Warning words in a warming world

Central bank communication and climate change

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Introduction

Two big and recent evolutions in the recent history of central banking:

- The increased importance of public communication (see this morning)
- The rise in awareness to climate-related dynamics (see this afternoon)

Our paper aims at exploring the intersection of both

Research questions:

Using the public communication of central banks, we explore

1. **When** and **where** did central bankers begin paying attention to climate dynamics?
2. **How** do they approach this topic? According to what narratives?
3. **Can** we find variables to explain this heterogeneous interest?
4. **Does** it have an impact on financial markets?

But first, we need central banker speeches!

A new database of speeches

The BIS dataset and its limitations

A lot of work has been done using the data compiled by the BIS on its website

- 17,372 speeches (1997-2021)
- Consistent collection of metadata (Date, Speaker, Institution)
- All in one place, easy to web-scrap

But this dataset has limitations:

- Missing institutions (e.g. Bank of Bangladesh)
- Data gaps (e.g. Bank of Argentina 2010-19)
- No translations (e.g. Bundesbank's 458 german speeches)

Our new dataset

We combine three sources:

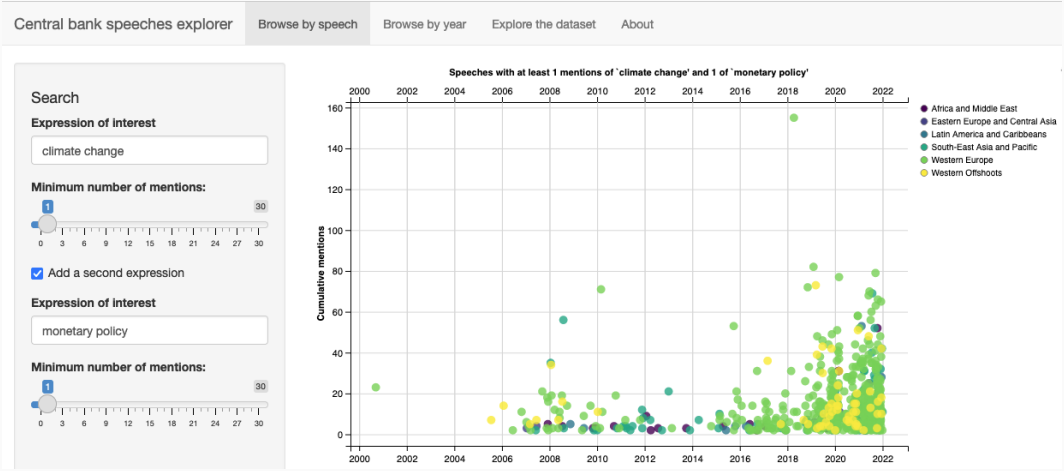
- BIS website : 17,372 speeches
- 145 CB websites : 33,411 speeches
- 4 CB archives : 1,655 speeches

After matching, we end up with **32,370 speeches** (+85%). Then,

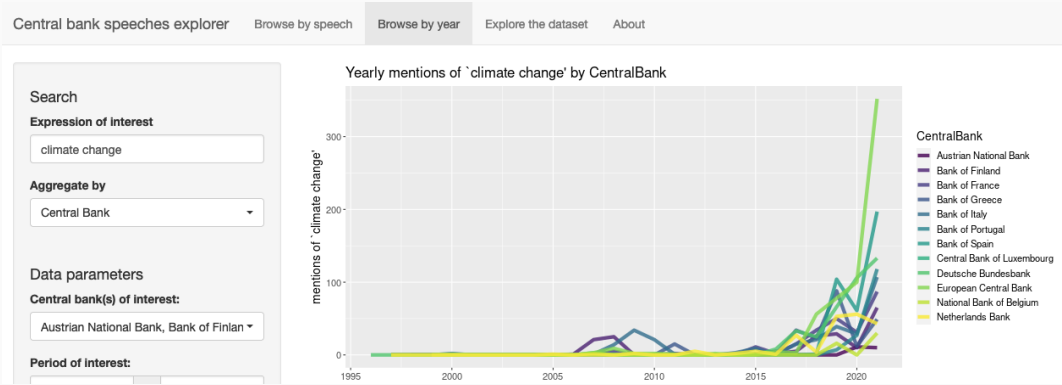
- We code the **Position** and **Gender** for each speech
- We **translate** 4,895 non-english speeches using Microsoft Translation

Soon to be updated and open access (with a *ShinyApp*)!

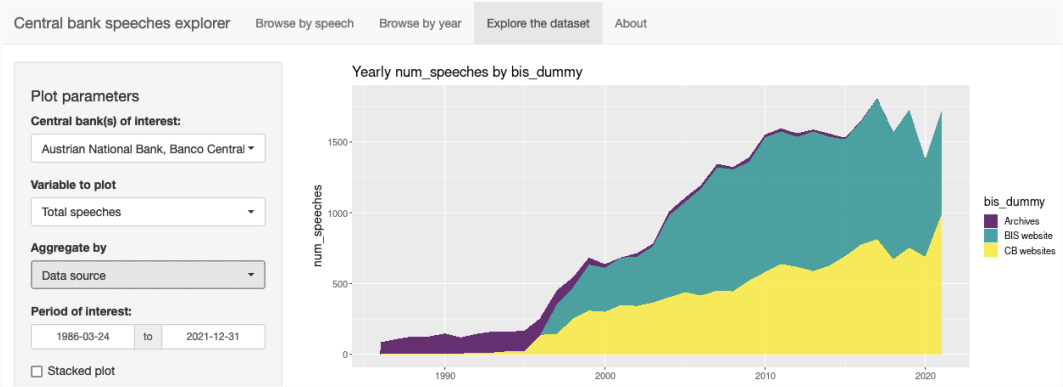
Shiny App


Central bank speeches explorer
Browse by speech
Browse by year
Explore the dataset
About
Search
Expression of interest
climate change
Minimum number of mentions:
1
30
0 3 6 9 12 15 18 21 24 27 30
Add a second expression
Expression of interest
monetary policy
Minimum number of mentions:
1
30
0 3 6 9 12 15 18 21 24 27 30
Speeches with at least 1 mentions of `climate change' and 1 of `monetary policy'
Cumulative mentions
0 20 40 60 80 100 120 140 160
2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022
Africa and Middle East
Eastern Europe and Central Asia
Latin America and Caribbeans
South-East Asia and Pacific
Western Europe
Western Offshoots

