Central bank communication with non-experts –A road to nowhere?

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Motivation

- Central banks long term: communication with experts, financial markets.
- After crisis: non-experts was thus needed:New mandates and new tools,highly controversial public debate,erosion of citizens' trust(Bergbauer et al. 2020).
- Is central bank messages actually reach the non-experts?
  - positive: requires news media as an intermediator,but can affect consumer confidence(Ter Ellen et al., 2022; Lewis et al., 2019)
  - negative: some people (especially Twitter users) reported receiving information from monetary policy announcements, it had limited impact on inflation and economic expectations. (Lamla and Vinogradov,2019;2021)
- This paper explore actual impact of central bank communication on non-experts via social media (Twitter).

Motivation

- this paper:a novel avenue——how they talk about the ECB in social media, by analysing tweets posted on Twitter

1. Real-life Data, Wide Representation: Based on social media data, reflecting public reactions more authentically. (in contrast to lab or survey experiments)
2. High-frequency and Continuous Data: for causal analysis.
3. Expert vs. Non-expert Comparison: as both are active on Twitter

Question

- Can central banks(ECB) reach non-experts?
  - Yes, it is not a "road to nowhere."
- How do non-experts respond to central bank communication(by Twitter) ?
  - Different responses to communication events:
    - **Information transmission:** For most central bank events, Twitter traffic normalizes within a day, with non-experts less involved and views converging.
    - **Controversial discussions:** In some cases (e.g., "Whatever it takes"), Twitter sparks divisive debates, attracting non-experts and diverging views.

Contribution

- contributes to literature on social media in financial market and central bank-related contexts.
  - prior: Central banks' and politicians' tweets can predict FOMC stock returns, identify policy shifts, and influence inflation expectations. (Tillmann, 2020)
  - expand: Analyzes Twitter activity by non-experts
- contributes to literature on central bank communication with non-experts
  - prior:RCTs:Simple and clear messages more effectively influence non-experts' beliefs and behavior (Coibion et al., 2022).
  - Limit: In real life, non-experts may not actually receive central bank signals.
  - expand: focus on ECB' s communication with non-experts on social media (Twitter): aligns with real-world conditions.

Design

Data base

data:Tweets——English & German,related to ECB
2012-2018,3.2 million & 97000

Differentiating experts from non-experts

Institutional Twitter accounts? ×

according to behaviour
- Comment Frequency
- ECB Centricity

Empirical

1. Can central banks(ECB) reach non-experts?

Twitter traffic | user concentration

daily data,2532 observations | linear and quadratic time trend

$$x_t = \alpha_d + \alpha_m + \alpha_h + \alpha_t t + \alpha_{t^2} t^2 + \beta^e_{c,l} C^e_{t,l} + \varepsilon_t$$

day,month,holiday effects | various ECB communication events e,lag l

2. How do non-experts respond to central bank communication?

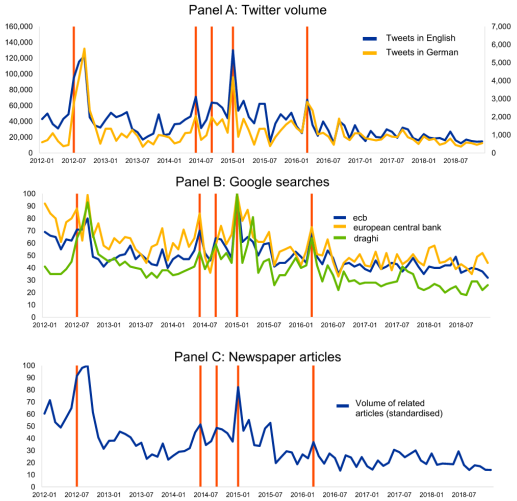
content analysis compare experts & non-experts
- subjectivity
- favourableness

absolute favourableness

Design-Data base

- Time: 2012-2018; language: English-German
  - Twitter stabilized-ECB leadership change (active Twitter use-structural break)
  - most ECB communication; most widely in euro area,heated public debate
- Step:
  1. Collection: Python-GetOldTweets,Twint, filtering tweets containing **"ecb", "european central bank",** or **"draghi"** (in text, hashtag, or username).
  2. Record: Original tweets, number of replies, likes, and retweets.
  3. clean:
     - Ensure ECB relevance: manual identify, distinguish keywords, word cloud check.
     - **Active Accounts**: Only accounts with at least **100 tweets** are retained.
     - **Avoid Circular**: Tweets from the **ECB' s official account** are removed.
  4. content: TextBlob——favourableness (tone,-1 to 1), absolute favourableness (sentiment strength,0-1) and subjectivity(0,1).

