



# Climate – Modelling Challenges for the Next Big Financial Risk

# Introduction

**The demand for companies to assess and monitor the potential impact of different climate risks on their organization is gathering pace**

- EIOPA in its consultation paper of October 2020 (EIOPA-BoS-20/561)
- UK PRA Exploratory Stress Tests 2019/2020 and CBES (2021)
- MAS December 2020 Statement on Environmental Risk
- Chinese Regulatory Authority
- TCFD, PRI, IAIS, NGFS etc.

## **Aims of the regulator:**

- Size the risk
- Understand the impact on a firm's business model
- Encourage management of risks and inform future strategic decisions

**Assessing climate risk on a portfolio is however challenging to implement in practice**

- “What?” is clear
- “How?” is more challenging

# Global Regulatory Perspective

*“A forward-looking and risk-based approach to the ORSA necessitates that undertakings consider a wide range of outcomes. A clear view of the risks and uncertainties to which the undertaking is exposed allows the management body to discuss and decide on actions to mitigate excessive risks and anticipate future management actions contingent on certain future events unfolding.”*

**EIOPA Consultation paper (EIOPA-BoS-20/561)**

*“Environmental risk poses potential financial and reputational impact to insurers..... As such, the extent to which environmental risk is relevant and material to an insurer will vary depending on the insurer’s business strategies and activities. ”*

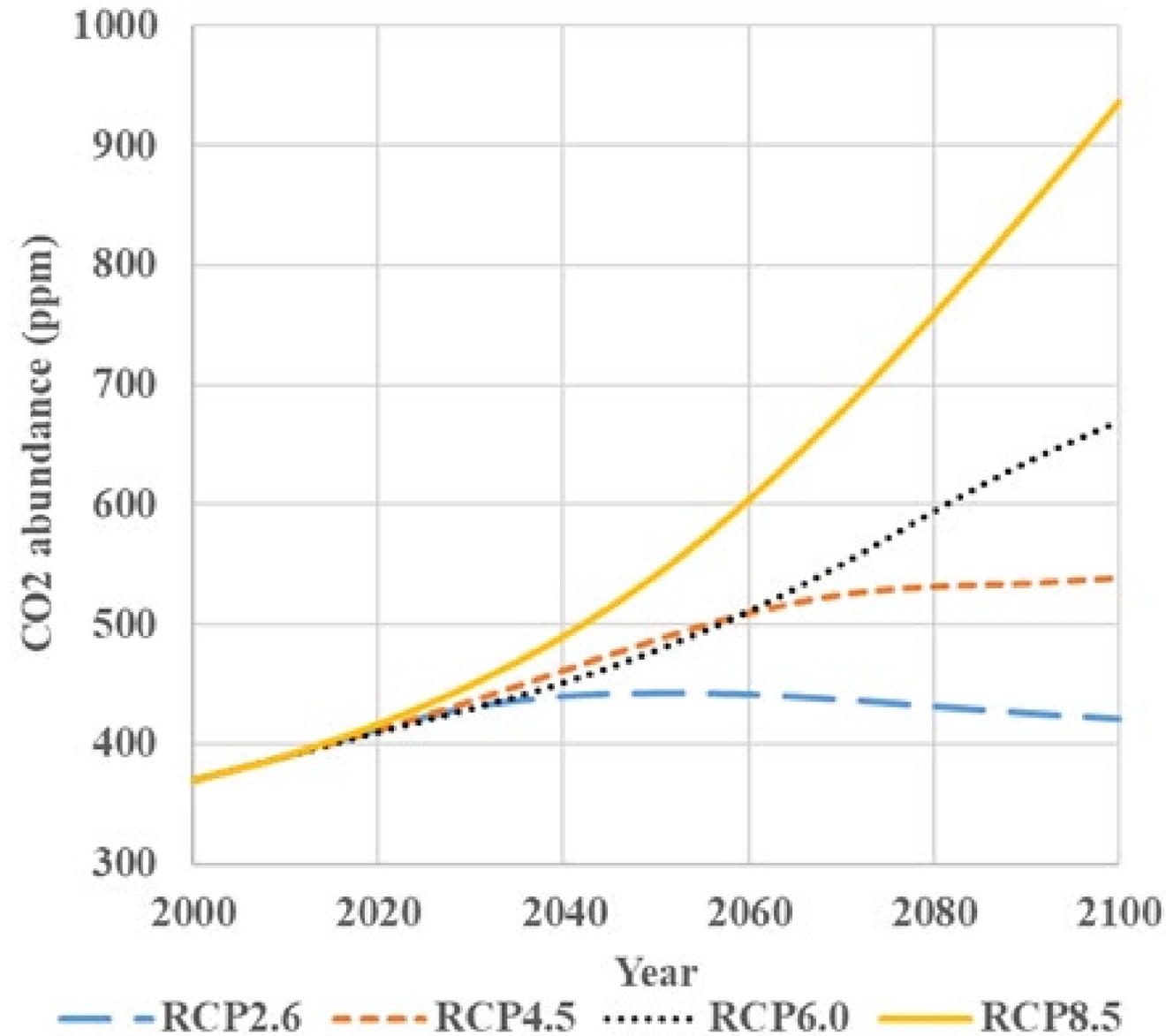
**Monetary Authority Singapore December 2020**

Source: <https://www.mas.gov.sg/-/media/MAS/Regulations-and-Financial-Stability/Regulations-Guidance-and-Licensing/Insurance/Regulations-Guidance-and-Licensing/Guidelines/Guidelines-on-Environmental-Risk-Management-Insurers.pdf>

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# DEFINING CLIMATE SCENARIOS

# Defining Stresses



## Stress tests vs. scenario analysis

- Stress tests are usually point in time
- Scenario analysis has an element of through time
- Scenario analysis useful when it is difficult to assign probabilities to outcomes