Shiny App


Central bank speeches explorer
Browse by speech
Browse by year
Explore the dataset
About
Search
Expression of interest
climate change
Aggregate by
Central Bank
Data parameters
Central bank(s) of interest:
Austrian National Bank, Bank of Finlan
Period of interest:
Yearly mentions of `climate change' by CentralBank
mentions of `climate change'
300
200
100
0
1995
2000
2005
2010
2015
2020
CentralBank
Austrian National Bank
Bank of Finland
Bank of France
Bank of Greece
Bank of Italy
Bank of Portugal
Bank of Spain
Central Bank of Luxembourg
Deutsche Bundesbank
European Central Bank
National Bank of Belgium
Netherlands Bank

Shiny App


Central bank speeches explorer
Browse by speech
Browse by year
Explore the dataset
About
Plot parameters
Central bank(s) of interest:
Austrian National Bank, Banco Central
Variable to plot
Total speeches
Aggregate by
Data source
Period of interest:
1986-03-24
to
2021-12-31
Stacked plot
Yearly num_speeches by bis_dummy
num_speeches
1500
1000
500
0
1990
2000
2010
2020
bis_dummy
Archives
BIS website
CB websites

Identifying climate-related speeches

First step: dictionary creation

First, we **decide on a dictionary** of climate-related expressions

- Expressions of several words rather than single keywords
- Iterative procedure to remove false positives

$\rightarrow$ We end up with a dictionary of **104 climate-related expressions**

Dictionary of climate-related $N-grams$

abrupt transition	14	brown penalising factors	1	carbon emission	49	carbon emissions	169
carbon price	41	carbon prices	26	carbon pricing	57	carbon tax	55
carbon taxes	39	climate action	100	climate actions	8	climate adaptation	14
climate aligned	7	climate change	1319	climate changes	26	climate crisis	63
climate damage	1	climate data	20	climate economics	5	climate event	1
climate events	30	climate exposure	1	climate exposures	4	climate extremes	6
climate finance	33	climate friendly	42	climate goals	39	climate harm	1
climate hazard	1	climate hazards	2	climate impact	30	climate impacts	9
climate metrics	3	climate minsky moment	14	climate policies	78	climate policy	104
climate protection	46	climate related	439	climate relevant	4	climate risk	243
climate risks	286	climate scenario	21	climate scenarios	58	climate science	15
climate sensitivity	3	climate shock	1	climate shocks	12	climate stability	6
climate stress test	36	climate stress tests	24	climatologist	2	climatologists	7
climatology	1	cotwo	109	decarbonise	6	decarbonised	8
decarbonising	8	decarbonization	11	decarbonize	4	decarbonized	4
decarbonizing	6	disorderly transition	28	disorderly transitions	2	environment risk	3
environment risks	3	environmental risk	90	environmental risks	164	global warming	251
green bond	190	green bonds	223	green economy	72	green finance	307
green finances	2	green investment	73	green investments	80	green monetary	5
green policies	4	green policy	13	green qe	5	green quantitative easing	4
green supporting factor	9	green supporting factors	4	green swan	23	green swans	3
green technologies	42	green technology	43	green transition	70	green transitions	3
greener	212	greenhouse	262	greening	369	low carbon	303
ngfs	237	paris agreement	179	physical risk	53	physical risks	150
stranded asset	3	stranded assets	52	sustainable finance	393	sustainable finances	8
sustainable investing	33	tcfd	103	transition risk	68	transition risks	195

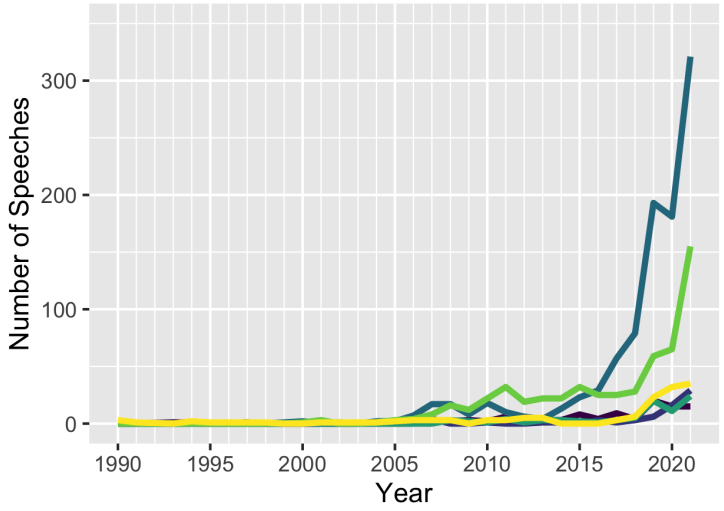
Second step: threshold selection

Second, we **select a threshold**

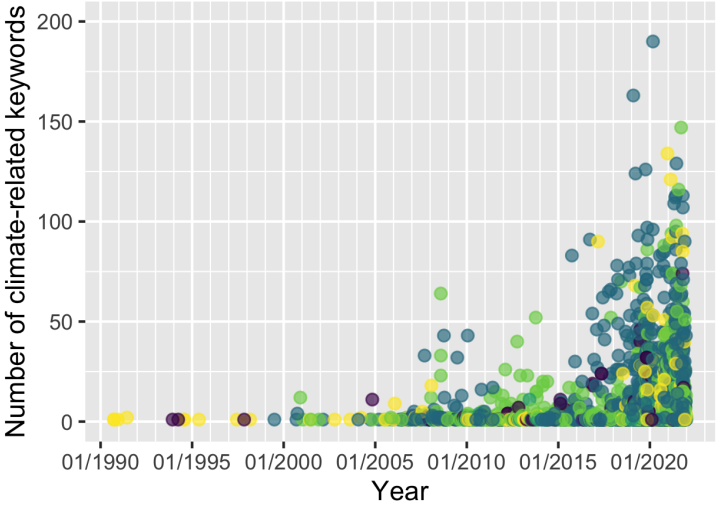
- We want to be as broad as possible, (even *en passant* mentions matter)
- Our conservative dictionary allows us to set the threshold at 1

1,939 speeches have at least one climate-related expression.