Design-Data base



- red lines: Twitter activity peaks around major ECB decisions
- first red line: Whatever it takes
- 3 sources yield similar trend——reflect general interest in ECB-related matters well

Design-Data base

- ECB communication events:
  - Monetary policy announcements and press conferences (68 events).
  - Economic Bulletin (published two weeks after policy meetings; 68 events).
  - Monetary policy meeting accounts (since 2015, released 4 weeks after meetings; 31 events).
  - ECB institutional Twitter posts on non-event days (1,062 tweets).
  - Speeches by the ECB president (131 events).
  - Speeches by other Executive Board members (519 events).
  - Draghi' s "Whatever it takes" speech on July 26, 2012.

Design-Differentiating experts from non-experts

- Criteria:
  - Comment Frequency ($AP_{C,i}$): Experts regularly comment on ECB policy.
  - ECB Relevance($S_{ECB,i}$): Non-experts mention the ECB occasionally.
- Baseline Definition:

$$E_i^{bm} = \begin{cases} 1, & \text{if } AP_{C,i} \geq 0.5 \\ 0, & \text{else} \end{cases}$$

$$N_i^{bm} = \begin{cases} 1, & \text{if } AP_{C,i} < 0.5 \text{ and } S_{ECB,i} < P25(S_{ECB}) \\ 0, & \text{else} \end{cases}$$

- 3 parts –experts,non-experts,between

Design-Differentiating experts from non-experts

	English Sample			German Sample		
	Experts	*Non-experts*		*Experts*	*Non-experts*	
Account characteristics						
Number of accounts	1,158	61,278		18	3,548	
Average weekend activity	0.0691	0.1837	***	0.0567	0.2026	*
Average percentile followers	68	68		67	66	
Average percentile ECB centricity	84	12	***	85	12	***
Subjectivity						
Average	0.2472	0.2750	***	0.0603	0.0211	
Average of account-specific standard deviation	0.2578	0.2163	***	0.1635	0.0335	***
Standard deviation of account-specific average	0.0926	0.2722	***	0.1129	0.1250	
Favourableness						
Average	0.0428	0.0515		0.0264	0.0274	
Average of account-specific standard deviation	0.1709	0.1498	***	0.4242	0.2054	***
Standard deviation of account-specific average	0.0567	0.2161	***	0.2099	0.3354	
Absolute favourableness						
Average	0.0997	0.1350	***	0.2612	0.1576	
Average of account-specific standard deviation	0.1483	0.1285	***	0.3635	0.1802	***
Standard deviation of account-specific average	0.0511	0.1837	***	0.1394	0.3062	***

0.5% 24% singel account across account

- succeeded in singling out experts and non-experts

Design-Empirical

1. Can central banks(ECB) reach non-experts?
   - Twitter traffic: volume
   - user concentration: Herfindahl-Hirschman: $HHI_t = \sum_{i=1}^{U_t} s_{i,t}^2$, $s_{i,t} = \frac{\sum \text{tweets}_{i,t}}{\sum \text{tweets}_t}$, near 1: tweets highly concentrated among small users; small:evenly distributed.

daily data,2532 observations linear and quadratic time trend

$$x_t = \alpha_d + \alpha_m + \alpha_h + \alpha_t t + \alpha_{t^2} t^2 + \beta^e_{c,l} C^e_{t,l} + \varepsilon_t$$

day,month,holiday effects various ECB communication events e,lag l

   - lag and lead periods are selected based on model statistical significance.

2. How do non-experts respond to central bank communication?
   - favourableness, absolute favourableness and subjectivity
   - **Information transmission**: more objective,emotion weak,with discussion intensity quickly returning to normal.
   - **Controversial discussions**:More subjective, emotionally intense, significant differences, with discussions lasting longer.

