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Rising temperatures, falling ratings:
the impact climate change on sovereign risk

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Climate time travel

- We’re going to fast-forward through time
- keeping everything the same,
- except climate and its impact on key macroeconomic indicators
  - How different are ratings?
  - How might climate policy affect this?
  - What might be the impacts on sovereign debt (cost/servicing)?

Overarching principle

Natural science

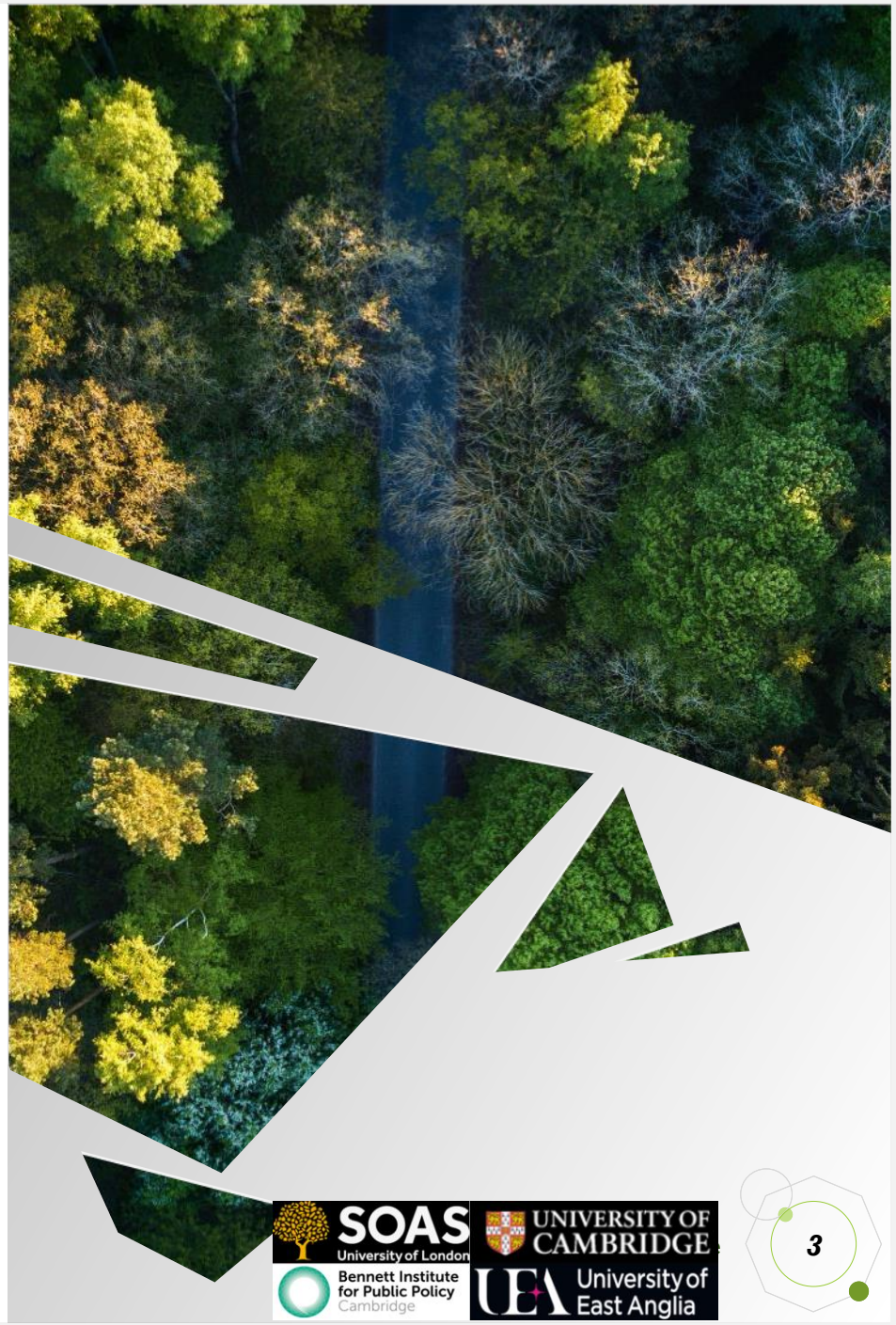
Remain as close as possible to natural science!

Economic principles

Use best available climate economics.

Real life ratings

Remain as close as possible to S&P's actual credit rating methodology.



