

Rising Temperatures, Falling Ratings: The effect of climate change on sovereign creditworthiness

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Bridging the gap

Can we bridge this gap?

Climate
Science

Sovereign Credit Ratings

Train a ratings
model on
historical data

Adjust data for
environmental
change

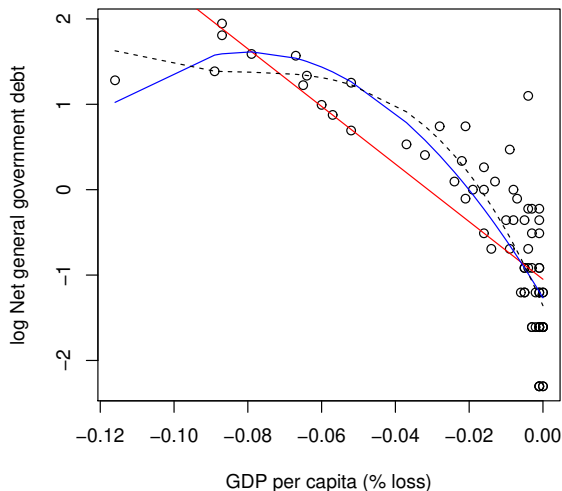
Feed adjusted
data to the
trained model

Environmentally
Adjusted Credit
Ratings

Machine Learning Approach

- Sovereign rating prediction;
 - Linear regressions
 - Logit/probit models
 - Limitations
- Solution;
 - Non-linear modelling;
 - Machine learning algorithms
 - Our improvements;
 - Parsimony
 - Transparency
 - Confidence intervals

Climate-adjusted government balance variables



- With the following variables;
 - **GDP per capita**
 - **GDP growth rate**
 - Net General Govt Debt/GDP
 - Narrow Net External Debt/CARs
 - Current Account Balance/GDP
 - General Government Balance/GDP

- Random forest seemed to be the most obvious modelling approach;
 - Some literature had implemented this before with success (over and above other ML algorithms)
 - Handled non-linearities
 - Adaptations to the algorithm enabled us to remain as close as possible to the actual practice of sovereign rating assessment;
 - Thresholds
 - Rating ranges (confidence intervals)

The Model

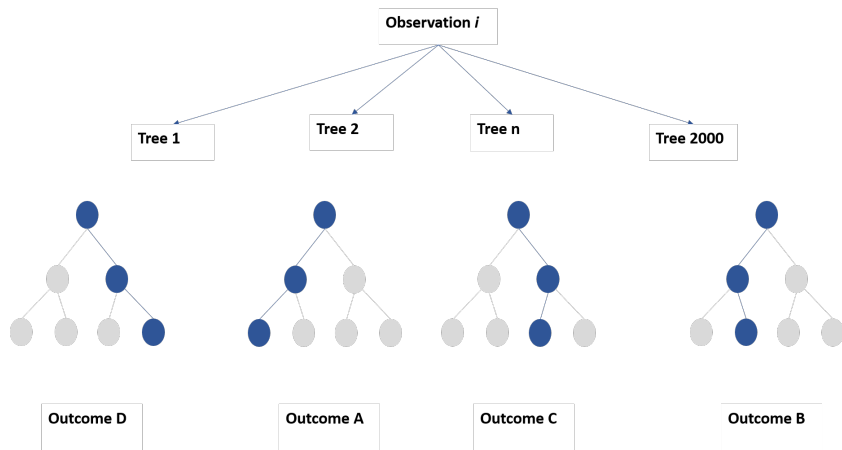
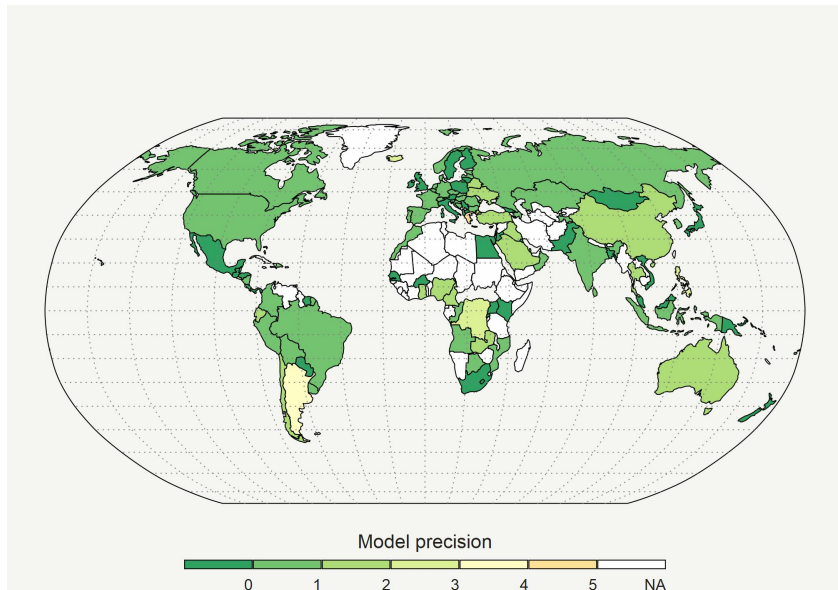
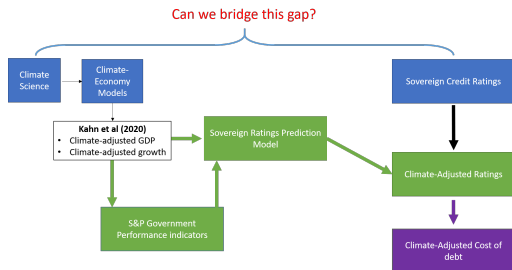