Result-Can central banks(ECB) reach non-experts

	Log number of tweets						Concentration index					
	English sample			*German sample*			*English sample*			*German sample*		
	All	*Non-experts*	*Experts*	*All*	*Non-experts*	*Experts*	*All*	*Non-experts*	*Experts*	*All*	*Non-experts*	*Experts*
Panel A: Contemporaneous response												
Press Conference	2.467***	2.056***	2.816***	2.422***	1.200***	2.605***	-0.004***	-0.043***	-0.024***	-0.134***	-0.403***	-0.538***
	(0.083)	(0.121)	(0.086)	(0.126)	(0.181)	(0.148)	(0.001)	(0.003)	(0.003)	(0.016)	(0.047)	(0.041)
Whatever it takes	1.975***	1.929***	1.831***	3.198***	1.530***	2.453***	-0.002***	-0.017***	-0.013***	-0.101***	-0.430***	-0.419***
	(0.080)	(0.103)	(0.090)	(0.133)	(0.180)	(0.159)	(0.000)	(0.004)	(0.004)	(0.019)	(0.059)	(0.053)
Economic Bulletin	0.205**	0.180	0.275***	-0.203	-0.264	-0.171	-0.001	-0.006*	-0.008***	-0.000	0.067	-0.014
	(0.089)	(0.109)	(0.095)	(0.141)	(0.186)	(0.162)	(0.001)	(0.004)	(0.003)	(0.025)	(0.073)	(0.060)
Accounts	0.542***	0.312***	0.853***	0.115	0.067	-0.146	-0.002***	-0.021***	-0.017***	-0.035	-0.048	0.005
	(0.086)	(0.098)	(0.095)	(0.149)	(0.214)	(0.186)	(0.001)	(0.004)	(0.004)	(0.024)	(0.075)	(0.064)
Speeches by others	0.252***	0.084	0.394***	0.164**	0.031	0.044	-0.002***	-0.006**	-0.015***	-0.040***	-0.009	-0.031
	(0.045)	(0.057)	(0.053)	(0.076)	(0.097)	(0.093)	(0.001)	(0.003)	(0.003)	(0.014)	(0.034)	(0.034)
Speeches by president	0.449***	0.360***	0.509***	0.863***	0.488***	1.119***	-0.001***	-0.013***	-0.001	-0.057***	-0.183***	-0.305***
	(0.054)	(0.074)	(0.057)	(0.095)	(0.132)	(0.104)	(0.000)	(0.003)	(0.001)	(0.009)	(0.040)	(0.030)
Tweet	0.188***	0.150***	0.247***	0.108	0.076	0.075	-0.001**	-0.008***	-0.012***	-0.032**	-0.040	-0.051
	(0.044)	(0.054)	(0.053)	(0.071)	(0.087)	(0.087)	(0.001)	(0.003)	(0.003)	(0.014)	(0.031)	(0.032)
Panel B: Overall response												
Press Conference	**5.447**	**4.116**	**6.358**	**4.512**	**2.036**	**4.295**	**-0.023**	**-0.138**	**-0.226**	**-0.358**	**-0.776**	**-1.061**
Std. error	0.269	0.335	0.315	0.256	0.350	0.308	0.003	0.016	0.023	0.034	0.112	0.109
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Whatever it takes	**30.044**	**27.876**	**26.597**	**43.845**	**27.471**	**15.494**	**-0.095**	**-0.720**	**-0.875**	**-3.115**	**-6.962**	**-3.911**
Std. error	1.059	1.052	1.276	1.230	1.518	1.008	0.011	0.081	0.099	0.212	0.516	0.354
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	2,532	2,532	2,532	2,523	1,461	1,177	2,532	2,532	2,532	2,523	1,461	1,177
R-squared	0.582	0.324	0.628	0.352	0.177	0.442	0.259	0.198	0.394	0.163	0.167	0.277
Mean(dependent var)	7.051	3.685	5.756	3.155	1.003	1.220	0.006	0.051	0.042	0.150	0.608	0.604
Stdev(dependent var)	0.905	0.880	1.158	1.192	1.037	1.115	0.007	0.047	0.068	0.182	0.359	0.339

50%×9

140%×20

- Non-experts' Twitter discussions increase during central bank communication events.

