EUROPEAN CENTRAL BANK

EUROSYSTEM

Central Bank Communication with Non-Experts – A Road to Nowhere?

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Monetary Policy Tools and their Impact on the Macroeconomy
Bank of Finland / CEPR

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The views expressed here are our own and do not necessarily reflect those of the ECB or the Eurosystem

Introduction

- Long journey of central bank communication towards more transparency (Issing 2019)
  - Mostly with expert audiences
  - Discussion about limits to transparency – how much further down the road to travel?
- New road travelled recently: communication with non-experts
  - E.g. Lagarde: one of the priorities of her presidency
  - Unconventional monetary policy, broadening of mandates, erosion of citizens' trust
  - In addition, more interest in listening (i.e. two-way traffic)

Introduction

- “Central banks will keep trying to communicate with the general public, as they should. But for the most part, they will fail.” (Blinder 2018)
- The challenges of communicating with non-experts
  - Not necessarily in reach
  - Less knowledge about central banks
  - Response not as fast and visible as for experts
  - “3 E’s of central bank communication with the public”: explanation, engagement and education (Haldane et al. 2020)

Introduction

- Evidence from focus groups, targeted surveys or lab experiments
  - Simple and relatable messages are more powerful in affecting beliefs or behaviours of non-experts (e.g., Bholat et al. 2019; Coibion et al. 2019; Kryvtsov and Petersen 2019)
  - Several central bank experiments
    - Bank of England: layered content of its Inflation Report (Haldane and McMahon 2017)
    - ECB: Changed order of questions knowledge and attitudes survey to study determinants of trust (Angino and Secola 2019)
    - Bank of Canada: Lab experiments to test effects on expectations (Kryvtsov and Petersen 2019)
  - Upside: controlled experiments allow causal interpretation
  - Downside: Non-experts are engineered to be “in reach”

Introduction

- Surveys before and after communications
  - FOMC press conferences noticed, but don’t affect beliefs (Lamla and Vinogradov 2019)
  - Monetary policy surprises affect economic confidence instantaneously (Lewis et al. 2019)
- Our alternative: Twitter-traffic about the ECB
  - Real-life data (reception of central bank signals not engineered)
  - High frequency (identification)
  - Continuous (many events)
  - Many individuals, experts and non-experts
  - Caveats: Twitter users not representative for general public; need to differentiate experts from non-experts

Introduction

- Key findings
  - Non-experts express stronger and more subjective opinions, larger variety of views
  - Retweets/likes of ECB-related tweets increase with language strength and subjectivity
  - Twitter traffic responds to ECB communication events
    - Press conference and “Whatever it takes” lead to larger and more persistent response, with many more people, in particular non-experts, participating
    - Non-experts become more factual , express more moderate views; exception: “Whatever it takes” in German-speaking community
  - Twitter users differentiate between the ECB president and the institution / its policies

1 Data

Data

- Collect tweets from Twitter's Advanced Search
  - Henrique Jefferson's Python package GetOldTweets
  - Posted between 2012 and 2018, still online and publicly available
  - In English (global and economics/financial language) and German (largest language)
  - Containing at least one of "ecb", "european central bank", "draghi" in the text, hashtag or username
- Cleaning procedure
  - Drop tweets unrelated to the European Central Bank (e.g. English Cricket Board; content and user name)
  - Drop tweets not in English
  - Drop tweets for which account information is missing
  - Drop tweets by users who have tweeted less than 100 times in their Twitter history

