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Working Paper

The impact of climate transition risks on financial stability: A systemic risk approach

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The impact of climate transition risks on financial stability. A systemic risk approach.

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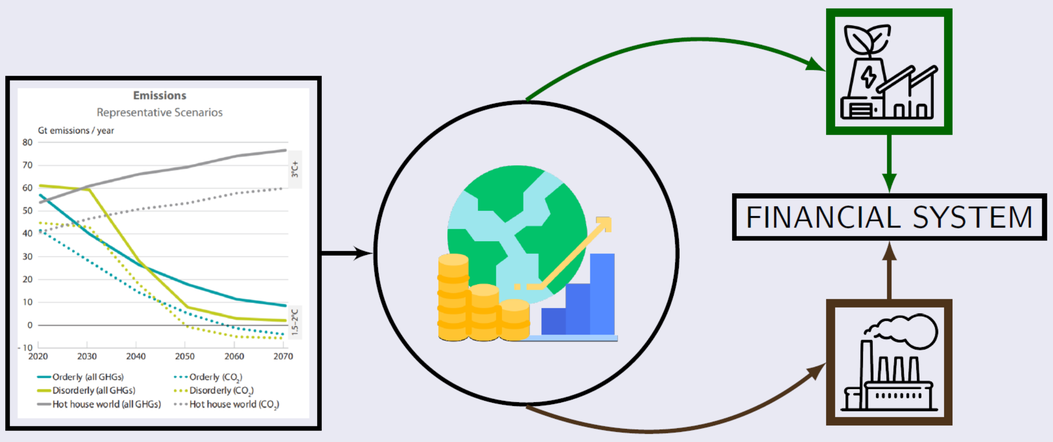
Motivation: EU Sustainable Finance Strategy

Key role of the financial system in the low-carbon transition

- **Monitor and address systemic risks stemming from climate challenges.** Systemic risk measures adapted to climate transition (CT) scenarios ([1],[2]).
- **Integrate climate transition risk in the risk management of financial institutions.** Change in benchmark risk measures and potential capital needs under different climate scenarios.
- **Develop a robust monitoring framework to measure the systemic risk coming from climate transition risk.** Analysis based on public available data and easily replicable methodology.

The NGFS climate transition narrative:

Different transition scenarios imply changes in the speed of the process that modify current expectation of the economic agents, leading to asset price adjustments.
Disruption to current business models coming from a change in the timing and speed of the adjustment towards a low-carbon economy.



CLIMATE TRANSITION SCENARIOS

Climate transition scenarios translated into a coherent combination of green, neutral and brown stock portfolios

Disorderly transition

Green portfolio value surges and brown portfolio value plunges.

$$P\left(r_g > F_g^{-1}(1-\beta), r_b < F_b^{-1}(\alpha)\right)$$

Orderly transition

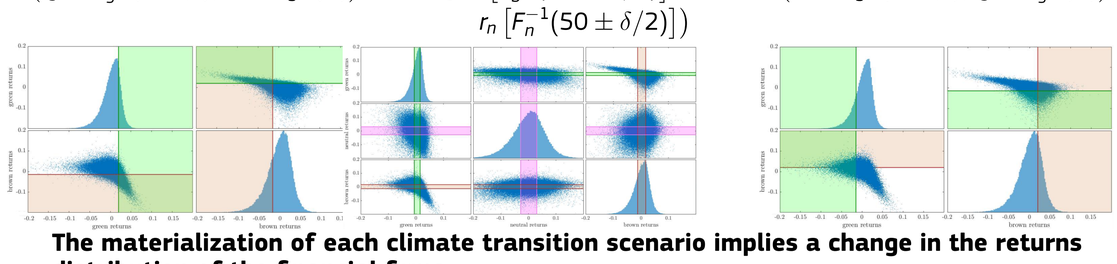
Green, neutral and brown portfolios are around their median returns.

$$P\left(r_g \in \left[F_g^{-1}(50 \pm \beta/2)\right], r_b \in \left[F_b^{-1}(50 \pm \alpha/2)\right], r_n\left[F_n^{-1}(50 \pm \delta/2)\right]\right)$$

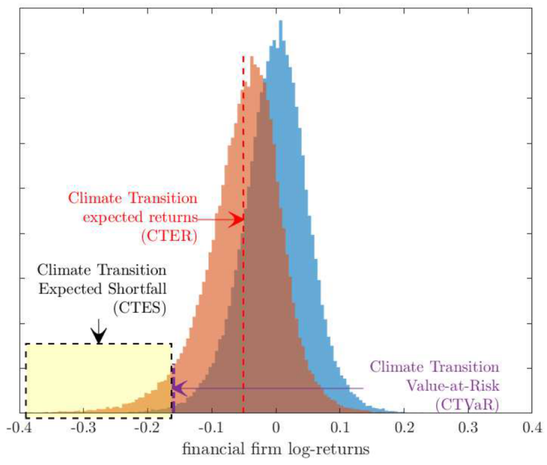
Hot house world

Green portfolio sharply decreases and brown portfolio experiences an acute increase.

$$P\left(r_b > F_b^{-1}(1-\beta), r_g < F_g^{-1}(\alpha)\right)$$



The materialization of each climate transition scenario implies a change in the returns distribution of the financial firms.