**For Climate there are many useful tools to get started**

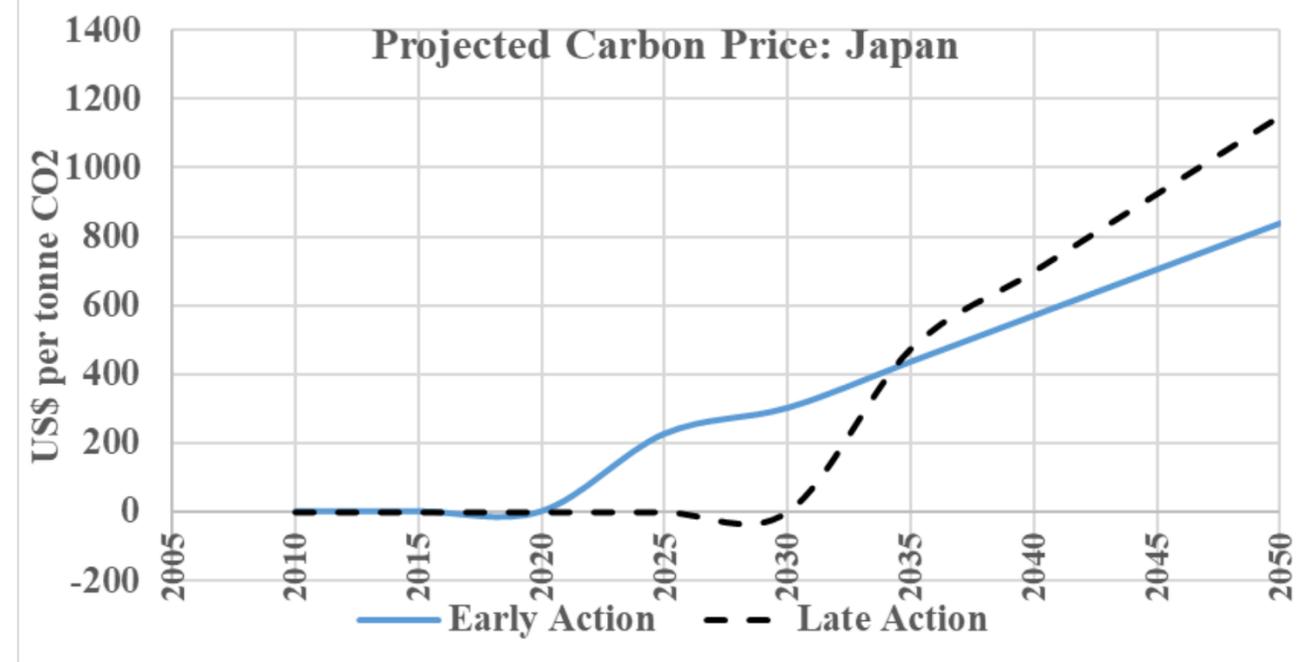
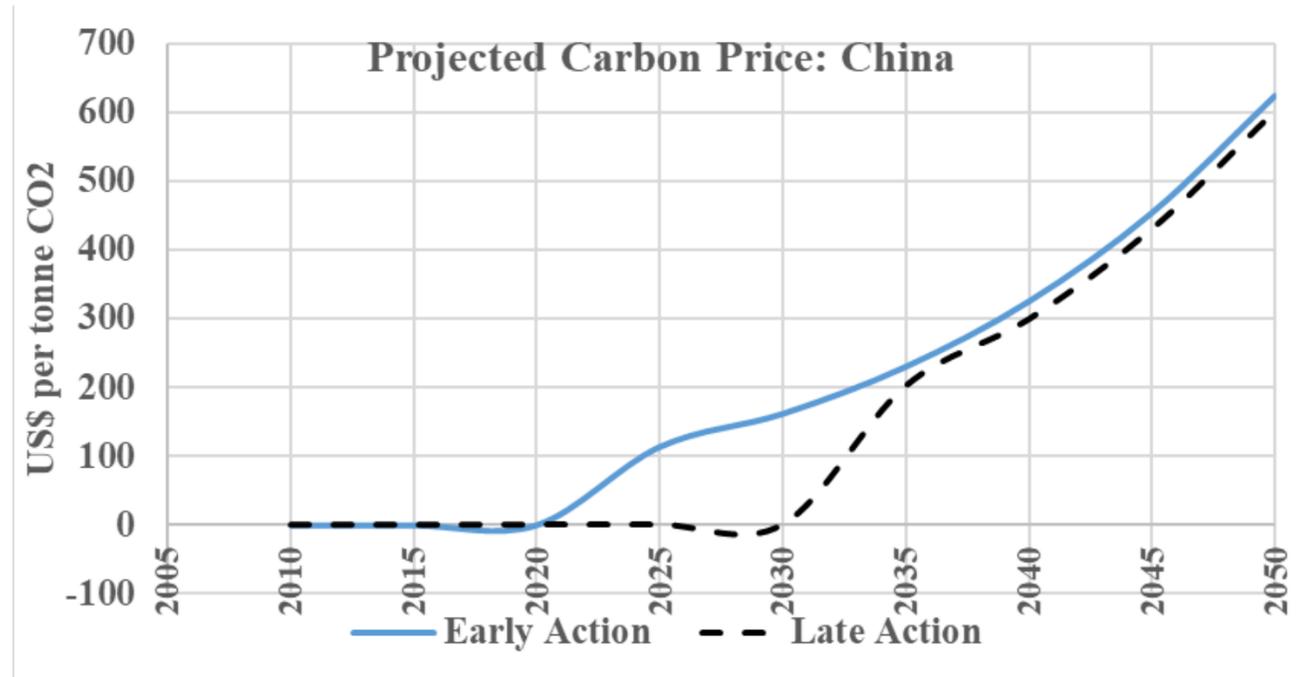
## IPCC

- Representative Concentration pathways
- Give a common language across domains

**Modelling climate related risks is still in its infancy**

Source: Prepared by Conning, Inc., IPCC, 2013: Annex II: Climate System Scenario Tables [Prather, M., G. Flato, P. Friedlingstein, C. Jones, J.-F. Lamarque, H. Liao and P. Rasch (eds.)]. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