Data

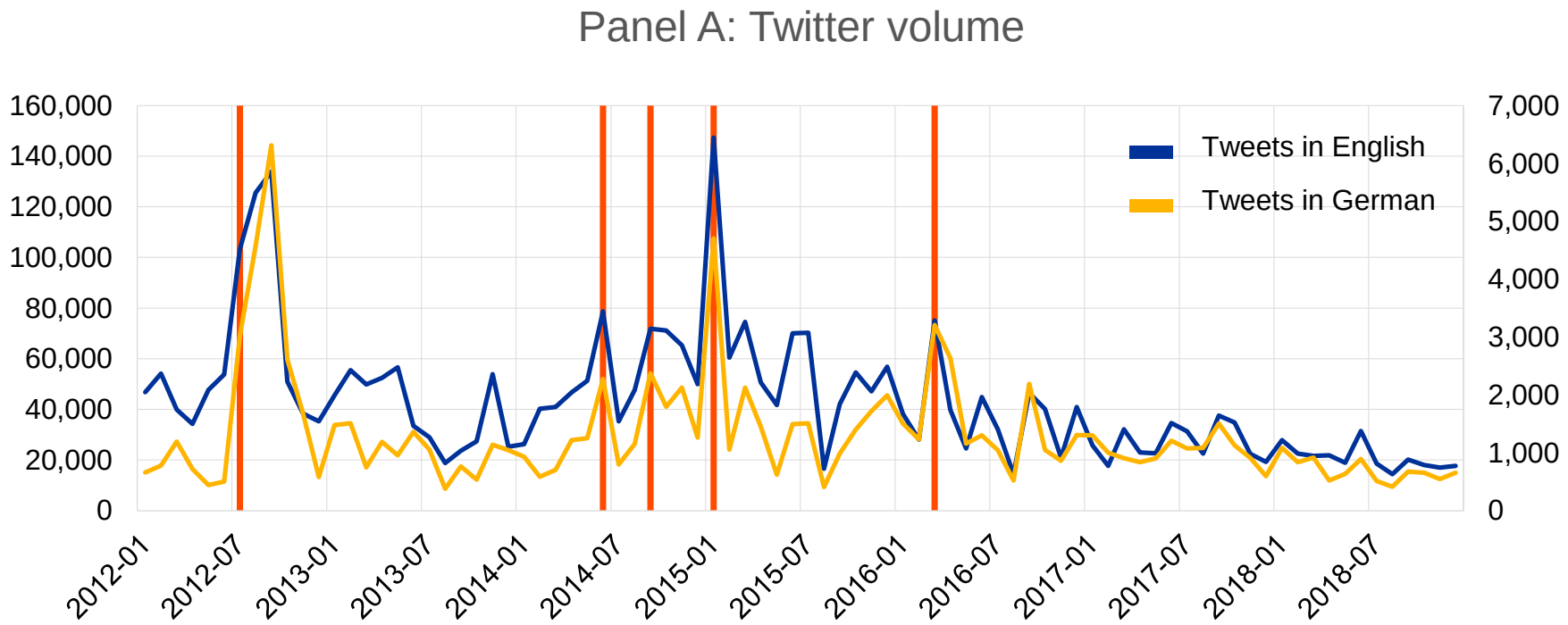
Related tweets

Unrelated tweets

Data

Year	English		German	
	Tweets	Retweets	Tweets	Retweets
2012	763,667	167,242	23,063	3,375
2013	471,206	149,320	12,140	2,542
2014	625,313	278,859	16,471	5,053
2015	731,745	600,296	19,454	9,465
2016	445,482	335,137	18,008	9,069
2017	323,540	270,475	12,456	6,798
2018	249,769	307,069	8,339	15,237
Total	3,610,722	2,108,398	109,931	51,539

Data



Data

- Content of tweets
  - Dictionary approach
    - English sample: Python library TextBlob (Loria 2014) based on Princeton University's WordNet
    - German sample: extension (Killer 2015) based on German equivalent GermaNet
  - Favourableness
    - -1 to 1; higher value reflects a more positive sentiment
    - "Awful" or "dreadful" (-1), "exceptional" or "marvelous" (1), "challenging" (0.5), "inconvenient" (-0.6)
  - Absolute favourableness
    - 0 to 1; higher value reflects stronger sentiment
    - "Awful", "dreadful", "exceptional", "marvelous" (1); "consistent" or "basic" (0)
  - Subjectivity
    - 0 to 1; higher value indicates less factual (more subjective) statements
    - "Nasty" or "terrible" (1), "actual" or "contemporary" (0)

