Central Banking Challenges Posed by Uncertain Climate Change and Natural Disasters

Lars Peter Hansen (University of Chicago)

Carnegie-Rochester-NYU Conference on Public Policy: Central Banking in the 2020s and Beyond

April 16, 2021

Important Considerations

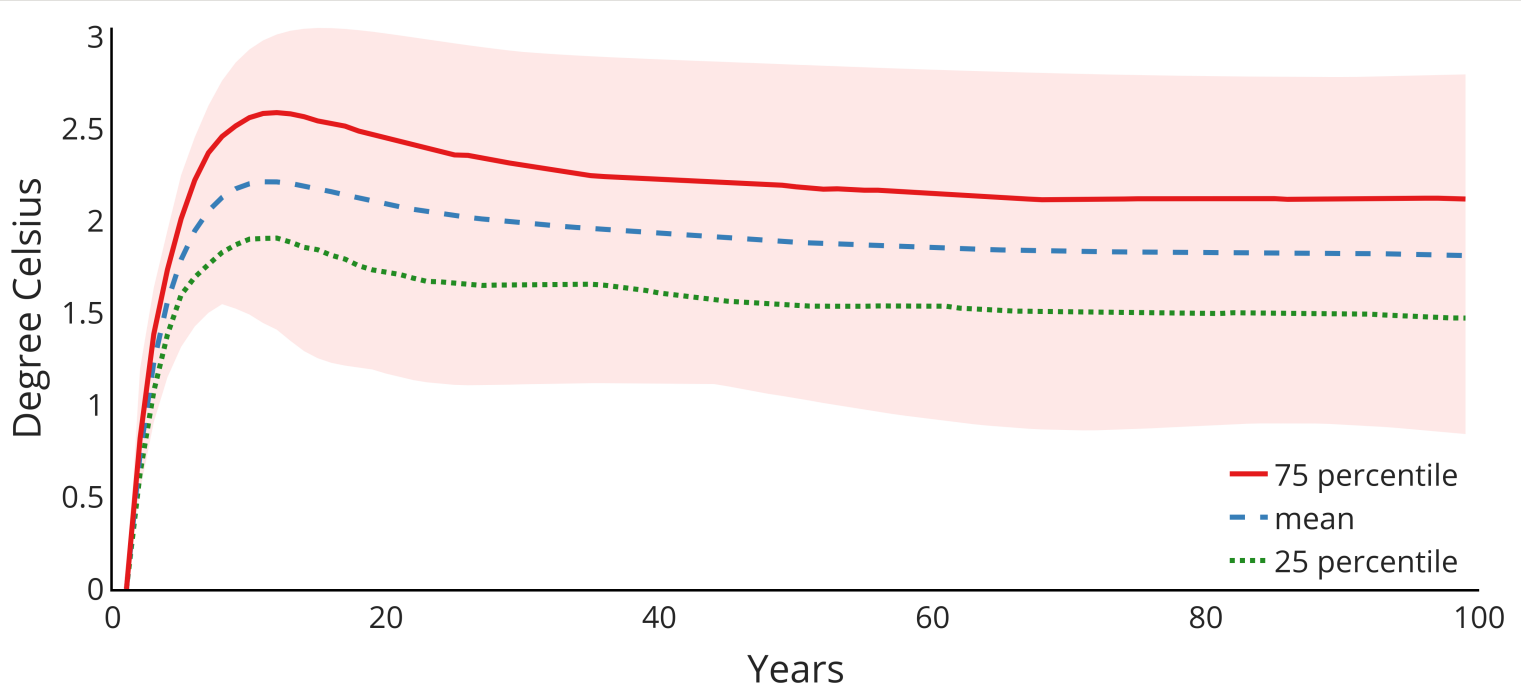
- hastily devised policy rules unsupported by quantitative modeling could backfire, harming reputations of central banks
- broadening the mission without well-defined mandates could compromise central bank independence
- climate change mitigation targets may generate unwarranted confidence in the abilities of central banks to address this important problem

Systemic uncertainty?

I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind. Lord Kelvin, 1883.