Backwards look versus forward look

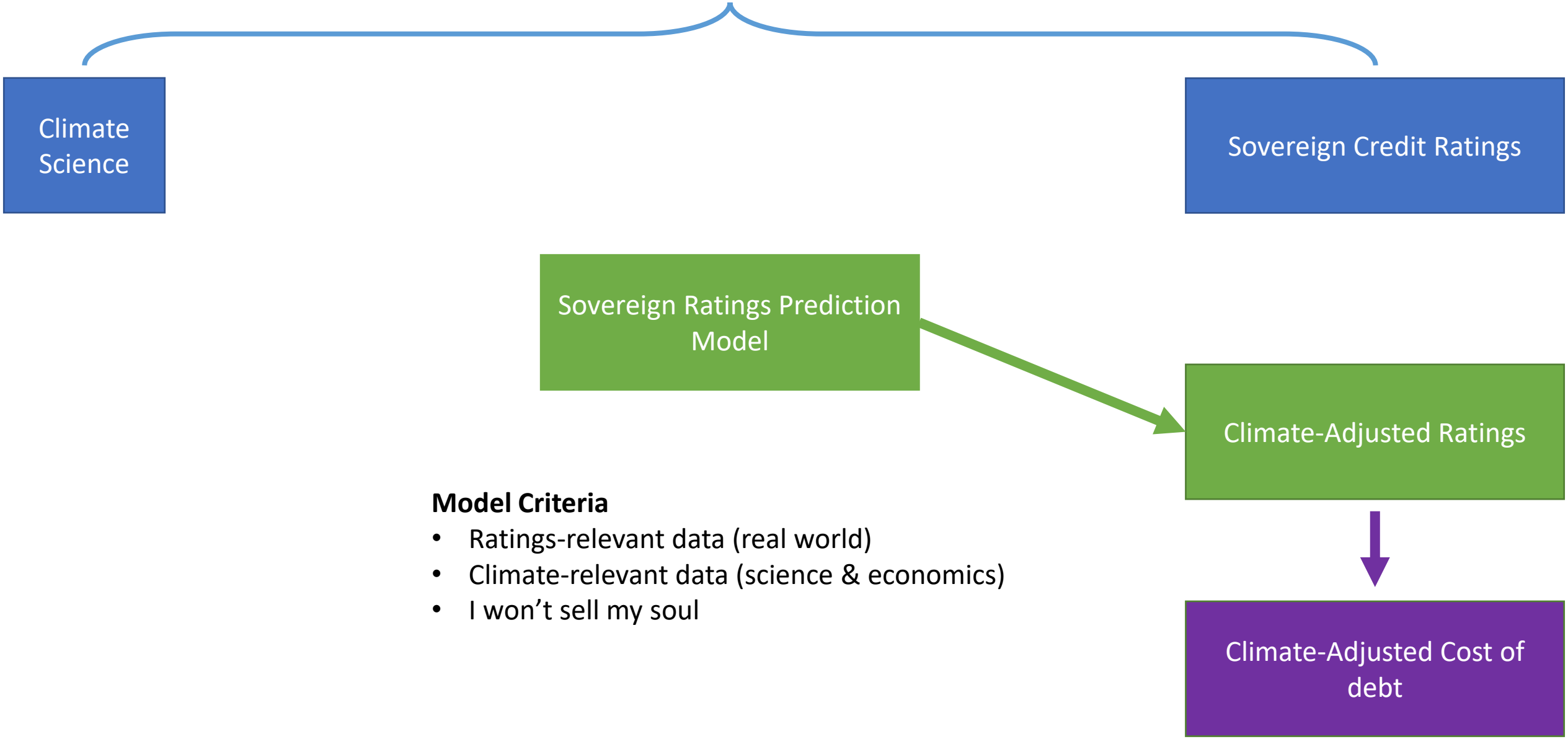
back

- Using regression models to investigate empirically the effect of climate change on sovereign ratings over the past two decades.
- CRA methodologies do not include climate as a ratings factor.
- Investigate whether climate has crept in as an “implicit factor” through influencing other credit-relevant variables.
- Caveat: future climate change may differ from past trends, making any results difficult to interpret.

forward

- Extending the ratings methodology from a leading CRA to explicitly incorporate nature and climate-related risks under a range of future scenarios.
- This approach offers a ‘forward-look’, and is capable of providing insights into the future creditworthiness of nations.
- This approach will provide the foundations for an enhanced sovereign credit risk methodology.

Can we bridge this gap?



Model Criteria

- Ratings-relevant data (real world)
- Climate-relevant data (science & economics)
- I won't sell my soul

What's in the model?

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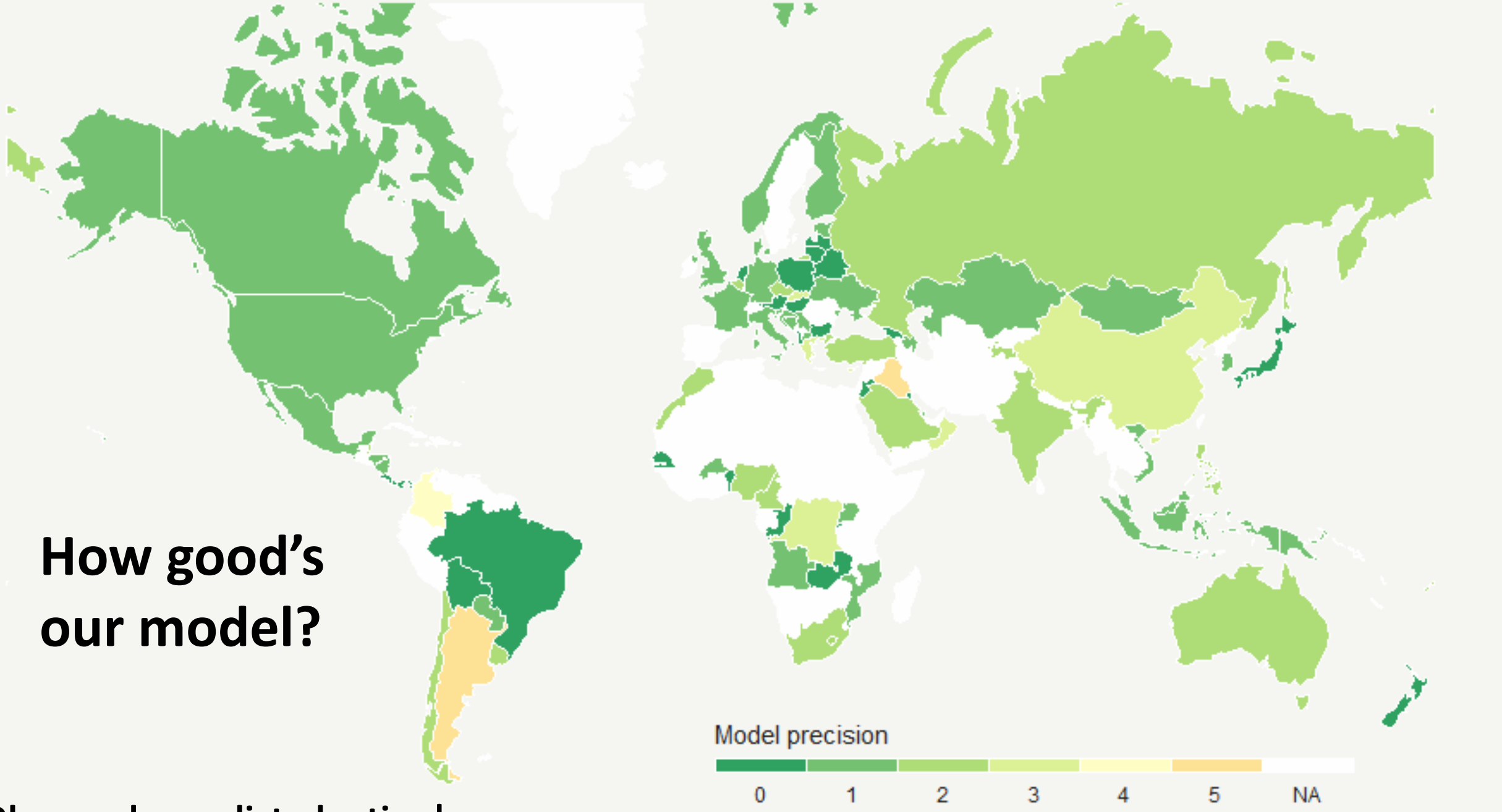
- GDP
- GDP Growth