Result-How do non-experts respond

	Average subjectivity						Standard deviation of subjectivity					
	English sample			*German sample*			*English sample*			*German sample*		
	All	*Non-experts*	*Experts*	*All*	*Non-experts*	*Experts*	*All*	*Non-experts*	*Experts*	*All*	*Non-experts*	*Experts*
Panel A: Contemporaneous response												
Press Conference	-0.010*	-0.031***	0.012*	-0.012*	-0.031*	-0.023	-0.011***	-0.022***	0.002	0.028**	0.008	0.069***
	(0.005)	(0.007)	(0.006)	(0.006)	(0.017)	(0.022)	(0.003)	(0.004)	(0.004)	(0.013)	(0.017)	(0.019)
Whatever it takes	-0.003	-0.021**	0.016**	-0.007	0.040*	-0.001	-0.003	-0.013***	0.006	0.011	0.204***	0.157***
	(0.006)	(0.008)	(0.008)	(0.007)	(0.023)	(0.029)	(0.003)	(0.004)	(0.005)	(0.015)	(0.018)	(0.016)
Economic Bulletin	-0.010*	-0.008	-0.002	-0.006	-0.020	-0.001	-0.010***	-0.010**	-0.006	-0.007	-0.036***	0.014
	(0.006)	(0.009)	(0.007)	(0.008)	(0.033)	(0.028)	(0.003)	(0.004)	(0.004)	(0.017)	(0.012)	(0.025)
Accounts	-0.026***	-0.025**	-0.015*	-0.005	-0.054***	-0.055**	-0.012***	-0.011	-0.006	0.007	-0.036***	-0.027**
	(0.006)	(0.011)	(0.007)	(0.011)	(0.017)	(0.022)	(0.004)	(0.007)	(0.006)	(0.025)	(0.012)	(0.012)
Speeches by others	0.001	-0.002	0.008	-0.005	-0.004	-0.010	-0.001	-0.002	0.004	-0.005	-0.011	-0.007
	(0.004)	(0.005)	(0.005)	(0.004)	(0.014)	(0.015)	(0.002)	(0.003)	(0.003)	(0.009)	(0.008)	(0.012)
Speeches by president	-0.007*	-0.018***	-0.005	-0.001	-0.002	-0.011	-0.005**	-0.007**	-0.004	0.026**	0.025*	0.017
	(0.004)	(0.006)	(0.005)	(0.005)	(0.015)	(0.011)	(0.002)	(0.003)	(0.003)	(0.010)	(0.013)	(0.011)
Tweet	-0.005	-0.006	-0.002	-0.004	-0.010	0.011	-0.003	-0.004	-0.001	-0.007	-0.006	0.002
	(0.003)	(0.004)	(0.005)	(0.004)	(0.013)	(0.015)	(0.002)	(0.002)	(0.003)	(0.008)	(0.008)	(0.012)
Panel B: Overall response												
Press Conference	**-0.068**	**-0.115**	0.005	**-0.024**	-0.008	0.017	-0.016	**-0.046**	**0.063**	**0.073**	**0.057**	**0.169**
Std. error	0.022	0.028	0.032	0.014	0.041	0.053	0.012	0.015	0.020	0.030	0.033	0.041
p-value	0.002	0.000	0.871	0.088	0.845	0.743	0.198	0.002	0.002	0.016	0.081	0.000
Whatever it takes	0.213	0.096	**0.544**	0.046	0.202	-0.146	**-0.072**	0.018	0.076	**0.845**	**1.188**	**0.570**
Std. error	0.074	0.092	0.104	0.064	0.154	0.169	0.040	0.049	0.070	0.123	0.090	0.108
p-value	0.004	0.297	0.000	0.472	0.190	0.388	0.072	0.715	0.276	0.000	0.000	0.000
Observations	2,532	2,532	2,532	2,523	1,461	1,177	2,532	2,532	2,532	2,523	1,461	1,177
R-squared	0.174	0.145	0.110	0.038	0.031	0.048	0.066	0.067	0.102	0.083	0.062	0.094
Mean(dependent var)	0.256	0.269	0.229	0.035	0.029	0.036	0.280	0.284	0.263	0.098	0.022	0.033
Stdev(dependent var)	0.051	0.067	0.072	0.068	0.127	0.142	0.027	0.034	0.045	0.121	0.088	0.100