# Transition Risk



**Transition risk represents the risks to the financial system from moving to a low carbon economy**

**Primary mechanism by which risk propagates is through increases in the cost of carbon**

- **Governmental policy actions**
- **Carbon Taxes**
- **Cap and Trade**

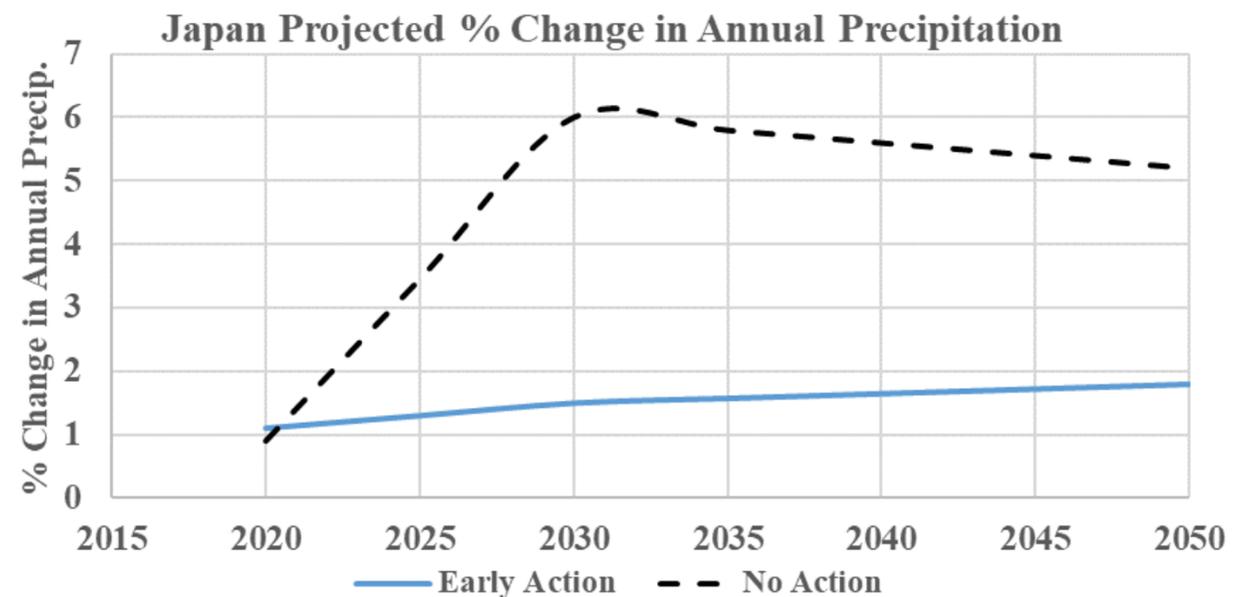
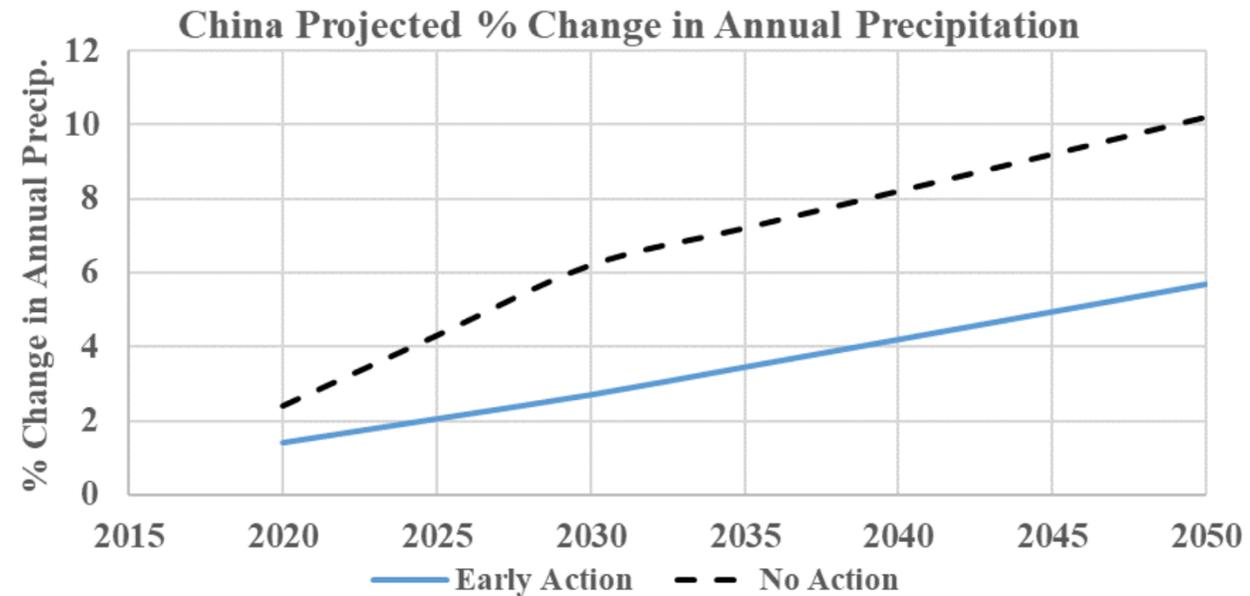
**Incentivization too**

- **Green subsidies**
- **Green tax rates**

**Negative and positive effects on asset prices depending on exposure**

Source: Prepared by Conning Inc., NGFS Climate Scenarios for central banks and supervisors, June 2020

# Physical Risk



**Physical risks arise due threats to physical assets arising from climate change**

- Increased frequency and severity of extreme weather events
- Coastal/riverine flooding/wildfires etc.

**Typically, a strong geographical component**

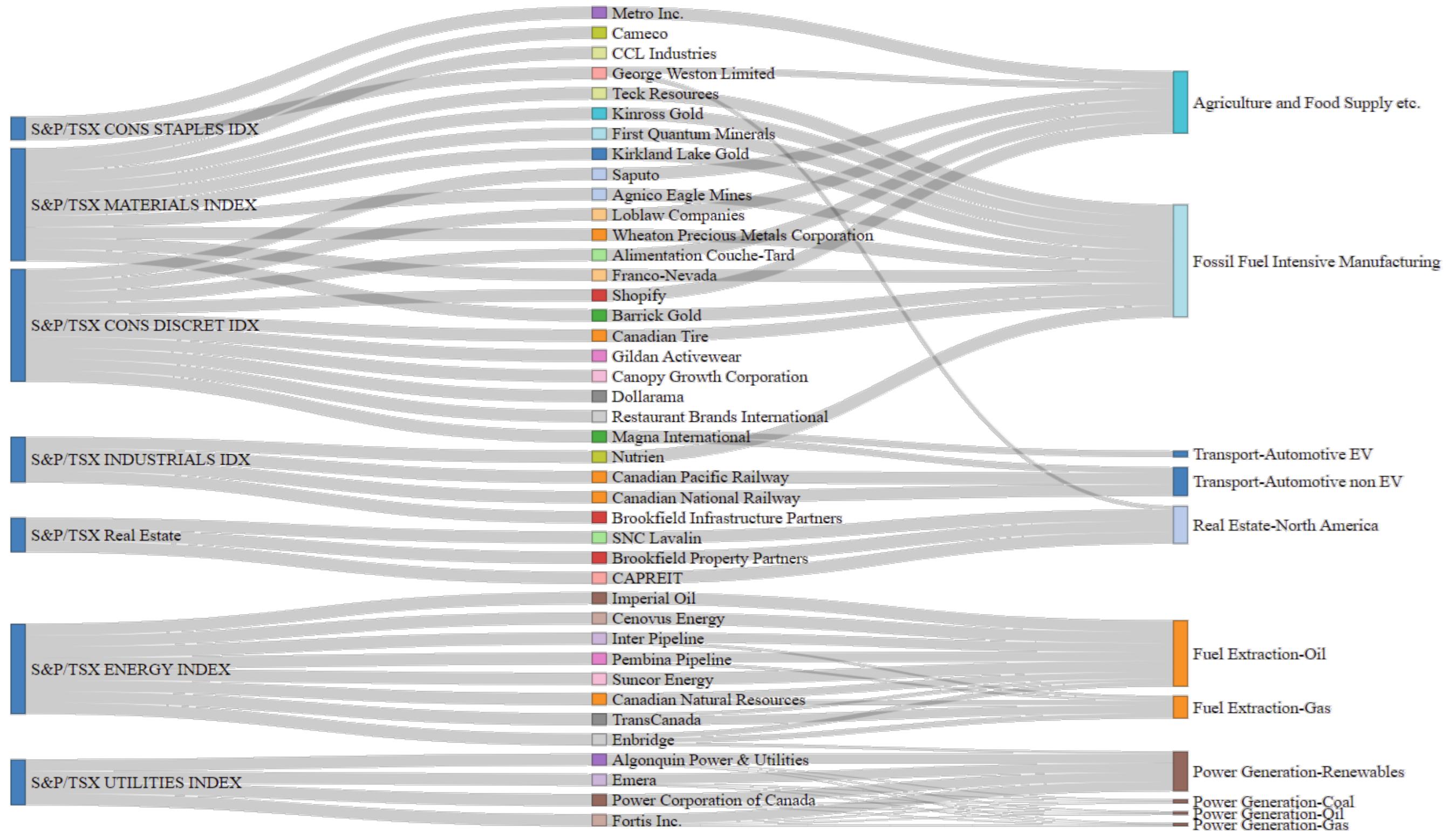
**Real estate and related assets (mortgages, insurance liabilities etc.) need particular consideration**

