# Does the CDS market reflect the risk from regulatory climate disclosures?**

Julian Koelbel, Markus Leippold, Jordy Rillaerts, and Qian Wang

University of Zurich, Department of Banking and Finance

**Paper downloadable on SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3616324


NAT·
MDCCC
XXXIII
OB·
MDCCC
XCVI
ALFR·
NOBEL

Social Utility

Population

Net Growth

Productivity Factor

Technology Innovation

Discount Rate

Gross Output

Investment

Global Capital

Depreciation

Adaptation/ Abatement Costs

Consumption

Climate Damages

Emission Control

Fossile Fuels

Atmosphere

Surface Ocean

Temperature Change

Soil

Biodiversity

Deep Ocean

Social Utility

Population

Net Growth

Productivity Factor

Technology Innovation

Discount Rate

Gross Output

Investment

Global Capital

Depreciation

Adaptation/ Abatement Costs

Consumption

Climate Damages

Emission Control

Fossile Fuels

Atmosphere

Surface Ocean

Temperature Change

Soil

Biodiversity

Deep Ocean


Mid Peninsula
High School

Social Utility

Population

Net Growth

Productivity Factor

Technology Innovation

Discount Rate

Gross Output

Investment

Global Capital

Depreciation

Adaptation/ Abatement Costs

Consumption

Climate Damages

Emission Control

Fossile Fuels

Atmosphere

Surface Ocean

Temperature Change

Soil

Biodiversity

Deep Ocean

# Transition Risks

``Without effective disclosure of these risks, the financial impacts of climate change may not be correctly priced - and as the costs eventually become clearer, the potential for rapid adjustments could have destabilizing effects on markets.''

**``Climate change has become a defining factor in companies' long-term prospects […] The evidence on climate risk is compelling investors to reassess core assumptions about modern finance. […] Disclosure should be a means to achieving a more sustainable and inclusive capitalism.''**

Sincerely,

**Larry Fink**

*Chairman and Chief Executive Officer*

› **Read more**

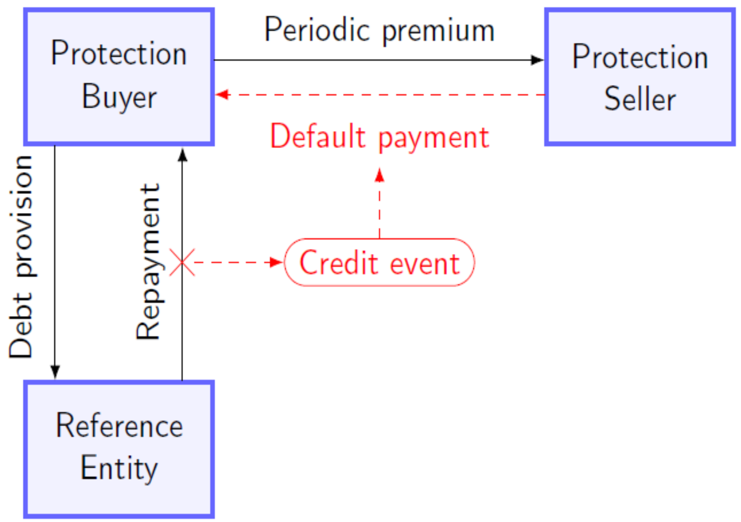
University of Zurich[UZH]

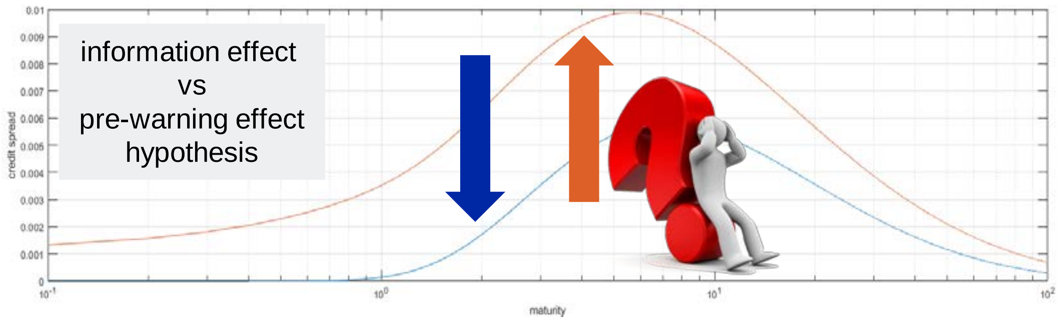
Department of Banking and Finance

# Our research question:

- Companies are exposed to climate change \`Climate Risk‘:
  - **Physical** *and* **transitional** risk.
  - Possible effect on future cash-flows, affecting **credit risk**.
- **Regulatory climate-risk disclosure** (SEC, 10-K filings):
  - 2006: Introduction of risk factors (Item 1A)
  - 2010: Guidance report on climate-change risk
- **Do investors in the CDS market account for climate risk based on regulatory disclosure information? And if so, how?**

