CLIMATE RISKS: THEORY AND PRACTICE

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Outline

1. Macroeconomic Stability
2. Financial Stability
3. Measuring Climate Risk Exposure
1990s: Positive supply shocks

• Globalization
  • Peace dividend: Berlin Wall and Soviet Union
  • Goods trade: Opening of China and the WTO
  • Factor mobility: Migration and capital flows

• Diffusion and Growth of Information Technology
  • Plummeting costs and miniaturization
  • Mobile communication and internet

Reduced pressure to trade off inflation and growth.
2020s-30s: Adverse supply shocks

- Globalization in reverse
  - Heightened security concerns
  - Supply chain resilience
  - Immigration and capital flows constraints
- Climate change
- Demographic change

We need large investment just to do what we are doing now!

Creates difficult tradeoffs.
Financial Stability and Climate Risk

• Financial instability: sudden and typically unforeseen
• Climate change: gradual and largely foreseeable

Difficult to see connection
Financial Stability and Climate Risk

• Financial instability: sudden and typically unforeseen
• Climate change: gradual and largely foreseeable

Possible connection:

• Markets underprice (physical and transition) climate risk
• Severely adverse climate events trigger
  • Sudden repricing of climate-sensitive assets
  • Losses to exposed intermediaries

Difficult to see connection
Measuring systemic risk

• Severely adverse macroeconomic events
• Climate-related events

• Conventional stress tests
  • Develop severely adverse scenarios
  • Measure impact on capitalization

Authorities are not developing sudden climate stress scenarios.
SRISK and CRISK

• Real-time stress tests using daily market prices
• SRISK:
  • Losses from 40% decline of global equities over 6 months
  • Measure capital loss from impact on market value of equity using conditional market $\beta$

• CRISK:
  • 50% loss in return on stranded asset portfolio over 6 months
  • Measure capital loss using conditional climate $\beta$

NYU Stern V-Lab computes both using publicly available data
SRISK and CRISK

\[ CRISK_{it} + SRISK_{it} = E[k(D_{it} + MV_{it}) - MV_{it} \mid R_M = -40\%, R_C = -50\%] \]

\[ = E[kD_{it} - MV_{it} (1 - k - 40\% \beta^M_{it} - 50\% \beta^C_{it})] \]

- \( k \) = the unweighted leverage ratio benchmark (8% for US banks)
- \( MV \) = market capitalization of the bank
- \( D \) = debt liabilities of the bank
- \( \beta^M_{it} \) = conditional market beta
- \( \beta^C_{it} \) = conditional climate beta

C&SRISK change with changes in:
1) Market value of equity
2) Debt outstanding
3) Conditional correlation with market
4) Conditional correlation with climate stress
SRISK + CRISK: US intermediaries ranked by shortfall

Climate risk appears to be a small source of systemic risk.

Note: Baseline is shortfall from 8% leverage ratio. Source: NYU Stern V-Lab.
Climate shock: California Camp Fire, Nov 2018

Large response to severely adverse climate-related event.

Impact is primarily on US intermediaries (black).

Impact largely on firms with big capital buffers.

Source: NYU Stern V-Lab.
Conclusions

• Short-run challenge:
  • The 1990s running in reverse creates difficult tradeoffs
  • Climate is only one of numerous short-run challenges

• Financial stability
  • Adverse climate events may create sudden asset price declines
  • Use market information for real-time climate stress testing
  • Look at severely adverse climate events to see if firms have big enough buffers
  • Virtually costless climate stress tests available for all publicly traded intermediaries
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SRISK and CRISK

• Expected capital shortfall given a severe event
• Depends on institution’s correlations with
  • Global market
  • Climate factor (stranded asset portfolio)
What about Hurricane Ian?

September 2022:

CRISK changes big & global (grey bars are non-U.S.)

But this mixes
1) Impact of Ian
2) Fossil fuel price declines (which drive up CRISK)

Source: NYU Stern V-Lab.