Resource Economics (Spring Term 2025)

Project Assignment
Topic 2

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Administrative Remarks

- **Task Structure**
  - There are five main topics to be covered, one topic per group.
  - Each topic is split into three tasks of increasing difficulty.
  - Grade will depend on how many tasks you solve and the quality of your report.
    - Solved 1st task, passing; 2nd task, good; and 3rd task, excellent grade
- **Report Structure**
  - Introduction (Why is the topic / model feature relevant?)
  - Description of procedure (Which model settings or additional extensions are chosen for certain scenario runs and why? Assume you write for an informed reader and focus on your changes/extensions.)
  - Result interpretation (Which insights can you derive from your model scenario outputs and what is there relevance?)
- **Prerequisites**
  - There will be a final "DICE default" model version uploaded to ADAM that you can use for your modeling scenarios (ipynb).
- **Hand in**
  - Your written report (PDF, max 10 pages text).
    - Self-disclaimer, who worked on what part of the project (1 Grade per group)
    - No further formality requirements (font, spacing etc.) but keep it reason-

able for a good reading experience (also with regards to the number of graphs in your text).

- Your model code (one or multiple files, .ipynb or .py)
  - 1 Code "version" per scenario (e.g. 1 function with specified settings, 1 separate code file)
  - All your scenarios should run through with no changes (exception: path adjustment to import exogenous variables CSV)
  - If not, separate the scenario so as to not disturb your other simulations
- One naming convention for all files (e.g. "GroupX_Lastname1Lastname2.pdf")
- **Deadline: 29thJune 2025**, by email to raul.hochuli@unibas.ch

Topic 2 - Temperature Targets

Description

The DICE model optimizes for consumption utility, but its main innovative feature is to take the environmental consequences into consideration. The change in average atmospheric temperature is a well-known metric to describe the severity of climate change. Use the three tasks below to elaborate on how this feature could be implemented in DICE and interpret its effects on the modeled future.

Tasks

1. The DICE default model assumes a low initial effort level to control carbon emissions in the first few model periods. But what if we would do "all that we can" to reduce emissions already now? Assume we would reduce our emissions starting today by at least 80%. What would be the outcomes in terms of global temperature increase and growth?

2. The DICE model's "optimal" outcome is debated, as it's not strictly clear which environmental scenarios are truly favorable for human well-being. Scientific consensus provides suggestions on how levels of warming have different climate-related consequences. To reflect this requirement in your model, make an additional adjustment to avoid any atmospheric temperature increase above 2.5 degrees Celsius. Implement this by adding a parameter `Temp_atmo_lim:str` and a constraint function `c_Temp_atmo_lim()`. Look at how an interaction of the temperature constraint and the "all we can" scenario affects your model results compared to the first task.

3. Given the DICE model's assumption and default specifications, negative emissions (carbon capture and storage) will become feasible in the next couple of years. Having this in mind, you could argue that a slight temperature overshoot is acceptable, as long as the overall increase over the model period remains on average below 2.5 degrees Celsius. Adjust your model accordingly and interpret the results in comparison to your previous model runs.