**Other risks worth considering**

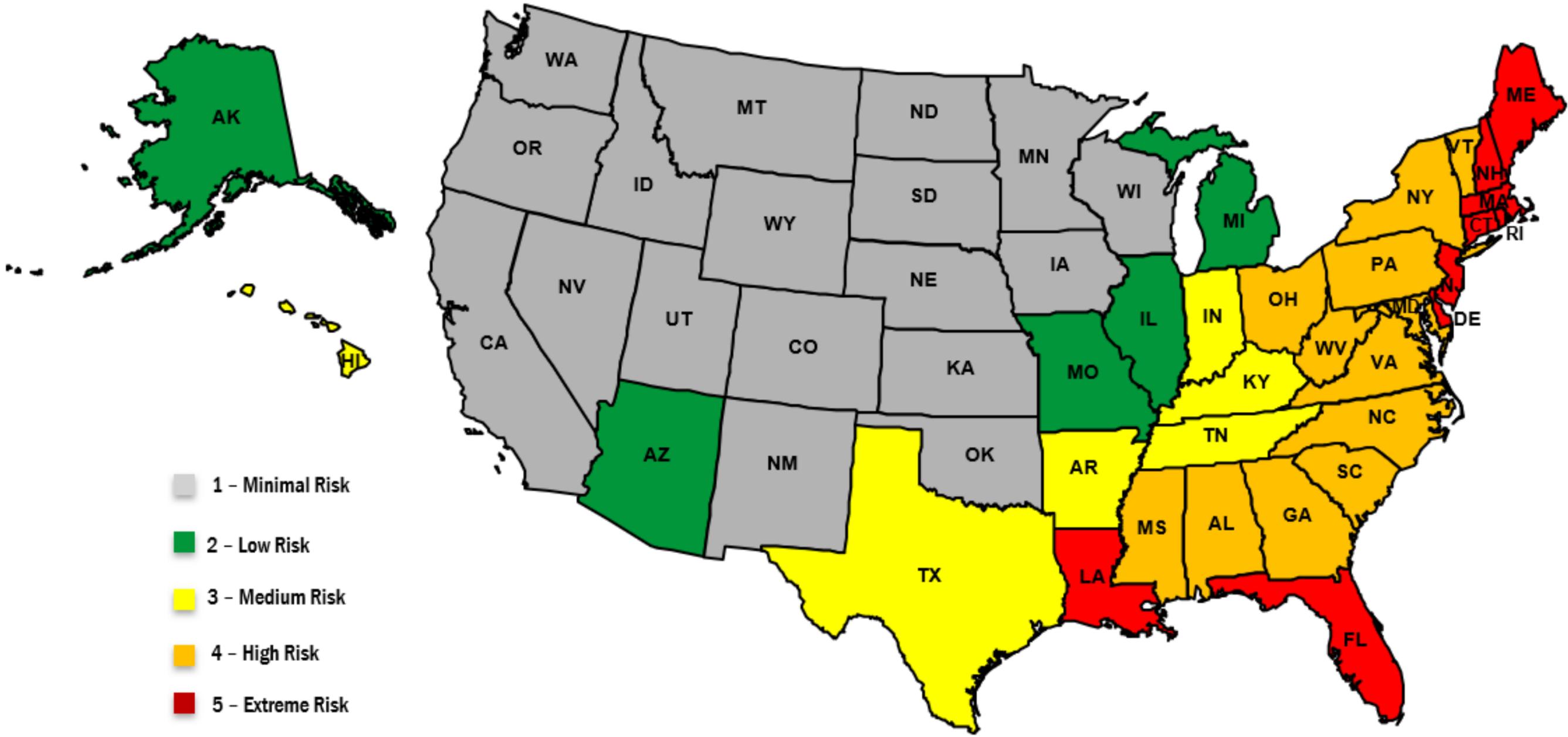
- Litigation risk
- Risk arising from increased migration
- Conflict and geopolitical risks

Source: Prepared by Conning Inc., NGFS Climate Scenarios for central banks and supervisors, June 2020

# Defining Stresses – Mapping Problem



# Defining Stresses – Spatial and Geographic Considerations



Source: Prepared by Conning Inc.

# Scenario Definition Methodologies

## Regulator Defined

- Regulators globally have defined many stress tests
- One of the most complete is the BoE/PRA CBES Stress test
- Based on NGFS and other academic work the scenarios defined are globally applicable