Climate speeches per year and region



Climate-related keywords per speech by Area



A few important speeches

Year	Speaker	Title	Country
2000	David Carse	Environmental issues and their implications for financial institutions in Hong Kong	Hong Kong
2007	Erkki Liikanen	Climate change, economy and investment (translated)	Finland
2008	Alan Bollard	Coping with shocks: a New Zealand perspective	New Zealand
2008	Bandid Nijathaworn	Is climate change a big deal for the financial system?	Thailand
2008	Miranda S. Goeltom	Macroeconomic impact of climate change - opportunities and challenges (Closing remarks)	Indonesia
2008	Boediono	Macroeconomic impact of climate change - opportunities and challenges (Keynote speech)	Indonesia
2008	Sinikka Salo	Environmental challenges and financial markets	Finland
2009	Anna Maria Tarantola	Solidarity economy and sustainable development in the post-globalization era	Italy
2010	Anna Maria Tarantola	Economic growth, well-being and sustainability of energy demand	Italy
2012	Atiur Rahman	Climate Change and Banking Sector of Bangladesh	Bangladesh
2013	Kamalesh C. Chakrabarty	Environmental and social sustainability - key issues and concerns	India
2012	Muhammad bin Ibrahim	Role and opportunities of the financial system in supporting green technology	Malaysia
2012	Atiur Rahman	Financing Adaptation	Bangladesh
2013	Muhammad bin Ibrahim	Role of the Islamic financial system in supporting green technology	Malaysia
2015	Ravi Menon	An economic history of Singapore - 1965-2065	Singapore

The dictionary approach... and Its limits

This first quantitative exploration highlights:

- The pioneering role of institutions in Southeast Asia
- The strong rise since 2015... with still an important heterogeneity

However, this does not provide *any* insights into the **substance of the speeches**.

Exploring the variety of narratives

Topic Models: A Brief Introduction

The purpose of unsupervised topic models in general:

- Discover latent themes in a corpus of texts
- Rank documents based on the discovered themes
- Use the classification to organize/summarize/search documents.

Structural Topic Models (STM):

- Consider each speech as a 'bag of words'
- Based on the co-occurrence probabilities of words, it clusters them into topics

The choice of k

Only one choice to make: deciding on k, the number of topics.

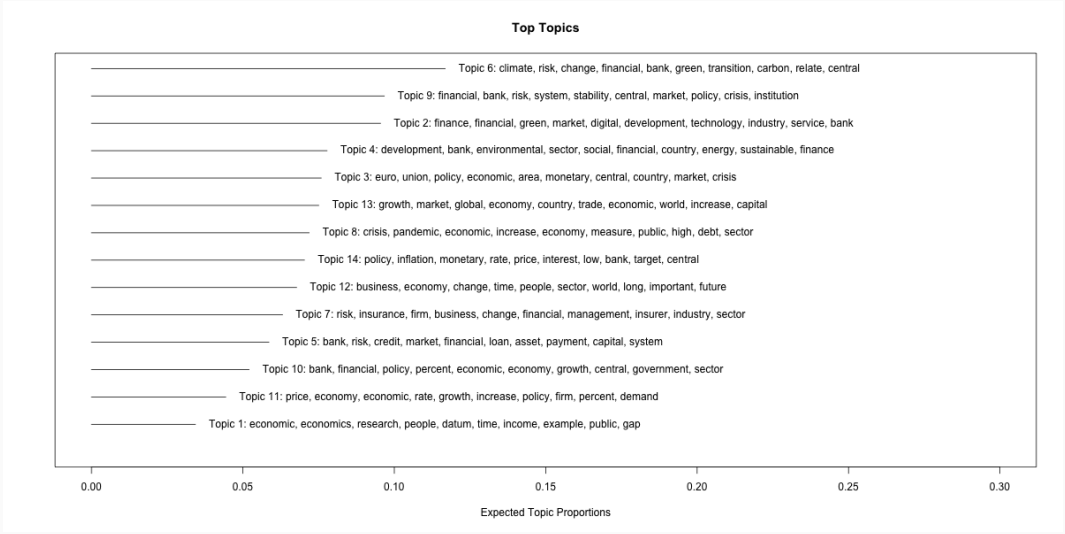
This must be decided based on the interpretability of the output (taking into account the size of the corpus and the broadness of the research question)

- Here, we pick $k = 14$
- We test different specifications with very stable topics

