WWZ Research Seminar
Faculty of Business and Economics, University of Basel

Tuesday, May 24, 2022, 12:30, S15, HG, WWZ and Zoom

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"Bayesian climate estimation and optimal policy derivation"

Abstract

While much progress in understanding climate change has been achieved over the past decades, much uncertainty about the quantitative effect of anthropogenic carbon emissions on the Earth system remains. For instance, an accurate estimate of equilibrium climate sensitivity (ECS) remains elusive, as this key parameter's assessed range has seen little reduction throughout six reports by the Intergovernmental Panel on Climate Change (IPCC). The current and future response of the carbon cycle - another key component of the Earth system - is even more uncertain. There is little doubt that given enough time and resources, scientists could reduce these uncertainties to a second order issue. But the climate urgency dictates that climate policies must be designed now, and that physical uncertainty is therefore a first-order consideration that must be integrated into policy design.

The economic theory presents us with two radically different approaches to do so. The overwhelmingly dominant "ex-post" approach consists in designing climate policies first, and dealing with physical uncertainty afterwards. This can be through analysing an optimal policy's sensitivity to a few key parameters, quantifying a probabilistic ensemble of optimal policies using Monte Carlo (MC) methods, or projecting probabilistic climate change for a given optimal policy. In opposition, the "ex-ante" approach consists in embedding physical uncertainty into policy design, so that optimal policies are determined by anticipating future outcomes for the Earth system and, depending on the exact method, their respective probability and desirability. As experts continuously call for better integration of uncertainty into climate policies, and into key economic indicators such as the social cost of carbon, we argue the ex-ante approach is the only proper way of doing so, because it leads to policies that are robust to uncertainty and thus more likely to provide the desired outcome.

However, past works on ex-ante approach have remained focused on theoretical aspects and simple illustrative setups. To be quantitatively relevant, the approach must be stepped up and applied within a realistic framework that uses the best available knowledge from physical sciences. Here, we offer this methodological leap forward by combining a robust decision-making algorithm - called expected utility criterion - and a specifically designed reduced-form model of the carbon-climate system, whose calibration embeds the latest knowledge from state-of-the-art Earth system models and observations. We use this novel integrated assessment framework to derive robust cost-benefit and cost-effective policies, and we demonstrate they require significantly more ambitious action than their non-robust counterparts.

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