Climate Change Belief and Investor Behaviour

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Hurricane Dorian
28/08/2019 to 06/09/2019
Estimated Cost (in bn US$): tbd

How do extreme weather events affect institutional investors' climate change related investment decisions?

Global warming leads to an increase in frequency and magnitude - one of the visible impacts of climate change.
Hsiang & Kopp (2018), IPCC (2018)

Climate change risks are highly uncertain and long term in nature - they are to some extent priced, but may be imperfectly as well as inefficiently priced.
Bolton & Kacperczyk (2019), Hong *et al.* (2019)

Belief towards climate change seems to affect asset valuations and portfolio compositions.
Baldauf *et al.* (2018), Choi *et al.* (2018), Krueger *et al.* (2018)

Intuitively, extreme weather events should drive investors to increase "climate friendly" investments, ...

Extreme Weather Events may lead to an

increase in "climate friendly" investments

- Experimental learning

  Malmendier & Nagel (2011), Malmendier & Nagel (2015), ...
- Greater concern for Climate Change

  Howe *et al.* (2014), Konisky *et al.* (2016), Myers *et al.* (2013), ...
- Reevaluate risk and adjust portfolios

... but I find that investors experiencing extreme weather events reduce "climate friendly" investments relatively

Extreme Weather Events may lead to a

increase in "climate friendly" investments

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  Malmendier & Nagel (2011), Malmendier & Nagel (2015), ...
- Greater concern for Climate Change
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- Reevaluate risk and adjust portfolios

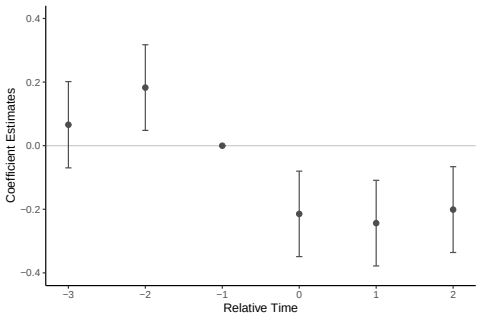
decrease in "climate friendly" investments

- Overreaction of retail investors
- "Short-term" return maximization
- Opinion polarization

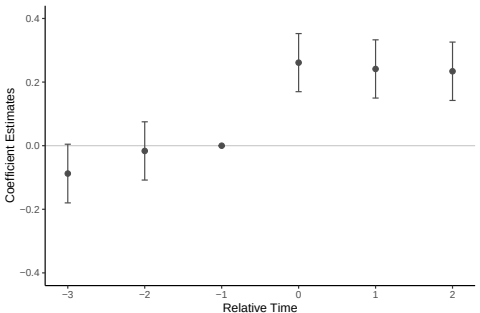
Extreme weather event experiences lead institutional investors to reduce green investments and increase brown investments

Relative time period & Treatment indicator coefficients
using a fatal extreme weather event identifier

Green firms



Brown firms



Uncovering the relationship - challenges in the ideal experiment

Ideal World Experiment

Analyse how the investment behaviour/ portfolio stock allocation of a random group of investors, who is shocked with an extreme weather event holding all other factors constant, subsequently differs from the control group.

Challenges

- How to identify extreme weather event exposed investors?
- How to identify investors' portfolio?
- How to ensure that no other omitted variables drive the change in investor behaviour?

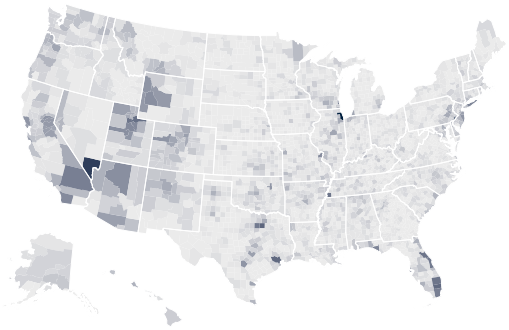
Data (1) - Summary Data Sources

- US Extreme Weather Events: NOAA Storm Events Database
- ESG rating Data: KLD ratings from 2003 to 2016
- Institutional Holdings: Thomson Reuters Institutional 13f Holdings
- Institutional Investor Classification: Bushee's website
- Investment Manager Locations: SEC web scrape
- Stock Prices: CRSP
- Standard Financial Statement Data/ Company HQ: Compustat