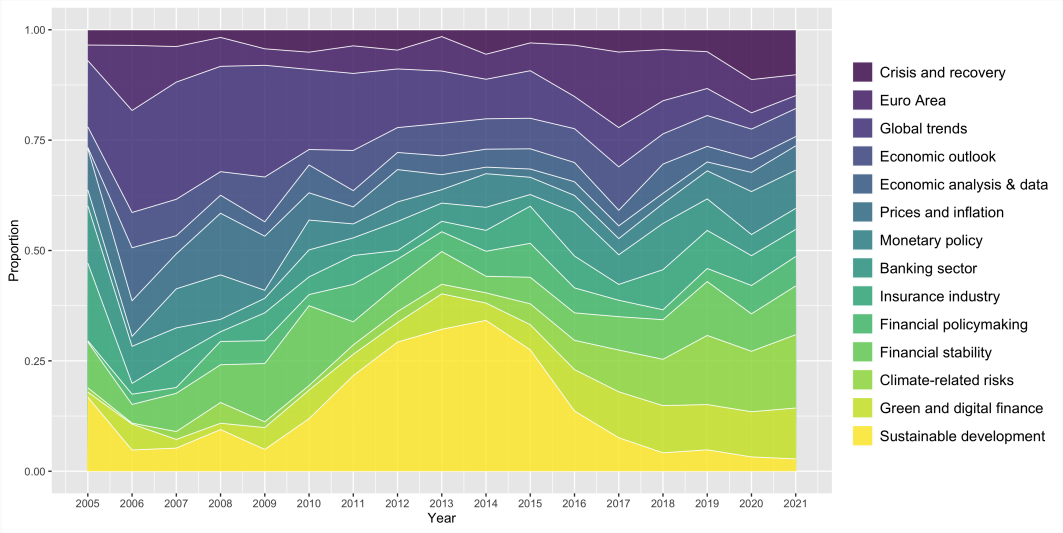
More on the choice of k

Other STM results

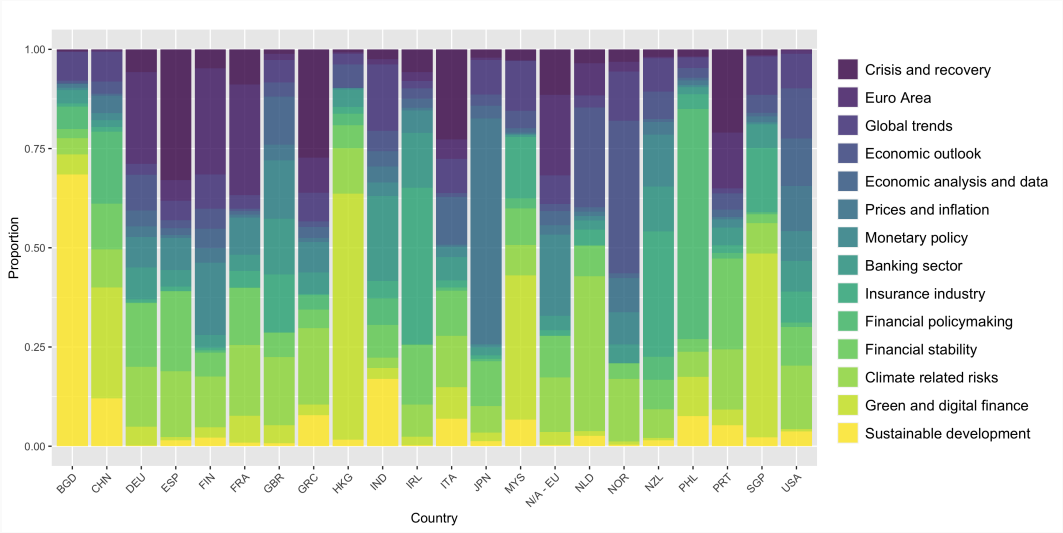
14 topics and their most frequent words



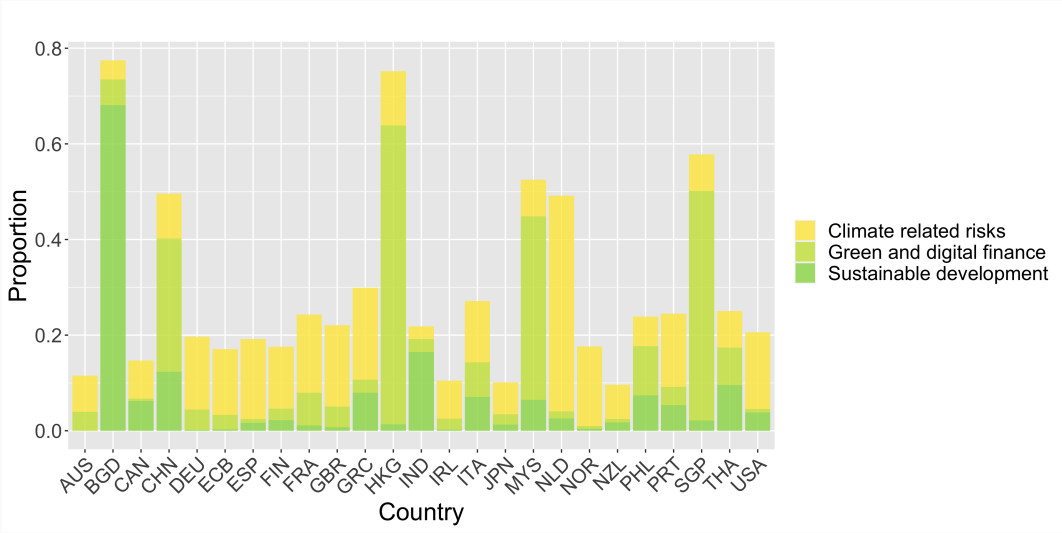
Topic prevalence through time



Topic prevalence across institutions



Topic prevalence across institutions



Varieties of green central banking (communication)

- **Developmental central banks** in climate-vulnerable countries: Bangladesh, India, China (also Haiti, Zambia, Nigeria, Cambodia, Ghana, Kenya...) - very promotional oriented (mitigation, adaptation), focus on 'Sustainable development'
- '**Asian (new) tigers**': Singapore, Malaysia, Hong Kong (also China, Indonesia) - also promotional, but focus on 'Green and digital finance' as an opportunity
- **Western late-comers**: European countries and Western offshoots, prudential 'climate-related risks' narratives are the dominant climate-related topic

In summary

These results allow us to highlight:

- The **growing diversity** of topics (monetary policy, inflation, financial stability)
- The **loss of momentum** in the "Sustainable finance" topic in favor of "Green and digital finance" and "Climate-related risks"
- The **persistent polarization** among three groups of institutions focusing on very different aspects of climate change

Conclusion

Conclusion

Using a new original dataset of central banker speeches, we highlight:

- Impressive rise in climate attention, but big differences in **timing and intensity**
- Heterogeneity is also important in the **content of the speeches**
- Mandates and peer pressure explain this pattern, not climate vulnerability
- Days in which G20 central banks mention climate issues are associated with higher returns of green stocks.

Merci pour votre attention !

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appendix

This is a man's world

Slow increase of women speakers over the period:

- 3,7% of speeches in the 1990s
- 11,9% in the last ten years.