## Climate Economics Models

- Use model-based assumptions to impute scenario impacts on the economy

## Physical Risk

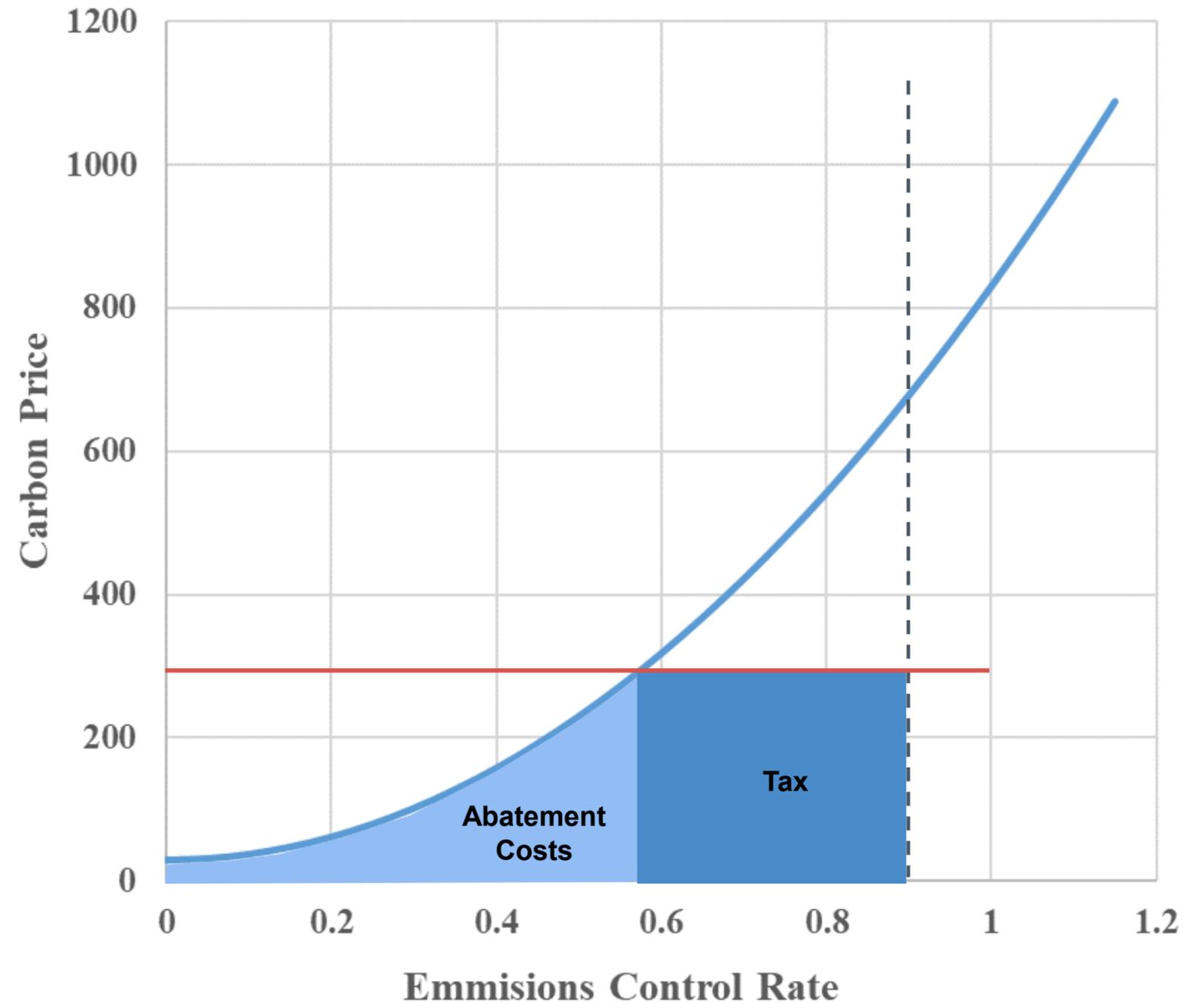
- E.g. Nordhaus or Kalkuh and Weinz

$$\text{Damage}(t) = \alpha_1 \Delta T(t) + \alpha_2 \Delta T(t)^2$$

## Transition risk

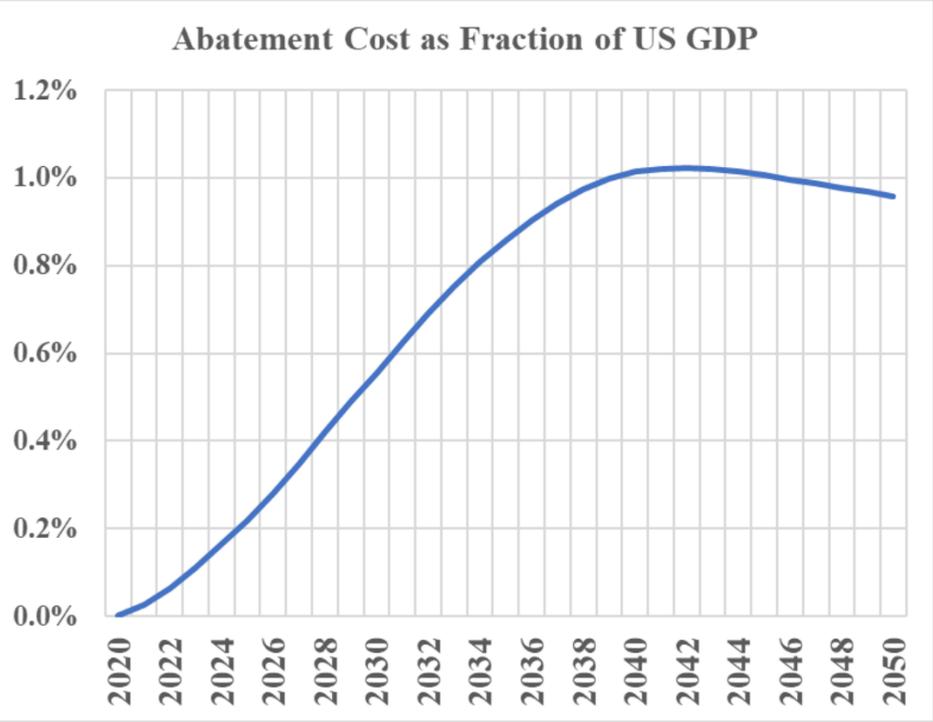