- more factual discussion

Result-How do non-experts respond

	Average favourableness						Standard deviation of favourableness					
	English sample			*German sample*			*English sample*			*German sample*		
	All	*Non-experts*	*Experts*	*All*	*Non-experts*	*Experts*	*All*	*Non-experts*	*Experts*	*All*	*Non-experts*	*Experts*
Panel A: Contemporaneous response												
Press Conference	-0.001	-0.007	0.004	-0.026	-0.037	0.025	-0.029***	-0.045***	-0.010**	0.077***	0.201***	0.272***
	(0.004)	(0.006)	(0.004)	(0.019)	(0.048)	(0.049)	(0.004)	(0.005)	(0.004)	(0.017)	(0.037)	(0.030)
Whatever it takes	0.017***	0.008	0.017***	0.049**	0.054	0.096	-0.008*	-0.030***	0.016***	0.160***	0.309***	0.297***
	(0.005)	(0.007)	(0.005)	(0.024)	(0.051)	(0.059)	(0.004)	(0.006)	(0.005)	(0.020)	(0.033)	(0.039)
Economic Bulletin	0.005	0.008	0.005	-0.024	0.001	0.043	-0.009**	-0.003	-0.005	0.007	-0.022	0.013
	(0.004)	(0.006)	(0.004)	(0.030)	(0.050)	(0.058)	(0.004)	(0.006)	(0.005)	(0.023)	(0.036)	(0.044)
Accounts	0.005	0.010	0.005	-0.026	0.077	-0.032	-0.019***	-0.017**	-0.015***	-0.009	0.043	-0.044
	(0.005)	(0.007)	(0.005)	(0.034)	(0.067)	(0.064)	(0.005)	(0.008)	(0.005)	(0.027)	(0.059)	(0.035)
Speeches by others	0.001	-0.001	0.002	-0.016	0.043	-0.040	-0.003	-0.005	0.003	0.015	0.006	0.024
	(0.003)	(0.004)	(0.003)	(0.014)	(0.032)	(0.040)	(0.003)	(0.003)	(0.003)	(0.013)	(0.019)	(0.024)
Speeches by president	0.004	0.004	0.007**	-0.001	-0.090***	0.036	-0.010***	-0.014***	-0.010***	0.038***	0.055**	0.157***
	(0.003)	(0.004)	(0.003)	(0.015)	(0.030)	(0.031)	(0.003)	(0.004)	(0.003)	(0.014)	(0.025)	(0.025)
Tweet	-0.000	-0.002	0.000	-0.006	0.046*	-0.009	-0.003	-0.004	-0.003	0.024**	0.013	0.009
	(0.002)	(0.003)	(0.003)	(0.012)	(0.027)	(0.039)	(0.002)	(0.003)	(0.003)	(0.011)	(0.016)	(0.022)
Panel B: Overall response												
Press Conference	-0.010	0.003	0.025	-0.047	**-0.171**	-0.052	**-0.100**	**-0.089**	-0.005	**0.169**	**0.304**	**0.575**
Std. error	0.017	0.021	0.020	0.049	0.102	0.134	0.016	0.020	0.022	0.036	0.066	0.081
p-value	0.563	0.888	0.219	0.337	0.094	0.701	0.000	0.000	0.811	0.000	0.000	0.000
Whatever it takes	**-0.084**	**-0.197**	0.021	**-0.952**	-0.512	**-1.905**	**0.179**	0.005	**0.427**	**1.700**	**2.581**	**1.676**
Std. error	0.050	0.066	0.063	0.225	0.399	0.466	0.050	0.062	0.067	0.190	0.259	0.257
p-value	0.095	0.003	0.736	0.000	0.199	0.000	0.000	0.932	0.000	0.000	0.000	0.000
Observations	2,532	2,532	2,532	2,523	1,461	1,177	2,532	2,532	2,532	2,523	1,461	1,177
R-squared	0.069	0.053	0.043	0.034	0.047	0.050	0.132	0.096	0.105	0.088	0.097	0.181
Mean(dependent var)	0.047	0.051	0.038	0.042	0.032	0.029	0.205	0.218	0.171	0.377	0.114	0.172
Stdev(dependent var)	0.035	0.047	0.044	0.183	0.307	0.338	0.036	0.045	0.048	0.166	0.196	0.218