} Macroeconomic climate model (Kahn et al 2019)

- Net General Govt Debt/GDP
- Narrow Net External Debt/CARs
- Current Account Balance/GDP
- General Government Balance/GDP

} S&P's own thinking
Kahn et al (2019)
Creativity

How good's our model?



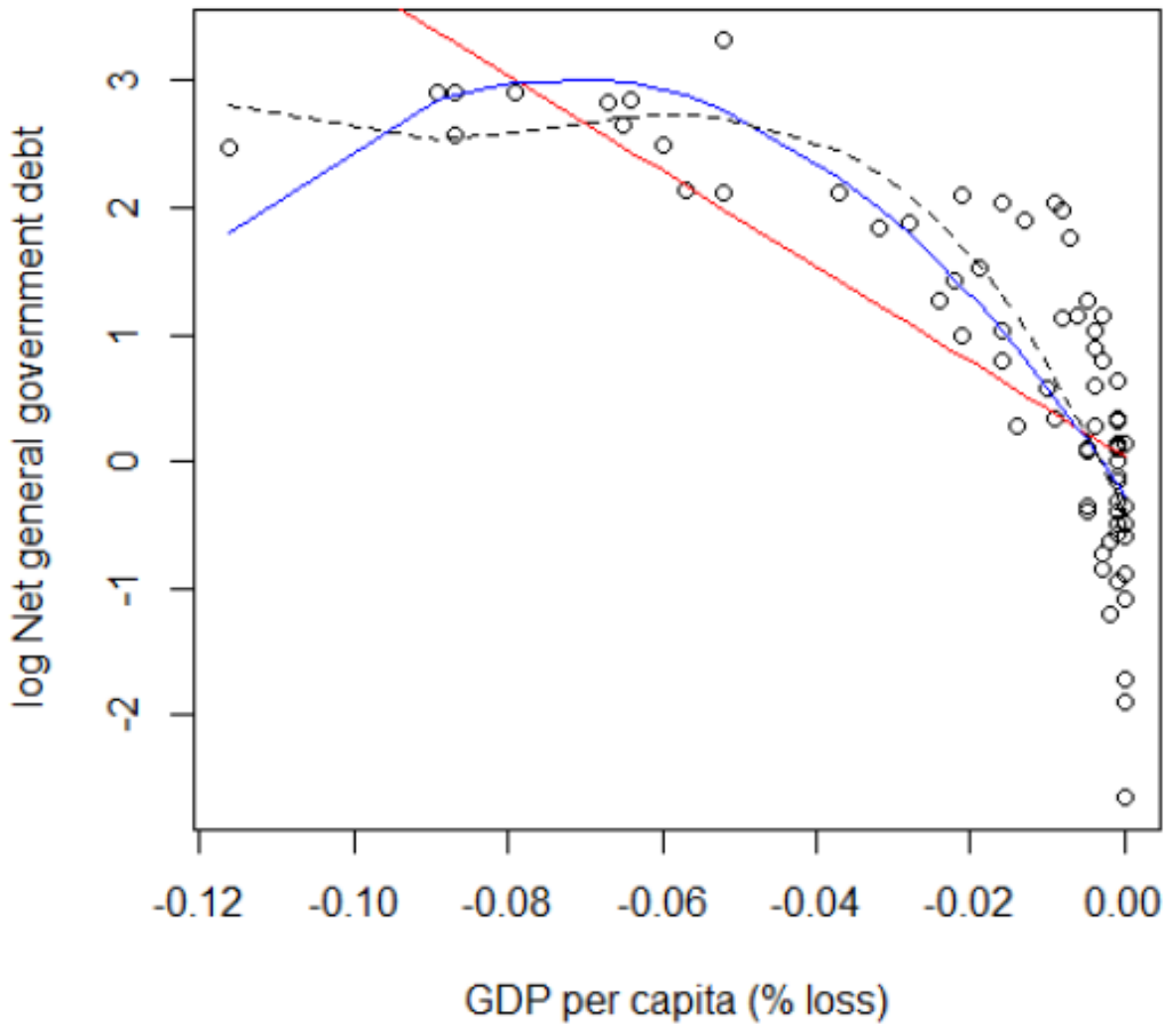
|Observed - predicted rating|

Adjusting for climate change

- GDP & pcGDP → Kahn et al (2019)

