

### CRISK: Measuring the Climate Risk Exposure of the Financial System

By Hyeyoon Jung, Robert Engle, and Richard Berner



#### KEY RECOMMENDATIONS

It is important for researchers, financial institutions, businesses, and regulators to understand the impact of climate risk on financial stability. However, figuring out how much risk financial institutions face from climate change poses challenges. Past climate events may not effectively capture how investors' perception of risk change, and market expectations can shift without directly experiencing these events. Moreover, finding reliable data sources can be difficult. Even though there are voluntary disclosures about climate, they often lack completeness and have inconsistencies. To address these challenges, this paper suggests using market-based metrics. The market-based approach allows for both a dynamic and a timely estimation of financial institutions' exposure to climate risk, providing a valuable complement to traditional approaches to climate stress testing.

#### RESEARCH SUMMARY

Over the past three decades, many countries have implemented a multitude of climate-related policies to reduce their dependence on carbon and foster greener economies. This raises a crucial question: do these policies pose a risk to the economy, known as "transition risk"? One way this risk affects the real economy is through the banking sector. For instance, if borrowers face higher transition risk, they may struggle to repay loans. This can create a ripple effect, impacting the profits of banks both now and in the future. Ultimately, it might lead to a situation where banks don't have enough capital, potentially slowing down economic growth due to a reduced availability of credit.

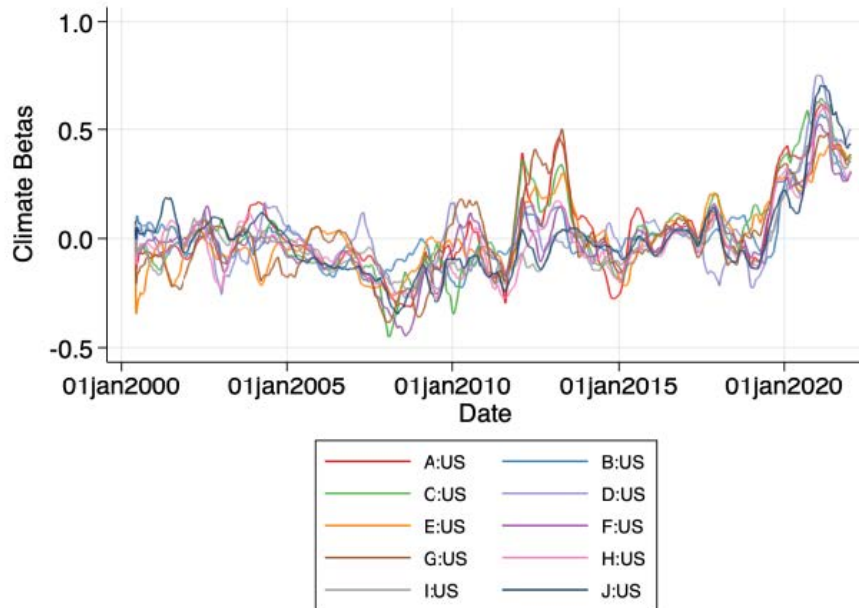
Despite this important question, there has been a lack of an adequate framework to assess the financial stability implications of transition risk. To address this, the paper develops a new approach to assess whether banks are adequately capitalized to withstand losses during stressful conditions triggered by a heightened transition risk. Specifically, this paper proposes a three-step methodology to estimate "CRISK" - a new measure to assess banks' resilience to climate-related risks. First, the paper constructs equity portfolios designed to underperform when climate risk rises—termed "Climate Risks Factors." Second, the

paper dynamically estimates climate betas, representing the relationship between banks' stock returns and the previously defined Climate Risks Factors. Third, CRISK is calculated as the bank's capital shortfall in a climate stress scenario, based on the estimated climate betas.

