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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

Output ⇑
Inflation ⇓

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

Output ⇓
Inflation ⇑

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

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Possible connection:

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

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 <u>sudden</u> 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 β
- CRISK:
  - 50% loss in return on stranded asset portfolio over 6 months
  - Measure capital loss using *conditional* climate β

NYU Stern V-Lab computes both using publicly available data

SRISK and CRISK

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

$$= E[kD_{it} - MV_{it}(1 - k - 40\%\beta_{it}^{M} - 50\%\beta_{it}^{C})]$$

k = the unweight leverage ratio benchmark (8% for US banks)

MV = market capitalization of the bank

D = debt liabilities of the bank

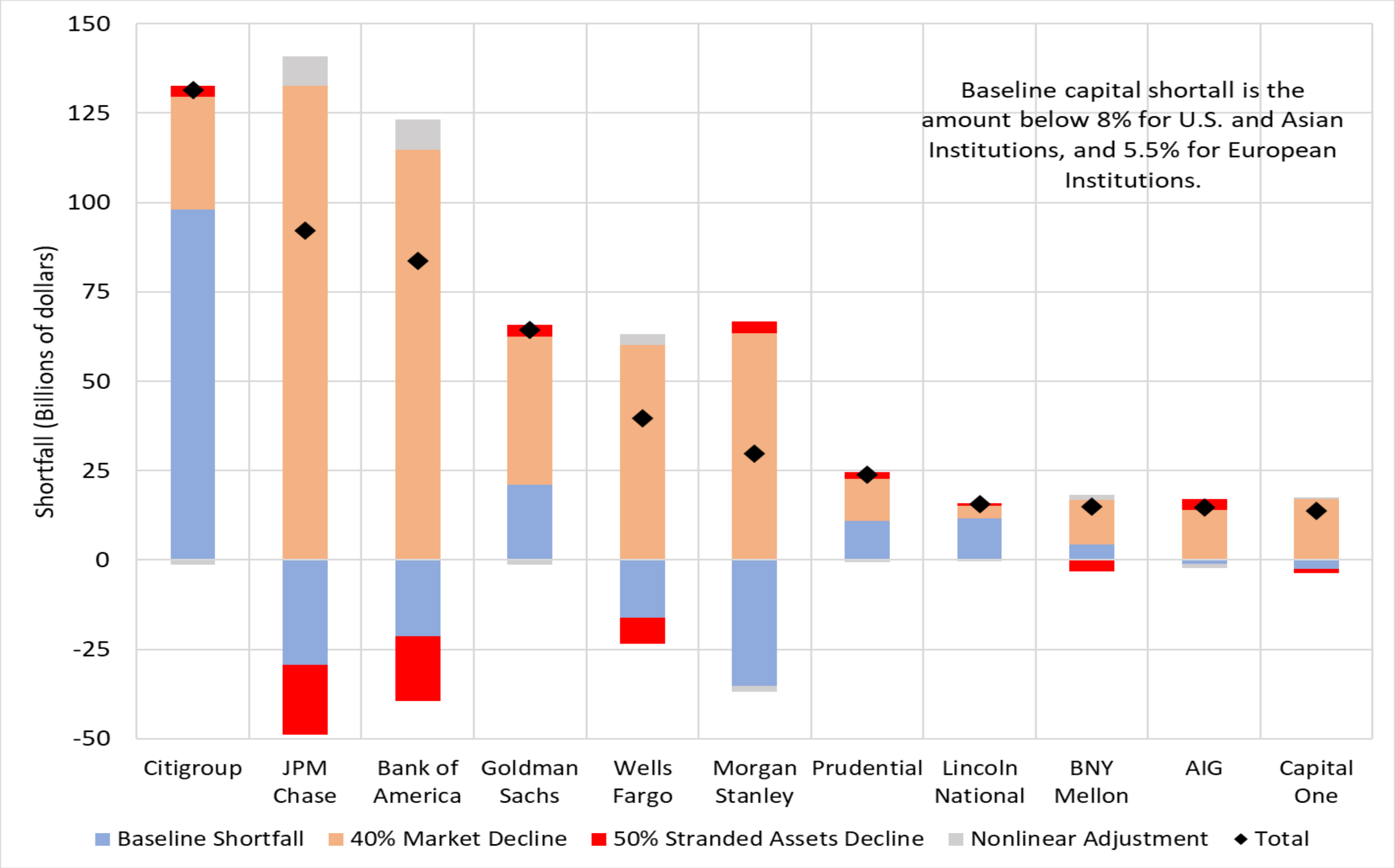
β_{it}^{M} = conditional market beta

β_{it}^{C} = 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

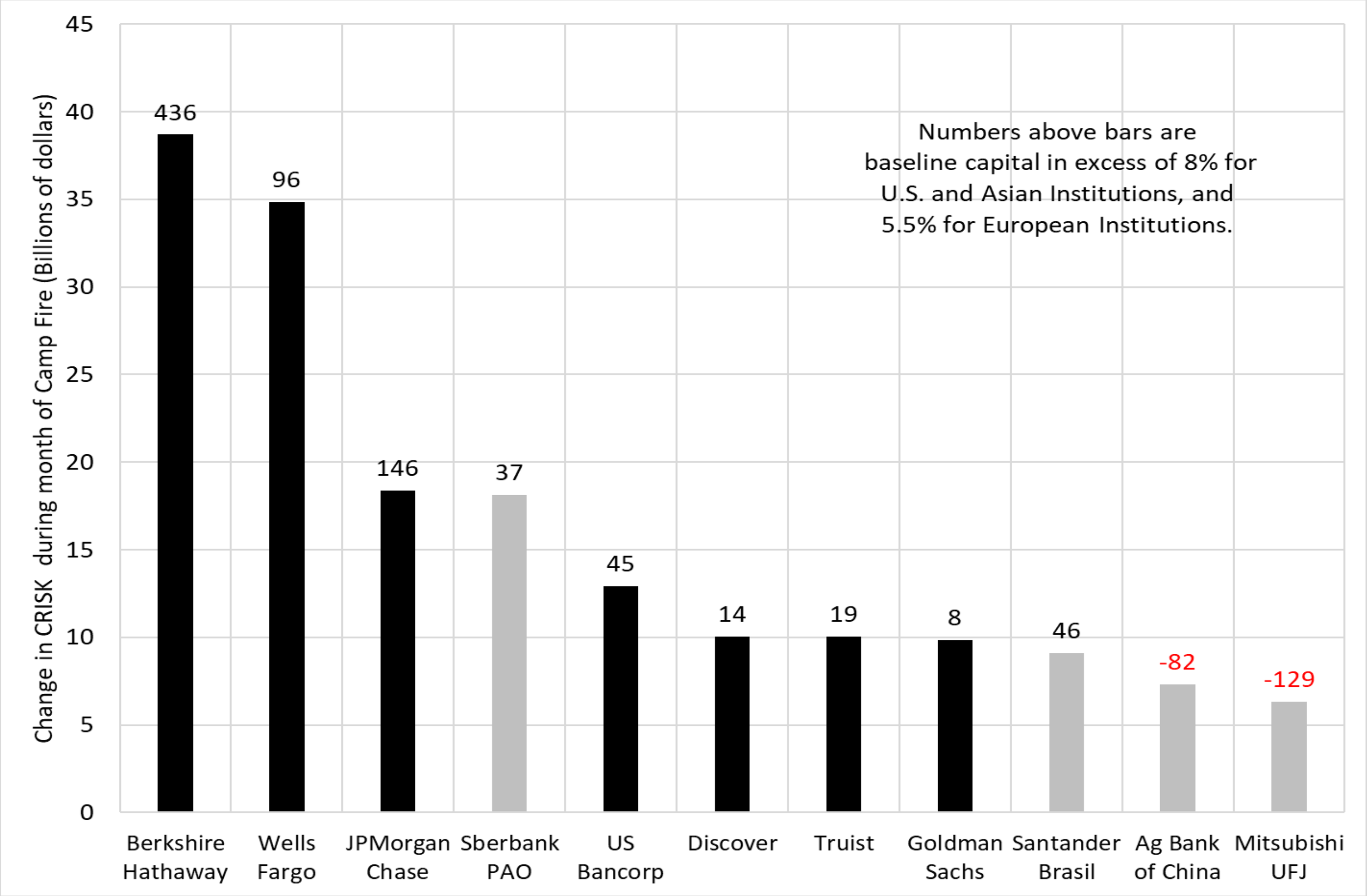
SRISK + CRISK: US intermediaries ranked by shortfall



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



Source: NYU Stern V-Lab.

