Expert judgement for uncertainty quantification

A presentation for COST Action IS1304

Outline of the presentation

- Introduction
  - About me
  - Background on climate change
  - About the UNEP DTU Partnership (UDP)
- Expert judgement for uncertainty quantification
  - Scenarios to avoid post-hoc dependency analysis
  - Probabilistic vs. deterministic emission forecasts
  - Accountability imperative of uncertainty quantification

About me

- Employment
  - 1994-1995: National Board of Waters and the Environment (Helsinki, Finland)
  - 1996-2001: COWI Consulting Engineers and Planners (Lyngby, Denmark)
  - 2001-2011: United Nations Environment Programme (Paris, France)
  - 2011-present: UNEP DTU Partnership (Copenhagen, Denmark)
- Expertise
  - Climate change scenarios, uncertainty, and risk management

United Nations Framework Convention on Climate Change

- 1992: [the goal is to] "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system"
- 2009: [Parties recognize] "the scientific view that the increase in global temperature should be below 2 degrees Celsius"
- 2015: “in order to [hold the increase in the global average temperature to well below 2 degrees Celsius], each Party shall prepare, communicate and maintain successive nationally determined contributions it intends to achieve"

Who we are

- Established in 1991
- About 70 staff from 20 nationalities
- Income (2015): 10.3 million USD
- Four programmes: cleaner energy, climate change mitigation, climate change adaptation, energy efficiency

Who we are (continued)

- Not-for-profit
- Applied research
- Collaborating centre of the United Nations Environment Programme