- S&P assess impact of natural disasters → pcGDP → Performance Indicators
- We derive a function describing that data
- Apply it to climate-induced GDP loss to proxy impact on govt performance indicators

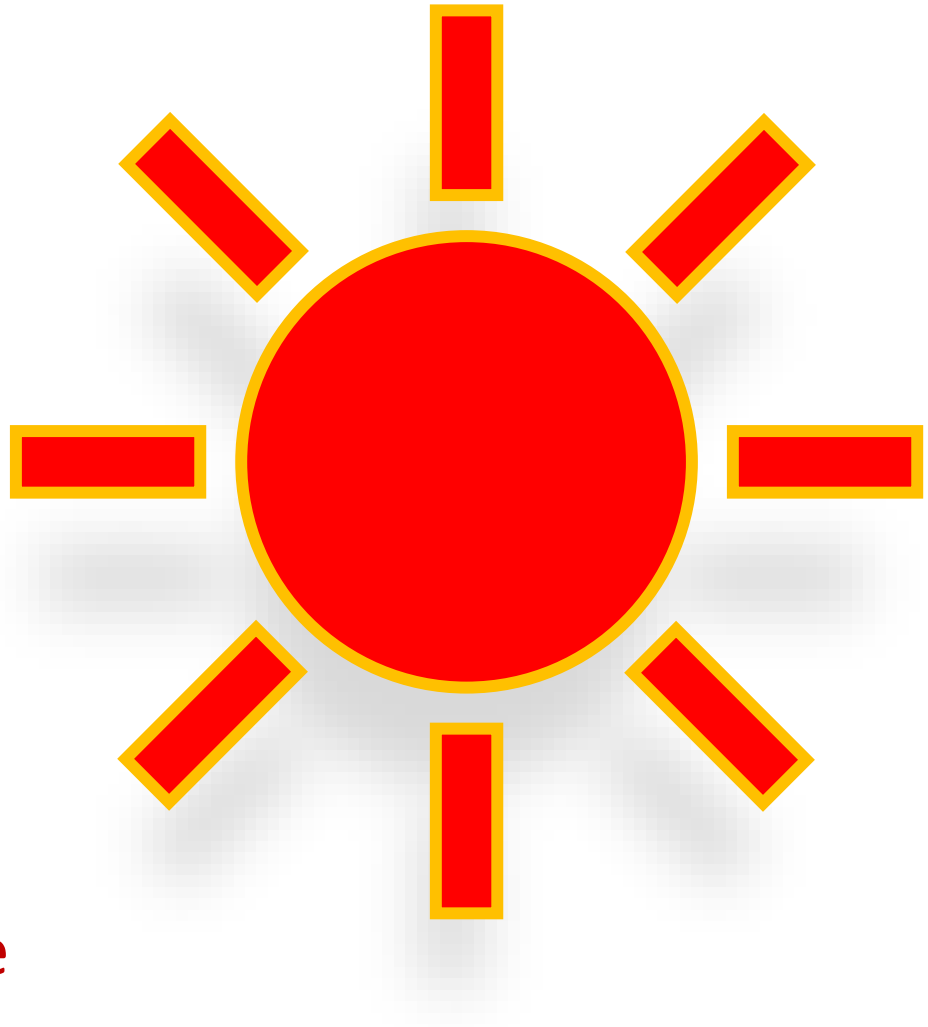
- Add to our model



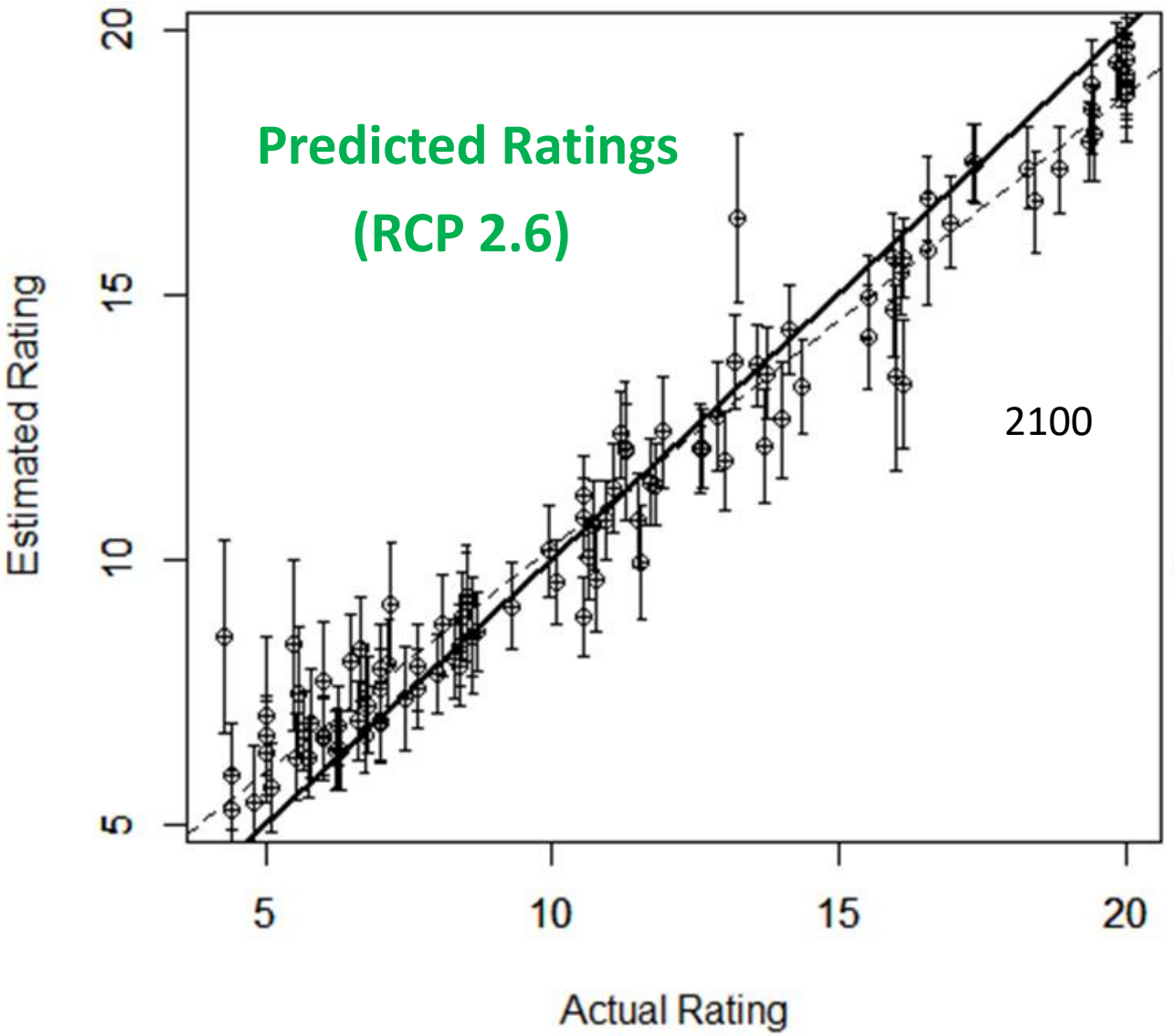
Investigate 3 scenarios

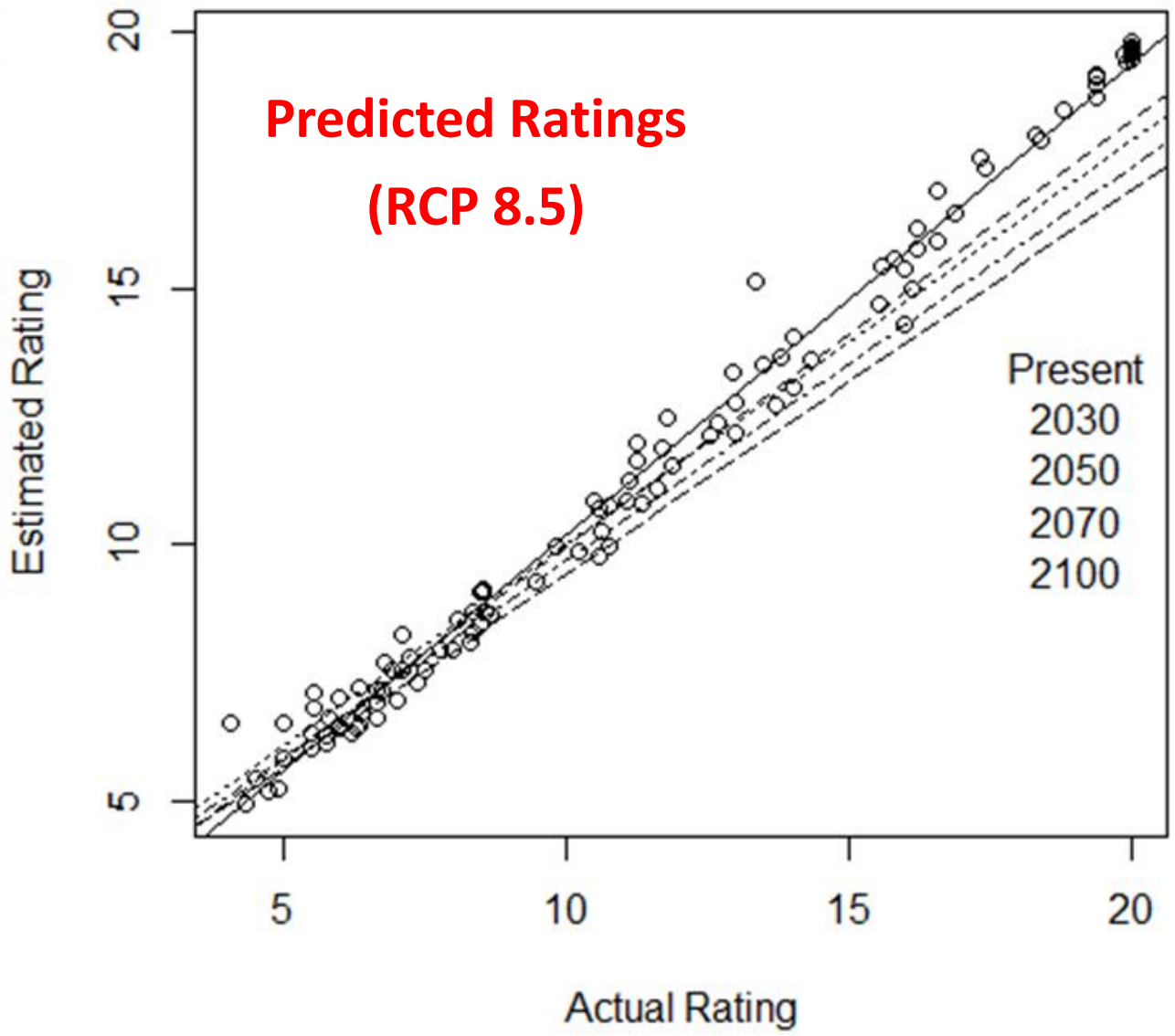
- For 108 sovereigns using our model and climate-adjusted indicators