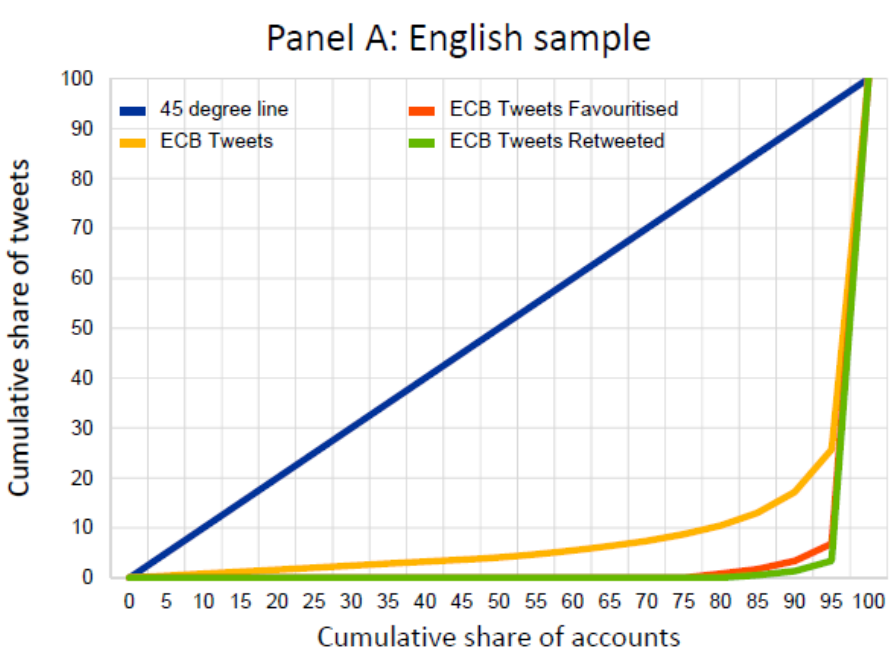
Data

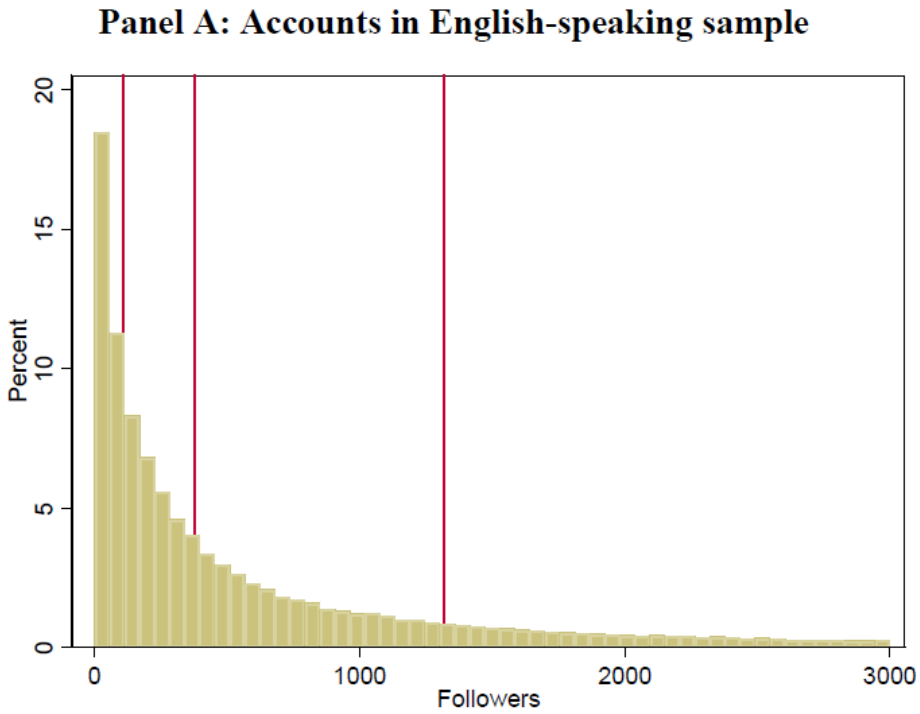
- Content of tweets
  - Combinations and co-occurrence of words taken into account
  - For multiple words carrying sentiment, return average value of favourability and subjectivity
  - Negation (“not” appears before a word):
    - Favourability multiplied by –(1/2), subjectivity remains the same
    - “good”: Favourability (0.7), subjectivity (0.6)
    - “not good”: Favourability (-0.35), subjectivity (0.6)
  - Qualifications
    - “very good”: Favourability (0.9), subjectivity (0.8)

Data

- For relevant accounts, get account information
  - Date of account creation, number of followers, number of accounts following, number of overall tweets issued by the account since its creation
  - English sample: 287,648 accounts; German sample: 16,336
  - Very unequal distribution, few accounts generate most of the traffic
  - Even more for retweets, implying that few accounts are extremely influential

Data





2

Differentiating experts from non-experts

Differentiating experts from non-experts

- Experts (0.5% of sample, issuing 25% of tweets)
  - Required to be “regulars”, at least for the press conference

$$expert_i^{bm} = \begin{cases} 1 \; if \; PC\_activity_i \geq 0.5 \\ 0 \; else \end{cases}$$

- Non-experts (25% of sample, issuing 4% of tweets)
  - Irregular, and tweet about many things, i.e. low ECB centricity

$$nonexpert_i^{bm} = \begin{cases} 1 \; if \; PC\_activity_i < 0.5 \; \& \; centricity_i < P25(centricity) \\ 0 \; else \end{cases}$$