A quick refresher on CDS:



# Our contribution

1. We introduce a novel climate risk score (**Climate Risk**) using **BERT** (Bidirectional Encoder Representations from Transformers), developed by Devlin et al. (2019).
   - We show that the technique significantly improves upon traditional NLP methods, contributing to a small but growing literature that uses artificial intelligence to identify climate-relevant information in text data.
2. We provide evidence that **CDS spreads are responsive to regulatory climate-risk disclosures**, at least in industries where climate risks are expected to be material. Hence, **disclosed climate risks are priced in the CDS market.**
3. Only **transition risks** are being priced, but not the **physical risks** of climate change.
   - The price effect of transition risk increased with the **Paris Climate Accord of 2015**.
   - The **absence of priced physical risks** may indicate a blind spot for companies, investors, and regulators.
   - The effect of transition risk is not only statistically but also **economically significant**: after Paris, the increase in the 5-year CDS spread is **5%** on average.

# Related Literature

- Growing evidence that **transition risks** are priced, especially risks associated with a firm's **carbon emissions** level, as these firms are most likely to be subjected to future regulation.
  - Equity prices worldwide contain a "carbon premium“ (Bolton and Kacperczyk, 2020).
  - Option prices indicate greater risk for firms with carbon-intensive business models (Ilhan et al., 2019).

- **Physical risks** are less explored, and there is still much uncertainty whether they are incorporated into prices.
  - Flood risk affects real estate prices under certain conditions (Baldauf et al., 2020).
  - Risks related to drought seem to have no impact on the stock prices of food companies (Hong et al., 2017).

- **Hedging climate risk news**: Engle et al. (2020) dynamically hedge climate change risk. We extract innovations from climate news series that we construct through textual analysis of newspapers.

# Methodology

# Analyzing climate risk disclosure with algorithms

- **Previous approaches:**
  - Traditional approaches from NLP are based on a **pre-defined list of presumably relevant word**s and then search for these words within the documents (Typically: **bag-of-words approac**hes).
  - As a remedy, we can represent each word by a multi-dimensional vector to learn **similarities** between them (measured as Euclidian distance).
  - While word-embeddings are already a significant improvement on bag-of-words, they still do not account for context (e.g., negotiations cannot be interpreted).
  - Climate disclosure initiative by **CERES** and **CookESG Research** offers a climate score based on rule-based text analysis with an iteratively constructed keyword dictionary.
  - Other research has used this score and interpreted it as "**climate risk**" (See, e.g., Berkmann et al., 2019).

University of Zurich[UZH]

Department of Banking and Finance

# Using deep algorithms

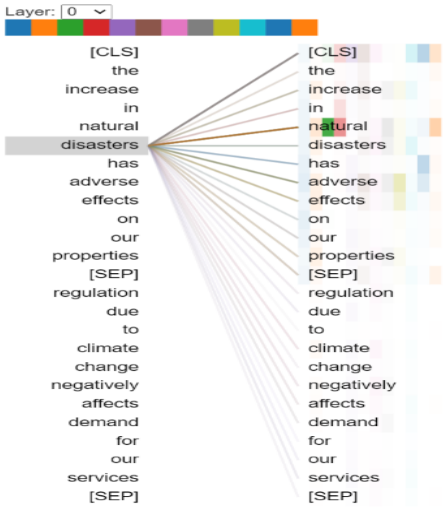
– **Our approach:**

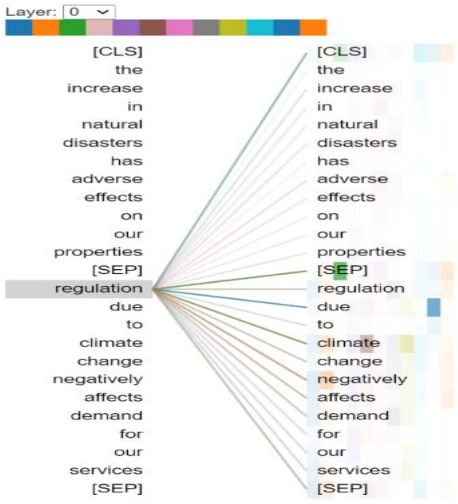
  – Recently, we have witnessed enormous progress in text understanding with the introduction of pre-trained neural language models like BERT.

