Resource Economics (Spring Term 2025)

Project Assignment
Topic 5

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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 5 - Feedback Effects

Description

Industrial emissions play a major role in the modeled future scenarios of the DICE model, while non-industrial carbon emissions only have a minor impact. However, these types of emissions are a much debated hot topic, as some of these emissions might increase due to feedback effects. Use the three tasks below to elaborate on how changes/adjustments in the size and model of the non-industrial carbon emissions have an impact in DICE and interpret its effects on the modeled future.

Tasks

1. The DICE default assumes a given initial level of non-industrial carbon emissions which declines exponentially over time. Assume a higher initial level of non-industrial emissions or a lower decline rate. How does this affect your model results?

2. Carbon emissions affect the radiative forcing in DICE which in turn affects atmospheric temperature. We expect these relationships to be static regardless of the circumstances. Use multiple scenarios to show how changing these assumptions affects the prediction outcomes, by changing the exogenous land emissions to have a much slower decline rate and or raising the increase of radiative forcing from a doubling of the relative carbon stock (`incr_RFor_dbl_crbn`) by at least 30%. Look at how the interaction of these parameters/variables affects your model outcomes compared to the first task.

3. DICE makes a distinction between exogenous land-based emissions and endogenous industry-based emissions, despite both altering the radiative forcing. Recently, feedback effects have become a hot topic in the environmental debate, arguably accelerating climate change at a faster rate (e.g. thawing of permafrost). Try to adjust your model by using the parameter `pos_feedbk_Temp_CEms_lnd:float` to allow for land-based emissions to increase at a linear rate with higher atmospheric temperature.