- Note we do not classify a large part of accounts “in between”

Differentiating experts from non-experts

	Non-experts	Experts
Panel A: English		
Number of accounts	69,031	1,282
Average percentile followers	68	68
Average subjectivity	0.2746 ***	0.2434
Average favourableness	0.0544 **	0.0418
Average absolute favourableness	0.1389 ***	0.0994
Average weekend activity	0.1835 ***	0.0716

Notes: */**/*** denote 10%/5%/1% significance

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Determinants of Retweets and Likes

Determinants of Retweets and Likes

- Which tweets get liked and retweeted?
- Sample contains 3.6 mio tweets in English, 2.1 mio retweets
  - < 500,000 tweets got retweeted
  - Conditional on being retweeted: 4.5 retweets on average, median 2, maximum 4,868
- 418,000 tweets get liked
  - Conditional being liked: 3.8 likes on average, median 1, maximum 20,622
- 50% of retweeted tweets are liked; 50% of liked tweets are retweeted
- H0: Higher likelihood for more subjective tweets, negative views and strong views (Mullainathan and Shleifer 2005, Berger et al. 2013, Naveed et al. 2011)

Determinants of Retweets and Likes

- Explain likelihood of being liked or retweeted (probit model)

$$R_i = \begin{cases} 1 & if \quad Y_i^* > 0 \\ 0 & otherwise \end{cases}$$

$$Y_i^* = \alpha_{dow} + \alpha_{moy} + \alpha_{hol} + \alpha_t t + \alpha_{t^2} t^2 + \beta_p p_i + \beta_l l_i + \beta_n D_i^n + \beta_f |f_i| + \beta_s s_i + \beta_{ne} D_i^{n-exp} + \beta_e D_i^{exp} + \varepsilon_i$$

- Robust standard errors, marginal effects
- Plus:
  - Number of retweets/likes conditional on being retweeted/liked
  - Multinomial model of retweets and likes

Determinants of Retweets and Likes

- Little evidence for negativity bias, but stronger and more subjective views travel further

	Probit	OLS	Probit	OLS
	Retweet		Like	
Negative sentiment	0.001	-0.008**	0.002***	-0.021***
Abs(favourableness)	0.030***	0.049***	0.049***	0.118***
Subjectivity	0.014***	-0.000	0.026***	0.004
Percentile Followers	0.005***	0.014***	0.003***	0.010***
Non-expert	-0.047***	-0.109***	-0.022***	-0.070***
Expert	0.036***	0.237***	0.008***	0.143***
No. of Characters	0.000***	0.001***	0.000***	0.001***
Observations	3,610,722	463,973	3,610,722	417,903
R-squared		0.113		0.124

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Determinants of Twitter Behaviour

Determinants of Twitter Behaviour

- Daily data, 2,537 observations
- All accounts, experts, non-experts
- Dependent variables:
  - (log) number of tweets
  - Herfindahl-Hirschman indicator
  - Subjectivity, favourableness and absolute favourableness
    - Daily average
    - Standard deviation across tweets

Determinants of Twitter Behaviour

$$x_t = \alpha_{dow} + \alpha_{moy} + \alpha_{hol} + \alpha_t t + \alpha_{t^2} t^2 + \beta^e_{c,l} C^e_{t,l} + \varepsilon_t$$

- OLS, robust standard errors
- Allow for lags of communication events, plus leads for press conference
  - Delete insignificant leads and lags in model explain number of tweets from all accounts
  - Keep this lead and lag structure across all other specifications
  - Effects only on same day
  - Exception 1: press conference (5 leads and 4 lags)
  - Exception 2: “Whatever it takes” (15 lags)

Determinants of Twitter Behaviour

	Log number of tweets		
	All	**Non-experts**	**Experts**
Panel A: Contemporaneous response			
Press Conference	2.475***	2.059***	2.847***
Whatever it takes	2.020***	1.883***	1.740***
Economic Bulletin	0.233***	0.142	0.362***
Accounts	0.608***	0.324***	0.986***
Speeches by others	0.270***	0.080	0.450***
Speeches by president	0.434***	0.385***	0.499***
Tweet	0.191***	0.157***	0.274***
Panel B: Overall response			
Press Conference	**5.965**	**4.169**	**7.494**
Whatever it takes	**24.800**	**20.901**	**22.446**
Observations	2,537	2,537	2,537
R-squared	0.630	0.365	0.717
Mean(dependent var)	6.742	3.606	5.135
Stdev(dependent var)	0.899	0.823	1.168