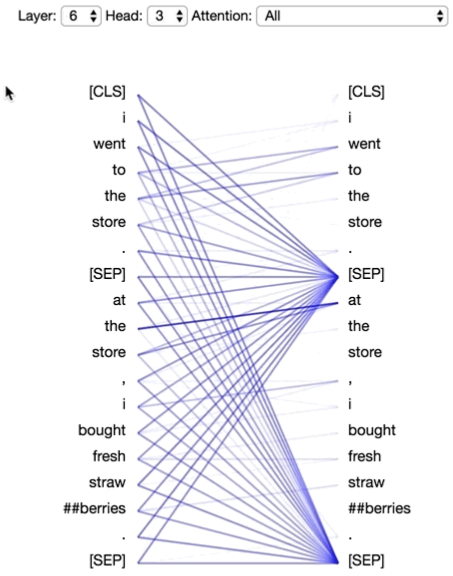
  – Unlike traditional word embedding, **BERT is a contextual model**, i.e., the representation of a word is a function of the entire input text, respecting the word dependencies and sentence structures.

  – Contextual neural language models like BERT have outperformed traditional word embeddings on various NLP tasks.

  – Motivated by these new achievements, we intend to leverage BERT to provide a deeper text understanding of climate-risk relevant sentences in the 10-K reports.

