Dissecting Climate Risks: Are they Reflected in Stock Prices?

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Motivation

- Scientific consensus: Climate change is happening.
- It matters for Central Banks, e.g. if threat to Financial Stability.
- FS threats arise when risks are not properly priced.
- Are climate change risks priced?
- Dissect direct risks from climate change vs. government intervention.

What we do

1. Use Reuters news to construct novel proxies for market-wide climate risks
2. For each U.S. stock, measure sensitivity of stock price to news (beta)
3. Test whether riskier assets pay higher return (alpha)

Contributions:

1. **Provide first-time evidence** on what types of market-wide climate risks are priced
2. **Document** which firms are the most exposed to these risks

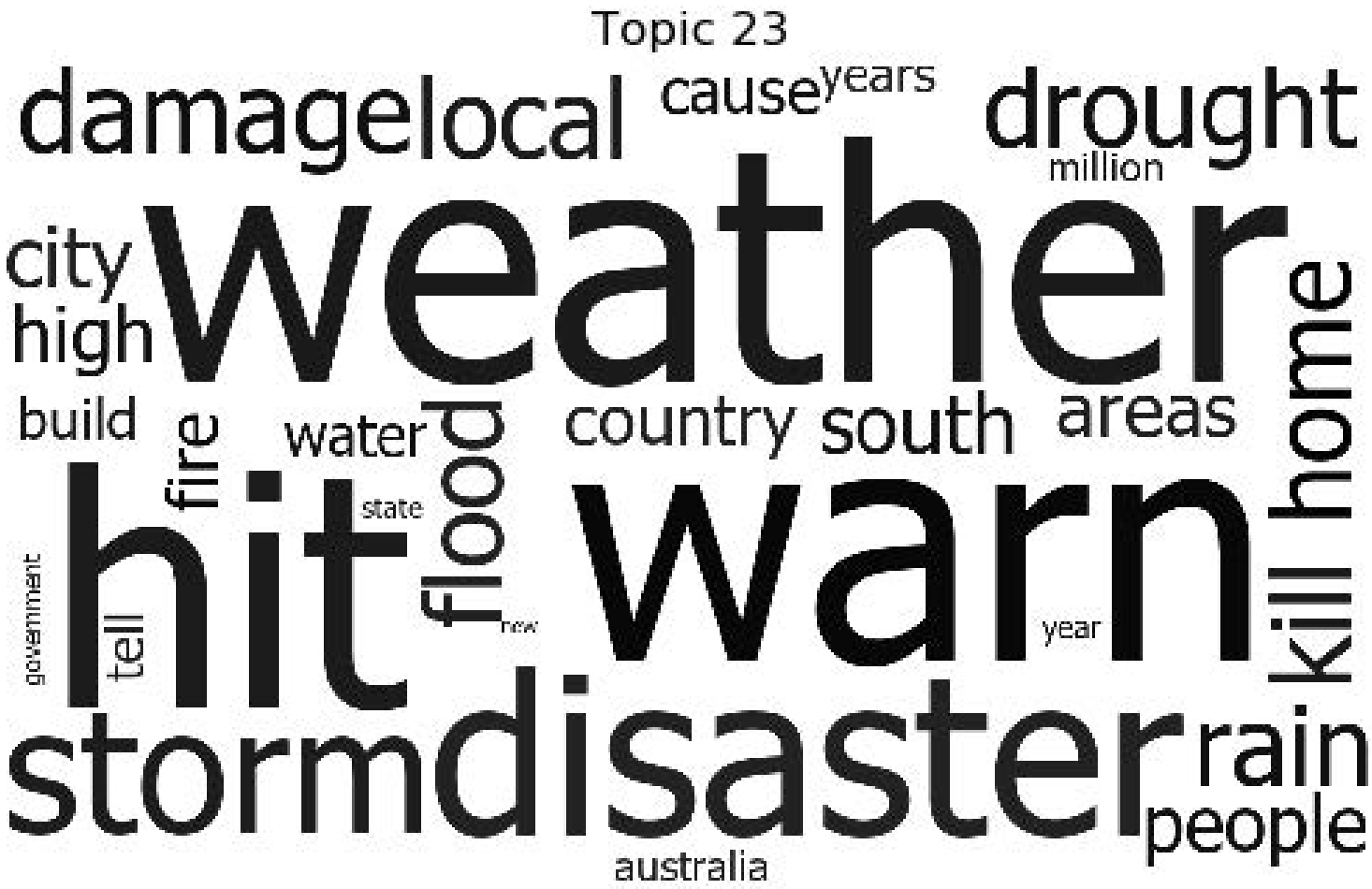
Empirical findings

1. Only the risk of government intervention is priced
2. Its pricing is a recent phenomenon: Stemming from post-2012
3. The most exposed firms are polluters with no intention to become greener