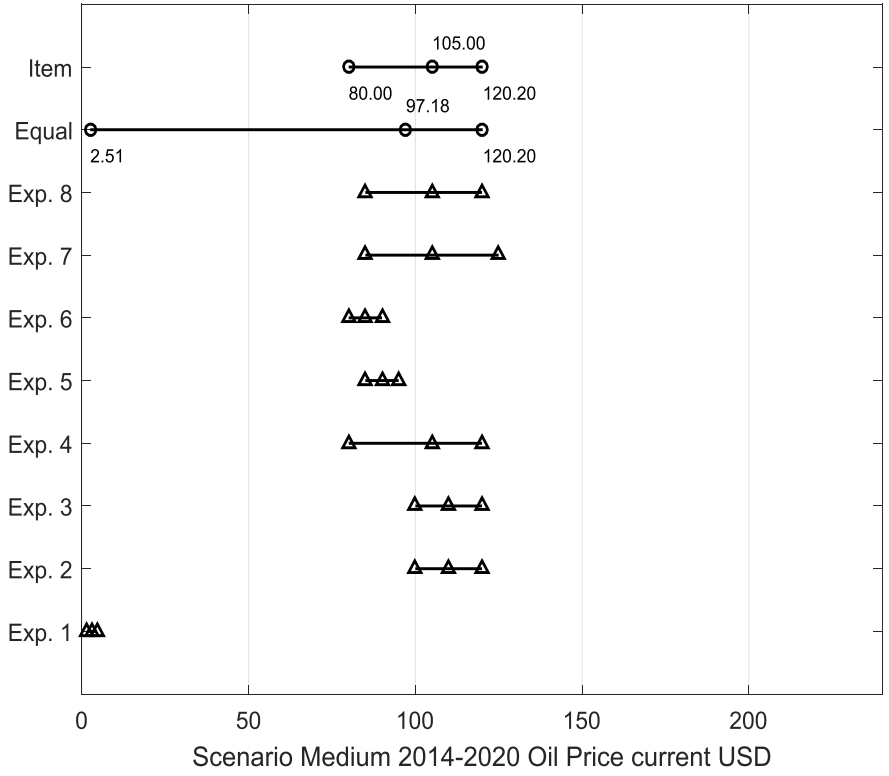
Key drivers of greenhouse-gas emissions

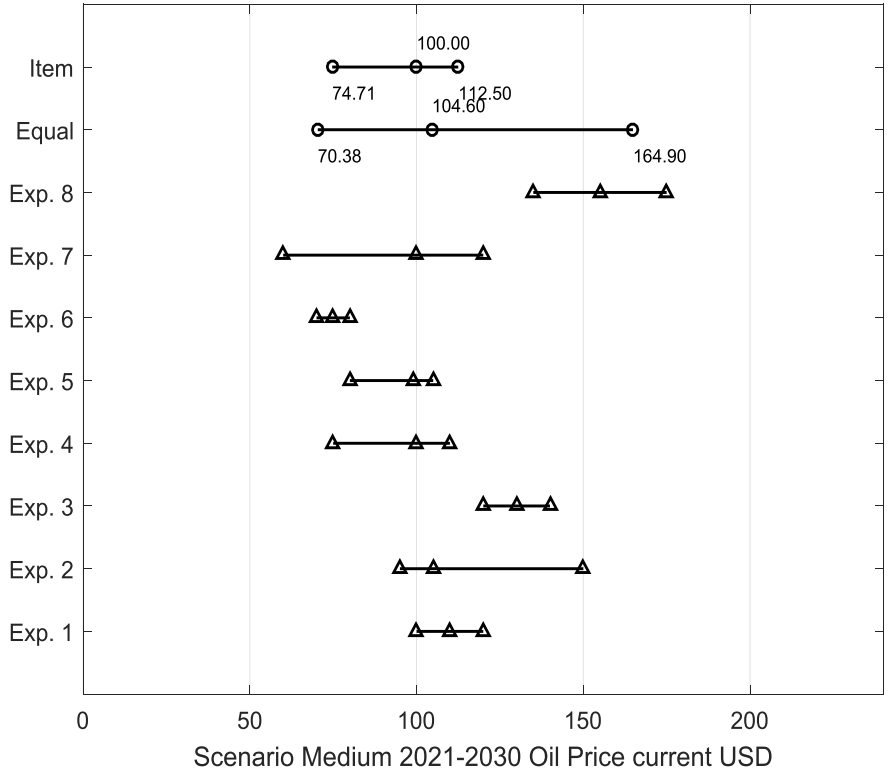
- Gross domestic product
- Energy prices

Three macro-economic scenarios

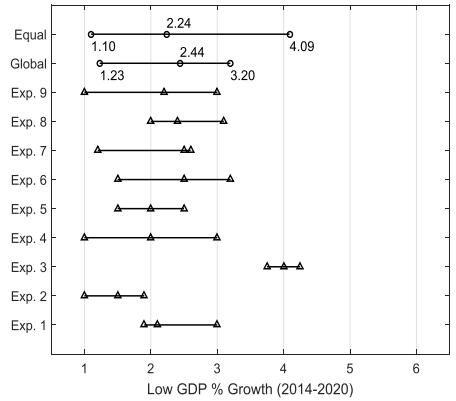
- Interest rates
- Unemployment
- Inflation
- Economic growth in the United States
- …

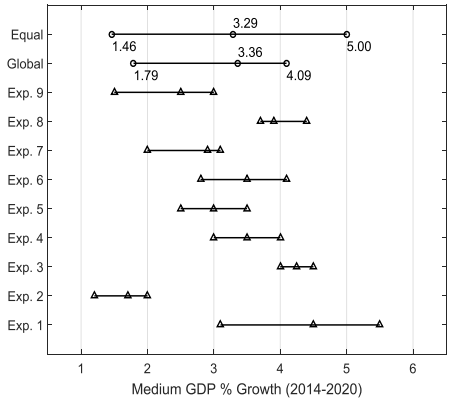
Expert judgement elicitation – results for GDP