- What is systemic risk? modeling successes have been largely qualitative
- How do we integrate climate change into our current understanding?
- What time scale do we expect climate change uncertainty to unfold under?

Divergent climate model predictions



Percentiles for temperature responses to emission impulses. The emission pulse was 100 gigatons of carbon (GtC) spread over the first year. The temperature units for the vertical axis have been multiplied by ten. The boundaries of the shaded regions are the upper and lower envelopes based on 144 models.

Uncertainty impacts on fiscal policy

Much quantitative research in climate economics has targeted the SCC (social cost of carbon)

- Much guess work involve in specifying damage functions intended to capture how climate change alters economic opportunities
- Environmental tipping points, missed by the pulse experiments, could come on the radar screen depending on technological progress and policy responses

In stylized calculations explicit accounting for uncertainty can enhance the SCC by twenty to thirty percent.

Quantitative implications for financial stability are still unknown.

Quantifying Exposures to Climate Uncertainty

Well-articulated mandate for regulatory/supervisory role for the banking sector

- systematic uncertainty in contrast to systemic uncertainty
- historical measurement is of limited value - push advanced economies in realms that we have yet to experience
- concern that private sector collectively under-estimates magnitudes of their exposure to climate change

Uncertainty categorization

Common dichotomy:

- transition risk - uncertain policies, advances in green technology, and economic damages
- physical risk - climate sensitivity to fossil fuel emissions, environmental tipping points triggered by temperature increases

Role for decision theory under uncertainty

- when using models, decision theory formalizes a tradeoff between best guesses and possible bad outcomes
- uncertainty components
  - risk - unknown outcomes with known probabilities
  - ambiguity - unknown weights to assign to alternative probability models
  - misspecification - unknown ways in which a model might give flawed probabilistic predictions
- whose models: regulator's or regulated's - see Behn, Haselmann, and Vig, "The Limits of Model-Based Regulation."

Scenario-based stress tests

Aims:

- confront "extreme uncertainty" connected to climate change without resort to probabilities
- explore events through a small number of well-defined scenarios that can extend over three decades
- investigate tail events that stress the financial system