Data (2) - Extreme Weather Events

- US Extreme Weather Event Data: NOAA Storm Events Database

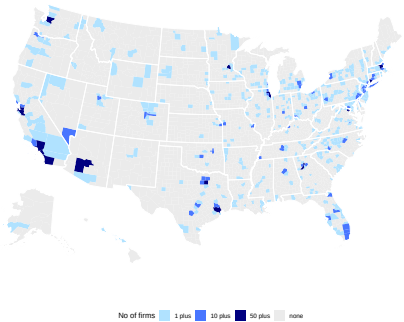
Number of events with casualty/casualties



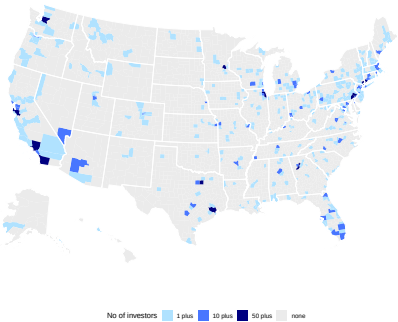
Alternative Extreme Weather Event specifications

Data (3) - US State-level Dispersion

5141 KLD-rated Firms



5680 Institutional Investors



Green/Brown Firms | Inst Investors

Data (4) - Company Descriptives

- Data set divided into two subperiods to allow for meaningful numbers of green and brown firms
- Green and brown firm classification based on continuous location in the top, respectively bottom, KLD enviornmental rating quintile

Table: Summary statistics green and brown firms

	Brown pre 2009	Green pre 2009	Brown post 2009	Green post 2009
No firms	178	247	77	45
Total assets (in bn USD)	19.174	36.622	9.094	27.210
Sales (in bn USD)	14.978	5.765	3.292	17.905
E Score rel Total Qu	0.441	0.589	0.497	0.860
E Score rel worst firm	0.421	0.651	0.359	0.683
ESG Score rel Total Qu	0.453	0.534	0.617	0.783
ESG Score rel worst firm	0.478	0.596	0.501	0.631
Mode state	TX	CA	TX	CA
No firms Mode state	30	52	7	10
Mode GICS	Energy	Financials	Financials	IT
No firms Mode GICS	35	64	57	12

Cum Returns

Main Methodology: Institutional Investor level - pooled DiD

$$Port\ Proportion_{it} = \alpha_1 + \beta_1\, Treat_i + \beta_2\, Post_t + \beta_3\, TreatPost_{it} + InvestorFEs + QuarterFEs + \varepsilon_{it}$$

1. Time frame: Q1 2003 to Q1 2009, resp. Q1 2010 to Q4 2016, with quarterly observations
2. "$Port\ Proportion_{it}$" is the portfolio proportion in the defined green, respectively brown stocks, per institutional investor and quarter
3. Construct -3/+2 rolling event windows per quarter
4. "Control" investors must have no extreme weather event in full 6 period window
5. "Treated" investors must experience an extreme weather event on event quarter (t = 0) and may experience an event in the post event quarters
6. Aggregate relative event windows into panel dataset

More Detail

Results: Investors reduce green investments post 2009

Table: Extreme Weather Events death_events and Investor Reactions - green stocks

	(1)	(2)	(3)	(4)	(5)	(6)
	Green - pre 2009	Green - pre 2009	Green - pre 2009	Green - post 2009	Green - post 2009	Green - post 2009
TREATPOST	0.0756	0.0527	0.0622	-0.302***	-0.297***	-0.298***
	(0.0945)	(0.0959)	(0.0960)	(0.0663)	(0.0665)	(0.0665)
TREAT	-0.158	-0.0811	-0.0679	0.199**	0.326***	0.361***
	(0.0983)	(0.141)	(0.139)	(0.0903)	(0.111)	(0.110)
POST	-0.0450	0.112***	0.136***	0.0510***	-0.0218	-0.00268
	(0.0297)	(0.0403)	(0.0399)	(0.0173)	(0.0235)	(0.0233)
Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Investor F.E.	Yes	No	No	Yes	No	No
Type F.E.	No	Yes	No	No	Yes	No
Class F.E.	No	No	Yes	No	No	Yes
County F.E.	No	Yes	Yes	No	Yes	Yes
Cluster	Investor	Investor	Investor	Investor	Investor	Investor
R-Sq.	0.798	0.190	0.212	0.834	0.305	0.332
Obs.	139578	139578	139140	192570	192570	192054