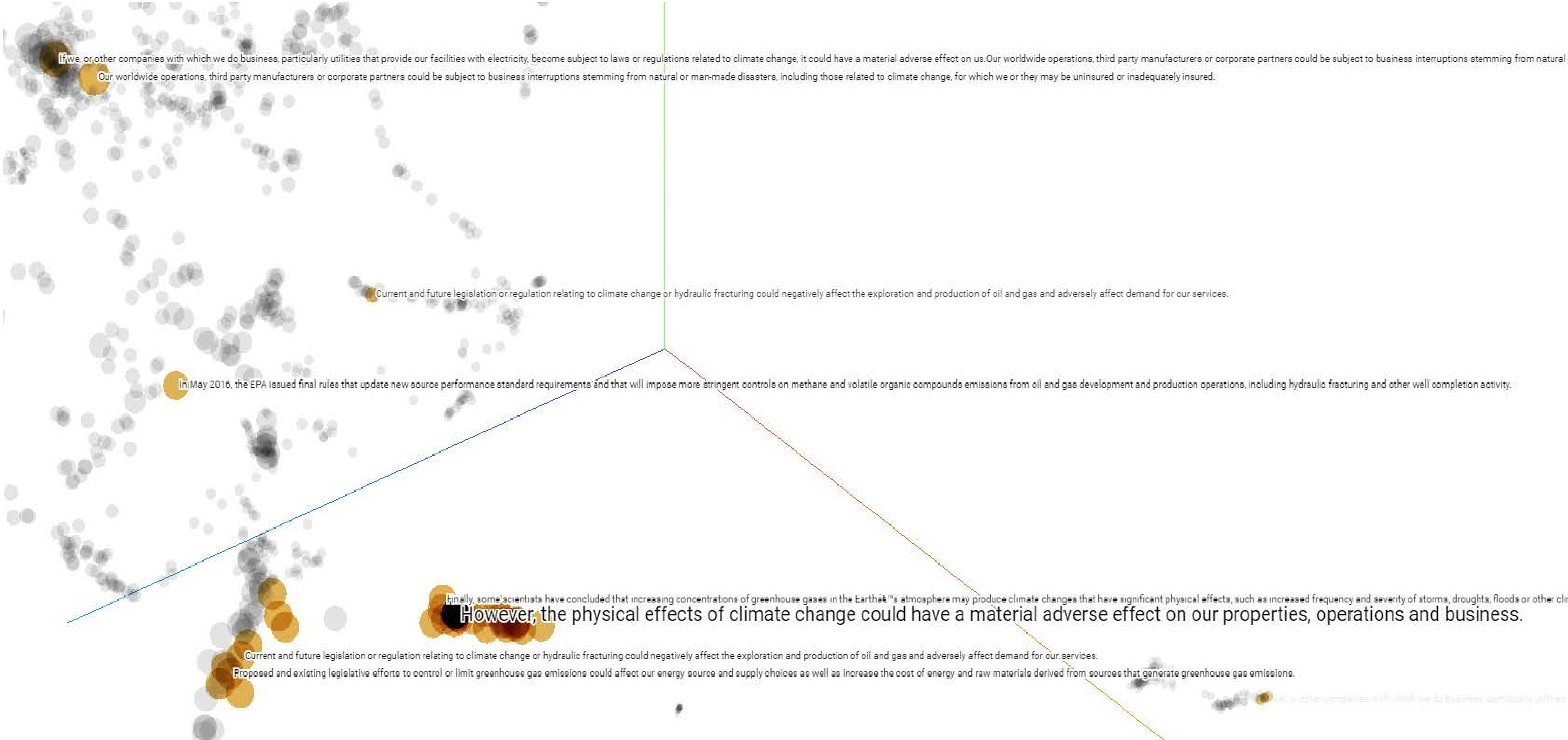


University of Zurich[UZH]

**Department of Banking and Finance**



# Analyzing BERT

- **Defining tasks**
  - Check whether **climate-relevant topics are mentioned** in Item 1.A (CN task).
  - Assess whether climate-related topics are concerned about **physical or transitional risks** (TP task).
  - Each of the methods above gives us raw scores for each sentence of the SEC filings.
- **Test data:**
  - As a source for our training set, we use the sample reports provided in the TCFD guidelines, which gives us almost a thousand examples (sentences) for the TP and CN tasks.
  - We further collect random sentences that are not climate-related. We then feed the data to our model and train the model for a few epochs.
  - Next, we run the trained model on the 10-K data set and collect the most confusing examples for the current model on which we perform active learning.
  - We end up with 2,506 data points.

| | CN Task | | TP Task | |
|---|---|---|---|---|
| **Model** | **Acc** | **F1** | **Acc** | **F1** |
| Baseline | 81.07 | 82.03 | 58.60 | 48.60 |
| BERT-Single | 94.17 | 94.07 | **90.78** | **90.27** |
| BERT-Multitask | 98.06 | 98.02 | 85.44 | 82.36 |
| BERT-GCE | 94.17 | 94.07 | 90.29 | 89.68 |
| BERT-Multi-GCE | **99.51** | **99.50** | 89.81 | 88.45 |

# Results

## Data

- CDS spreads for February 2010 to December 2018, six months to 30 years.
- Macroeconomic and firm-specific variables as controls, following prior literature (Collin-Dufresne et al., 2001; Ericsson et al., 2009; Han and Zhou, 2015).
- We end up with observations for 447 different CDS contracts.
- We collect the CookESG score from the corresponding website.

## Baseline regression

$$\Delta S^{m}_{i,t+1} = \beta \Delta CR_{i,t} + \Phi \Delta X_{i,t} + \Theta \Delta Y_t + \epsilon_{i,t+1}$$

- It was our expectation that climate risks, as disclosed in regulatory filings, driv up CDS spreads, given that a greater exposure to risk should increase the ris premia required by investors.
- However, both climate-risk measures are not significantly affecting CDS spreads.

| | (I) $\Delta S^{5Y}$ | (II) $\Delta S^{5Y}$ |
|---|---|---|
| $\Delta CookESG$ | $-0.002$ | |
| | (0.015) | |
| $\Delta ClimateRisk$ | | 11.232 |
| | | (7.930) |
| $\Delta BC$ | $-0.281^{***}$ | $-0.266^{***}$ |
| | (0.060) | (0.059) |
| $\Delta IR$ | $25.451^{***}$ | $25.312^{***}$ |
| | (5.697) | (5.415) |
| $\Delta IR2$ | $-5.086^{***}$ | $-5.080^{***}$ |
| | (1.152) | (1.086) |
| $\Delta Lev$ | $2.466^{***}$ | $2.427^{***}$ |
| | (0.299) | (0.302) |
| $\Delta ROA$ | 0.121 | 0.139 |
| | (0.108) | (0.113) |
| $\Delta Vol$ | $2.983^{*}$ | 2.440 |
| | (1.716) | (1.569) |
| No. Observations | 41288 | 39224 |
| R-squared | 0.041 | 0.040 |

