

Risk and Return of Climate Investments

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Norges Bank Climate Conference

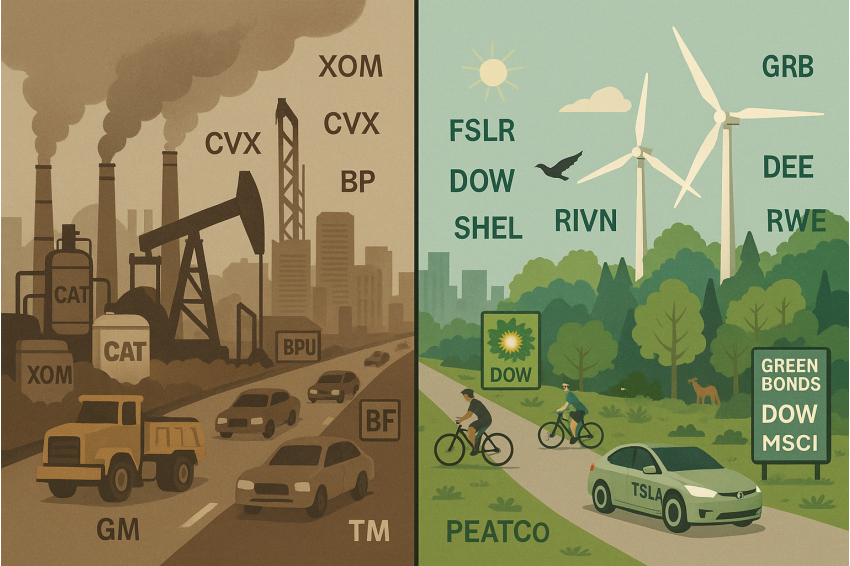
October 21, 2025

Motivation

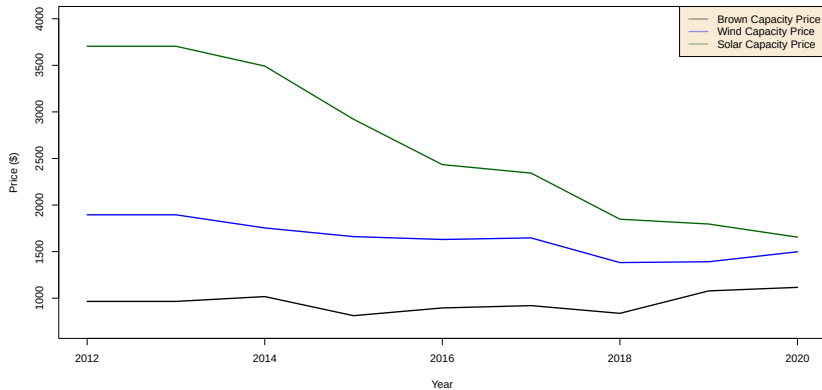
► Conventional wisdom

1. Concern about climate disaster leads society to substitute away from fossil fuels to renewables
2. Nature-based solutions (NbS) might fill in the gap
3. Adaptation an afterthought to mitigation, perhaps because of individual incentives, migration, insurance, etc...

Green Investment Thesis



Salient First Moment Effects



Neglected Second Moment Effects

OPINION

REVIEW & OUTLOOK

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When the Wind Didn't Blow in Germany

A years-long renewables push leaves the economy hostage to the weather.

By **The Editorial Board**

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Updated April 27, 2025 at 1:31 pm ET



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Portfolio Diversification Lens

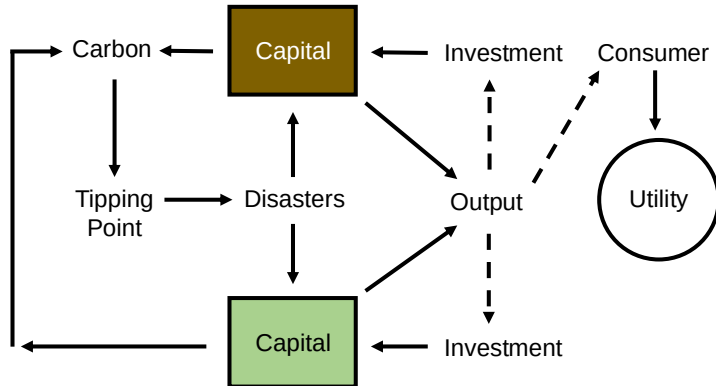
- ▶ Take a portfolio diversification lens
 - ▶ Assets (renewables, NbS, adaptation capital) need to be held by representative investor
 - ▶ Characteristics: pecuniary benefits, non-pecuniary benefits and asset price volatility
- ▶ End up with a different portfolio mix than conventional wisdom
 - ▶ Draw on various joint work with Edward Shore, Jeffrey Kubik, Serena Ng and Jiangmin Xu