Standard errors in parentheses. Significance Levels: *p<0.1; **p<0.05; ***p<0.01

Summary Stats | Event Total Damages | Event Total Damages G5m

Results: Investors increase brown investments post 2009

Table: Extreme Weather Events death_events and Investor Portfolio Proportions - brown stocks

	(1)	(2)	(3)	(4)	(5)	(6)
	Brown - pre 2009	Brown - pre 2009	Brown - pre 2009	Brown - post 2009	Brown - post 2009	Brown - post 2009
TREATPOST	-0.0144	-0.0227	-0.0185	0.281***	0.282***	0.278***
	(0.0844)	(0.0855)	(0.0853)	(0.0574)	(0.0573)	(0.0573)
TREAT	0.139	0.0855	0.0880	-0.227***	-0.272***	-0.261***
	(0.0927)	(0.123)	(0.123)	(0.0619)	(0.0679)	(0.0677)
POST	0.0258	0.0769**	0.0967***	-0.0289**	-0.0650***	-0.0641***
	(0.0268)	(0.0364)	(0.0360)	(0.0120)	(0.0140)	(0.0140)
Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Investor F.E.	Yes	No	No	Yes	No	No
Type F.E.	No	Yes	No	No	Yes	No
Class F.E.	No	No	Yes	No	No	Yes
County F.E.	No	Yes	Yes	No	Yes	Yes
Cluster	Investor	Investor	Investor	Investor	Investor	Investor
R-Sq.	0.803	0.211	0.214	0.717	0.316	0.316
Obs.	139578	139578	139140	192570	192570	192054

Standard errors in parentheses. Significance Levels: *p<0.1; **p<0.05; ***p<0.01

Summary Stats | Event Total Damages | Event Total Damages G5m

Sub-setting investors into three classes by Bushee (2001)

	Quasi Indexers (QIX)	Transient (TRA)	Dedicated (DED)
Time-horizon	Long-term	Short-term	Long-term
Diversification	high	high	lower (large average investments)
Turnover	low	high	low
Investment Style	Passive buy & hold	Short-term Value	Relationship Investment

Quasi Indexers and Transient investors drive the response

Table: Extreme Weather Events death_events and Investor Portfolio Proportions for investor classes

	(1) QIX	(2) TRA	(3) DED	(4) QIX	(5) TRA	(6) DED
	Green - post 2009	Green - post 2009	Green - post 2009	Brown - post 2009	Brown - post 2009	Brown - post 2009
TREATPOST	-0.193***	-0.119	-0.849	0.140**	0.251**	-0.0842
	(0.0739)	(0.123)	(0.513)	(0.0654)	(0.105)	(0.325)
TREAT	0.122	0.366**	0.694	-0.186***	-0.0931	0.353
	(0.104)	(0.182)	(0.822)	(0.0719)	(0.131)	(0.283)
POST	0.0185	0.0363	0.247	-0.0138	-0.0251	0.0468
	(0.0188)	(0.0375)	(0.156)	(0.0138)	(0.0240)	(0.0846)
Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Investor F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Investor	Investor	Investor	Investor	Investor	Investor
R-Sq.	0.857	0.637	0.768	0.766	0.547	0.830
Obs.	132720	53940	5394	132720	53940	5394

Standard errors in parentheses. Significance Levels: *p<0.1; **p<0.05; ***p<0.01

Event Total Damages | Event Total Damages G5m

Conclusion

- As climate change becomes a more prevalent topic in the society, institutional investors, particularly non-relationship ones, respond to extreme weather event shocks.
- In contrast to my initial hypothesis, they increase climate "harmful" investments and decrease climate "friendly" investments.
- Overall, institutional investors seem to be focused on short-term risk/return optimization.
- This arguable short-term focus possibly exposes clients to large long-term or tail risks while also hindering the transition to a low carbon economy