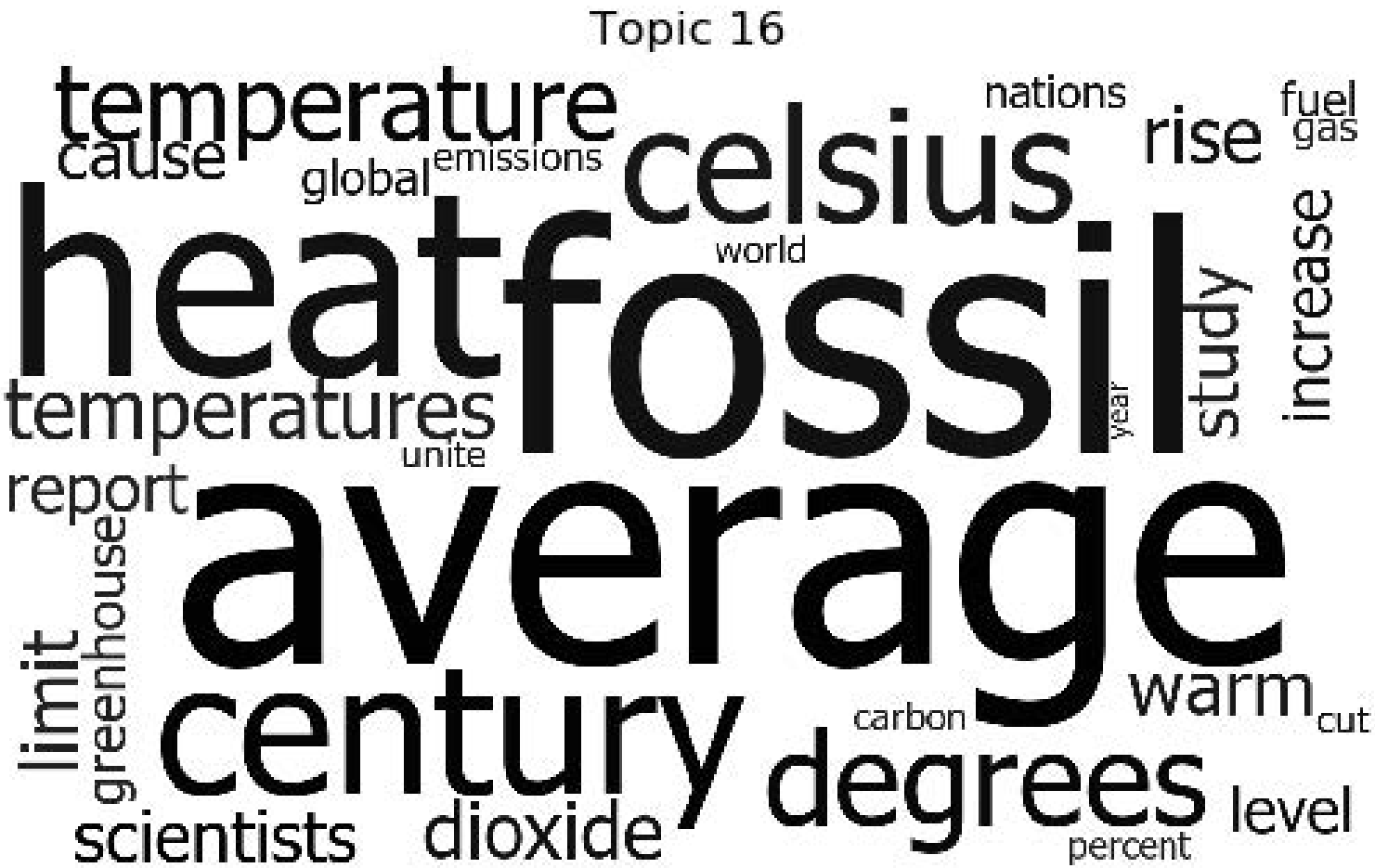
Dataset

- Reuters news: 1st Jan. 2000 - 31st Dec.2018 (13 million articles)
  - Select articles where "*climate change*" or "*global warming*" appear at least once $\longrightarrow$ $\approx$34,000 articles
- U.S. common stocks returns & characteristics (daily data, CRSP, Compustat)
- Equity risk factors from authors' websites
- '*E*' score from Refinitiv.