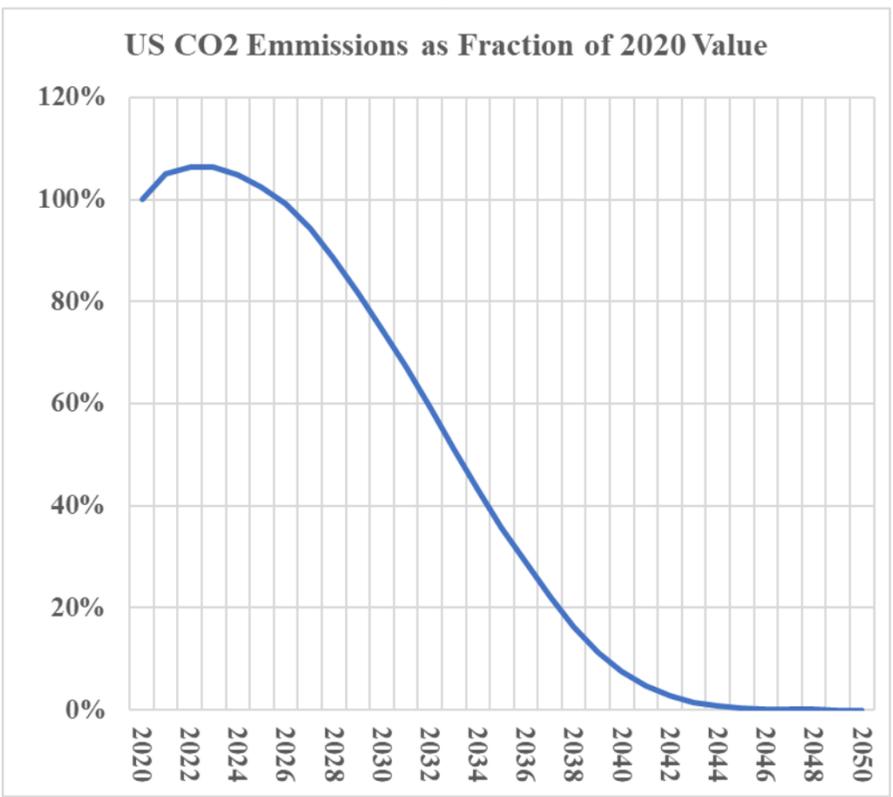
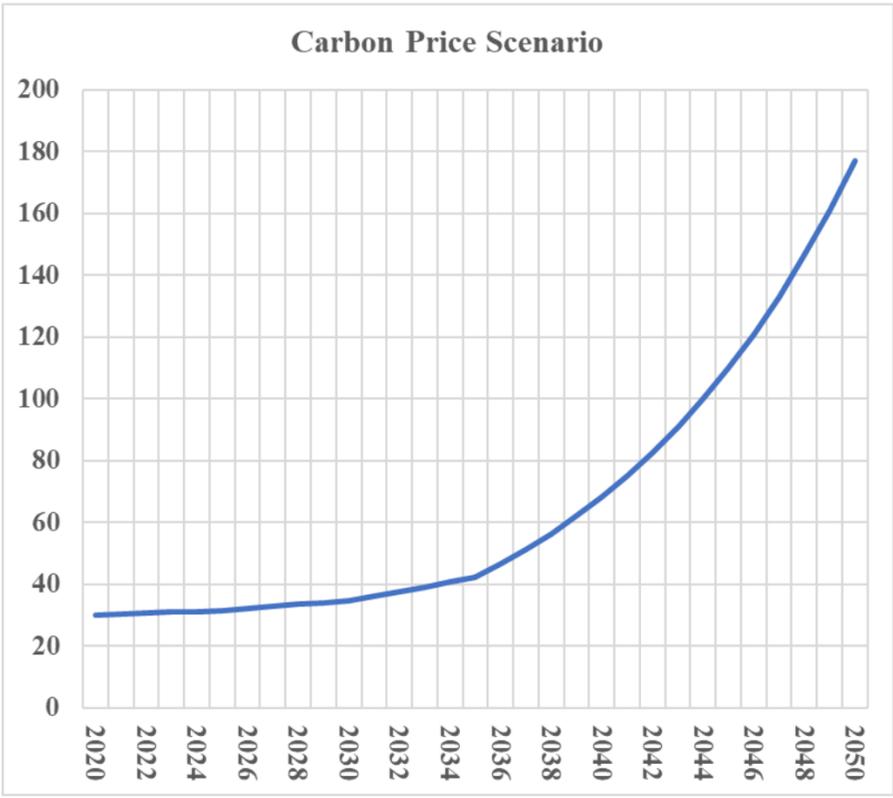
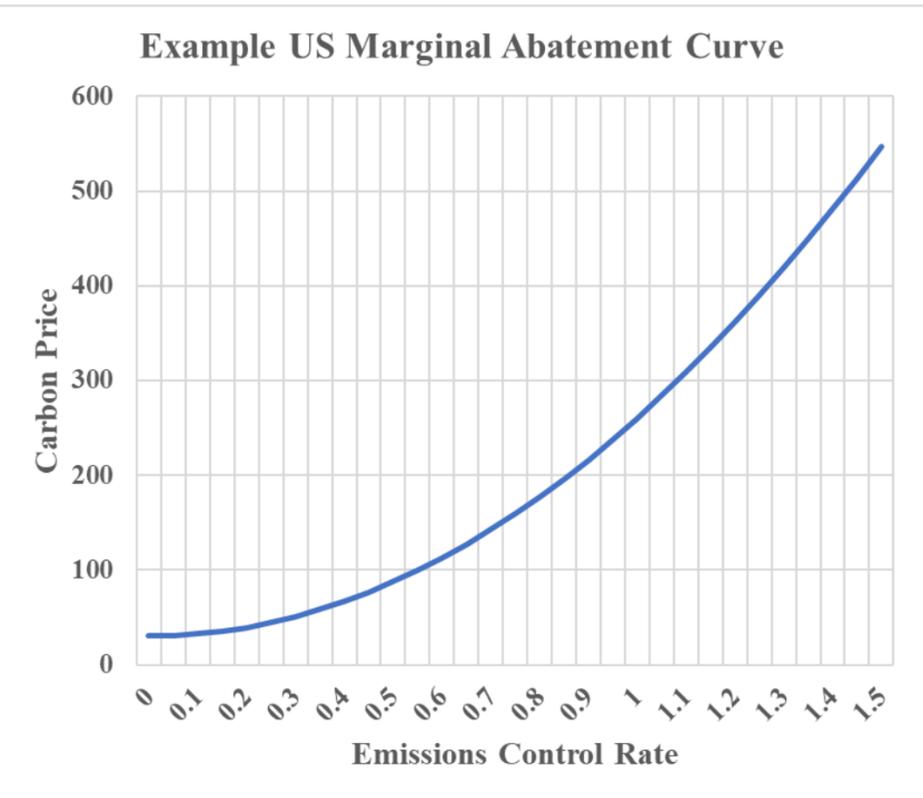
- Use an equilibrium model
- Define “cost of carbon” scenarios
- Impute the impact on global GDP

Marginal Abatement Curve



Source: Prepared by Conning Inc.

