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Uncertainty in Climate-Economic Modeling

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Aim and relevance of my research
The mainstream macroeconomics still uses optimization models based on neoclassical assumptions such as perfect rationality for analyzing economic problems.
There are various problems:
• Such models assume a rather static economy with some growth rates for technological progress, population or GDP, but these are mostly given exogenously
• Neoclassical optimization models cannot resist an empirical verification. It seems quite obvious that people in the real world do not behave as optimization models assume.
• Optimization models could at best give an impression of what is possible to achieve maximally, but what truly happens depends on the actual decision of relevant actors.
• Optimization models consist of representative economic agents but the economic system rather consists of various economic agents with different attitudes, beliefs, goals etc.
To cope with all these problems alternative methods are required. Agent-based models (ABM) are able to account for all this. They allow the realistic representation of agents and their decision behavior under uncertainty based on statistical data. Furthermore, such models are able to take the complexity and dynamic of the system's evolution and connection into account.
My research interests refer to the application of agent-based modeling in environmental economics. ABMs are particularly appropriate to assess environmental economic problems since these problems are even more characterized by long-term consequences (e.g. climate change) or cross-systemic dynamics (e.g. resource use). Coupling economic and ecological systems therefore increases the complexity and consequently the uncertainty of the agent's decisions. Hence, it is all the more important to ascertain (1) why some decisions are made too late or not all, (2) how the agents can be manipulated in a sufficient way, and (3) to what extend learning can/does affect the agent's decisions and therefore the system's behavior.

Uncertainty in my current research on climate-economic models
Most of the previous and current climate-economic models (integrated assessment models) are inter-temporal cost-benefit-analyses, trying to assess the economic costs of damages from climate change or costs of its mitigation, and balancing them against benefits from economic output and damage prevention by calculating an inter-temporal optimum.
In my current research project I suggest putting some effort into investigating the impact of personal beliefs on climate policy and the resulting climate change. For this purpose I work with a multi-agent climate-economy model based on climate-economy equations, but instead of deriving an optimal solution, contains adaptive agents, controlling some of the parameters of the economic model. Such models are important to demonstrate the long-term consequences of wrong or delayed action in relation to the real world's behavior due to high uncertainty about the system's behavior.
Another concern of my research is the problem that conventional models do not allow for a change of the economic structure. Investments in climate protection might not just be a cost but simply an investment in a future technology with promising growth rates and the potential to incite further growth in adjoining sectors. Therefore, I want to enable the model to show how an economy can undergo structural change from within. This will enrich the climate discussion and hopefully change the way of thinking.