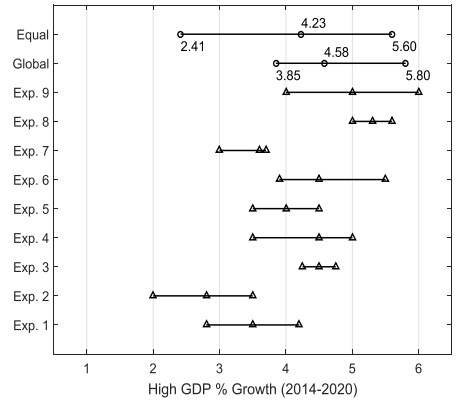


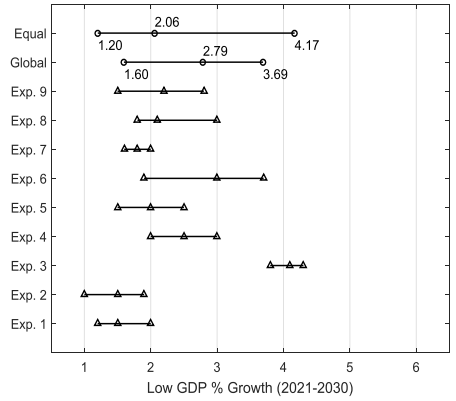


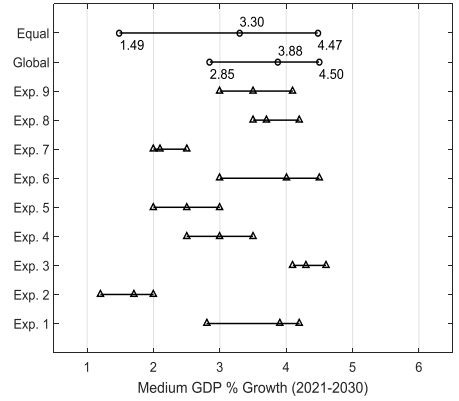
Expert judgement elicitation – results for GDP