Comparison Summary

Asset Class	Return (Annualized)	Volatility (Std. Dev.)	Liquidity	Main Risks	Inflation Hedge
Forests	7–9%	10–12%	Low	Fire, pests, long harvest cycles, carbon reversals	Strong
Farmland	10–11%	6–8%	Moderate	Weather, input costs, climate extremes	Strong
Infrastructure	8–10%	7–9%	Moderate	Regulatory, political, concession risk	Moderate–Strong

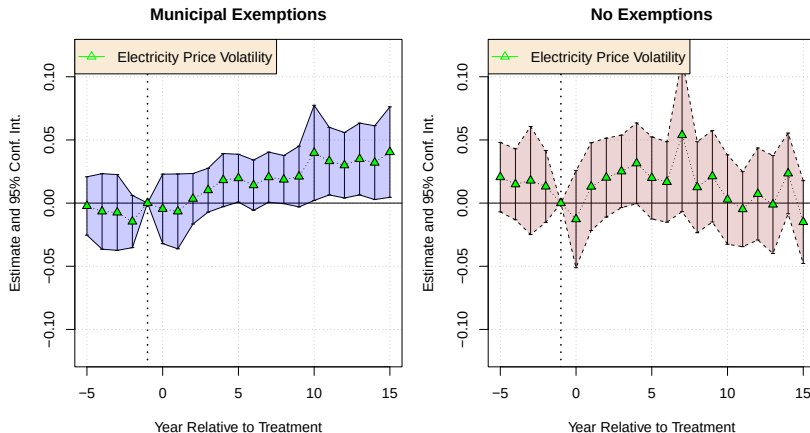
Renewable Asset Risk Limits Renewables in Portfolio

Figure: Integrated Assessment Model



Even If Equal Productivity with Fossil Fuels and Less Climate Disasters

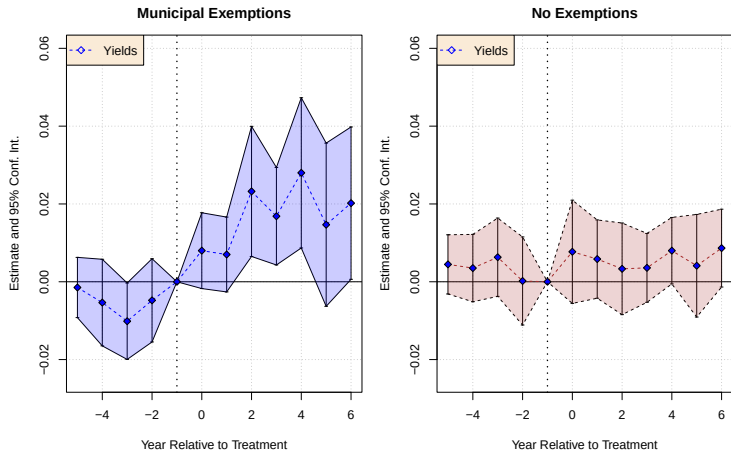
Implementation of US Renewal Portfolio Standards



► Post-RPS differential: **+4.3pp** (treated vs. exempt).

Impact on Credit Spreads

Figure: Adjusted Yields in States with and without Exemptions– Event Study



Adaptation

What are the returns to investing in climate resilience?



Non-i.i.d. Extreme Weather Risk

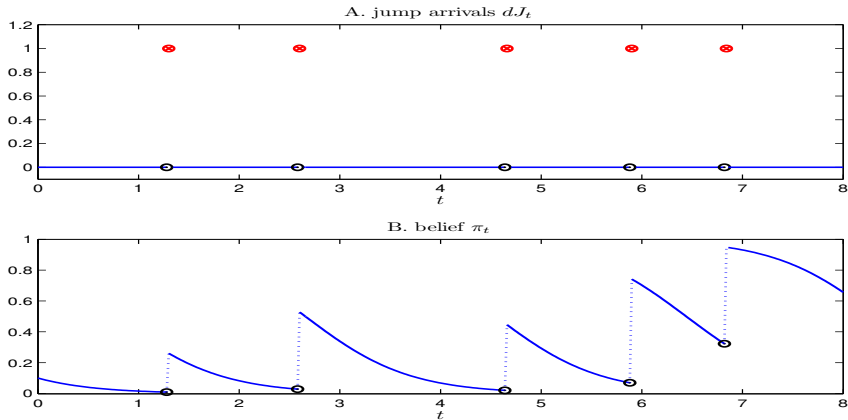


Figure: This simulation starts with a prior at $\pi_0 = 0.104$.

