Climate Change, Bank Fragility, and Systemic Risk

Yuna Heo
Faculty of Business and Economics
University of Basel

BACKGROUND & MOTIVATION

Climate change is the biggest challenges of our times.

✓According to the Bank of International Settlements (BIS), climate change could trigger the next financial crisis by exacerbating existing financial vulnerabilities.

Motivated by this, this research studies how both physical and transitional climate changes affect to financial instability (systemic risk).

MAIN FINDING I

This study finds both physical and transitional climate changes substantially increase systemic risk.

Panel A: Sea level rise

	(1) MES_{t+1}	(2) MES_{t+1}	(3) $\Delta CoVar_{t+1}$	(4) $\Delta CoVar_{t+1}$
Sea level rise	0.0043**	0.0035*	0.0007***	0.0005***
	(2.23)	(1.82)	(3.81)	(2.93)

Panel A: Climate disaster

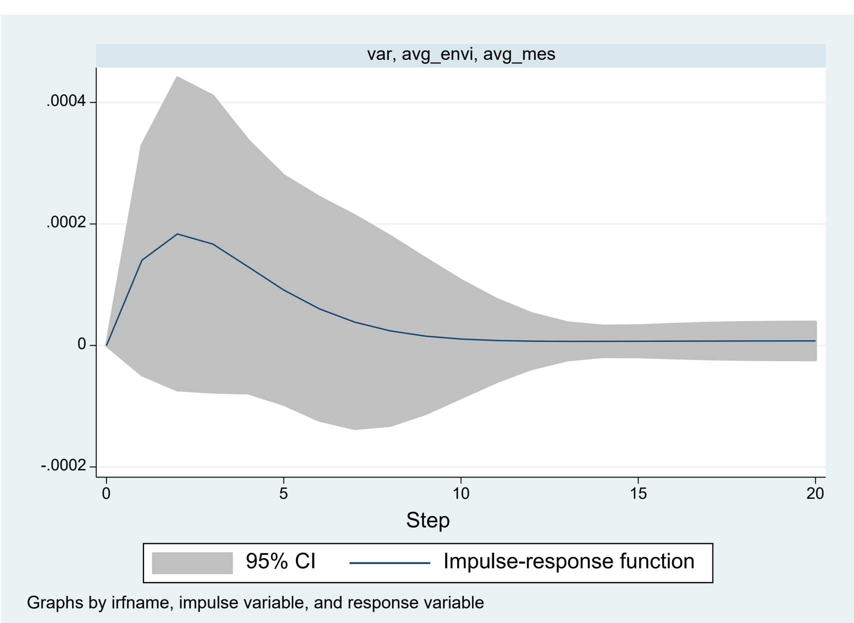
	(1) MES_{t+1}	(2) MES_{t+1}	(3) $\Delta CoVar_{t+1}$	(4) $\Delta CoVar_{t+1}$
Climate disaster	0.3953*	0.4627**	0.2193*	0.2225**
	(1.68)	(1.98)	(1.96)	(1.98)

Panel B: Environmental and climate policy uncertainty

	(1) MES_{t+1}	(2) MES_{t+1}	(3) $\Delta CoVar_{t+1}$	(4) $\Delta CoVar_{t+1}$
Environmental and climate policy uncertainty	0.0212***	0.0210***	0.0016***	0.0016***
	(28.55)	(28.30)	(18.69)	(19.09)

Panel B: Firm-level environmental risk

	(1) MES_{t+1}	(2) MES_{t+1}	(3) $\Delta CoVar_{t+1}$	(4) $\Delta CoVar_{t+1}$
Firm-level environmental risk	1.1282***	1.0508***	0.1222***	0.1086***
	(4.75)	(4.52)	(4.03)	(3.78)



This figure depicts impulse response functions (IRF) quantifying the effect of climate change on aggregate level of systemic risk.

The figure climate change shock to sea level rise has a significant positive effect on systemic risk more than 10 quarters into the future.

SYSTEMIC RISK

Climate change, undoubtedly, can be a source of systemic risk by generating cascading unprecedented damages to the financial markets and institutions.

MES(marginal expected shortfall) and ΔCoVaR(change in conditional value at risk) are used to proxy the systemic risk.

