Climate Change Salience and International Equity Returns

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ABFER

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Goals

- Propose a measure of Climate Change Salience based on Google Trends' worldwide index of searches for "Climate Change"
- Measure the return sensitivity (beta risk) of international stocks to Climate Change Salience
- Examine whether the beta risk to Climate Change Salience is priced or not
- Explore determinants of beta risk
  - Firm-level characteristics (e.g. carbon emissions, firm size, book-to-market)
  - Country-level characteristics (e.g. emissions per capita, climate risk index, GDP per capita)

Findings

- Beta risk for Climate Change Salience is priced
  - Stocks with a higher beta (i.e. positive co-movement with climate change salience) will earn a lower return
  - The relationship between beta risk and return is nonlinear (discount for beta risk is magnified when climate change salience is high)

- Determinants of climate salience risk (i.e. beta sensitivity)
  - No relationship with carbon emission and physical plant & equipment
  - Large and value firms have lower climate salience risk
  - Firms in countries with higher climate risk index and lower GDP have lower climate salience risk exposure – Surprising !!

Contribution of the paper

- Provides an alternative measure of climate risk exposure (based on Google trends of search), as compared with Engle, Giglio, Kelly, Lee and Stroebel's (2020) measure based on textual analysis of climate-related articles
  - Simple to compute
  - Correlation with Engle et al (2020) sentiment index (computed based on Crimson Hexagon's negative climate-related articles) is 53%; correction with the benchmark index is lower

- Pricing of climate risk in the international stock market

Comment (I):Comparison between the climate news measures

	Parsley & Popper (2023)	Engle, Giglio, Kelly, Lee, Stroebel (2019)
Source of information	Google Trends	Wall Street Journal
Key word(s)	Climate Change	Textual analysis for Climate Change Vocabulary
Difficulty of compilation	Simple	More technical
User types	Individuals	Business and financial audience
Geographic base of users	International	Leaned towards U.S or English-speaking countries

Comparison between the climate news measures

Parsley & Popper (2023)

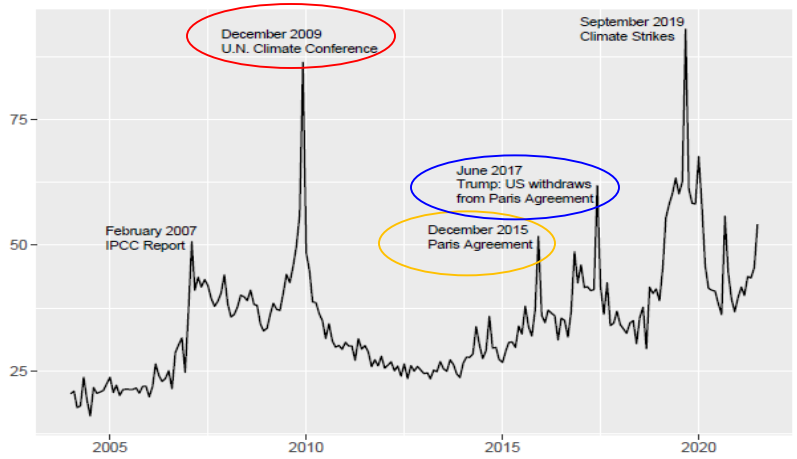
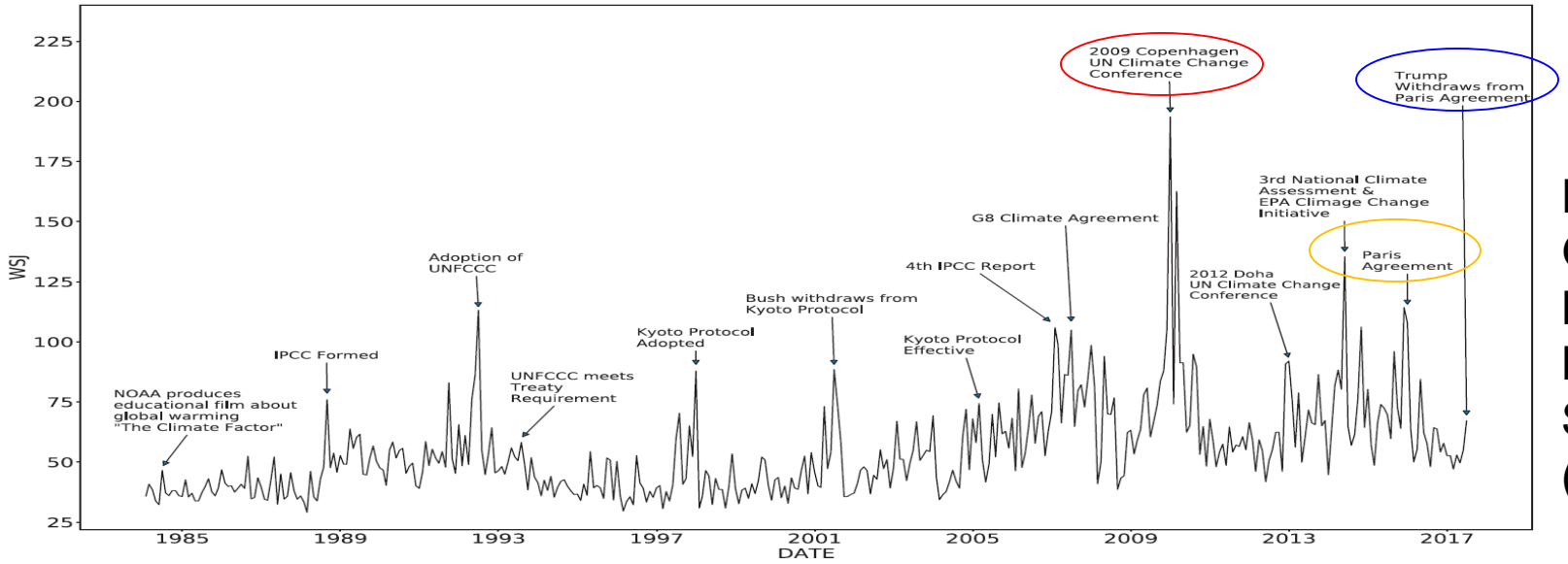