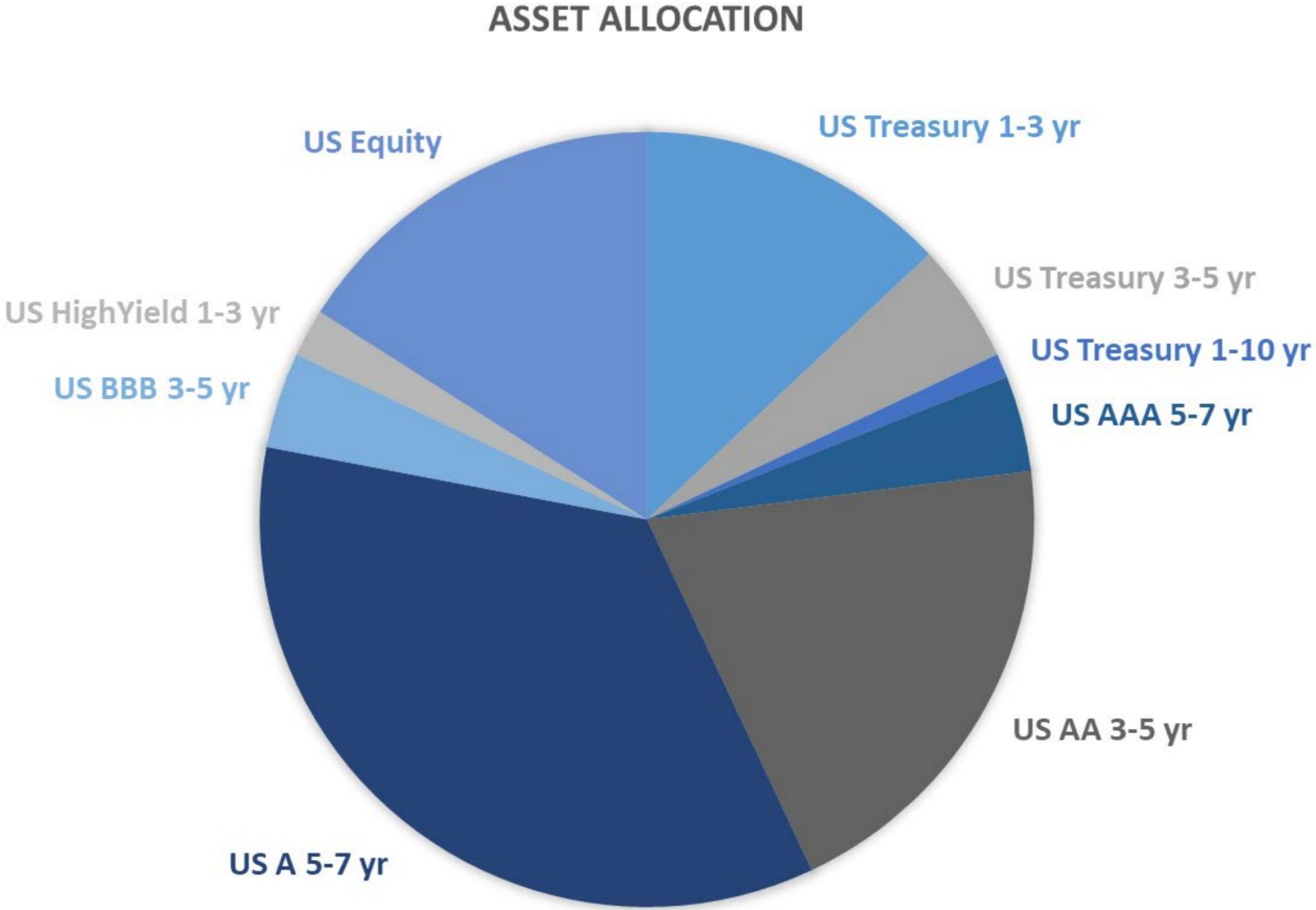
# Scenario Definition Methodologies – Equilibrium Models



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# CASE STUDY – CBES LATE ACTION SECENARIO