- Simultaneous reaction to all events; response to speeches by ECB president 60% higher than to speeches by other EB members

Determinants of Twitter Behaviour

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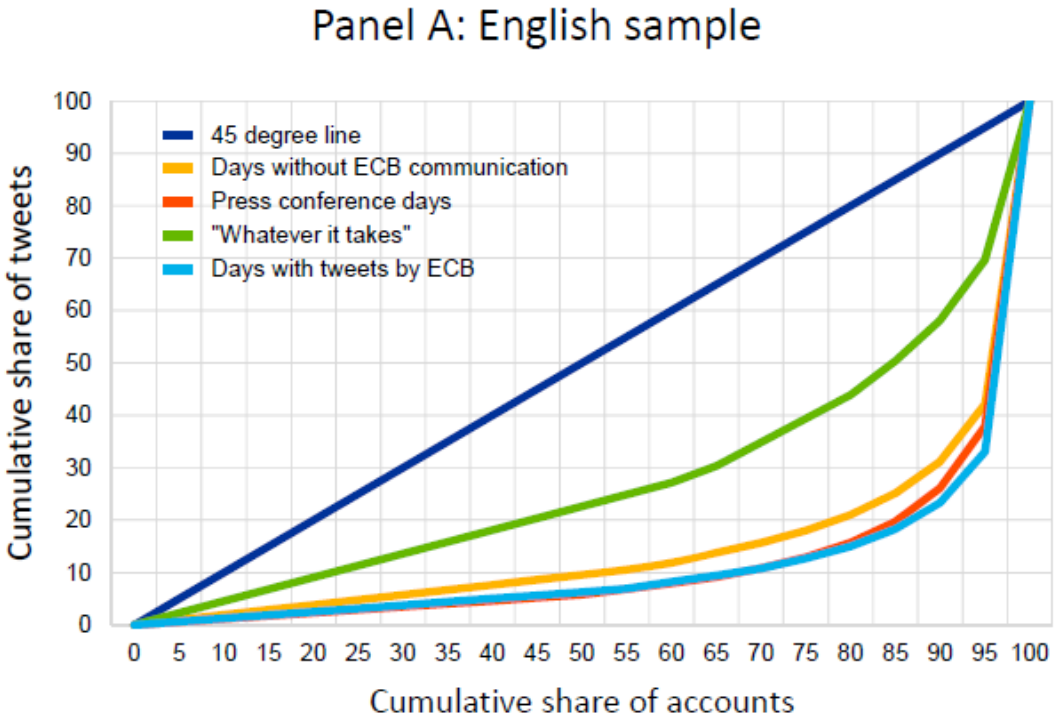
- Press conference: twitter traffic 60% higher than on normal days, for 10 days. “Whatever it takes”: 150% higher, for 16 days

Determinants of Twitter Behaviour

	Log number of tweets			Concentration index		
	All	**Non-experts**	**Experts**	**All**	**Non-experts**	**Experts**
Panel A: Contemporaneous response						
Press Conference	2.475***	2.059***	2.847***	-0.004***	-0.037***	-0.022***
Whatever it takes	2.020***	1.883***	1.740***	-0.002***	-0.016***	-0.012***
Economic Bulletin	0.233***	0.142	0.362***	-0.001	-0.006*	-0.006**
Accounts	0.608***	0.324***	0.986***	-0.002***	-0.016***	-0.016***
Speeches by others	0.270***	0.080	0.450***	-0.001***	-0.004**	-0.014***
Speeches by president	0.434***	0.385***	0.499***	-0.001***	-0.012***	-0.001
Tweet	0.191***	0.157***	0.274***	-0.001**	-0.006**	-0.012***
Panel B: Overall response						
Press Conference	**5.965**	**4.169**	**7.494**	**-0.020**	**-0.125**	**-0.205**
Whatever it takes	**24.800**	**20.901**	**22.446**	**-0.059**	**-0.433**	**-0.527**
Observations	2,537	2,537	2,537	2,537	2,537	2,537
R-squared	0.630	0.365	0.717	0.257	0.241	0.395
Mean(dependent var)	6.742	3.606	5.135	0.005	0.043	0.037
Stdev(dependent var)	0.899	0.823	1.168	0.006	0.035	0.061

- Events reduce concentration, in particular “Whatever it takes”