Figure: Random forest classification

Model accuracy



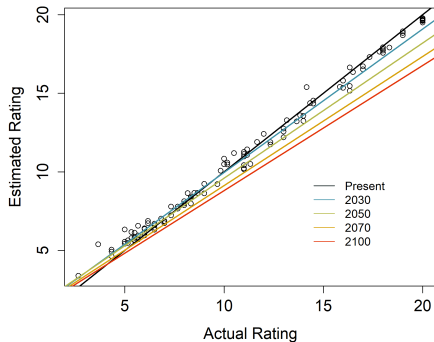
Putting it together



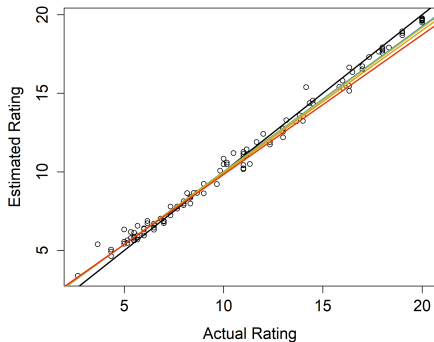
- Predict ratings using our model and climate-adjusted variables
- Using three warming scenarios
 - RCP 2.6
 - RCP 8.5
 - RCP 8.5 with increasing temperature variability

Results 1: Kahn et al (2021)

Panel A: Climate-adjusted Ratings: 2030-2100 (RCP 8.5)

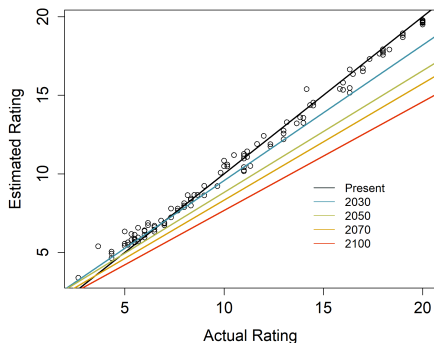


Panel B: Climate-adjusted Ratings: 2030-2100 (RCP 2.6)

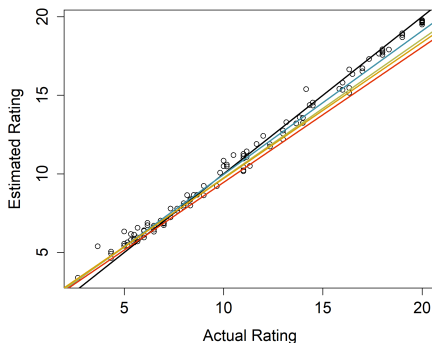


Results 2: Kahn et al (2021) Temperature variability

Panel A: Climate-adjusted Ratings: 2030-2100 (RCP 8.5)



Panel B: Climate-adjusted Ratings: 2030-2100 (RCP 2.6)



- Primary focus is to stay as true to the climate science as possible
- Paris commitments will reduce downgrades
- Delaying green investment increases future cost