Scenario based stress tests

Figure 3.1 Illustrative variable pathways in each scenario

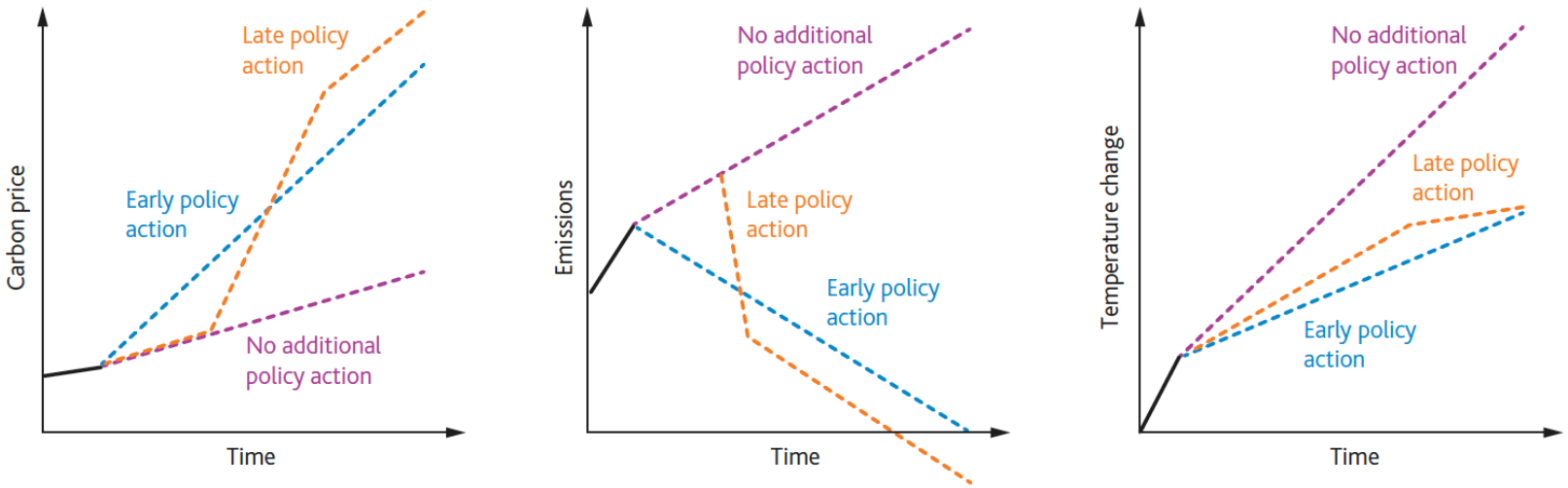


Figure taken from the Bank of England report: The 2021 Biennial Exploratory Scenario on the Financial Risks from Climate Change

Limits to stress tests

Static with no uncertainty along a path

- miss or disguise two important lessons from decision theory:
  - tradeoff between guarding against possible bad outcomes that could happen versus performing well over more likely outcomes
  - decisions respond recursively to state dynamics and information revelation
- provides misguided paths for price signals without explicit modeling
- opens the door to stress test answers that condition on the entire path

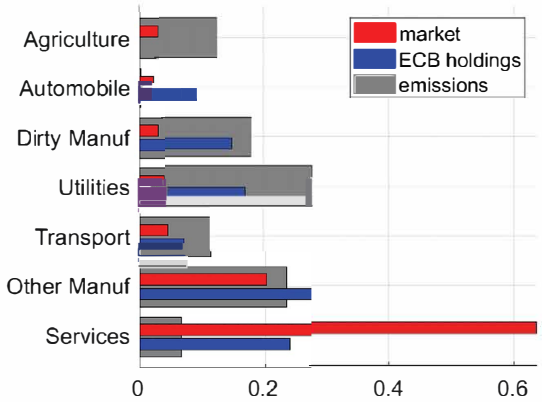
Shunting probabilities and dynamic information revelation to the background is unproductive.

Tilting portfolios green

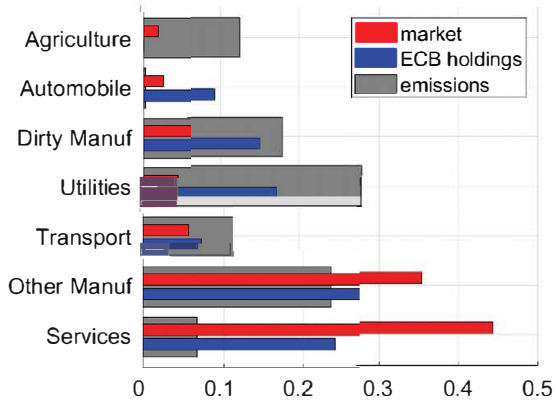
What is the role of central banks embracing sustainability in the construction of their own portfolios and certifying ESG (environmental, social and governance) portfolio standards for other investors?

- At best a weak substitute for fiscal policy which can tax carbon emissions and subsidize research and development
- Much of this is best handled by the private sector or other realms with more expertise
- Runs the danger of pushing central banks closer to political arena

Green versus market neutrality in asset purchases



(a) Market measured by capital income



(b) Market measured by total assets to revenues

Figure 1: Sector shares of the market portfolio, ECB holdings, and emissions

This figure is constructed the year-end 2017 data. In figure (a) market shares are measured as capital income by sector (capital income = value added - wages). In figure (b) market shares are measured as output (from Eurostat) times the ratio of total assets to revenues (from Orbis) by sector. Emission intensity is measured by Scope 1 air emissions by sector. The ECB portfolio includes only securities held under the corporate sector purchase programme (CSPP) that was initiated in March 2016.

Source: Papoutsi, Piazzesi, Schneider, 2021

Conclusion/Summary

- Uncertainty is pervasive when exploring the economic and social implications of climate change
- The time horizon over which climate change uncertainty plays out is different than in other forms of turbulence on the radar screen of central banks
- Rules based policy is most compelling when supported by quantitative models that reflect our understanding based on insight and evidence
- When uncertainty is “first-order,” guidance from decision theory under uncertainty becomes all the more valuable
- Understanding the sources of subjective uncertainty in models used by both the regulated and regulators will make oversight more effective