Glass ceiling gets thicker at the very top

- 22,5% of Board members' speeches where made by women
- 5,4% of Governors' speeches were made by women

Drivers of climate communication

What we want to explain

We have 2 measures of **general climate attention**

- Climate frequency$_{i,t}$: total number of climate-related words by CB$_t$ in year$_i$
- Climate share$_{i,t}$: same, but corrected by number of words for CB$_t$ in year$_i$

And 3 measures of attention to **specific climate-related topics**

- Green and digital finance$_{i,t}$: prevalence of this topic for CB$_t$ in year$_i$
- Sustainable development$_{i,t}$: prevalence of this topic for CB$_t$ in year$_i$
- Climate-related risks$_{i,t}$: prevalence of this topic for CB$_t$ in year$_i$

Theoretical assumptions

H1: More climate vulnerability = more climate attention

- Moreover, vulnerability to physical risks means more promotional speeches (H1a) while transition risks means more reliance on prudential narratives (H1b)

H2: Broader institutional responsibilities = more climate attention

- Moreover, broader objectives means more promotional (H2a) while supervision missions means more prudential (H2b)

H3: Peer pressure plays a driving and framing role

- Joining the NGFS means more climate attention (H3a), especially on topics linked to its workstreams (H3b)

Drivers of climate-related communication

Pseudo-Poisson Maximum Likelihood (PPML) specification (to deal with high proportion of 0)

$$\begin{aligned}\text{Climate Focus}_{i,t} = exp\{&\beta_0 + \beta_1 \text{Climate vulnerability}_{i,t} \\ &+ \beta_2 \text{Carbon intensity}_{i,t} + \beta_3 \text{CB Supervision}_{i,t} \\ &+ \beta_4 \text{CB Objectives}_{i,t} + \beta_5 \text{NGFS Membership}_{i,t} \\ &+ \beta_6 \text{Inflation}_{i,t} + \alpha_i + \alpha_t + \epsilon_{i,t}\}.\end{aligned}$$

- Climate vulnerability: amount of climate catastrophe losses per GDP (EMDAT database)
- Carbon intensity: CO2 per GDP (Carbon Disclosure Project)
- CB Supervision: indicator of involvement in financial supervision (CBIS index)
- CB Objectives: indicator of focus on price stability only (CBIE index)
- NGFS: dummy for belonging to the Network for Greening the Financial System
- α: country and time fixed effects

PPML baseline results

VARIABLES	(1) Green and digital finance	(2) Sustainable development	(3) Climate-related risks	(4) Climate frequency	(5) Climate share
Climate vulnerability	-4.272	-1.587	-6.806	-4.087	-9.077*
	(2.945)	(1.585)	(7.489)	(4.018)	(5.021)
Carbon intensity	-1.314	1.027	2.609**	0.095	1.062
	(1.320)	(0.677)	(1.292)	(0.916)	(0.995)
CB Supervision	3.546**	1.421	7.445**	5.711**	6.494***
	(1.732)	(1.757)	(3.211)	(2.793)	(2.313)
CB Objectives	2.081	0.130	-1.354**	0.321	-0.384
	(1.768)	(1.033)	(0.547)	(0.646)	(0.497)
NGFS membership	0.671*	-0.861**	1.031***	0.774***	0.764**
	(0.380)	(0.342)	(0.345)	(0.277)	(0.316)
Inflation	0.039	0.092	-0.057*	-0.021	-0.010
	(0.056)	(0.059)	(0.031)	(0.032)	(0.050)
Constant	-5.839***	-4.550***	-6.687***	-2.014	-5.180***
	(1.779)	(1.120)	(1.810)	(1.316)	(1.222)
Observations	1,221	1,221	1,221	1,221	1,221
R-squared	0.448	0.322	0.387	0.654	0.428

Central bank and year fixed effects are included. Robust standard errors in parenthesis. *, **, *** represent significance at 10, 5, and 1%, respectively.

Discussion of the results

Overall, robust results, following our hypothesis

Link to robustness

- **H1:** Puzzling effect for vulnerability (but low significance), effect of co2 intensity on climate-related risks
  - Bad proxies? Suggestions for better ones? Maybe CBs may be less concerned about their country's vulnerability than that of their financial sector
- **H2:** Strong positive effect of prudential responsibilities on climate in general, and more specifically on climate-related risks
- **H3:** Significant positive effect of NGFS membership on climate attention in general + important 'framing' effect (positive on two 'NGFS-related' topics, negative on the other)

Consequences of climate communication

Research design

We replicate the research design of Ardia et al. 2022, that try to test whether the stock returns of green vs brown stocks is impacted by higher climate concerns in newspaper, but using our index of central bank interest for climate change.

We focus the analysis on the USA for the first model, and for all G20 countries for the second.

Effects of climate-related communication

$$\text{GMB Return}_{i,t} = \beta_0 + \beta_1 \text{Climate Focus}_{i,t} + \beta_2 \text{MKT}_{i,t} + \beta_3 \text{HML}_{i,t} + \beta_4 \text{SMB}_{i,t} + \beta_5 \text{WTI}_{i,t} + \alpha_i + \alpha_t + \epsilon_{i,t}$$

where:

- GMB Return: green minus brown returns
- Climate Focus: Topic 2, Topic 4, Topic 6, Green Topics
- MKT: excess market return
- HML: high-minus-low factor
- SMB: small-minus-big factor
- WTI: WTI crude oil return

