln(EPU)	0.032*	−0.006	0.002	−0.001	0.100***	0.068***	0.043	0.019	0.002**
	(0.019)	(0.004)	(0.003)	(0.002)	(0.028)	(0.023)	(0.027)	(0.026)	(0.001)
ln(Monetary economics)	0.030**	−0.004	−0.000	−0.002	0.270***	0.041**	−0.006	0.004	0.001
	(0.012)	(0.003)	(0.002)	(0.002)	(0.022)	(0.019)	(0.019)	(0.021)	(0.001)
ln(Macroeconomics (Others))	−0.014	0.002	0.003	0.002	−0.067**	0.221***	−0.019	−0.039	−0.003*
	(0.016)	(0.004)	(0.003)	(0.002)	(0.029)	(0.025)	(0.024)	(0.027)	(0.002)
ln(Other sectors)	−0.019	−0.005	−0.002	−0.002	0.015	−0.021	0.173***	−0.058**	0.000
	(0.015)	(0.003)	(0.003)	(0.002)	(0.028)	(0.024)	(0.025)	(0.025)	(0.001)
ln(Banking sector)	−0.014	0.004	0.003	−0.005**	−0.011	−0.010	0.001	0.124***	0.001
	(0.016)	(0.003)	(0.003)	(0.002)	(0.029)	(0.024)	(0.025)	(0.026)	(0.001)
Sentiment	−0.281*	0.179***	0.061***	−0.019	0.052	0.071	−0.244	−0.270	0.014*
	(0.145)	(0.030)	(0.023)	(0.018)	(0.228)	(0.203)	(0.213)	(0.212)	(0.007)
Economic sentiment	−0.164*	−0.036*	0.071***	0.006	−0.272*	−0.208	−0.251**	−0.122	0.004
	(0.091)	(0.019)	(0.015)	(0.013)	(0.155)	(0.129)	(0.125)	(0.147)	(0.006)
ln(Fed accounts)	0.350***	0.007	0.010	−0.003	0.238***	0.298***	0.347***	0.219***	−0.008***
	(0.045)	(0.009)	(0.008)	(0.006)	(0.073)	(0.071)	(0.062)	(0.067)	(0.003)
ln(Fed tweets)	0.556***	0.032***	0.004	0.020***	0.383***	0.405***	0.389***	0.512***	0.006
	(0.049)	(0.010)	(0.008)	(0.007)	(0.080)	(0.074)	(0.070)	(0.078)	(0.004)
Obs.	2,445	2,445	2,445	2,445	2,341	2,397	2,402	2,409	2,445
R-squared	0.749	0.235	0.138	0.235	0.536	0.622	0.580	0.626	0.084

Engagement with the Fed—By user groups.

	Dependent variable:							
	Mentioners	*Followers*^{M}	*Public*	*Media*	*Economist*	*Finance*	*Manager*	*HHI*^{Users}
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FOMC^{Unchange}	0.638***	0.818***	0.590***	1.081***	0.748***	0.549***	0.682***	−0.053***
	(0.046)	(0.079)	(0.053)	(0.072)	(0.095)	(0.099)	(0.100)	(0.009)
FOMC^{Change}	1.153***	1.178***	1.060***	1.852***	1.105***	0.989***	1.255***	−0.069***
	(0.115)	(0.152)	(0.126)	(0.129)	(0.118)	(0.180)	(0.173)	(0.016)
ln(EPU)	0.038**	−0.019	0.035*	0.070**	0.036	0.028	0.050	0.004
	(0.017)	(0.033)	(0.020)	(0.027)	(0.030)	(0.031)	(0.033)	(0.004)
ln(Monetary economics)	0.020*	0.030	0.025*	0.087***	0.051**	0.045*	−0.022	−0.005
	(0.012)	(0.025)	(0.013)	(0.022)	(0.023)	(0.023)	(0.026)	(0.003)
ln(Macroeconomics (Others))	−0.007	−0.045	−0.016	−0.031	0.031	−0.053*	−0.046	−0.002
	(0.015)	(0.034)	(0.017)	(0.029)	(0.030)	(0.030)	(0.032)	(0.004)
ln(Other sectors)	−0.017	0.010	−0.014	−0.048*	−0.031	−0.042	−0.051	0.004
	(0.014)	(0.033)	(0.016)	(0.029)	(0.031)	(0.029)	(0.033)	(0.004)
ln(Banking sector)	−0.002	−0.031	−0.014	−0.021	−0.003	0.006	0.030	0.002
	(0.015)	(0.033)	(0.017)	(0.028)	(0.030)	(0.031)	(0.033)	(0.004)
Sentiment	−0.228*	−0.140	−0.303**	−0.276	0.010	−0.460*	−0.227	−0.032
	(0.138)	(0.268)	(0.152)	(0.250)	(0.259)	(0.277)	(0.294)	(0.032)
Economic sentiment	−0.155*	−0.117	−0.133	−0.387**	−0.275*	−0.161	−0.089	0.034
	(0.083)	(0.181)	(0.096)	(0.156)	(0.162)	(0.165)	(0.185)	(0.021)
ln(Fed accounts)	0.339***	0.315***	0.324***	0.409***	0.164**	0.087	−0.035	−0.039***
	(0.043)	(0.089)	(0.047)	(0.079)	(0.081)	(0.081)	(0.092)	(0.011)
ln(Fed tweets)	0.498***	0.131	0.516***	0.862***	0.450***	0.557***	0.549***	−0.047***
	(0.046)	(0.095)	(0.052)	(0.083)	(0.086)	(0.083)	(0.093)	(0.011)
Obs.	2,445	2,445	2,445	2,338	2,050	2,090	2,001	2,445
R-squared	0.766	0.119	0.734	0.512	0.515	0.404	0.227	0.302