- standard deviation of favourableness reduced

Result-How do non-experts respond

	Average absolute favourableness						Standard deviation of absolute favourableness					
	English sample			*German sample*			*English sample*			*German sample*		
	All	*Non-experts*	*Experts*	*All*	*Non-experts*	*Experts*	*All*	*Non-experts*	*Experts*	*All*	*Non-experts*	*Experts*
Panel A: Contemporaneous response												
Press Conference	-0.021***	-0.039***	-0.008**	0.033**	0.101**	0.013	-0.023***	-0.035***	-0.009***	0.054***	0.155***	0.230**
	(0.004)	(0.005)	(0.003)	(0.016)	(0.043)	(0.041)	(0.003)	(0.004)	(0.004)	(0.012)	(0.031)	(0.027)
Whatever it takes	-0.004	-0.021***	0.011***	0.095***	0.094**	0.154***	-0.005	-0.022***	0.014***	0.112***	0.276***	0.229**
	(0.004)	(0.006)	(0.004)	(0.021)	(0.046)	(0.053)	(0.003)	(0.005)	(0.004)	(0.015)	(0.029)	(0.032)
Economic Bulletin	-0.005	-0.001	-0.002	0.023	-0.036	-0.017	-0.008**	-0.005	-0.006	-0.003	-0.019	-0.006
	(0.004)	(0.006)	(0.004)	(0.026)	(0.050)	(0.054)	(0.004)	(0.005)	(0.004)	(0.017)	(0.031)	(0.036)
Accounts	-0.016***	-0.016**	-0.012***	0.001	0.009	-0.099*	-0.012***	-0.010*	-0.011**	-0.011	0.023	-0.035
	(0.004)	(0.007)	(0.004)	(0.028)	(0.065)	(0.053)	(0.004)	(0.006)	(0.004)	(0.019)	(0.049)	(0.034)
Speeches by others	-0.004	-0.006**	0.000	0.008	0.012	0.004	-0.003	-0.003	0.002	0.010	-0.004	0.019
	(0.002)	(0.003)	(0.003)	(0.013)	(0.029)	(0.035)	(0.002)	(0.003)	(0.003)	(0.010)	(0.016)	(0.020)
Speeches by president	-0.005**	-0.010***	-0.004*	0.014	-0.016	0.016	-0.007***	-0.008**	-0.008***	0.026***	0.052**	0.133**
	(0.002)	(0.004)	(0.002)	(0.014)	(0.028)	(0.029)	(0.002)	(0.003)	(0.003)	(0.009)	(0.022)	(0.020)
Tweet	-0.003	-0.005*	-0.003	0.017	0.026	0.009	-0.002	-0.004	-0.002	0.018**	0.006	0.007
	(0.002)	(0.003)	(0.003)	(0.011)	(0.025)	(0.033)	(0.002)	(0.002)	(0.003)	(0.009)	(0.014)	(0.019)
Panel B: Overall response												
Press Conference	**-0.078**	**-0.089**	**-0.030**	0.061	**-0.051**	0.069	**-0.077**	**-0.060**	-0.002	**0.146**	**0.269**	**0.494**
Std. error	0.014	0.018	0.018	0.038	0.091	0.112	0.013	0.015	0.018	0.028	0.058	0.069
p-value	0.000	0.000	0.089	0.103	0.576	0.539	0.000	0.000	0.898	0.000	0.000	0.000
Whatever it takes	**0.169**	-0.043	**0.360**	-0.065	-0.059	0.153	0.048	-0.058	**0.247**	**1.307**	**2.403**	**1.527**
Std. error	0.045	0.057	0.055	0.190	0.371	0.408	0.042	0.050	0.057	0.153	0.229	0.213
p-value	0.000	0.450	0.000	0.731	0.873	0.707	0.253	0.241	0.000	0.000	0.000	0.000
Observations	2,532	2,532	2,532	2,523	1,461	1,177	2,532	2,532	2,532	2,523	1,461	1,177
R-squared	0.133	0.102	0.085	0.044	0.055	0.046	0.122	0.079	0.090	0.087	0.097	0.184
Mean(dependent var)	0.116	0.129	0.095	0.241	0.175	0.227	0.177	0.186	0.151	0.324	0.100	0.150
Stdev(dependent var)	0.031	0.042	0.039	0.159	0.280	0.290	0.029	0.035	0.040	0.126	0.167	0.185

- average absolute favourableness and its standard deviation get reduced significantly

Idea

- 央行沟通的实际政策影响（如通胀预期、信任度）进行更直接的实证分析。
- 结合金融市场数据，检验社交媒体讨论是否影响市场对政策的解读。
- 反向研究：得出更好与非专家沟通的方式、文本类型等
- 央行沟通对于不同类型投资者（专业、非专业）的影响：股吧数据

Thanks!