- Use three warming scenarios
  - RCP 2.6 (2°C)
  - RCP 8.5 (5°C)
  - RCP 8.5 (5°C) + temperature variability rises with temperature



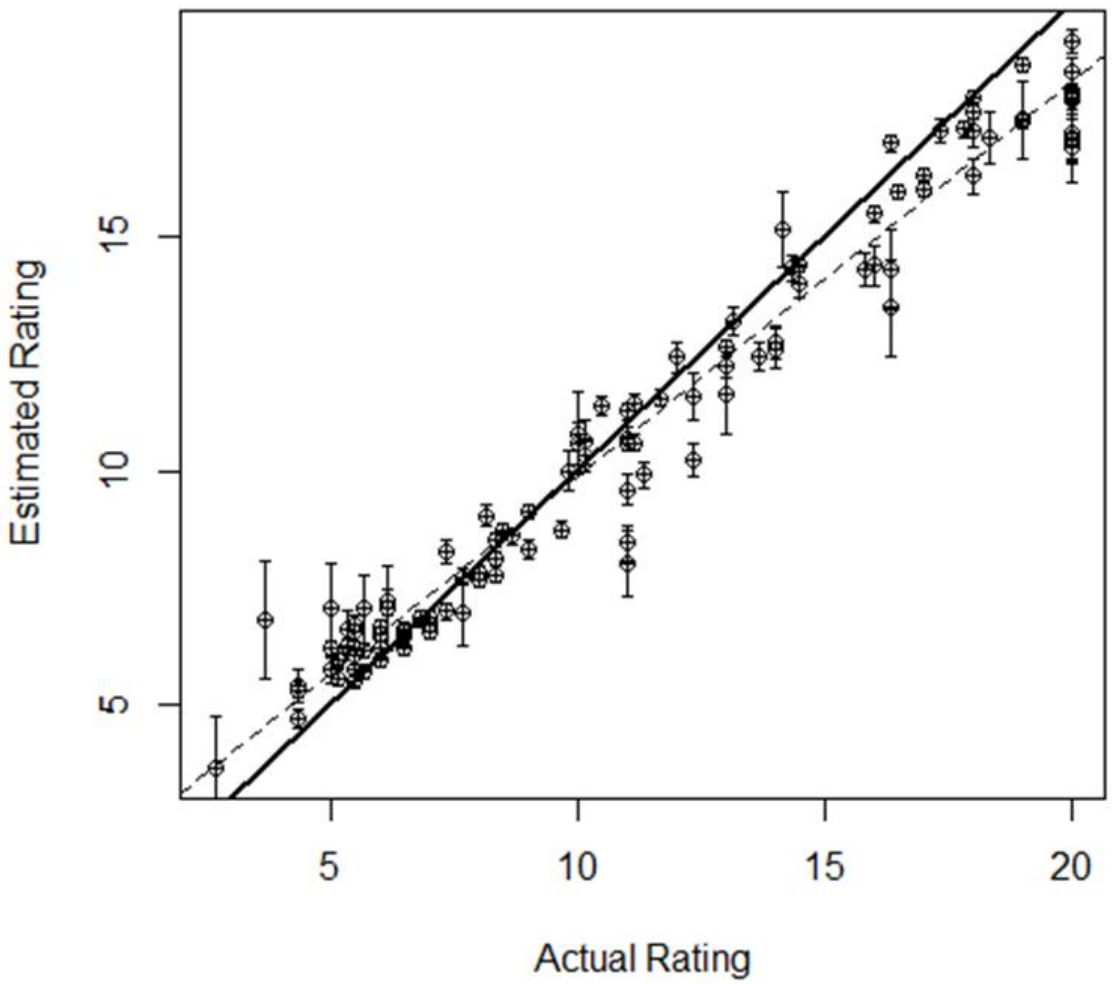
Predicted ratings: 2°C vs 4.5°C world (2100)