Effects of climate-related communication

	USA				G-20 Countries			
	(1) Green and digital finance	(2) Sustainable development	(3) Climate-related risks	(4) Green topics	(5) Green and digital finance	(6) Sustainable development	(7) Climate-related risks	(8) Green topics
Climate Focus	0.117	1.476*	0.746**	0.740**	-0.075	0.509	0.408**	0.337*
	(1.667)	(0.855)	(0.337)	(0.291)	(0.319)	(0.411)	(0.176)	(0.184)
MKT	-16.568***	-16.602***	-16.377***	-16.396***	-1.111	-1.112	-0.958	-0.990
	(4.403)	(4.401)	(4.399)	(4.397)	(1.872)	(1.871)	(1.841)	(1.840)
HML	3.598	3.627	3.896	3.902	4.252	4.284	4.472	4.454
	(4.108)	(4.104)	(4.105)	(4.104)	(3.219)	(3.210)	(3.171)	(3.167)
SMB	6.331	6.214	6.746	6.667	-9.059**	-9.121**	-8.805**	-8.903**
	(5.417)	(5.414)	(5.400)	(5.394)	(3.756)	(3.715)	(3.878)	(3.843)
WTI	-0.007	-0.007	-0.007	-0.007	-0.004***	-0.004***	-0.004***	-0.004***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	-0.116	-0.117	-0.112	-0.113	-0.135	-0.135	-0.136	-0.136
	(0.285)	(0.285)	(0.285)	(0.285)	(0.104)	(0.104)	(0.104)	(0.103)
Observations	2,303	2,303	2,303	2,303	7,632	7,632	7,632	7,632
R^2	0.089	0.089	0.090	0.091	0.039	0.039	0.040	0.040

Discussion of results

Positive and significant results, but...

- Very low number of observations (days in which there is a Fed speech).
- Most of them have a climate focus at 0.
- Should we focus on climate-speeches only? On governors only?
- Or rely on another design entirely? Event-study on targeted speeches?

Many questions!

Other avenues to spot climate-related speeches

From the most simple to the most elaborate:

- The BIS has a 'green and sustainable finance' category... but it starts in 2015 and we have non-BIS speeches
- We could launch a LDA/STM to endogenise the discovery of this topic... but it's too recent/small in the corpus
- We could train a LLM to spot climate-related speeches/paragraphs... but same caveat + time (+ ClimateBERT model disappointing)

Arseneau et al. (2022) come to the same conclusion, but use a more fancy dictionary generation process... But ours is better?

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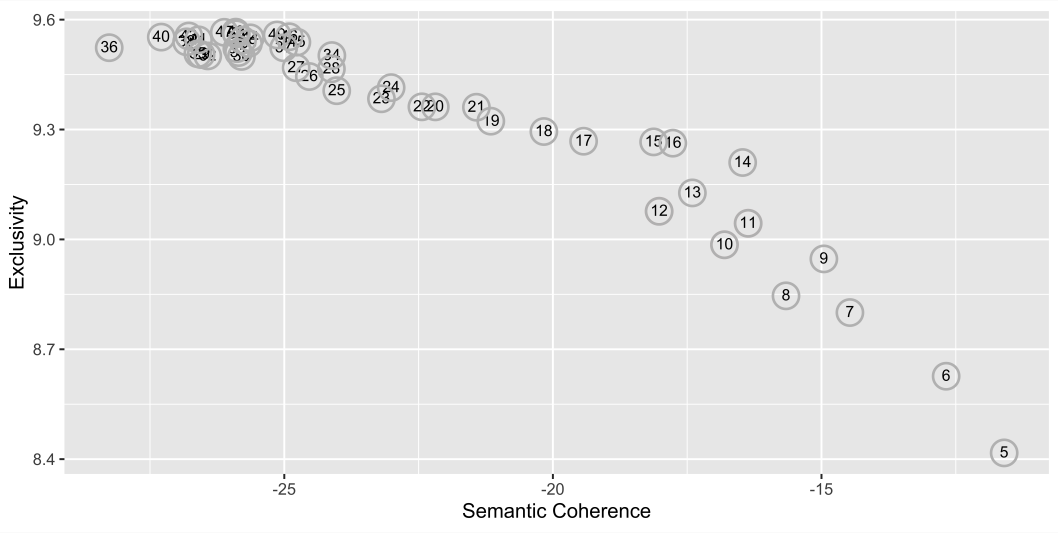
Model selection: how many topics?