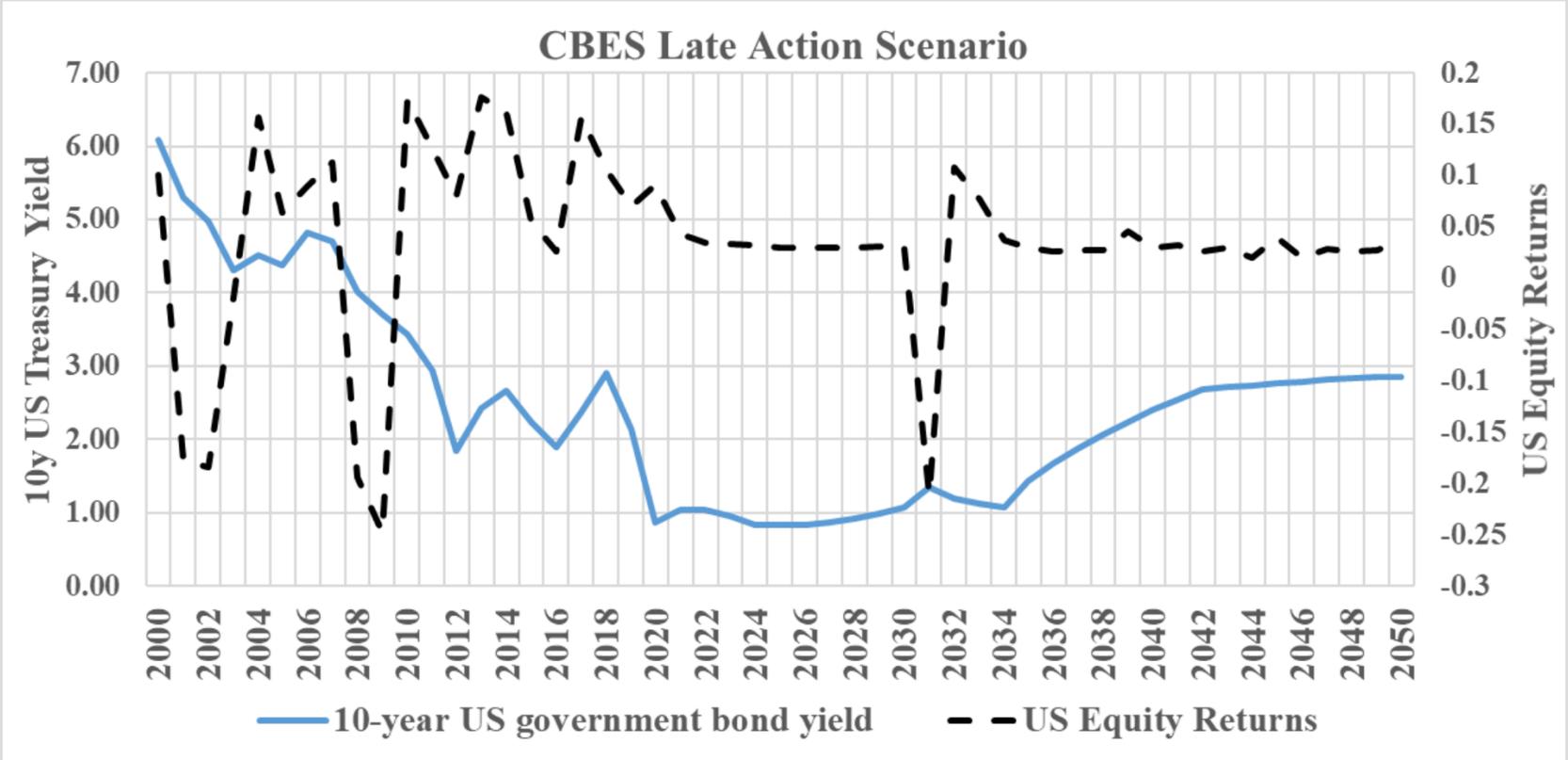
# Case Study – Asset Allocation



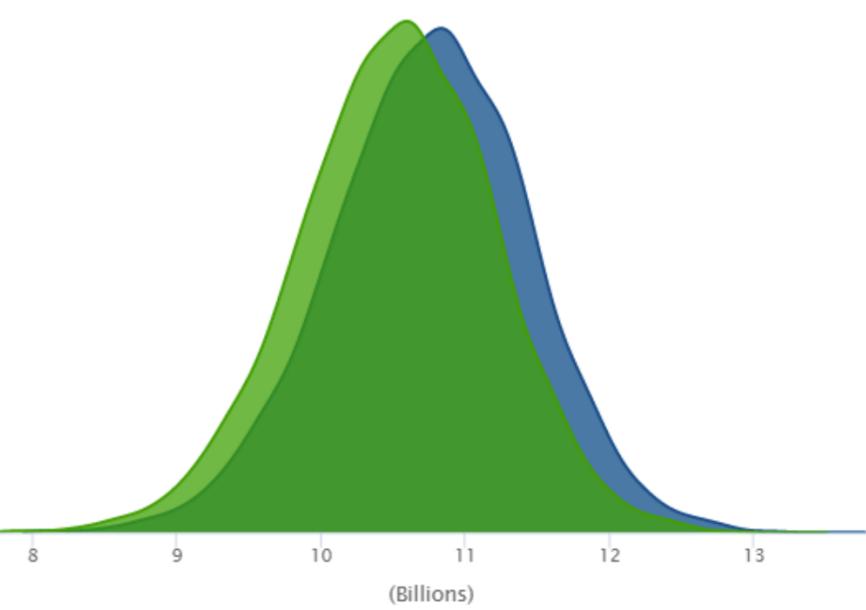
Source: Prepared by Conning Inc.

# 2019 vs 2021 Stress Test Comparison

CBES Late Action Scenario

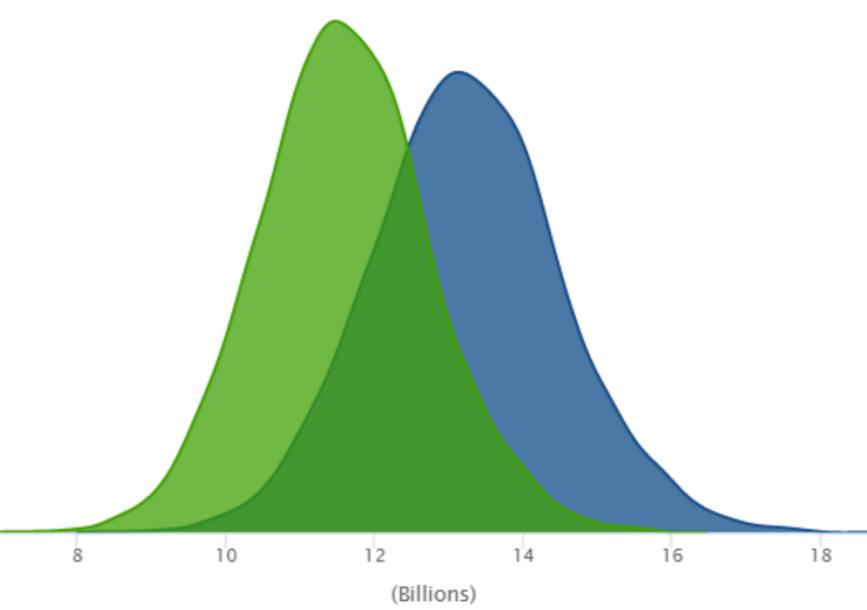


Market Value at +5 Years



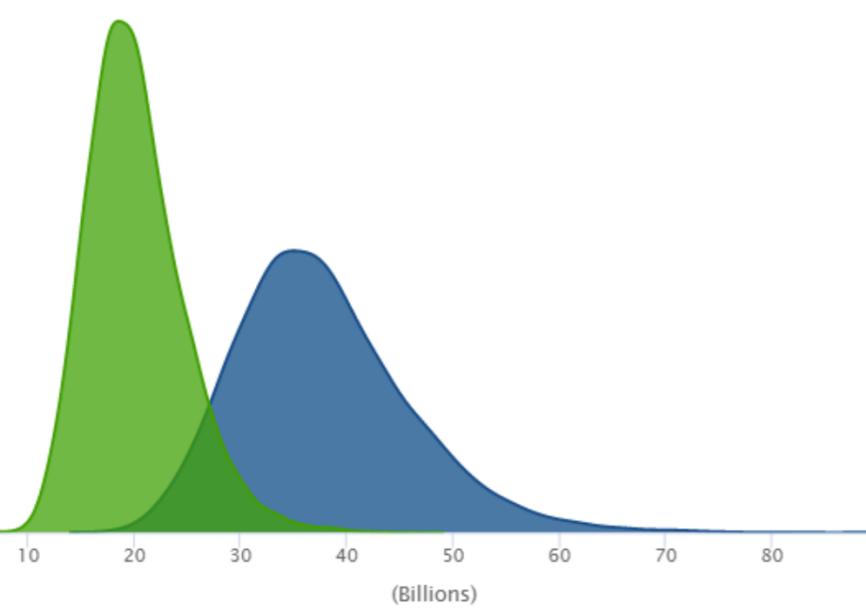
■ Base Case ■ Adjusted

Market Value at +10 Years



■ Base Case ■ Adjusted

Market Value at +30 Years



■ Base Case ■ Adjusted



# 2019 vs 2021 Stress Test Comparison

CBES Late Action

## Market Value Statistics Horizon 30

	Base Case	Stress Scenario	Excess Risk	
			Transition	Total
Mean	37,784,927,819	20,146,984,611	-17,637,943,208	-17,637,943,208
StDev.5	8,262,991,191	4,562,981,007	-3,700,010,184	-3,700,010,184
0.5%	21,582,014,396	11,267,029,244	-10,314,985,151	-10,314,985,151
1%	22,448,137,400	11,758,025,021	-10,690,112,378	-10,690,112,378
5%	26,019,001,434	13,684,353,269	-12,334,648,165	-12,334,648,165
25%	32,050,435,721	16,999,774,253	-15,050,661,468	-15,050,661,468
50%	36,815,202,074	19,605,628,379	-17,209,573,695	-17,209,573,695

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# Summary

## **Climate risk reporting is rapidly becoming a requirement for financial institutions**

- Can be challenging to define and implement
- Requires classification of scenarios
- Much uncertainty about timing and magnitude of effects
- Can be technically and resource intensive

## **More tools are becoming available to act as a basis for standardized approaches**

- NGFS scenarios
- Regulators and central banks
- Climate economic models

## **Extensions to existing stochastic modeling techniques are a useful tool**

- Case study presented here shows impacts of CBES on a typical portfolio
- Should we be worried about transition and physical risk in our portfolios?
- How does climate risk compare in magnitude to other types of risk?

## **The future**

- Talk becomes action!

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