Labeling Topics: Natural disasters



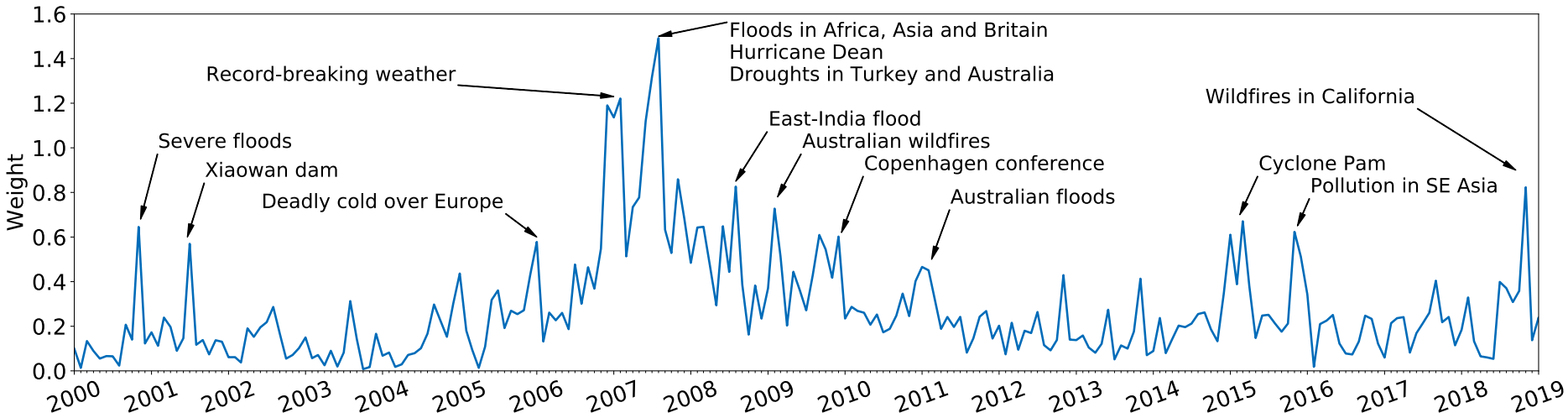
Labeling Topics: Global warming



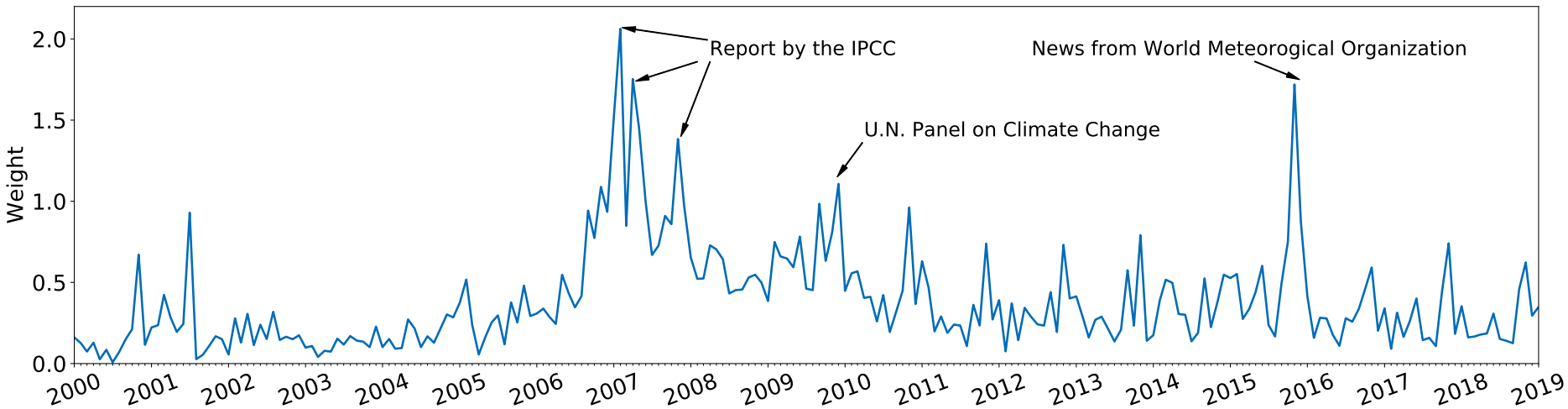
Labeling Topics: International summits

Labeling Topics: U.S. climate policy

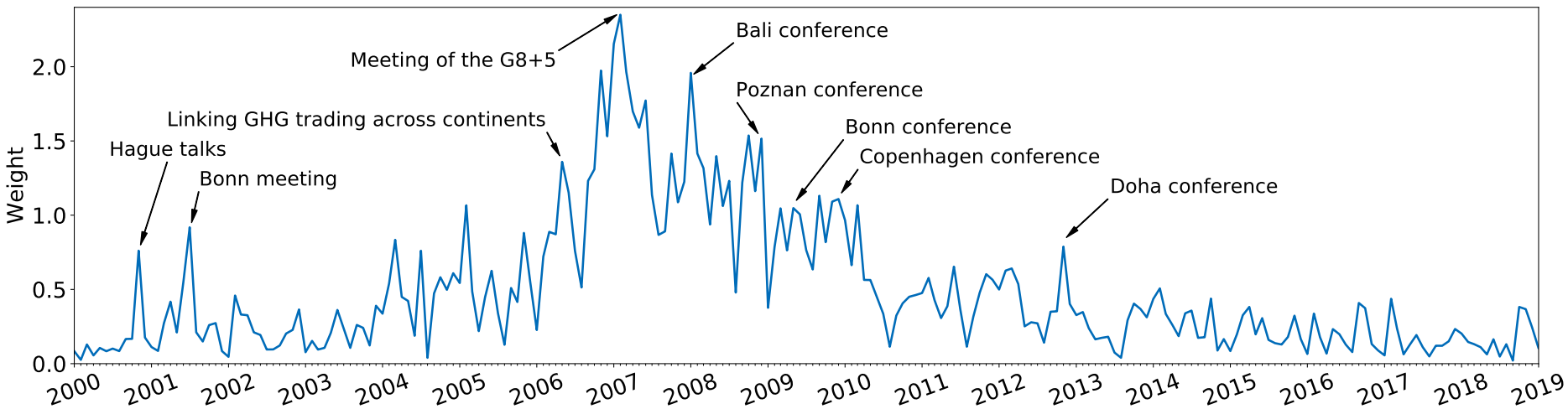
Natural disasters factor



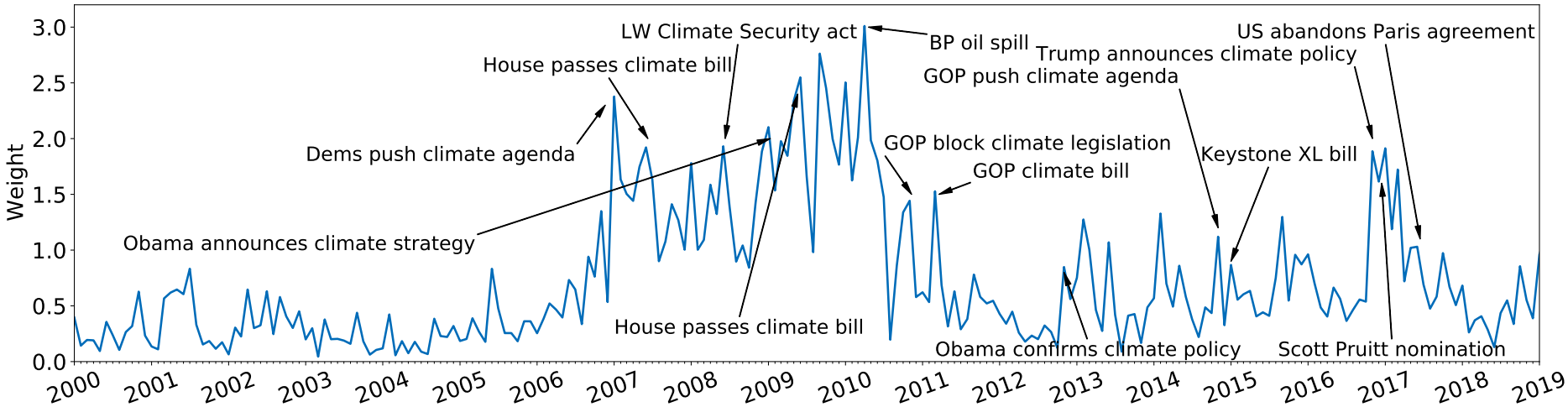
Global warming factor