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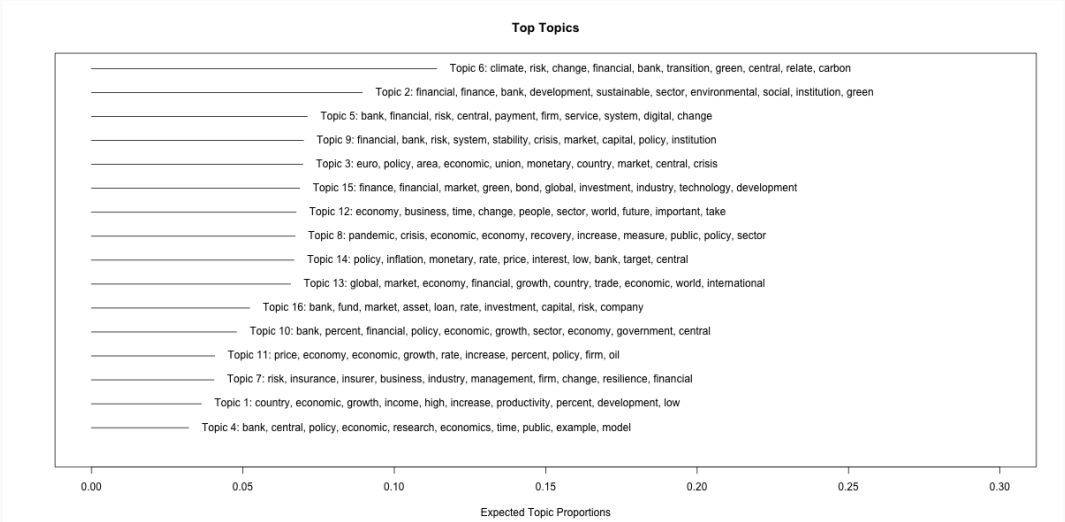
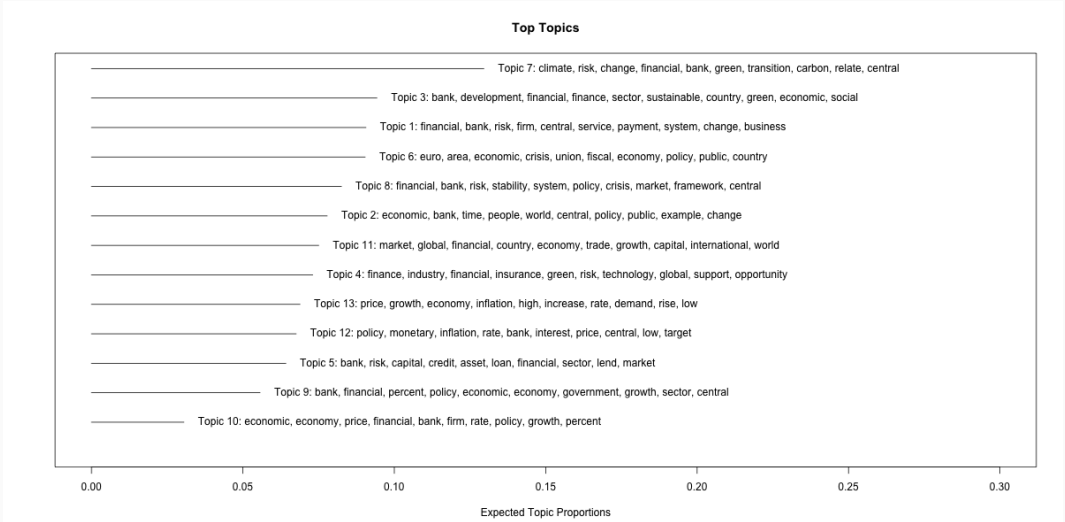
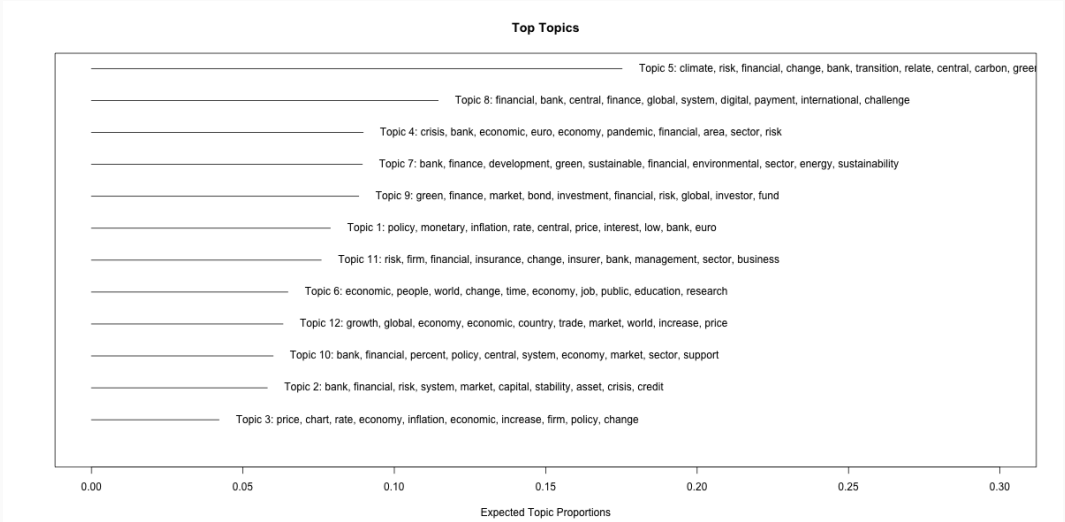
STM Robustness: Same corpus, more topics



STM Robustness: English only corpus



STM Robustness: Higher threshold



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Drivers Robustness: PPML post 2005

VARIABLES	(1) Green and digital finance	(2) Sustainable development	(3) Climate-related risks	(4) Climate frequency	(5) Climate share
Climate vulnerability	-4.519	-2.120	-6.815	-4.232	-9.225*
	(3.056)	(1.599)	(7.490)	(4.140)	(5.082)
Carbon intensity	-1.156	1.420	2.623**	0.196	1.191
	(1.847)	(0.925)	(1.297)	(1.017)	(1.071)
CB Supervision	3.560**	1.993	7.448**	5.817**	6.606***
	(1.794)	(1.633)	(3.212)	(2.803)	(2.305)
CB Objectives	2.852	-0.088	-1.355**	0.287	-0.411
	(2.116)	(1.036)	(0.548)	(0.656)	(0.503)
NGFS membership	0.692*	-0.845**	1.031***	0.776***	0.766**
	(0.382)	(0.342)	(0.345)	(0.277)	(0.316)
Inflation	0.042	0.100	-0.057*	-0.023	-0.011
	(0.055)	(0.071)	(0.031)	(0.032)	(0.050)
Constant	-6.411***	-4.758***	-6.691***	-2.054	-5.242***
	(2.037)	(1.169)	(1.812)	(1.331)	(1.230)
Observations	954	954	954	954	954
r2_p	0.425	0.301	0.357	0.620	0.393

Central bank and year fixed effects are included. Robust standard errors in parenthesis. *, **, *** represent significance at 10, 5, and 1%, respectively.

Drivers Robustness: PPML English only

VARIABLES	(1) Green and digital finance	(2) Sustainable development	(3) Climate-related risks	(4) Climate frequency	(5) Climate share
Climate vulnerability	-6.503	-3.330**	-10.355	-4.087	-9.077*
	(5.677)	(1.488)	(8.066)	(4.018)	(5.021)
Carbon intensity	-0.213	1.475**	2.421*	0.095	1.062
	(0.959)	(0.692)	(1.242)	(0.916)	(0.995)
CB Supervision	3.264**	2.044	7.610**	5.711**	6.494***
	(1.541)	(1.655)	(3.137)	(2.793)	(2.313)
CB Objectives	-0.419	0.349	-0.980**	0.321	-0.384
	(1.216)	(0.861)	(0.402)	(0.646)	(0.497)
NGFS membership	0.101	-0.462	1.195***	0.774***	0.764**
	(0.332)	(0.312)	(0.348)	(0.277)	(0.316)
Inflation	-0.064	0.093	-0.050	-0.021	-0.010
	(0.061)	(0.061)	(0.035)	(0.032)	(0.050)
Constant	-4.529***	-4.902***	-7.172***	-2.014	-5.180***
	(1.495)	(1.149)	(1.682)	(1.316)	(1.222)
Observations	1,051	1,051	1,051	1,221	1,221
r2_p	0.402	0.362	0.370	0.654	0.428

Central bank and year fixed effects are included. Robust standard errors in parenthesis. *, **, *** represent significance at 10, 5, and 1%, respectively.