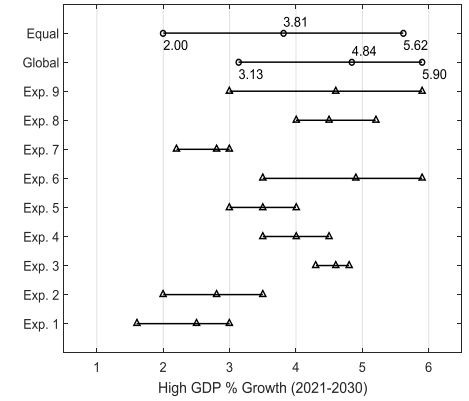




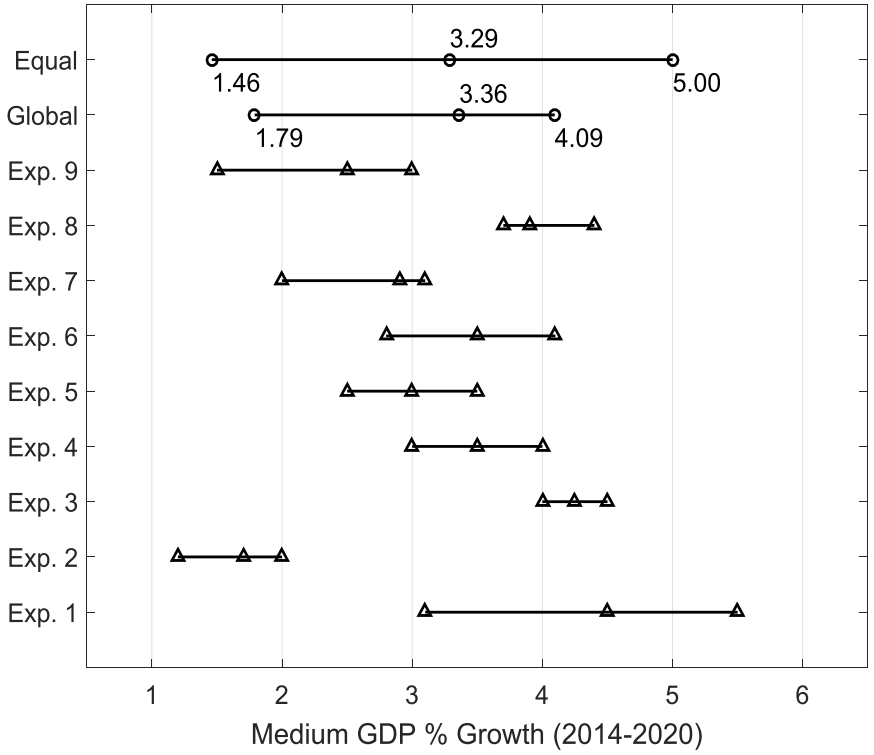


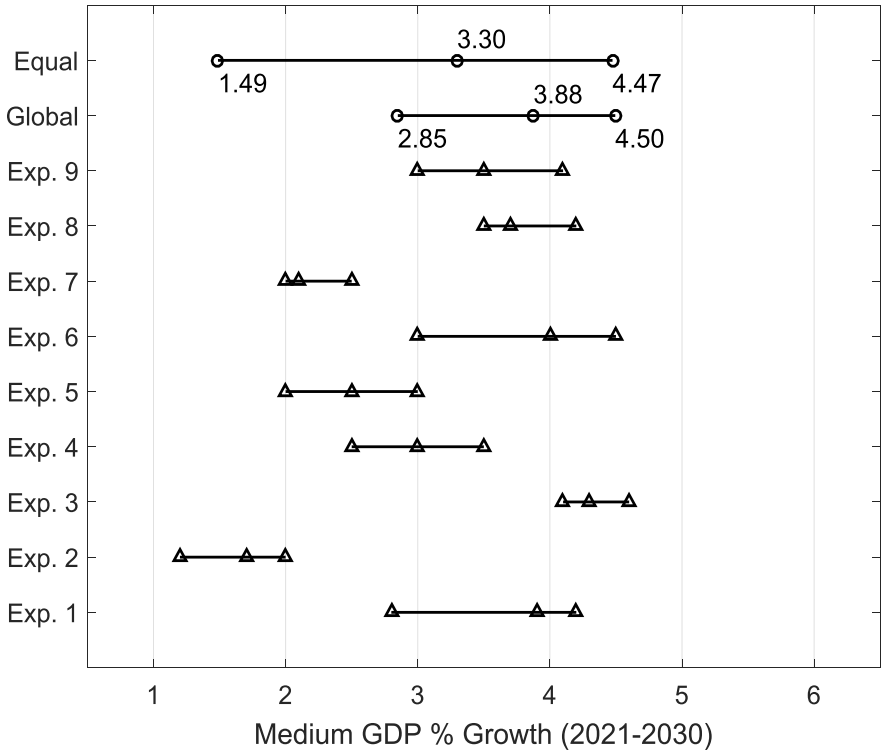




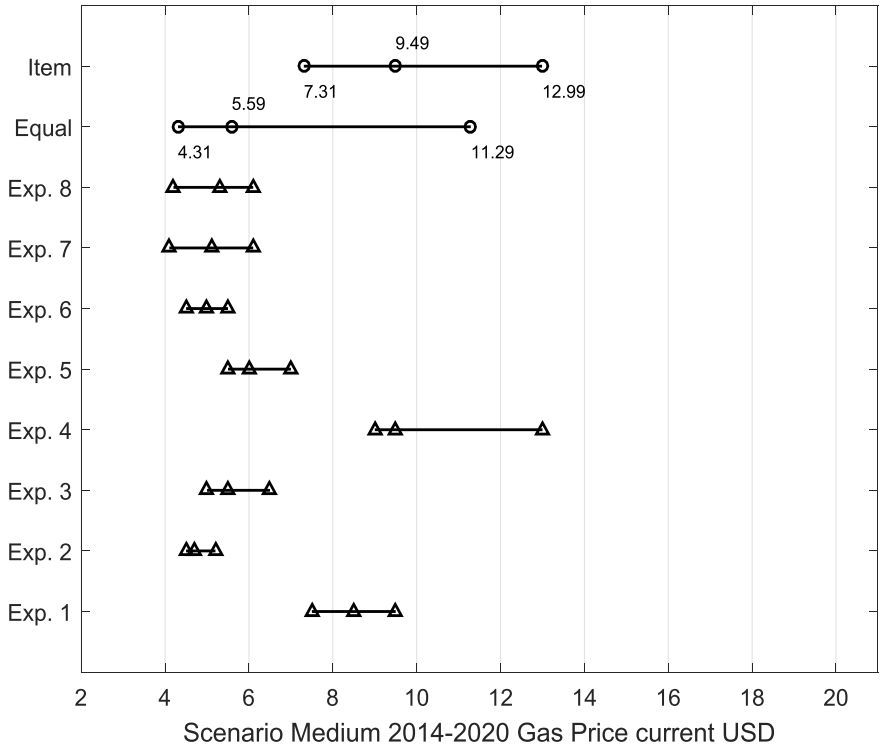


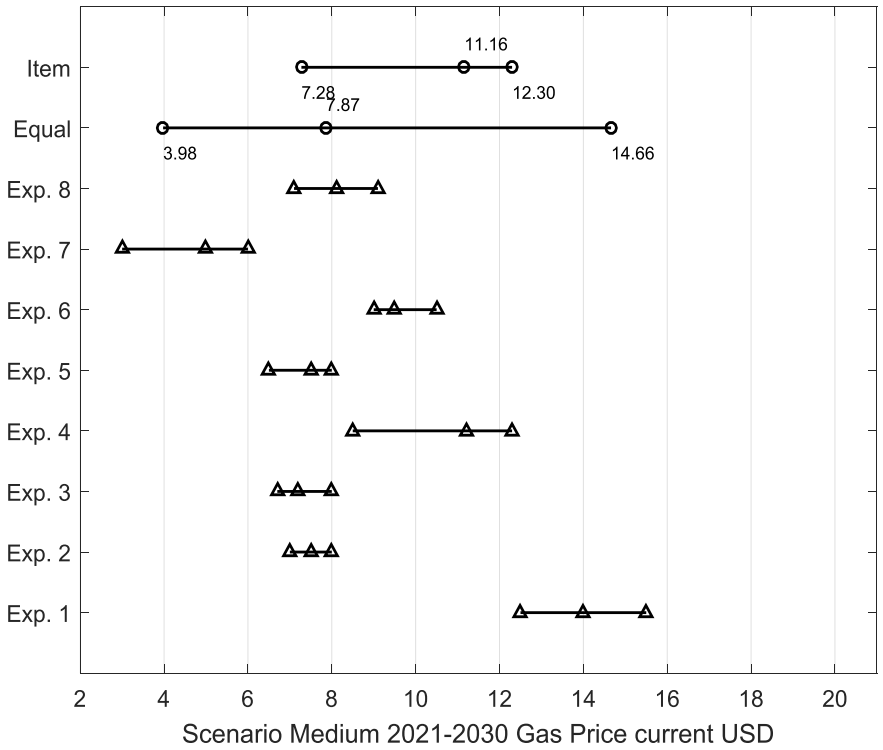
Expert judgement elicitation – results for oil prices





Expert judgement elicitation – results for gas prices





Percentile	Gross domestic product annual growth rates (percent)	
	2014-2020	2021-2030
'Pessimistic' scenario		
5th	1.23	1.60
50th	2.44	2.79
95th	3.20	3.69
'Neutral' scenario		
5th	1.79	2.85
50th	3.36	3.88
95th	4.10	4.50
'Optimistic' scenario		
5th	3.85	3.13
50th	4.58	4.84
95th	5.80	5.90

Percentile	Gross domestic product annual growth rates (percent)		Reference scenario forecasts ($MtCO_2e$)	
	2014-2020	2021-2030	2020	2030
'Pessimistic' scenario				
5th	1.23	1.60	582	583
50th	2.44	2.79	613	694
95th	3.20	3.69	633	781
'Neutral' scenario				
5th	1.79	2.85	596	663
50th	3.36	3.88	638	801
95th	4.10	4.50	658	883
'Optimistic' scenario				
5th	3.85	3.13	651	790
50th	4.58	4.84	671	937
95th	5.80	5.90	889	1,102

Scenario	Reference scenario forecasts ($MtCO_2e$)		Annual growth rates (percent)		Ratio
	2020	2030	Emissions (2020-2030)	GDP (2021-2030)	
INDC (2015)	632	798	2.4	3.85	0.61
ThreeME pessimistic	613	694	1.2	2.79	0.45
ThreeME neutral	638	801	2.3	3.88	0.59
ThreeME optimistic	671	937	3.4	4.84	0.70

Policy process in support of which the scenario was prepared	Assumed annual growth rate for gross domestic product	Analytical method behind the assumption	Reference scenario forecasts ($MtCO_2e$)	
			2020	2030
Fifth National Communication (2012)	2.3 % (2006-2020)	Following "historical trends"	872	996
National Strategy on Climate Change (2013)	3.6 % (2010-2030)	Unspecified	960	1,276
Intended Nationally Determined Contribution (2015)	3.37 % (2014-2020) 3.85 % (2021-2030)	Expert judgement elicitation	792	973

Conclusions

- Because they fail to reflect uncertainty, deterministic forecasts are ill-suited for use – especially – in target-setting processes.
- Governments should be held accountable for the appropriateness of the forecasting approach applied.
- The UNFCCC should champion the development of minimum standards for forecasting approaches.

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