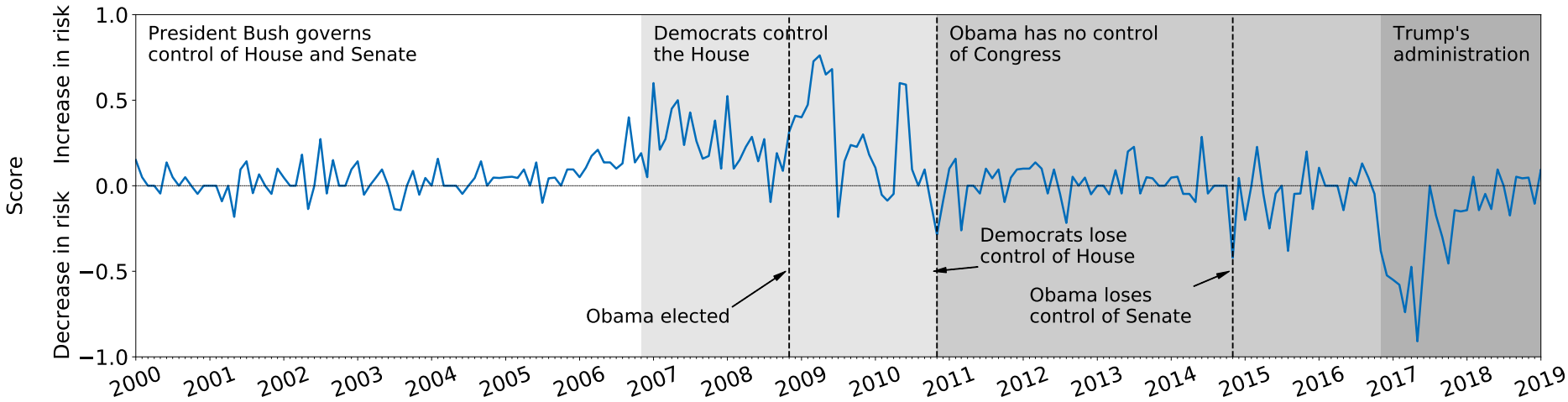
International summits factor



U.S. climate policy factor



U.S. climate policy narrative factor



Asset pricing tests

- For each stock i, at each time t, we estimate the climate beta with respect to each textual factor F_t separately

$$r_{it} - r_{ft} = c_i + \beta_i F_t + \gamma_i' X_t + \varepsilon_{it} \tag{1}$$

1. We sort stocks in (decile/quintile) portfolios based on β_i
2. Calculate monthly post-ranking portfolio returns (value-weighted)
3. Compute spread portfolio returns
4. Rolling window estimation: Repeat Steps (1 - 3) until we exhaust the sample
5. Estimate alpha of spread portfolio
    - Alternative models for estimating climate beta & alpha.