- **Climate Transition Expected Return (CTER)**

  $CTER_i = E(r_i|CT \quad scenario)$

- **Climate Transition Value-at-Risk (CTVaR)**

  $CTVaR_i = min\{r_i|F(r_i|CT \quad scenario) \geq \gamma\}$

- **Climate Transition Expected Shortfall (CTES)**

  $CTES_i = E(r_i|r_i < CTVaR_i, CT \quad scenario)$

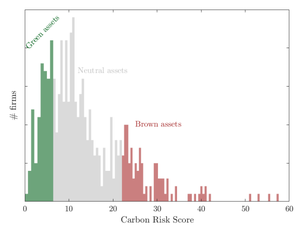
- **Capital needs: CTRISK** Adaptation of *SRISK* formula from [3] for a climate transition scenario.

Methodology

- **Marginal distribution:** ARMA-GJR-GARCH with Skewed Student t innovations.
- **Dependence structure:** Vine Copula with Patton's dynamics

Data

- **+900 European listed firms** employed to build green, neutral and brown portfolios based on their Carbon Risk Score (CRS) from Sustainalytics.
- **190 European financial firms** (22% banks, 19% insurance, 27% diversified financials, 31% real estate).
- Period: 04 January 2013 to 25 December 2020 (417 obs.)



Results

- **CTES by subsector**

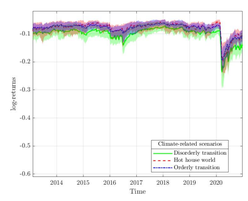


Figure: Banks

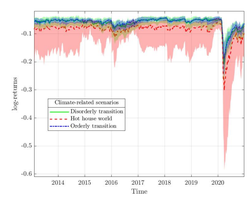


Figure: Insurance companies

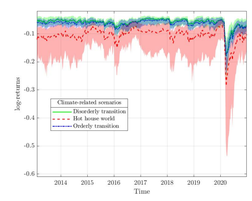


Figure: Financial services

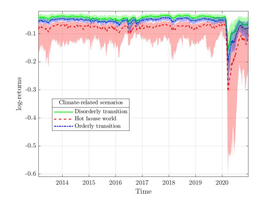


Figure: Real estate

- **CTER by country**

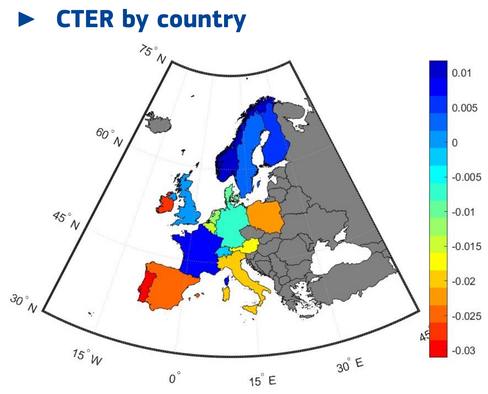


Figure: Disorderly transition

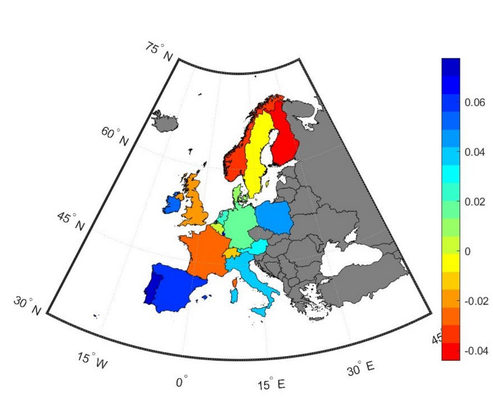


Figure: Hot house world

- **CTRISK in the banking sector**

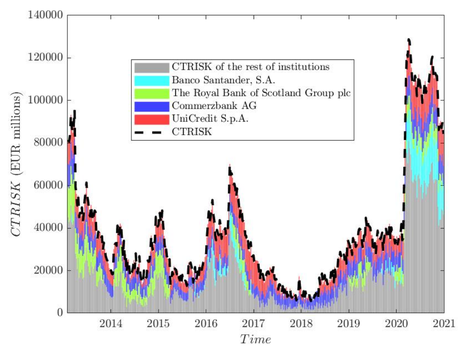


Figure: Disorderly transition

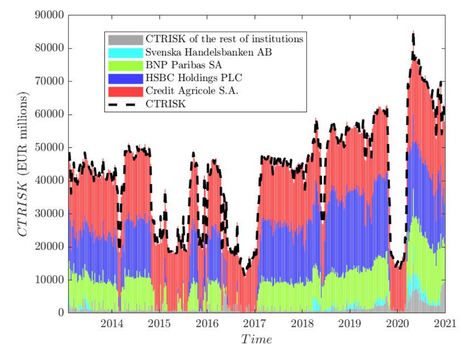


Figure: Hot house world

Conclusions

- Banks are negative exposed to the disorderly transition scenario while the remainder sectors are mainly exposed to hot house scenario.
- There is a larger heterogeneity in the cross-section performance of risk measures, specially for the non-banking system.
- Southern Europe experiences the largest financial losses in a disorderly transition scenario. United Kingdom, France and Northern Europe obtain the largest financial losses in a hot house world scenario.
- Capital needs are led by different firms depending on the scenario, while being manageable by the financial system.

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