Climate Risks and Market Efficiency
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Major comments

• I like this paper!
Global temperature

![Graph showing global mean temperature estimates based on land and ocean data. The graph includes a line for annual mean and a red line for Lowess smoothing, with data spanning from 1880 to 2020. The trend indicates a gradual increase in temperature anomalies over time.](image-url)
I like this paper!

• A very important topic
• Interesting findings
• What affects long-run discount rates?
  – Giglio, Maggiori, and Stroebel (2015)
  – Giglio, Maggiori, Stroebel, and Weber (2017)
  – …
• Careful empirical implementation
• Very well written
Other comments

• I will be critical here (maybe overly so), because
  – I like the paper
  – A very important topic: long-term wellfare of human being and beyond
  – It has significant policy relevance
Small sample problems

- A small cross-section: 31 countries
- Highly persistent independent variable
- In portfolio analysis:
  - 6 countries vs. 6 countries

<table>
<thead>
<tr>
<th>Quintile 1</th>
<th>Quintile 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peru (19 firms)</td>
<td>New Zealand (13 firms)</td>
</tr>
<tr>
<td>Israel (20 firms)</td>
<td>Mexico (11 firms)</td>
</tr>
<tr>
<td>Japan (77 firms)</td>
<td>Australia (28 firms)</td>
</tr>
<tr>
<td>Poland (21 firms)</td>
<td>Canada (15 firms)</td>
</tr>
<tr>
<td>Philippines (11 firms)</td>
<td>South Korea (39 firms)</td>
</tr>
</tbody>
</table>
Small sample problems: can we do better?

• Not much
  – A second world? Wait for another 30 years?
  – Parallel trends?

• More transparency in reporting
  – Disaggregate the middle three quintiles
  – Scatterplot? Driven by any single country?

• Other systematic differences between quintile 1 and 5 countries?
  – The placebo test is useful.
  – Matching sample?
  – Any systematic difference in subsidy to drought?
Estimating the trends

• The measure of trends adopted in this paper is $b_i$ from the below equation.

\[ PDSI_{i,t} = a_i + b_i t + c_i PDSI_{i,t-1} + \epsilon_{i,t} \]

\[ y_t = \beta_0 + \beta_1 t + \alpha y_{t-1} + \epsilon_t \quad (1) \]
Estimating the trends

\[ y_t = \beta_0 + \beta_1 t + \alpha y_{t-1} + \varepsilon_t \quad (1) \]

- This is a standard AR(1) model with a deterministic time trend. We see this very often, at least when we do the Dickey-Fuller unit root test
  - If \( b_1 = 0, \alpha < 1 \) suggests \( y_t \) is stationary around a constant
  - If \( b_1 \neq 0, \alpha < 1 \) suggests \( y_t \) is stationary around a linear time trend
- However, \( \beta_1 \) is not equal to the time trend.
Estimating the trends

\[ y_t = \beta_0 + \beta_1 t + \alpha y_{t-1} + \varepsilon_t \]  \hspace{1cm} (1)

- An equivalent DGP: the trend plus noise model

\[
\begin{aligned}
    y_t &= m_t + u_t \quad (2A) \\
    u_t &= \rho u_{t-1} + e_t \quad (2B) \\
    m_t &= \delta_0 + \delta_1 t \quad (2C)
\end{aligned}
\]

- Relation between E(1) and E(2)

\[ \beta_0 = (1 - \rho)\delta_0 + \rho \delta_1 \quad \delta_1 \text{ measures the trend, not } \beta_1! \]

\[ \beta_1 = (1 - \rho)\delta_1 \]

\[ \alpha = \rho \]

\[ \delta_1 = \frac{\beta_1}{1 - \alpha} \]
Estimating the trends

\[ \delta_1 \text{ measures the trend, not } \beta_1! \]

\[ \delta_1 = \frac{\beta_1}{1 - \alpha} \]

- **Good news**
  - \( \delta_1 \) and \( \beta_1 \) are positively correlated
  - The results are robust to some alternative measures

- **Bad news**
  - \( \alpha \) is close to 1.
Estimating the trends

• Are the “estimated time trends” persistent?
  – Compare the pre-1985 period and the post-1985 period?

• Structural breaks?
  – Global warming
  – Ignoring pre-WWII data in trend estimation?
Economic magnitude

- Difference between quintile 1 and 5
  - Annual alpha: 7%
  - $\Delta$ROA: 0.35%-0.5% per year
  - Highly persistent
  - Uncorrelated with PB
  - Leverage? ...

- Calibration?
  - Gordon growth formula: $\frac{P}{B} = \frac{ROE}{r-g}$?
Economic magnitude

• Three-year cumulative ROA diff-in-diff is around 1%
• 30 years, this is 10%
• How likely that the markets do not understand this?
Economic magnitude

• The contemporaneous effect of shock in drought?
  – profit
  – returns

• Assuming a quadratic loss function, the minimum mean squared error of the 1-step ahead forecast of $y_t$, is

$$y_{t+1|t} = [\beta_0 + \beta_1 (1 + t)] + \alpha y_t$$
Policy

• The public-listed sector of FOOD firms is representative?
• Maybe long-run drought has different effects on privately-traded firms (younger and innovative, etc.)
  – Water reservoir etc.
• Data on the overall FOOD/agricultural output at country level?
Others

• What is the best measure of profitability?
  – Returns to equity holders? ROE?
  – Operating profit vs. net income? Subsidy?
• Winsorize returns? Why?
• Change of ROA
  – Fixing the composition of firms
• PDSI does not account for snow or ice (assuming precipitation is immediately available)
  – Change in glacier cannot explain why Peru had negative trend in PDSI
Conclusions: I like this paper!

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