Large response to severely adverse climate-related event.

Impact is primarily on US intermediaries (black).

Impact largely on firms with big capital buffers.

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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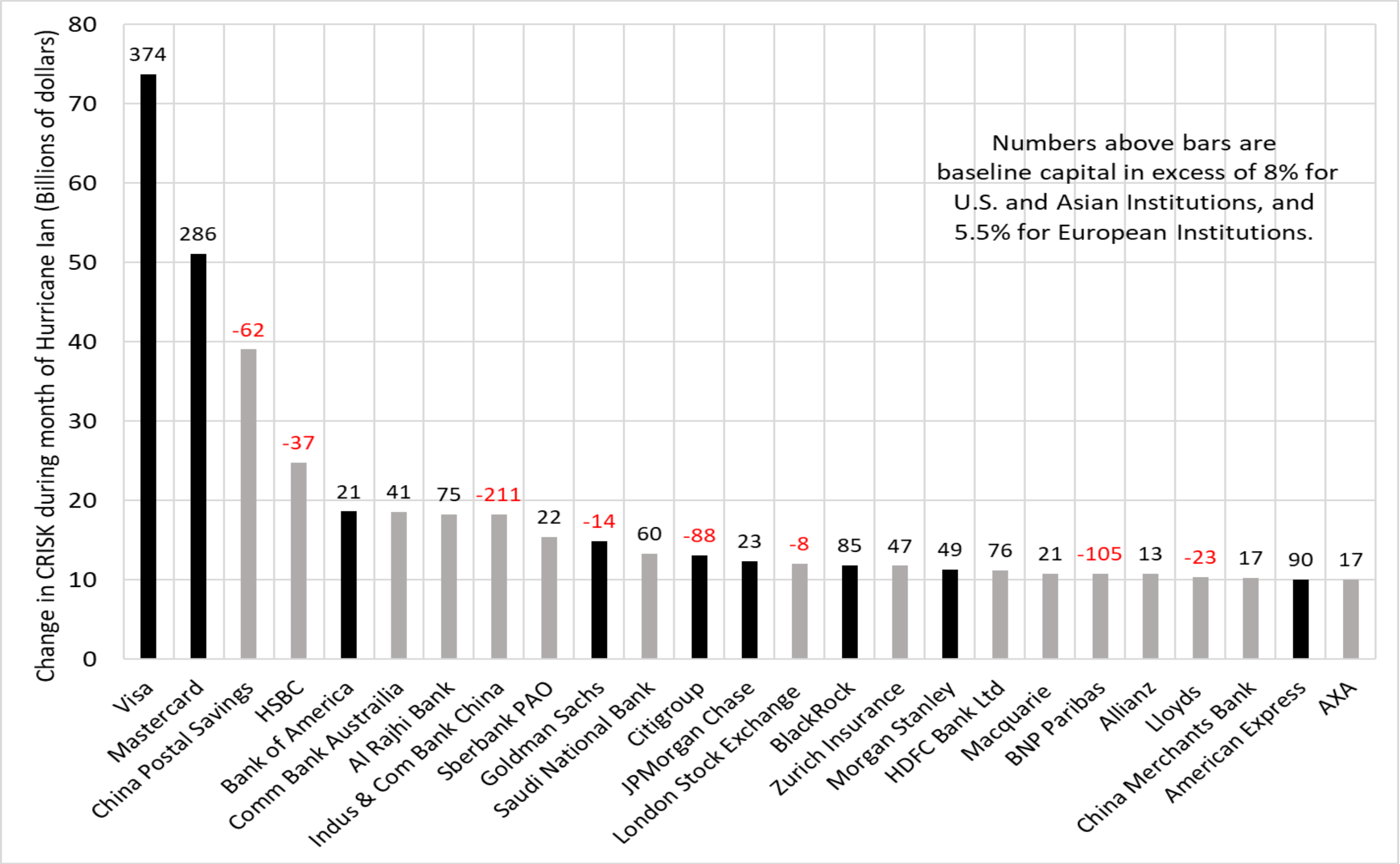
SRISK and CRISK

- Expected capital shortfall given a severe event
- Depends on institution's correlations with
  - Global market
  - Climate factor (stranded asset portfolio)

What about Hurricane Ian?



Source: NYU Stern V-Lab.

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)