Determinants of Twitter Behaviour



Determinants of Twitter Behaviour

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Stdev(dependent var)	0.899	0.823	1.168

- Non-experts generally less responsive; exception: “Whatever it takes” (even more so for German tweets)

Determinants of Twitter Behaviour

	Average subjectivity			Standard deviation of subjectivity		
	All	Non-experts	Experts	All	Non-experts	Experts
Panel A: Contemporaneous response						
Press Conference	-0.011**	-0.029***	0.012**	-0.012***	-0.015***	0.001
Whatever it takes	-0.005	-0.045***	0.010	-0.006**	-0.005	0.003
Economic Bulletin	-0.010*	-0.010	-0.003	-0.010***	-0.013*	-0.009**
Accounts	-0.029***	-0.026*	-0.018**	-0.013***	-0.005	-0.009*
Speeches by others	0.001	0.004	0.007	-0.001	0.004	0.003
Speeches by president	-0.008**	-0.024***	-0.003	-0.005**	-0.012**	-0.003
Tweet	-0.004	0.005	-0.004	-0.002	0.003	-0.002
Panel B: Overall response						
Press Conference	**-0.064**	**-0.098**	0.010	**-0.025**	**-0.040**	**0.046**
Whatever it takes	-0.010	-0.087	**0.362**	**-0.171**	-0.061	0.011
Observations	2,537	2,537	2,537	2,537	2,537	2,537
R-squared	0.170	0.075	0.084	0.069	0.029	0.096
Mean(dependent var)	0.253	0.267	0.223	0.282	0.286	0.265
Stdev(dependent var)	0.050	0.087	0.069	0.027	0.049	0.044

- Tweets become more factual in response to ECB communication, in particular for non-experts (narrower distribution around a lower mean)

Determinants of Twitter Behaviour

	Average absolute favourableness					
	English			German		
	All	Non-experts	Experts	All	Non-experts	Experts
Panel A: Contemporaneous response						
Press Conference	-0.023***	-0.035***	-0.008**	-0.007*	-0.025	0.017***
Whatever it takes	-0.003	-0.021***	0.009**	-0.010**	0.007	0.028***
Economic Bulletin	-0.005	-0.000	-0.000	0.013*	0.009	0.046***
Accounts	-0.017***	-0.016*	-0.014***	-0.004	-0.036*	0.075*
Speeches by others	-0.004*	0.001	-0.001	0.002	-0.001	0.014*
Speeches by president	-0.006***	-0.012**	-0.003	-0.008***	-0.011	-0.009
Tweet	-0.003	0.005	-0.004	-0.002	0.003	0.005
Panel B: Overall response						
Press Conference	**-0.084**	**-0.092**	-0.015	-0.008	-0.032	0.053
Whatever it takes	0.027	**-0.173**	**0.219**	**-0.223**	-0.033	-0.014
Observations	2,537	2,537	2,537	2,531	1,551	1,284
R-squared	0.143	0.060	0.063	0.031	0.028	0.097
Mean(dependent var)	0.118	0.136	0.094	0.023	0.044	0.014
Stdev(dependent var)	0.033	0.058	0.038	0.044	0.113	0.061

- ECB communication events lead to a moderation of views; exception: German experts

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Views about Draghi vs views about the ECB

Views about Draghi vs views about the ECB

- Discard tweets without “draghi”
- Identify adjectives targeted toward Mario Draghi (part-of-speech tagging)
  - Adjectives before “draghi” (e.g. “famous draghi”)
  - Connect adjectives to the most recent noun in a sentence (e.g. “draghi is famous and well-known”)
  - Estimate sentiment using dictionary approach only to adjectives (with their negation whenever applicable)

Determinants of Twitter Behaviour

	Draghi				Benchmark			
	Subjectivity		Abs. favourableness		Subjectivity		Abs. favourableness	
	Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev
Panel A: Whatever it takes (contemporaneous effect)								
All	0.050***	0.018***	0.019***	0.005	-0.005	-0.006**	-0.003	-0.003
	(0.011)	(0.006)	(0.007)	(0.006)	(0.006)	(0.003)	(0.004)	(0.004)
Non-experts	0.036	0.093***	0.007	0.062***	-0.045***	-0.005	-0.021***	-0.015**
	(0.028)	(0.018)	(0.019)	(0.014)	(0.012)	(0.007)	(0.008)	(0.007)
Experts	0.056***	0.049***	0.018*	0.028***	0.010	0.003	0.009**	0.011**
	(0.015)	(0.011)	(0.010)	(0.009)	(0.008)	(0.005)	(0.004)	(0.004)
Mean(dependent var - All)	0.259	0.292	0.138	0.197	0.253	0.282	0.118	0.183
Stdev(dependent var - All)	0.125	0.079	0.087	0.071	0.050	0.027	0.033	0.032