# Adjusting for materiality

- SASB's materiality map creates a unique materiality profile for each industry.
- Based on the U.S. Supreme Court definition of materiality, it groups companies according to their similarities in their resource intensity and sustainability risks and opportunities.
- The materiality map identifies 26 sustainability-related business issues that are likely to affect the financial conditions or operating performance of companies within an industry.
- From those 26 issues, seven are climate risk-related.

| | (I) Non-Mat $\Delta S^{5Y}$ | (II) Mat $\Delta S^{5Y}$ | (III) Non-Mat $\Delta S^{5Y}$ | (IV) Mat $\Delta S^{5Y}$ |
|---|---|---|---|---|
| $\Delta CookESG$ | $0.101^{*}$ | $-0.015^{***}$ | | |
| | (0.056) | (0.006) | | |
| $\Delta ClimateRisk$ | | | $-12.417$ | $30.329^{***}$ |
| | | | (9.797) | (10.049) |
| $\Delta BC$ | $-0.289^{***}$ | $-0.267^{***}$ | $-0.270^{***}$ | $-0.267^{***}$ |
| | (0.076) | (0.074) | (0.076) | (0.074) |
| $\Delta IR$ | $27.081^{***}$ | $21.005^{**}$ | $27.164^{***}$ | $19.819^{**}$ |
| | (6.854) | (9.500) | (6.493) | (9.277) |
| $\Delta IR2$ | $-5.657^{***}$ | $-3.503^{**}$ | $-5.685^{***}$ | $-3.335^{**}$ |
| | (1.393) | (1.675) | (1.306) | (1.642) |
| $\Delta Lev$ | $2.217^{***}$ | $3.069^{***}$ | $2.167^{***}$ | $3.043^{***}$ |
| | (0.346) | (0.521) | (0.349) | (0.513) |
| $\Delta ROA$ | 0.013 | $0.603^{*}$ | 0.035 | 0.581 |
| | (0.097) | (0.357) | (0.105) | (0.358) |
| $\Delta Vol$ | $3.700^{**}$ | 0.583 | $3.051^{*}$ | 0.473 |
| | (1.862) | (4.775) | (1.636) | (4.968) |
| No. Observations | 30959 | 10329 | 29252 | 9972 |
| R-squared | 0.033 | 0.070 | 0.032 | 0.068 |

# Impact of the Paris Agreement 2015


COP21 · CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

| | (I) All $\Delta S^{5Y}$ | (II) Non-Mat $\Delta S^{5Y}$ | (III) Mat $\Delta S^{5Y}$ | (IV) All $\Delta S^{5Y}$ | (V) Non-Mat $\Delta S^{5Y}$ | (VI) Mat $\Delta S^{5Y}$ |
|---|---|---|---|---|---|---|
| $\Delta CookESG$ | −0.003 | 0.081 | −0.004 | | | |
| | (0.010) | (0.060) | (0.008) | | | |
| $\Delta CookESG \times Post$ | 0.006 | 0.059 | −0.038 | | | |
| | (0.026) | (0.038) | (0.033) | | | |
| $\Delta ClimateRisk$ | | | | −6.596 | −9.921 | 1.590 |
| | | | | (13.130) | (8.277) | (16.029) |
| $\Delta ClimateRisk \times Post$ | | | | 56.530 | −6.965 | 110.049** |
| | | | | (39.822) | (13.790) | (53.656) |
| $\Delta Post$ | 8.532*** | 5.425*** | 20.196* | 2.965 | 6.822*** | −9.479* |
| | (2.603) | (1.505) | (11.990) | (2.733) | (2.145) | (5.636) |
| $\Delta BC$ | −0.272*** | −0.282*** | −0.248*** | −0.256*** | −0.263*** | −0.244*** |
| | (0.059) | (0.076) | (0.066) | (0.058) | (0.076) | (0.064) |
| $\Delta IR$ | 27.119*** | 28.287*** | 24.173** | 26.953*** | 28.383*** | 22.268** |
| | (5.893) | (6.992) | (10.673) | (5.611) | (6.625) | (10.291) |
| $\Delta IR2$ | −5.356*** | −5.853*** | −4.030** | −5.342*** | −5.882*** | −3.720** |
| | (1.178) | (1.416) | (1.854) | (1.113) | (1.328) | (1.792) |
| $\Delta Lev$ | 2.453*** | 2.206*** | 3.047*** | 2.419*** | 2.156*** | 3.046*** |
| | (0.298) | (0.345) | (0.518) | (0.301) | (0.348) | (0.508) |
| $\Delta ROA$ | 0.120 | 0.012 | 0.598* | 0.138 | 0.035 | 0.569 |
| | (0.108) | (0.097) | (0.360) | (0.113) | (0.105) | (0.367) |
| $\Delta Vol$ | 2.706 | 3.508* | −0.249 | 2.112 | 2.868* | −0.780 |
| | (1.679) | (1.829) | (4.511) | (1.511) | (1.605) | (4.370) |
| No. Observations | 41288 | 30959 | 10329 | 39224 | 29252 | 9972 |
| R-squared | 0.041 | 0.033 | 0.073 | 0.042 | 0.033 | 0.076 |