Time varying $\hat{\pi}_{it}$ Fiji and Germany

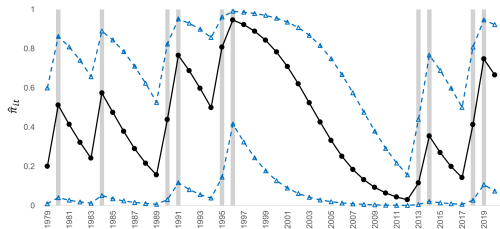


Figure: Fiji Cyclones

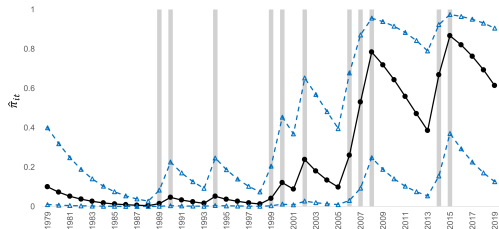


Figure: Germany Heatwaves

Scatterplot of GDP growth against $\hat{\pi}_{it-1}$ for Fiji and Germany

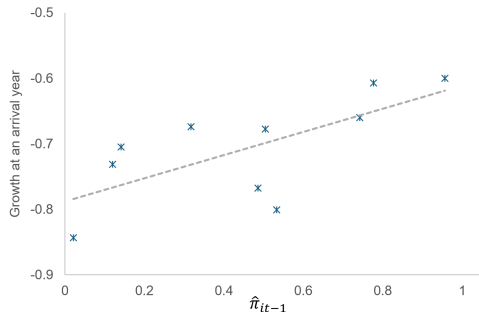


Figure: Fiji Cyclones

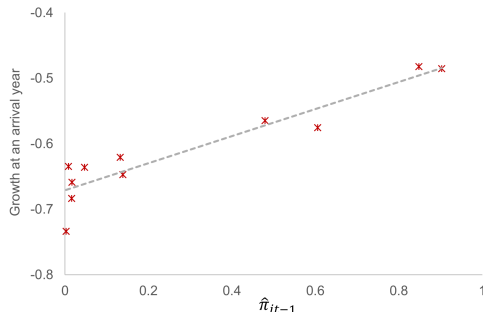
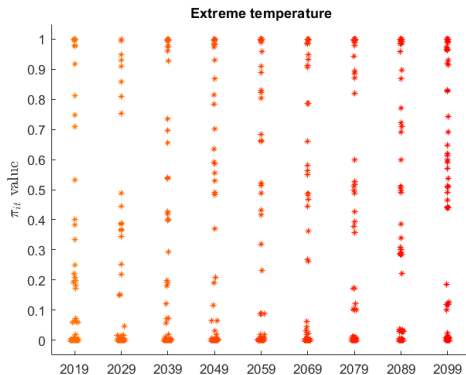
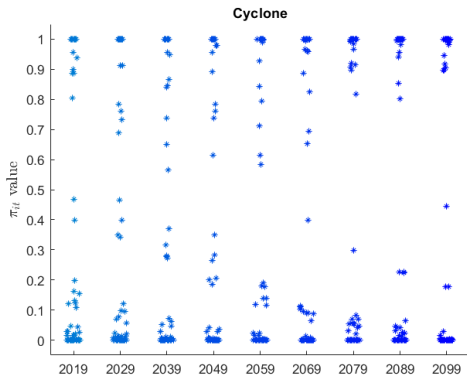


Figure: Germany Heatwaves

Simulations of π 's out of sample

Figure: Evolution of π_{it} over time

This figure plots the evolution of π_{it} over time at each decade end from the sample end to the projection end. The scatter plot of π_{it} values is shown at each decade end.



Conclusions

- ▶ Renewables and NbS asset price risk a significant impediment to further expansion
- ▶ Return of adaptation to climate disasters large in long run