Fed communication and inflation expectations

- Few-shot learning for classification (higher inflation vs. lower inflation)
  - $IE_t^{Twitter} = \frac{\sum Mentions^{Higher} - \sum Mentions^{Lower}}{All\ "Price"\ mentions_t}$
  - A mixture of expectations and perceptions: (1)expected price changes in the future; (2)perceived inflations in the past/present

Variables	$IE^{Twitter}$ (1)	$wIE^{Twitter}$ (2)
$Rate^{MICH}$	0.220*	0.230*
	(0.022)	(0.098)
IE^{MICH}	0.031	0.093
	(0.749)	(0.510)
ΔIE^{MICH}	0.067	0.193
	(0.495)	(0.166)
$Rate^{NY}$	0.032	0.084
	(0.764)	(0.553)
IE^{NY}	−0.025	0.124
	(0.812)	(0.382)
ΔIE^{NY}	0.188*	0.269*
	(0.076)	(0.053)
MoM^{Infl}	0.406*	0.485*
	(0.000)	(0.000)

Impact on Twitter-based inflation expectations.

	Dependent variable:							
	$IE^{Twitter}$	$wIE^{Twitter}$	$Mentions^{Higher}$	$Mentions^{Lower}$	$IE^{Twitter}$	$wIE^{Twitter}$	$Mentions^{Higher}$	$Mentions^{Lower}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$FOMC^{Unchange}$	−0.266***	−0.264***	−0.111***	0.059*	−0.259**	−0.256**	−0.108***	0.056
	(0.102)	(0.102)	(0.036)	(0.036)	(0.104)	(0.104)	(0.037)	(0.036)
$FOMC^{Change}$	0.043	0.073	0.006	−0.022	0.036	0.067	0.004	−0.019
	(0.123)	(0.123)	(0.047)	(0.042)	(0.122)	(0.122)	(0.047)	(0.042)
ln(EPU)	−0.016	−0.008	0.001	0.011	−0.021	−0.013	−0.001	0.012
	(0.057)	(0.056)	(0.020)	(0.019)	(0.058)	(0.056)	(0.020)	(0.020)
ln(Monetary economics)	0.037	0.035	0.004	−0.020*	0.038	0.037	0.004	−0.020*
	(0.033)	(0.033)	(0.012)	(0.011)	(0.033)	(0.032)	(0.012)	(0.011)
ln(Macroeconomics (Others))	0.050	0.052	0.019	−0.013	0.048	0.050	0.018	−0.012
	(0.051)	(0.050)	(0.018)	(0.017)	(0.050)	(0.050)	(0.018)	(0.017)
ln(Other sectors)	−0.064	−0.062	−0.020	0.021	−0.066	−0.064	−0.021	0.021
	(0.051)	(0.051)	(0.019)	(0.017)	(0.051)	(0.051)	(0.019)	(0.017)
ln(Banking sector)	0.013	0.017	0.003	−0.005	0.012	0.016	0.003	−0.005
	(0.047)	(0.047)	(0.017)	(0.015)	(0.047)	(0.047)	(0.017)	(0.015)
Sentiment	−0.246	−0.300	−0.146	0.011	−0.207	−0.262	−0.135	−0.003
	(0.393)	(0.376)	(0.138)	(0.130)	(0.394)	(0.375)	(0.138)	(0.130)
Economic sentiment	0.652**	0.754***	0.226**	−0.189**	0.359	0.457	0.140	−0.089
	(0.286)	(0.284)	(0.105)	(0.091)	(0.315)	(0.309)	(0.116)	(0.100)
ZLB					−0.116	−0.112	−0.032	0.042
					(0.116)	(0.115)	(0.041)	(0.037)
Economic sentiment × ZLB					1.194**	1.208**	0.352*	−0.408**
					(0.562)	(0.572)	(0.205)	(0.182)
ln(Fed accounts)	0.145	0.155	0.023	−0.069	0.147	0.157	0.024	−0.070
	(0.143)	(0.138)	(0.051)	(0.047)	(0.142)	(0.137)	(0.051)	(0.047)
ln(Fed tweets)	−0.201	−0.185	−0.056	0.072	−0.210	−0.195	−0.059	0.075*
	(0.137)	(0.134)	(0.050)	(0.045)	(0.135)	(0.132)	(0.049)	(0.044)
MoM^{Infl}	0.315***	0.314***	0.105***	−0.095***	0.347***	0.345***	0.114***	−0.107***
	(0.087)	(0.085)	(0.032)	(0.029)	(0.090)	(0.088)	(0.034)	(0.030)
Obs.	685	685	685	685	685	685	685	685
R-squared	0.168	0.169	0.155	0.158	0.175	0.176	0.159	0.166

New ideas

- Company fundamentals forecast based on Twitter.
  - Product sales forecast (JAR, 2018)
  - Earning forecast, fraud detection, valuation forecast