The MES is calculated using the 5 % worst days of market returns over the previous quarter of return data.

$$MES_{i,t} = -\frac{1}{\#days}\sum_{t}^{t^*} R_{i,t}$$

The $\Delta CoVaR$ is the marginal contribution of an institution to overall systemic risk. $\Delta CoVaR$ is calculated using the following equations:

$$VaR_{i,t}^{q} = \widehat{\alpha_i^q} + \widehat{\gamma_i^q} M_{t-1}$$

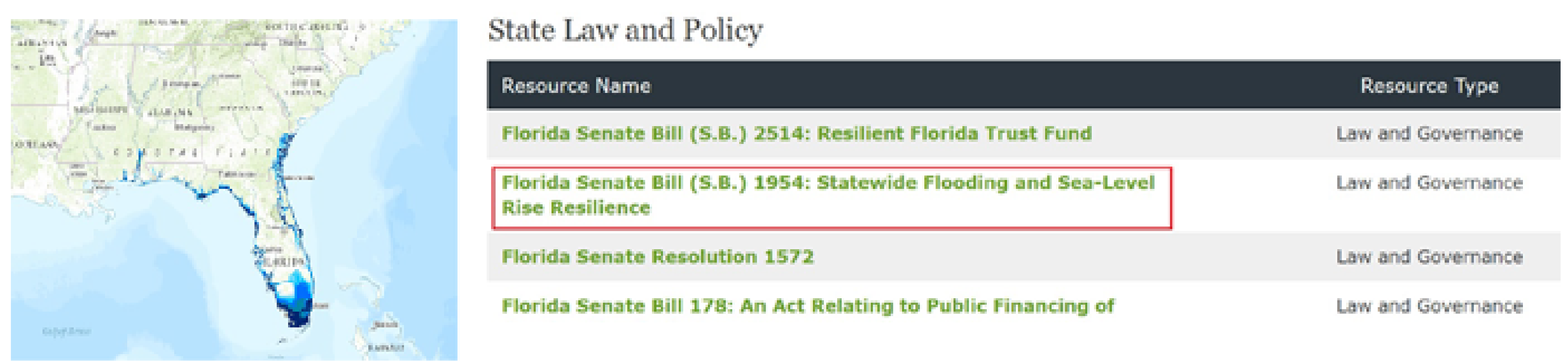
$$CoVaR_{i,t}^{q} = \widehat{\alpha_{system|i}^{q}} + \widehat{\gamma_{system|i}^{q}} + \widehat{\beta_{system|i}^{q}} VaR_{i,t}^{q}$$

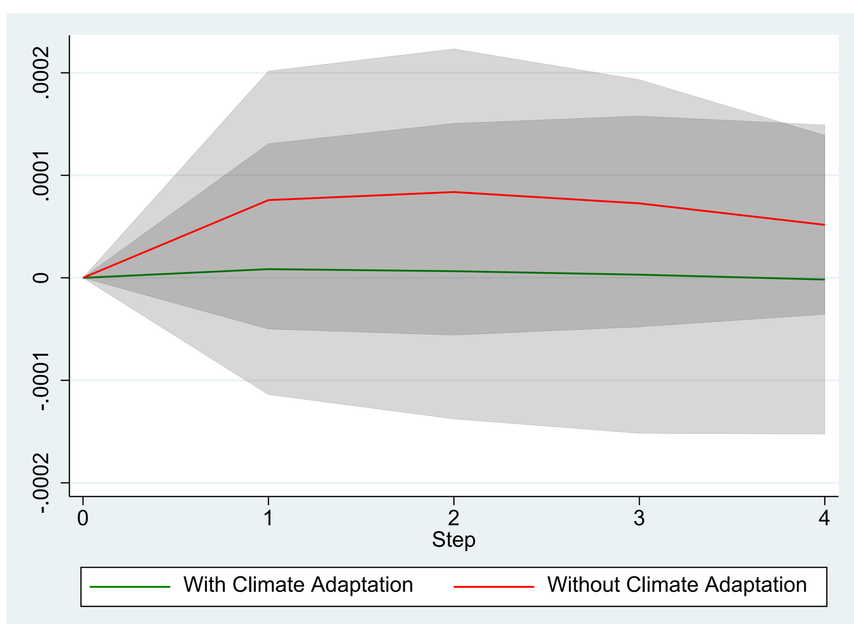
$$\Delta CoVaR_{i,t}^{q} = CoVaR_{i,t}^{q} - CoVaR_{i,t}^{50}$$

MAIN FINDING II

Further, this study examines whether state-led climate change adaptation actions can build resilience to the detrimental impacts from climate change.

- Each state has particular characteristics and capacities. For example, coastal states emphasize the risk of sea level rise.





The figure depicts impulse response functions (IRF) quantifying the effect of increasing climate change on aggregate bank fragility.

The separate VAR by aggregating banks with climate change adaptation plans (green line) and banks without adaptation plans (red line).

This study finds that climate change adaption actions can mitigate the effects of climate change on systemic risk.

For more information, scan this! >>