

# *Divergent market reactions to abstract language: a multi-country event study of European Central Bank communications*

Article

Supplemental Material

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## APPENDIX A

**Table A1. Data Description**

<b>Data Source</b>	<b>Variable</b>	<b>Description</b>	<b>Measurement description</b>
Bloomberg	Market reaction	Market reaction of each Eurozone country's stock market index	Cumulative abnormal returns of each Eurozone country stock market index during three-day window ( $t_{-1}$ to $t_1$ ) around focal speech
	Extant market returns	Direction a country's stock market index is moving	Average market returns on country stock market index in the 30 days leading up to focal speech
Campos and Macchiarelli (2021)	Core-periphery	Degree to which country is in the core or periphery of the Eurozone	See Campos and Macchiarelli (2021)
European Central Bank website	Speech abstraction	Level of abstractness or concreteness of speech	Linguistic Category Model (LCM) (Semin & Fiedler, 1988, 1991), most recently used by Seih et al. (2017)
	Speech tone	How positive or negative the speech is	LIWC dictionary "tone," reverse-coded
	Speech wordcount	Number of words in the speech	LIWC "wc"
	Speech complexity	Reading grade level of speech	Flesch-Kincaid reading grade level
	Speech future focus	Degree to which speech focuses on the future	LIWC dictionary "futurefocus"
	Speech uncertainty	Degree to which speech expresses uncertainty	Loughran and McDonald's (2011) Financial Sentiments Dictionary "uncertainty"

	Speech vagueness	How vague speech is	Hiller and colleagues (1969) dictionary “vagueness”
	Policy action	Whether or not the ECB changed their primary interest rate	Coded 1 if the ECB President speech being delivered was within three months of an interest rate change, 0 otherwise
	ECB communications	Whether or not the ECB, on the same day as the speech, released additional communication to the public	Coded 1 if the ECB had a press release, press conference, or interview on the same day as the speech, 0 otherwise
	Voting power	Degree to which a Eurozone country has voting representation and power on the ECB Governing Council	Coded 3 if, at the time of the speech, the ECB President was from their country, 2 if the Vice President was from their country, 1 if any other council member was from their country (excluding the President and Vice President), and 0 if the country has no member represented on the council
Organisation for Economic Co-operation and Development website	Inflation	Country-level inflation rate	Inflation rate in the month before the focal speech
	Unemployment	Country-level unemployment rate	Unemployment rate in the month before the focal speech
International Monetary Fund website	Debt to GDP	Country-level debt to GDP ratio	Debt to GDP ratio in the year before the focal speech

**Table A2. Parts of speech used in the Linguistic Category Model**

Part of speech	Characteristic features	Examples
Verbs (VERBs)	Refers to <i>specific</i> action, occurrence, or state of being	
<i>Descriptive action verbs (DAVs)</i>	Refer to <i>specific</i> behaviors, actions, contexts, or events; objective description of observable events	call, meet, walk, hit, stab, shoot
<i>Interpretative action verbs (IAVs)</i>	Refer to <i>specific</i> behaviors, actions, contexts, or events; interpretation goes beyond description	cheat, help, inhibit, kill, struggle
<i>State verbs (SVs)</i>	Refer to subjective states just beyond a <i>specific</i> behaviors, actions, contexts, or events; interpretation goes beyond description and immediate context	admire, hate, know, intend
Adjectives (ADJs)	Refer to <i>general</i> attributes that depict qualities or states, detached from specific behaviors, actions, contexts, or events	beautiful, honest, independent, helpful, responsible, confident
Nouns (NOUNs)	Refer to <i>general</i> categories of people, places, or ideas, detached from specific behaviors, actions, contexts, or events	beauty, honesty, independence, helpfulness, responsibility

**Table A3. Top 25 verbs, adjectives, and nouns in ECB President speeches**

VERBs	%	ADJs	%	NOUNs	%
have	3.09	financial	4.77	area	2.50
make	1.87	monetary	4.02	policy	2.44
take	1.67	economic	3.12	market	2.05
be	1.43	central	1.82	euro	1.70
need	1.30	other	1.39	price	1.62
increase	1.26	important	1.37	rate	1.36
see	1.14	high	1.36	bank	1.26
remain	1.11	new	1.34	country	1.24
let	1.05	european	1.31	growth	1.21
provide	1.04	long	1.14	stability	1.20
say	0.98	national	1.11	term	1.09
give	0.97	global	1.10	economy	1.03
like	0.86	structural	1.09	inflation	1.01
ensure	0.84	fiscal	1.08	year	0.96
continue	0.84	low	1.08	risk	0.87
do	0.80	such	1.05	time	0.78
become	0.75	single	0.97	level	0.73
support	0.75	particular	0.97	development	0.71
include	0.74	first	0.89	integration	0.63
contribute	0.68	large	0.87	system	0.63
come	0.67	real	0.85	reform	0.61
reduce	0.66	medium	0.82	interest	0.61
look	0.65	more	0.82	crisis	0.59
lead	0.65	recent	0.79	sector	0.49
expect	0.64	international	0.79	currency	0.48