Drivers Robustness: PPML Threshold at 2

VARIABLES	(1) Green and digital finance	(2) Sustainable development	(3) Climate-related risks	(4) Climate frequency	(5) Climate share
Climate vulnerability	-6.771**	-5.832	-14.993	-4.087	-9.077*
	(3.401)	(4.012)	(10.404)	(4.018)	(5.021)
Carbon intensity	-6.304**	2.016***	3.590**	0.095	1.062
	(2.555)	(0.780)	(1.693)	(0.916)	(0.995)
CB Supervision	1.679	2.299*	10.638***	5.711**	6.494***
	(1.108)	(1.306)	(2.679)	(2.793)	(2.313)
CB Objectives	-1.483	0.974	-1.113***	0.321	-0.384
	(1.269)	(0.652)	(0.363)	(0.646)	(0.497)
NGFS membership	0.731**	-0.559	1.267***	0.774***	0.764**
	(0.300)	(0.459)	(0.345)	(0.277)	(0.316)
Inflation	0.037	0.129*	-0.067**	-0.021	-0.010
	(0.087)	(0.078)	(0.032)	(0.032)	(0.050)
Constant	-2.170	-5.943***	-8.868***	-2.014	-5.180***
	(1.334)	(0.971)	(1.559)	(1.316)	(1.222)
Observations	865	865	865	1,221	1,221
r2_p	0.417	0.357	0.372	0.654	0.428

Central bank and year fixed effects are included. Robust standard errors in parenthesis. *, **, *** represent significance at 10, 5, and 1%, respectively.

Robustness: PPML Model 16

VARIABLES	(1) Green and digital finance	(2) Sustainable development	(3) Climate-related risks	(4) Climate frequency	(5) Climate share
Climate vulnerability	-3.589	-3.157	-8.871	-4.087	-9.077*
	(4.446)	(2.085)	(8.365)	(4.018)	(5.021)
Carbon intensity	-1.492	1.474**	3.027**	0.095	1.062
	(0.990)	(0.750)	(1.239)	(0.916)	(0.995)
CB Supervision	1.662	2.588	7.024**	5.711**	6.494***
	(1.596)	(1.670)	(3.414)	(2.793)	(2.313)
CB Objectives	0.404	0.271	-1.447***	0.321	-0.384
	(0.968)	(1.054)	(0.482)	(0.646)	(0.497)
NGFS membership	0.499	-0.228	1.106***	0.774***	0.764**
	(0.305)	(0.463)	(0.350)	(0.277)	(0.316)
Inflation	-0.046	0.079	-0.055	-0.021	-0.010
	(0.063)	(0.052)	(0.036)	(0.032)	(0.050)
Constant	-3.920***	-4.834***	-6.577***	-2.014	-5.180***
	(1.316)	(1.176)	(1.871)	(1.316)	(1.222)
Observations	1,221	1,221	1,221	1,221	1,221
r2_p	0.433	0.393	0.397	0.654	0.428

Central bank and year fixed effects are included. Robust standard errors in parenthesis. *, **, *** represent significance at 10, 5, and 1%, respectively.

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Drivers of climate-related communication (Adv economies)

	Green and digital finance (1)	Sustainable development (2)	Climate-related risks (3)	Climate frequency (4)	Climate share (5)
Climate vulnerability	-1,148.595*	2,215.598***	-130.874	306.456	-358.535
	(662.968)	(411.181)	(599.797)	(407.543)	(418.843)
Carbon intensity	-14.181	-6.382	0.770	2.750	2.347
	(12.079)	(5.588)	(5.627)	(3.311)	(3.802)
CB Supervision	2.619	0.344	0.429	0.205	1.113
	(2.900)	(1.624)	(1.343)	(0.764)	(1.521)
CB Objectives	-4.569***	-1.566***	-1.651*	0.196	-0.802
	(1.359)	(0.488)	(0.962)	(1.307)	(1.138)
NGFS membership	0.523	-0.234	1.140**	1.139***	1.274***
	(0.457)	(0.563)	(0.453)	(0.422)	(0.460)
Inflation	0.301*	-0.055	-0.185	-0.157	-0.130
	(0.176)	(0.106)	(0.236)	(0.120)	(0.191)
Constant	-0.189	-2.200	-2.233	0.044	-2.788**
	(2.452)	(1.777)	(1.401)	(1.569)	(1.392)
Observations	643	643	643	643	643
Pseudo R^2	0.311	0.223	0.383	0.693	0.445

Drivers of climate-related communication (Dev countries)

	Green and digital finance (1)	Sustainable development (2)	Climate-related risks (3)	Climate frequency (4)	Climate share (5)
Climate vulnerability	-582.710	-257.581	-48.930	-34.653	-150.211*
	(403.890)	(262.146)	(71.357)	(25.015)	(78.375)
Carbon intensity	-2.324	1.835*	2.481*	-0.243	0.705
	(1.512)	(1.085)	(1.271)	(1.020)	(1.088)
CB Supervision	2.806	4.118***	14.161***	9.332***	9.605***
	(1.845)	(1.469)	(1.667)	(1.130)	(1.472)
CB Objectives	4.179	0.607	-1.506***	0.507	-0.164
	(2.567)	(1.111)	(0.566)	(0.676)	(0.646)
NGFS membership	0.618	-0.809**	0.944	0.488	0.555
	(0.409)	(0.362)	(0.635)	(0.380)	(0.472)
Inflation	0.017	0.105	-0.076**	-0.024	-0.012
	(0.047)	(0.075)	(0.033)	(0.027)	(0.053)
Constant	-5.868***	-6.119***	-8.991***	-3.392***	-6.049***
	(2.139)	(1.313)	(1.322)	(1.046)	(1.004)
Observations	501	501	501	501	501
Pseudo R^2	0.421	0.305	0.389	0.598	0.411