# Transition and/or physical climate risk?

- The interplay between transition risks and physical risks is critical in understanding the impact of climate change on the performance of companies across sectors and geographies.
- Strong regulatory actions may avoid the worst physical impacts of climate change in the longer term, but at the same time endanger firms that are affected by the regulation in the short term.
- Are these two components of climate risk perceived differently by investors in the CDS market?

| | (I) All $\Delta S^{5Y}$ | (II) Non-Mat $\Delta S^{5Y}$ | (III) Mat $\Delta S^{5Y}$ |
|---|---|---|---|
| $\Delta Physical$ | 7.305 | 2.900 | 17.304 |
| | (10.253) | (12.339) | (14.276) |
| $\Delta Transition$ | 1.645 | −5.567 | 0.548 |
| | (17.075) | (13.477) | (19.797) |
| $\Delta Physical \times Post$ | −25.009 | −26.051 | 12.901 |
| | (31.509) | (24.749) | (103.051) |
| $\Delta Transition \times Post$ | 87.157* | 6.839 | 135.017*** |
| | (44.752) | (15.148) | (50.174) |
| $\Delta Post$ | 3.935 | 6.903*** | −8.076 |
| | (2.453) | (2.083) | (5.748) |
| $\Delta Lev$ | 2.417*** | 2.156*** | 3.046*** |
| | (0.300) | (0.348) | (0.505) |
| $\Delta ROA$ | 0.138 | 0.035 | 0.571 |
| | (0.113) | (0.105) | (0.370) |
| $\Delta Vol$ | 2.087 | 2.866* | −0.793 |
| | (1.502) | (1.603) | (4.361) |
| $\Delta IR$ | 26.947*** | 28.388*** | 22.474** |
| | (5.611) | (6.637) | (10.192) |
| $\Delta IR2$ | −5.341*** | −5.884*** | −3.746** |
| | (1.113) | (1.329) | (1.785) |
| $\Delta BC$ | −0.256*** | −0.263*** | −0.246*** |
| | (0.058) | (0.076) | (0.063) |
| No. Observations | 39224 | 29252 | 9972 |
| R-squared | 0.042 | 0.033 | 0.076 |

# Climate-risk timing

| | (I) All $\Delta Y^{5Y,1Y}$ | (II) All $\Delta Y^{5Y,1Y}$ | (III) Non-Mat $\Delta Y^{5Y,1Y}$ | (IV) Mat $\Delta Y^{5Y,1Y}$ | (V) All $\Delta Y^{10Y,5Y}$ | (VI) All $\Delta Y^{10Y,5Y}$ | (VII) Non-Mat $\Delta Y^{10Y,5Y}$ | (VIII) Mat $\Delta Y^{10Y,5Y}$ |
|---|---|---|---|---|---|---|---|---|
| $\Delta ClimateRisk$ | 9.510 | −1.193 | 3.333 | 1.863 | 0.053 | 2.258 | −1.687 | 5.238* |
| | (6.267) | (11.359) | (7.891) | (15.958) | (1.673) | (1.942) | (2.741) | (2.738) |
| $\Delta ClimateRisk \times Post$ | | 33.765 | −8.610 | 59.734* | | −7.104 | −1.914 | −12.294* |
| | | (22.292) | (10.554) | (32.025) | | (4.667) | (4.313) | (7.151) |

