# Week Eight

# EPA143A

# THE ECONOMICS OF GLOBAL WARMING

# EXERCISES

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Required readings:

E. Schröder & S. Storm. 2020. "Economic Growth and Carbon Emissions." *The International Journal of Political Economy* 49 (2): 153-173.

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Supplementary video:

Steve Keen on the economics of climate change:
https://www.youtube.com/watch?v=aoFiw2jMy-0

The EXERCISES **W-8.1** and **W.8-2** for Week 8 are given below.

EXERCISE **W-8.1**

1. Explain why in equation (8), $\frac{\partial g_Y}{\partial \sigma} > 0$.

2. Consider the following Cobb-Douglas production function $y_t = a \times L_t^{(\alpha)} \times K_t^{(\beta)}$ . Under which condition does this production function exhibit constant-returns-to-scale? Under which conditions does it exhibit increasing-returns-to-scale?

3. Compare the two climate damage functions – eq. (12) and eq. (15). What is the main difference between them? Which one would you consider more realistic?

4. What will happen to the social cost of carbon (SCC) if we use a lower social discount rate than Nordhaus' 4%? Explain your answer.

5. What is the difference between the prescriptive and the descriptive approach to the choice of social discount rate? Explain why the difference matters?

6. What do neoclassical economists mean when they argue for the internalisation of the global warming damage in the costs and prices of the economic system?

7. Why would the imposition of a global carbon tax (set at the level of the SCC) lead to a decline in economic welfare (which is defined in terms of real consumption per person)?

8. Explain why the trade-off between consuming today versus consuming tomorrow is a fallacy?

9. Explain how the carbon Kuznets curve can indicate decoupling between economic growth and carbon emissions? Is this relative decoupling or absolute decoupling?

EXERCISE **W-8.2**: a few numerical exercises.

1. Consider the cash flows (in constant 2020 prices) of a public infrastructure project:

| Year | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|---|---|---|
| Million € | -12 | -2 | 3 | 3 | 3 | 3 | 4 |

   Calculate the NPV of this project using a social discount rate of 4% and 1.5%.
   The NPV (using 4%) is negative. Is this project making a loss or having a negative rate of return? Explain your answer.
   Why do we know based on the two calculations that the internal rate of return of this project 1.5% < *irr* < 4% ?
   Calculate (by trial and error, in Excel), the *irr* (at the two digit-level).

2. Calculate the discount factor (with base-year 2020):
   - for the year 2060 using a social discount rate = 3%
   - for the year 2060 using a social discount rate = 5%
   - for the year 2120 using a social discount rate = 1%
   - for the year 2120 using a social discount rate = 3%

   Use your results to explain why discounting may trivialise future climate damages.

3. Assume that the future value of climate damage in the 2073 is US$ 3.7 trillion (in constant 2020 prices). GHG emissions in 2073 are projected to be $GtCO_{2eq}$ 24. Calculate the SCC using a social discount rate of 1.5% and of 4%.

If we assume that the carbon intensity of electricity is 0.0002 $tCO_{2eq}/\mathrm{kWh}$ by how much should electricity prices increase in 2073 in order to reflect the 'true' SCC – in these two cases?