**Table A4. Language families** (from Chen, 2013; Roberts, Winters, & Chen, 2015)

	<b>Tier 1</b>	<b>Tier 2</b>
Austria	Indo-European	Germanic
Germany	Indo-European	Germanic
Netherlands	Indo-European	Germanic
Belgium	Indo-European	Germanic
Luxembourg	Indo-European	Germanic
Italy	Indo-European	Latin
France	Indo-European	Latin
Portugal	Indo-European	Latin
Spain	Indo-European	Latin
Latvia	Indo-European	Slavic
Lithuania	Indo-European	Slavic
Slovakia	Indo-European	Slavic
Slovenia	Indo-European	Slavic
Estonia	Uralic	Uralic
Finland	Uralic	Uralic
Greece	Indo-European	Greek
Ireland	Indo-European	Celtic

*Note:* We use Tier 2 as fixed effects in our main analyses, but our results are the same using Tier 1.

## APPENDIX B

**Table B1. A comparison of speech abstraction measures**

We consider alternative measures of speech abstraction by comparing: 1) the LCM (Semin & Fiedler, 1988), the measure used in this paper; 2) a LIWC dictionary approach that constructs a measure of abstractness/concreteness based on parts of speech, the use of numbers, and temporal words (Pan et al., 2018); 3) a measure of abstract language based on nominalized nouns (Mergenthaler, 1996); and 4) a measure of concreteness (Brysbaert et al., 2014).

Measurement (sources)	Correlations			Hypotheses		
	1	2	3	H1	H2	H3
<b>1. Linguistic category model</b> Semin & Fielder, 1988; Seih et al., 2017				***	**	**
<b>2. LIWC dictionary approach</b> Pan et al., 2018	0.26			***	NS	NS
<b>3. Nominalization</b> Mergenthaler, 1996; Harmon, 2019	0.37	0.22		***	NS	**
<b>4. Concreteness norms</b> Brysbaert et al., 2014; Huang et al., 2020	-0.13	-0.09	-0.17	NS	NS	NS

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1, NS = not significant at canonical levels

Several observations based on the table above. First, although correlations between all four measures are quite low ( $r = 0.37$  or below), our results for H1 are replicated across the first three alternatives. Second, in our empirical setting, parts of speech appear to be important. Indeed, the LCM, the LIWC dictionary approach, and nominalization are all approaches based on different parts of speech, whereas Brysbaert's measure of concreteness is not. Third, it also seems like one part of speech that is especially important in our setting are nouns. Our main prediction, as well as H3, is replicated using the nominalization method, a dictionary of just highly abstract nouns.

Taken together, these findings offer robust support for our primary prediction (H1), but also suggest that scholars should pay careful attention when trying to match their linguistic measurement with the empirical setting (see Yeomans, 2021).



## APPENDIX C

### Explanation for the generation of speech topics using topic modeling

For an explanation on the methodology of topic modeling, please see either Blei's work (2003) or management papers for this (Hannigan et al., 2019; Kaplan & Vakili, 2015).

To generate our topics, we followed these steps:

1. We removed stop words (e.g., the, but, or, and) that do not contribute to the identification of topics.
2. We ran topic models with 5, 10, 15, 20, 25, and 50 topics, and found that above 15 topics, the fit—or our ability to make sense of the most prominent topics—began to fall part.
3. We used the model with 15 topics, which generated the table (below).
4. The first author and independent coders then tried to label the topics given the top words, and converged upon labels for the first 5 topics in terms of coverage. Topic labels for the remaining topics were less clear.
5. In our main analyses, we controlled for these 5 topics for two reasons: 1) there was a clear cutoff in terms of coverage between the 5<sup>th</sup> and 6<sup>th</sup> topic, and 2) since the weight of 15 topics add up to 100% of all the content in each speech, adding all 15 topics created multicollinearity issues and the OLS regression falls apart.

**Table C1. Topics**

Topic	Coverage	Label	Top words
1*	17%	European Union	euro european union countries area policies member states stability
7*	12%	European Central Bank	monetary policy stability ecb central banking euro inflation objectives
4*	9%	central banking activities	growth economic inflation price interest rates outlook council governing
13*	9%	financial system	financial system institutions stability supervisory framework supervision
12*	9%	financial crisis	financial crisis liquidity risk credit markets global refinancing systemic
2	6%		area euro rates banks inflation interest measures low economy conditions
9	6%		growth labour productivity reforms structural capital economy
10	6%		markets euro securities banking ecb statistics single services payment
6	6%		europe bank today people ecb currency banks president cultural history
14	5%		euro area states growth competitiveness gdp economies shocks trade
8	4%		price expectations economy asset shocks analysis economic research
11	4%		duisenberg banknotes question rate ecb european bank central coins
5	4%		global international world financial economies emerging countries
15	2%		banknotes coins changeover cash area information circulation currency
3	1%		cultural diversity unity art work identity project culture building
100%			

\* Topic used as control variable.