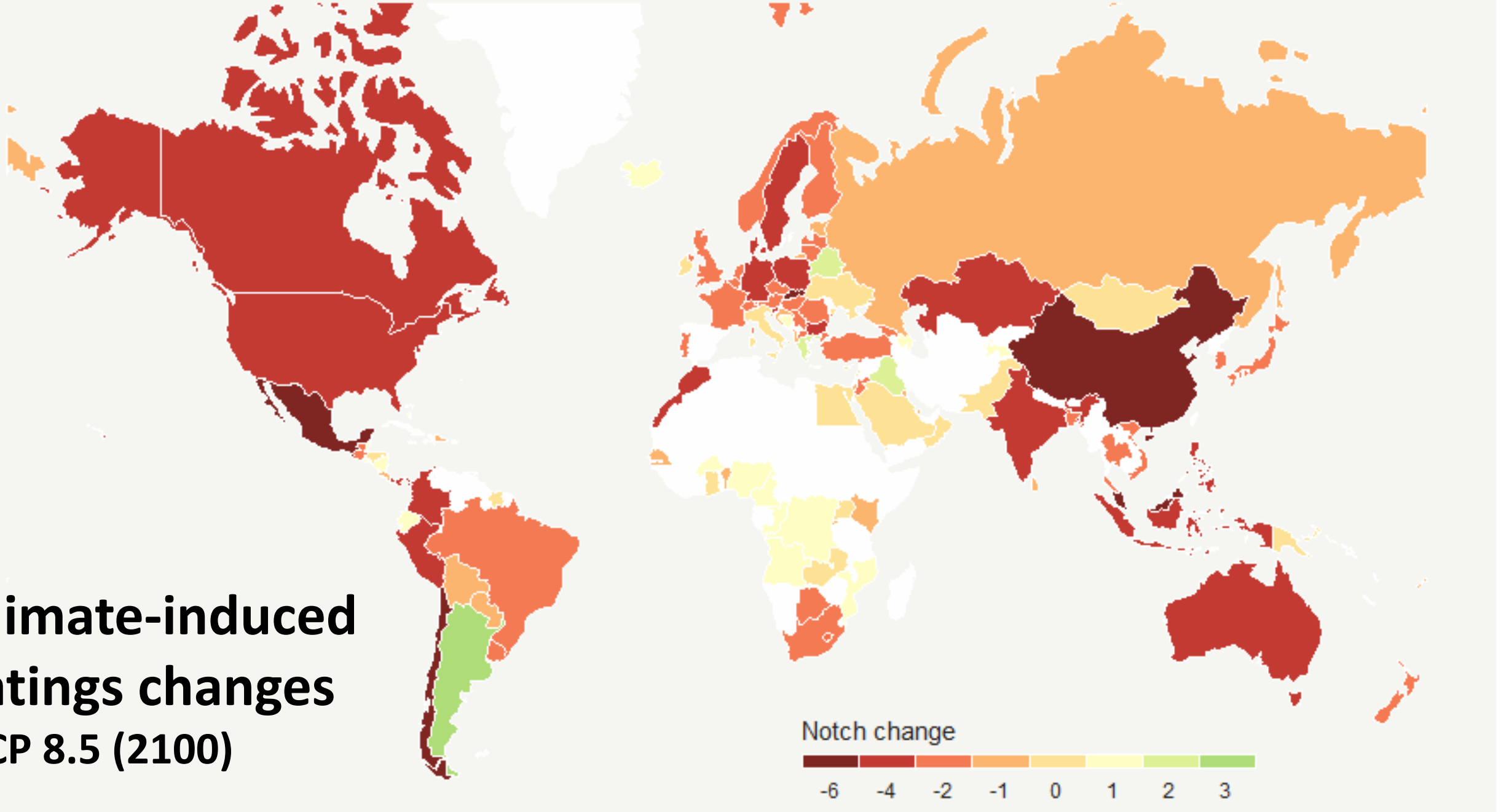
Predicted Ratings in 2030 (RCP 8.5)