| | (I) All $\Delta Y^{5Y,1Y}$ | (II) All $\Delta Y^{5Y,1Y}$ | (III) Non-Mat $\Delta Y^{5Y,1Y}$ | (IV) Mat $\Delta Y^{5Y,1Y}$ | (V) All $\Delta Y^{10Y,5Y}$ | (VI) All $\Delta Y^{10Y,5Y}$ | (VII) Non-Mat $\Delta Y^{10Y,5Y}$ | (VIII) Mat $\Delta Y^{10Y,5Y}$ |
|---|---|---|---|---|---|---|---|---|
| $\Delta Physical$ | 0.524 | −2.974 | 7.750 | −13.458 | −2.310 | −0.163 | −1.689 | 2.114 |
| | (9.037) | (17.673) | (8.224) | (39.270) | (1.929) | (3.201) | (3.909) | (5.164) |
| $\Delta Transition$ | 20.049** | 8.538 | 16.166 | 6.894 | 0.846 | 2.760 | −1.291 | 4.737 |
| | (8.208) | (11.157) | (13.829) | (12.470) | (2.695) | (2.454) | (4.263) | (3.366) |
| $\Delta Physical \times Post$ | | 3.236 | −22.647* | 78.191 | | −4.872 | −0.878 | −18.916 |
| | | (31.971) | (13.309) | (104.612) | | (7.121) | (6.573) | (21.072) |
| $\Delta Transition \times Post$ | | 46.846** | 1.101 | 60.158** | | −7.522 | −0.763 | −11.306* |
| | | (22.468) | (13.614) | (23.686) | | (4.951) | (8.164) | (5.933) |

# Long-term effects

- Transition risks still play a role for long-term horizons.
- Physical risks remain unaccounted for.
- Would not be in line with the information-effect hypothesis.
- Supports the pre-warning effect hypothesis.

| | (I) All $\Delta S^{10Y}$ | (II) Mat $\Delta S^{10Y}$ | (III) All $\Delta S^{10Y}$ | (IV) Mat $\Delta S^{10Y}$ | (V) All $\Delta S^{30Y}$ | (VI) Mat $\Delta S^{30Y}$ | (VII) All $\Delta S^{30Y}$ | (VIII) Mat $\Delta S^{30Y}$ |
|---|---|---|---|---|---|---|---|---|
| $\Delta ClimateRisk$ | −4.350 | 6.844 | | | −2.942 | 7.044 | | |
| | (12.266) | (16.194) | | | (11.794) | (16.183) | | |
| $\Delta ClimateRisk \times Post$ | 49.426 | 97.765** | | | 42.587 | 86.793** | | |
| | (36.487) | (49.591) | | | (32.731) | (44.101) | | |
| $\Delta Physical$ | | | 7.062 | 19.490 | | | 7.140 | 20.953 |
| | | | (9.155) | (13.909) | | | (9.147) | (13.802) |
| $\Delta Transition$ | | | 4.423 | 5.288 | | | 5.697 | 4.723 |
| | | | (17.073) | (20.791) | | | (17.402) | (21.181) |
| $\Delta Physical \times Post$ | | | −29.841 | −5.912 | | | −32.245 | −15.442 |
| | | | (27.662) | (85.884) | | | (26.849) | (81.507) |
| $\Delta Transition \times Post$ | | | 79.626* | 123.703** | | | 71.454* | 112.892** |
| | | | (41.886) | (48.843) | | | (37.627) | (43.981) |
| $\Delta Post$ | 4.613 | −6.190 | 5.501** | −4.699 | 5.149* | −4.597 | 5.944** | −3.282 |
| | (2.809) | (5.816) | (2.582) | (5.810) | (2.837) | (5.573) | (2.677) | (5.736) |
| $\Delta BC$ | −0.260*** | −0.262*** | −0.260*** | −0.265*** | −0.261*** | −0.270*** | −0.261*** | −0.273*** |
| | (0.053) | (0.049) | (0.053) | (0.049) | (0.050) | (0.044) | (0.050) | (0.043) |
| $\Delta IR$ | 28.064*** | 27.019** | 28.056*** | 27.263** | 30.483*** | 32.129** | 30.474*** | 32.366** |
| | (5.500) | (12.602) | (5.501) | (12.506) | (5.434) | (12.883) | (5.436) | (12.779) |
| $\Delta IR2$ | −5.441*** | −4.704** | −5.440*** | −4.735** | −5.936*** | −5.693** | −5.935*** | −5.723** |
| | (1.073) | (2.168) | (1.074) | (2.161) | (1.103) | (2.261) | (1.104) | (2.254) |
| $\Delta Lev$ | 2.275*** | 2.902*** | 2.274*** | 2.903*** | 2.201*** | 2.832*** | 2.200*** | 2.833*** |
| | (0.271) | (0.461) | (0.271) | (0.458) | (0.258) | (0.445) | (0.258) | (0.442) |
| $\Delta ROA$ | 0.074 | 0.469 | 0.075 | 0.472 | 0.061 | 0.502 | 0.061 | 0.505 |
| | (0.096) | (0.347) | (0.096) | (0.349) | (0.096) | (0.370) | (0.096) | (0.372) |
| $\Delta Vol$ | 1.345 | −3.548 | 1.319 | −3.565 | 1.414 | −4.575 | 1.389 | −4.596 |
| | (1.368) | (4.014) | (1.361) | (4.003) | (1.339) | (4.059) | (1.333) | (4.046) |
| No. Observations | 39224 | 9972 | 39224 | 9972 | 39224 | 9972 | 39224 | 9972 |
| R-squared | 0.043 | 0.074 | 0.044 | 0.074 | 0.042 | 0.067 | 0.042 | 0.067 |