- Following “Whatever it takes”, views about Draghi become more subjective, more opinionated and more disperse

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Summary and conclusions

Summary and conclusions

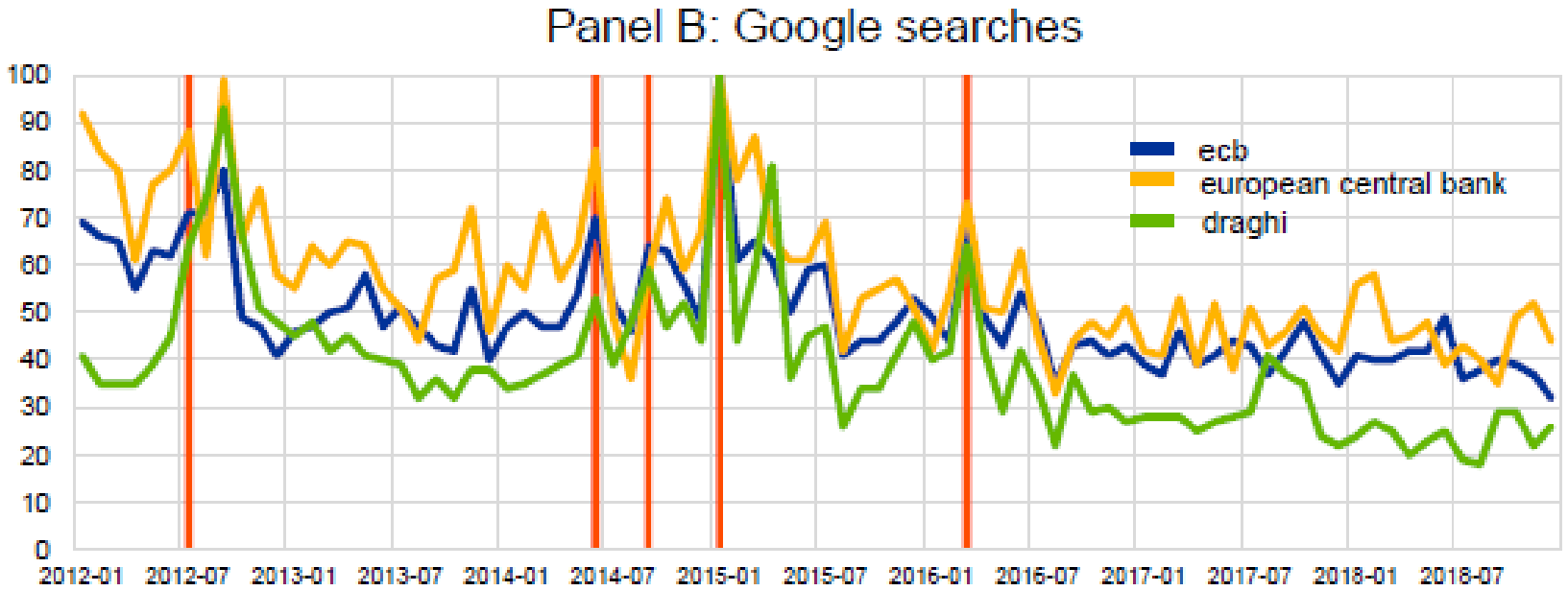
- Key findings
  - Non-experts express stronger and more subjective opinions, larger variety of views
  - Retweets/likes of ECB-related tweets increase with language strength and subjectivity
  - Twitter traffic responds to ECB communication events
    - Press conference and “Whatever it takes” lead to larger and more persistent response, with many more people, in particular non-experts, participating
    - Non-experts become more factual , express more moderate views; exception: “Whatever it takes” in German-speaking community
  - Twitter users differentiate between the ECB president and the institution / its policies

Summary and conclusions

- Policy implications
  - Central bank communication manages to reach out to non-experts (it is not a road to nowhere!)
  - Strong and more subjective views likely to be reposted more often, but central banks can make discussions in social media somewhat more factual and moderate
  - Important for central banks to reach out to non-expert audiences
    - Especially if they become part of a substantial and persistent debate among non-experts, as for “Whatever it takes”
  - Central banks might want to monitor the related social media traffic in a disaggregated fashion

Thank you! Questions?