- 63 sovereigns face climate-induced downgrades
- Avg = 1.02 notches

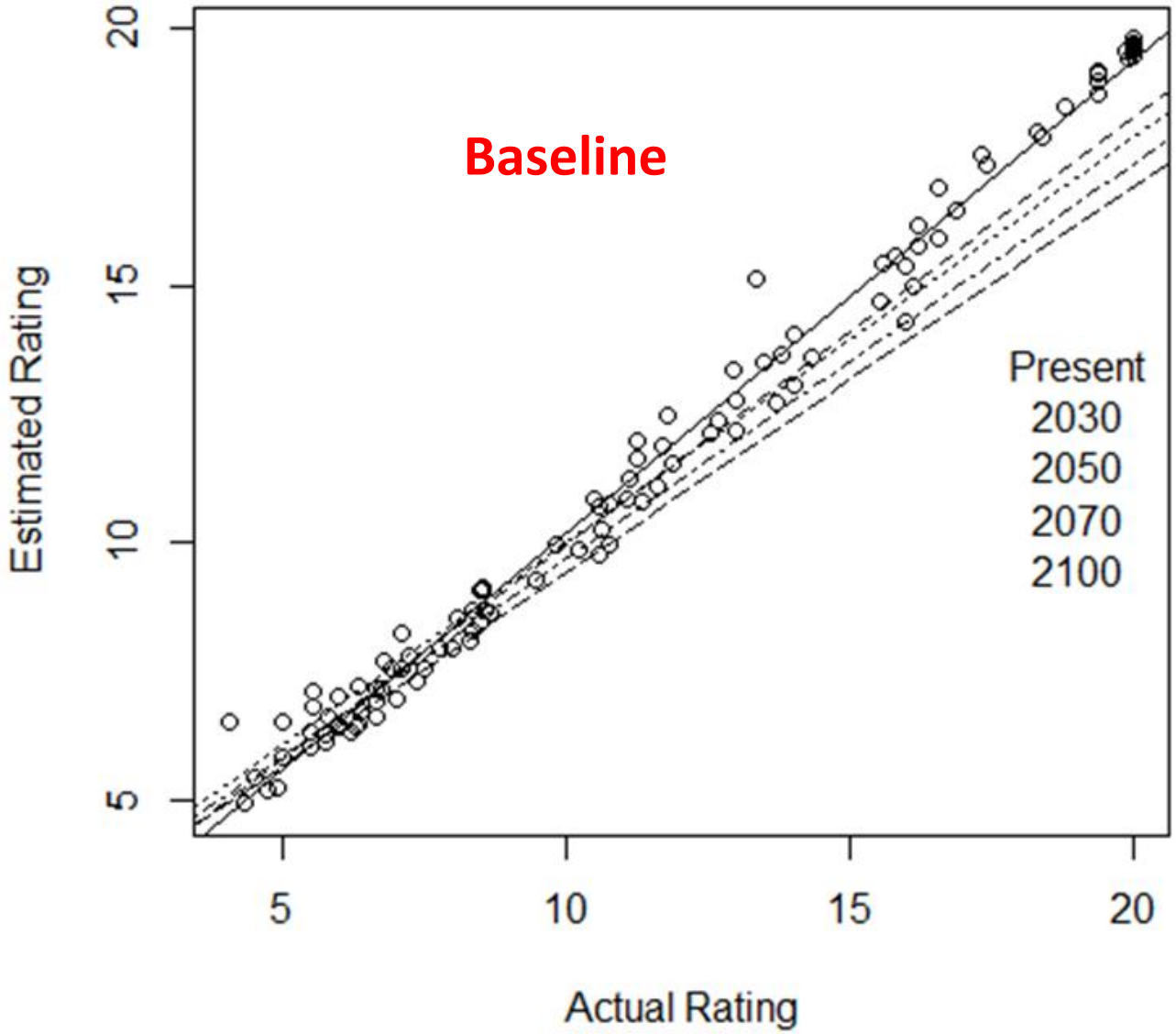


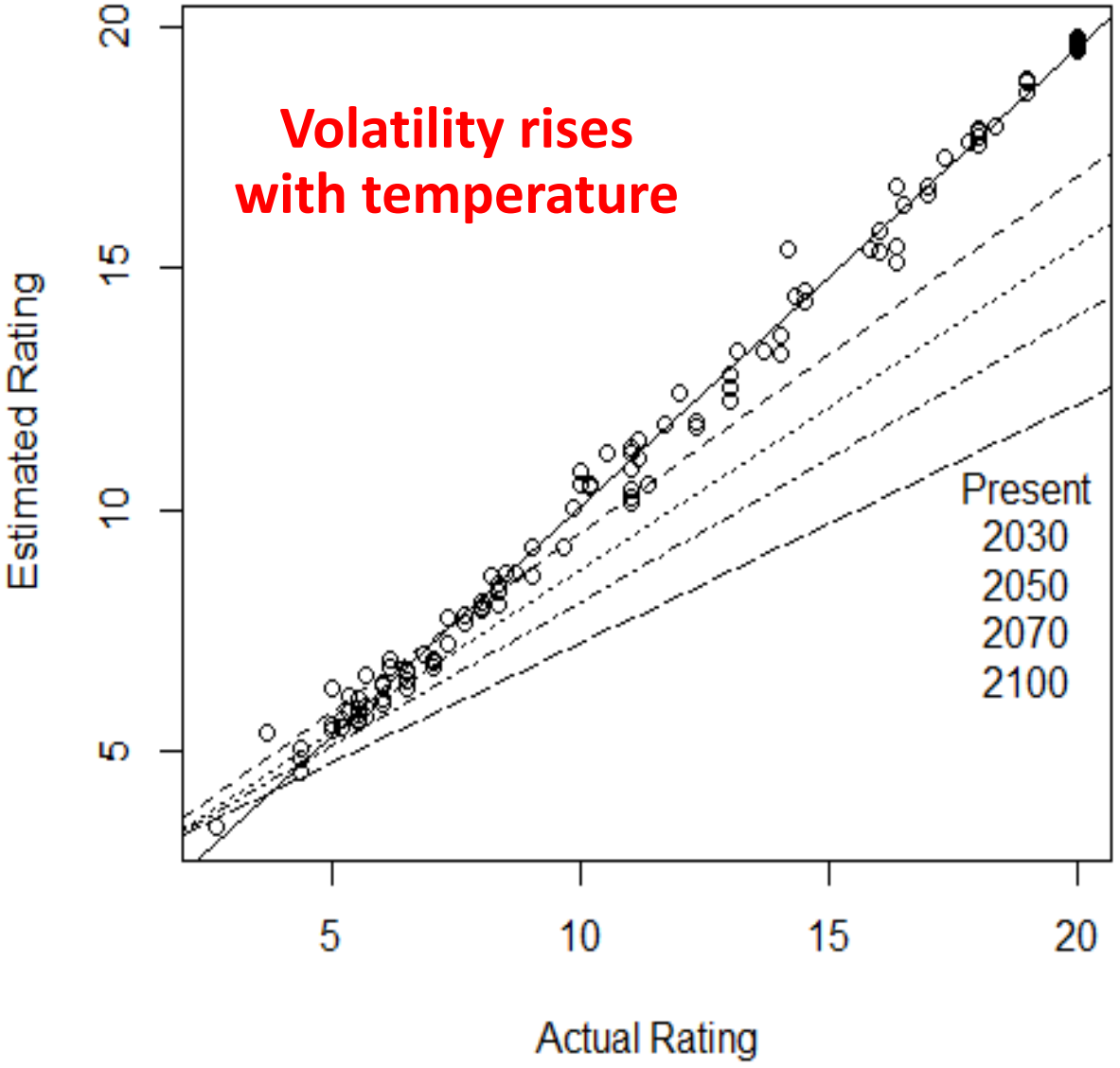
Climate-induced ratings changes

RCP 8.5 (2100)



RCP 8.5 with increased volatility





Climate-induced increases in costs of sovereign debt

Scenario	Countries	Outstanding Debt ($trn)	Climate-induced downgrades (Avg)	Additional cost of debt ($bn) (lower)	Additional cost of debt ($bn) (upper)
RCP 2.6	G7	33.6	0.58	14.1	21.2
	Full sample	**42.7**	**0.65**	**22.8**	**34.1**
RCP 8.5	G7	35.8	3.16	101	152
	Full sample	**47.3**	**2.48**	**137**	**205**

Final thoughts…

- Put climate science into climate finance
- Paris commitments will reduce downgrades
- Delaying green investment increases future costs