Figure 1: World-wide Google searches of 'climate change' relative to all Google searches, adjusted with an $ARIMA(111)(011)_{12}$, and scaled between zero and 100 over the sample



Engle, Giglio, Kelly, Lee, Stroebel (2019)

Figure 2
WSJ Climate Change News Index
This figure shows the WSJ Climate Change News Index from 1984 to 2017, annotated with climate-relevant news announcements

Comment (II): Motivation

- What does Google trends' search of "climate change" proxy for?
  - Attention ? Sentiment? Salience ?
  - The series might capture some major climate-change-related events, but what drives the fluctuation over a monthly basis?
  - Is the change of attention/sentiment/salience really a source of risk?

- Comparison with other "climate change" news indicator(s)
  - What is the advantage over Engle et al (2020)'s measure other than it is simple to compile?
  - Are the results the same or different versus Engle et al (2020) measure?
  - Why not replicate the analysis using Engle et al (2020) measure

Comment (III): Search Language

- Google Trends' search
  - Only English-language search
  - Rationale: From the perspective of U.S investors
- However, US investors (or English-speaking investors) are not representative investors for many foreign stock markets.
- What are the beta sensitivities to climate salience risk for English-speaking versus non-English-speaking countries?
- How about search based on local languages ?

Comment (IV): Beta estimation

$$r_{i,t} = \alpha_i + \beta_i^{\kappa}\kappa_t + \boldsymbol{f}_t'\beta_i^{f} + \eta_{i,t}$$

f_j is a vector of Fama-French factors

κ_t is log of the period-t climate change salience measure,

variable	mean	standard deviation	min	25th percentile	median	75th percentile	max
r_t	0.1012	0.1300	0.0000	0.0000	0.0200	0.1600	0.4400
r_t^m	0.9056	4.3233	-17.1500	-1.4000	1.3500	3.5200	13.6500
smb_t	0.1030	2.3453	-4.8900	-1.7200	0.1350	1.5000	6.0400
hml_t	-0.2481	2.7273	-14.0200	-1.8500	-0.2550	1.1850	8.2100
$r_{i,t}$	1.1262	8.7069	-22.6569	-4.3364	0.8045	6.2498	28.6974
κ	0.3462	0.1166	0.1605	0.2602	0.3348	0.4005	0.9296
$\beta_{i,t}^{\kappa}$	2.234	15.848	-187.123	-5.771	2.057	9.885	183.010

- Beta estimated by regression of stock returns on the climate change salience measure directly
  - How stable over time?
  - Prone to estimation error
  - Extreme beta values
  - Winsorizing the beta?

- Low explanatory power for beta - beta does not have a relationship with carbon emission and physical plant & equipment.
  - Beta estimation is noisy!

Comment (IV): Additional suggestions

- Examine the relationship between beta sensitivity and environmental rating of ESG providers
- Form a climate salience mimicking portfolio (follow Engle et al (2020)) that has exposure to climate salience risk but not other risk factors
  - What is the performance (risk premia) of the mimicking portfolio?
  - Estimate beta sensitivity with respect to mimicking portfolio
- Do the search by country
  - Use local language
  - Estimate beta sensitivity with respect to country-level climate salience measure
    - Local beta vs global beta (with respect to climate salience measure)

Overall

- Nice incremental contribution to understanding the climate salience risk
- Requires stronger motivation on the differentiation with other measures and corroboration of the results
- Need to have better explanatory power for beta sensitivity with respect to climate salience risk
- Need to explore local language search and conduct analysis at the country level