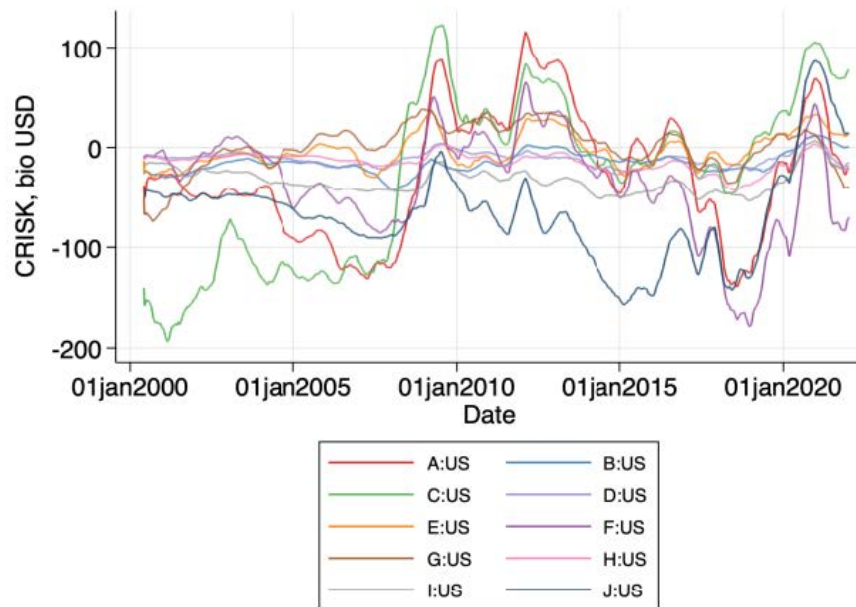
The findings, illustrated in the charts below, demonstrate the dynamic nature of the climate beta over time and show a substantial increase in both climate beta and CRISK in 2020 across all banks in the sample.

The methodology is validated by showing that Climate Risk Factors respond to transition-related events and documenting that banks lending more to "brown" firms tend to have a higher climate beta.

This versatile framework extends beyond banks, applicable to various financial institutions, and can be aggregated at the economy level. The paper calculates the aggregate CRISK for 105 financial firms in the U.S., including banks, broker-dealers, and insurance companies, providing a system-wide measure of climate risk. Furthermore, the framework accommodates different climate stress scenarios, allowing for the consideration of various transition scenarios, such as a carbon tax or the combination of a carbon tax and a green subsidy.



**Figure 4: Climate Beta of US Banks** The sample banks are the top 10 large US banks by the average total assets in 2019. The sample period is from June 2000 to December 2021.



**Figure 5: CRISK of US Banks** The sample banks are the top 10 large US banks by the average total assets in 2019. The sample period is from June 2000 to December 2021.

## BUSINESS OR POLICY IMPLICATIONS

Climate transition risk, which may render borrowers incapable of repaying their loans, can impair current and anticipated profits in the banking sector. Its negative impact could extend to banks' capitalization, leading to adverse consequences for the broader economy, such as reduced credit availability and slowed economic growth. Recognizing the growing concern among regulators regarding the influence of climate-driven policy transitions on financial stability, this paper introduces a novel methodology to assess the systemic vulnerability of financial institutions to climate transition risk. The innovative measure, systemic climate risk (CRISK), serves as a valuable complement to existing models, scenarios, and measures. For both private and public sectors, our work offers insights into diagnosing and addressing the challenges posed by climate transition risks on the financial system.

## ABOUT THE AUTHORS

**Hyeyoon Jung** - Federal Reserve Bank of New York, [hyeyoon.jung@ny.frb.org](mailto:hyeyoon.jung@ny.frb.org)

**Robert Engle** - NYU Stern, [rengle@stern.nyu.edu](mailto:rengle@stern.nyu.edu)

**Richard Berner** - NYU Stern, [rberner@stern.nyu.edu](mailto:rberner@stern.nyu.edu)

## ADDITIONAL RESOURCES

1. Blog post: <https://libertystreeteconomics.newyorkfed.org/2023/04/crisk-measuring-the-climate-risk-exposure-of-the-financial-system/>
2. Measuring the Climate Risk Exposure of Insurers: [https://www.newyorkfed.org/research/staff\\_reports/sr1066](https://www.newyorkfed.org/research/staff_reports/sr1066)
3. Climate Stress Testing: <https://www.annualreviews.org/doi/abs/10.1146/annurev-financial-110921-101555>
4. U.S. Banks' Exposures to Climate Transition Risks: [https://www.newyorkfed.org/research/staff\\_reports/sr1058.html](https://www.newyorkfed.org/research/staff_reports/sr1058.html)