Are factors priced? Jan 2000 - Dec 2018 (Deciles)

	International Summits	Global Warming	Natural Disasters
Panel A: Market model			
Deciles	−0.12	−0.08	0.14
	(−0.42)	(−0.28)	(0.38)
Quintiles	−0.17	0.31	0.06
	(−0.70)	(1.46)	(0.17)
Panel B: Fama-French three-factor model			
Deciles	−0.53*	0.20	0.07
	(−1.73)	(0.67)	(0.24)
Quintiles	−0.25	0.09	0.01
	(−1.21)	(0.55)	(0.04)
Panel C: Fama-French-Carhart model			
Deciles	−0.49	0.03	−0.07
	(−1.65)	(0.10)	(−0.24)
Quintiles	−0.14	0.27*	0.06
	(−0.71)	(1.92)	(0.38)
Panel D: Fama-French five-factor model			
Deciles	−0.66**	0.05	0.03
	(−2.58)	(0.19)	(0.08)
Quintiles	−0.18	0.13	0.04
	(−0.96)	(0.67)	(0.19)
Panel E: Fama-French five-factor model plus momentum factor			
Deciles	−0.76***	−0.09	0.27
	(−2.63)	(−0.34)	(0.89)
Quintiles	−0.16	0.22	0.10
	(−0.86)	(1.20)	(0.53)

Asset pricing tests: Narrative factor (Decile)

2000-2018	2000-2012	2012-2018
Panel A: Market model		
-0.64*	-0.52	-1.01**
(-1.86)	(-1.13)	(-2.43)
Panel B: FF 3F model		
-1.03***	0.77**	-1.39***
(-3.56)	(-2.37)	(-4.30)
Panel C: FFC model		
-0.85***	-0.59*	-1.37***
(-2.76)	(-1.66)	(-3.61)
Panel D: FF 5F model		
-0.65**	-0.62	-0.84***
(-1.97)	(-1.43)	(-2.97)
Panel E: FF 5F + momentum		
-0.31	0.00	-0.93***
(-1.07)	(0.00)	(-3.40)

Climate policy portfolio characteristics

	1 (L)	2	3	4	5 (H)
Panel A: Fama-French-Carhart model					
Average return	0.80*	1.03***	0.87***	0.89**	1.07***
	(1.84)	(2.88)	(2.84)	(2.60)	(2.66)
Climate beta	-0.48	-0.16	0.00	0.15	0.47
E score	35.12	40.37	41 .66	40.29	34.86
E score (change)	7.12	6.26	5.70	6.22	6.05
log(size)	6.36	6.91	7.02	6.91	6.43
N	747.00	751.00	751.00	750.00	747.00
Panel B: Fama-French five-factor model					
Average return	0.71	1.01***	0.86***	0.95***	1.10***
	(1.40)	(2.76)	(2.79)	(3.09)	(2.93)
Climate beta	-0.48	-0.16	0.00	0.16	0.48
E score	35.15	40.51	41.37	40.37	35.15
E score (change)	6.64	6.22	5.64	6.38	6.18
log(size)	6.38	6.92	7.01	6.91	6.43
N	747.00	748.00	752.00	752.00	747.00

Conclusions

- Only climate risks from government intervention are priced
- Direct risks from climate change are not
- **Interpretation of results**:
  1. Limited investors' attention; political arena as "wake-up call"
  2. Investors lack information about firms' exposure to physical risks $\Rightarrow$ regulation on disclosure of climate risks (EU Platform on Sustainable Finance, 2021)
  3. Investors' short-termism
- **Implication:** policy intervention is required to address the market failure behind the mispricing (Lagarde, 2021)

Thank you for your attention and time !

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