# Robustness Check

- Previous studies use carbon emissions as proxy for transition risk.
- We use Scope 1-3 emissions, scaled by total revenues.
- Over the whole period, only Scope123 and Scope123-Rev showed significant but negative effects.
- Performing the post-Paris analysis, results become more reasonable but hardly significant.
- We also use an emission score provided by Asset4.

| | (I) Non-Mat $\Delta S^{5Y}$ | (II) Mat $\Delta S^{5Y}$ | (III) All $\Delta S^{5Y}$ | (IV) Non-Mat $\Delta S^{5Y}$ | (V) Mat $\Delta S^{5Y}$ |
|---|---|---|---|---|---|
| $\Delta Scope123-Rev$ | −0.006 | 0.002* | 0.001 | −0.005 | 0.003 |
| | (0.004) | (0.001) | (0.001) | (0.004) | (0.002) |
| $\Delta Scope123-Rev \times Post$ | | | 0.000 | −0.001 | −0.002 |
| | | | (0.001) | (0.002) | (0.002) |
| $\Delta Post$ | | | 7.969* | 4.967** | 19.410 |
| | | | (4.481) | (2.470) | (16.797) |
| $\Delta BC$ | −0.104* | −0.237*** | −0.129*** | −0.098* | −0.214*** |
| | (0.055) | (0.082) | (0.047) | (0.054) | (0.067) |
| $\Delta IR$ | 24.310*** | 34.886*** | 29.323*** | 25.275*** | 38.199*** |
| | (7.185) | (11.187) | (6.411) | (7.230) | (12.474) |
| $\Delta IR2$ | −4.756*** | −6.898*** | −5.713*** | −4.915*** | −7.455*** |
| | (1.660) | (1.996) | (1.373) | (1.671) | (2.209) |
| $\Delta Lev$ | 1.871*** | 2.424*** | 2.053*** | 1.862*** | 2.412*** |
| | (0.365) | (0.553) | (0.310) | (0.366) | (0.549) |
| $\Delta ROA$ | 0.226 | 0.775** | 0.408** | 0.223 | 0.765** |
| | (0.184) | (0.327) | (0.173) | (0.184) | (0.333) |
| $\Delta Vol$ | 5.610* | 6.878 | 5.333** | 5.309* | 5.561 |
| | (3.258) | (4.199) | (2.487) | (3.201) | (3.581) |
| No. Observations | 13423 | 5459 | 18882 | 13423 | 5459 |
| R-squared | 0.028 | 0.064 | 0.039 | 0.029 | 0.070 |

# Conclusion

- **Novel metric** of climate risk based on mandatory disclosure
- CDS spreads are responsive to **regulatory climate-risk disclosures**
- Only **transition risks are being priced, not the physical risks**.
- At the same time, our results leave open whether the SEC's current approach has enough bite for adequate disclosure for physical risks.
- NLP continues to evolve rapidly. By now, there are already more powerful approaches available than BERT (e.g., GPT3).


# Next Steps

- Making the ClimateRisk scores publicly available.
- Extending the algorithm to rate voluntary disclosures along the TCFD guidelines.
- Generate fact-checking algorithms in the climate-science and climate-finance space.