Data



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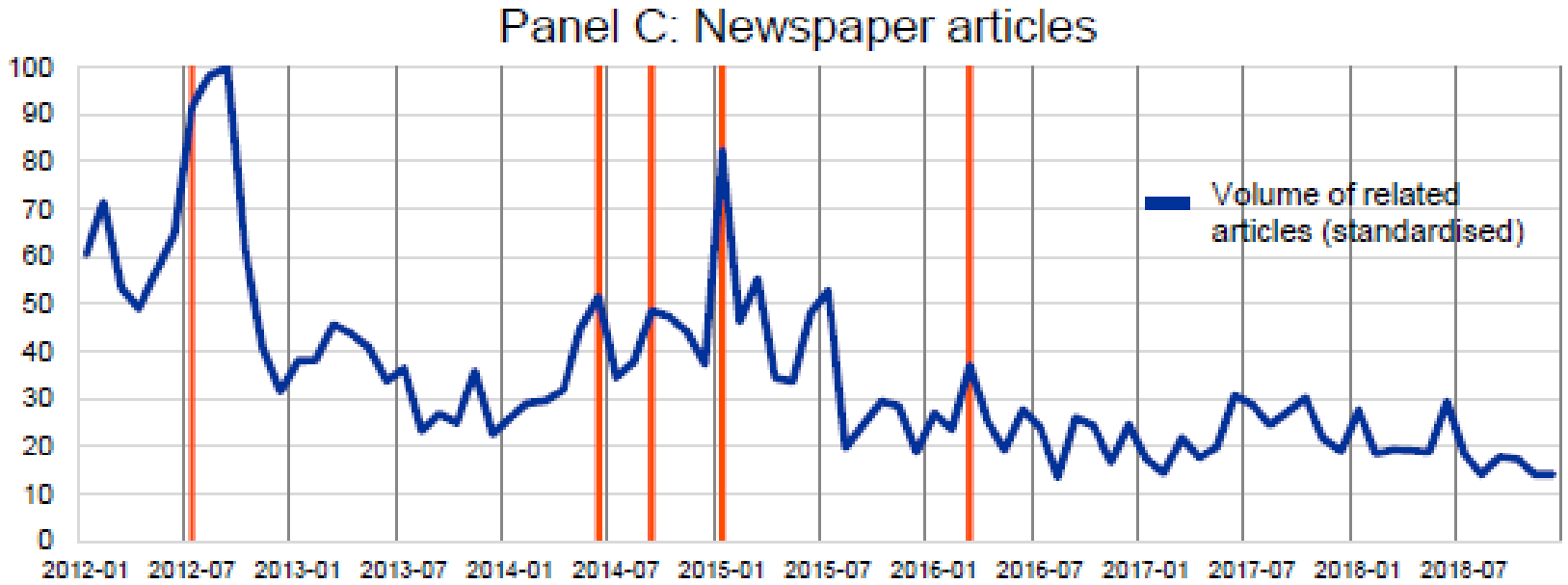

Determinants of Twitter Behaviour

	Standard deviation of favourableness					
	English			German		
	All	Non-experts	Experts	All	Non-experts	Experts
Panel A: Contemporaneous response						
Press Conference	-0.032***	-0.031***	-0.010**	0.012	0.015	0.065***
Whatever it takes	-0.008*	-0.027***	0.010*	-0.010	0.036**	0.051***
Economic Bulletin	-0.009**	0.001	-0.004	0.015	-0.006	0.027***
Accounts	-0.020***	-0.011	-0.017***	-0.002	-0.031**	0.009
Speeches by others	-0.004	0.005	0.000	0.004	-0.001	0.010**
Speeches by president	-0.011***	-0.015**	-0.007**	0.003	0.018	0.027***
Tweet	-0.003	0.010**	-0.003	-0.000	-0.004	0.011***
Panel B: Overall response						
Press Conference	**-0.123**	**-0.075**	0.001	0.021	0.051	**0.102**
Whatever it takes	-0.042	-0.118	**0.186**	**0.368**	**0.929**	**0.424**
Observations	2,537	2,537	2,537	2,531	1,551	1,284
R-squared	0.150	0.046	0.083	0.034	0.057	0.162
Mean(dependent var)	0.211	0.224	0.172	0.062	0.031	0.016
Stdev(dependent var)	0.038	0.068	0.046	0.073	0.079	0.049

- Views expressed in English tweets narrows considerably, spectrum of views by German experts widens up