Candidate instructions

ECON4910 – **Environmental Economics** – Open book, home exam

Exam date and time: Thursday, 20 May, 2021 from 09.00 – 14.00 (five hours)

Language: The examination text is given in English. You may submit your response in Norwegian, Swedish, Danish or English.

Guidelines: You should upload your text in pdf format - **only one pdf.**

You should familiarize yourself with the rules that apply to the use of sources and citations.
The answers to your exams are not expected to meet the formal requirements for references and citations in the spring 2021 exam. However, you should make references by indicating the source in the text. Creating a bibliography is not required. Whether you choose to do so, or not has no impact on your grade. The purpose of a reference is that the examiner should be able to look up the source him/herself, either to read it or to evaluate your interpretation. If you are referring to a limited part of the source, the reference should indicate which part of the source you refer to by using page numbers. If you are quoting directly from a source, follow the normal citation practice – with quotations marks and references to the source.
The exam lasts for only five hours. We recommend that you use the available time to work on the problem set, as well as allocate time to scan attachments with graphs and/or equations.

The problem set: The problem set consists of three questions, with several sub-questions. They count as indicated. Start by reading through the whole exam, and make sure that you allocate time to answering problems you find easy.

Note: You can resize the question by clicking on the three dots on the right, hold and pull to the right. Similarly for the three dots at the bottom, click, hold and pull down. Then the text will be larger. - **Or you can download the pdf file to your own device by using the link to the right (recommended).**

Digital hand drawings/graphs/equations: You will find information about options for hand drawings on this website: https://www.uio.no/english/studies/examinations/submissions/options-for-hand-drawings.html

Submission in Inspera

- Read more about exam and submission in Inspera. https://www.uio.no/english/studies/examinations/submissions/.
- Remember: It is your responsibility to upload **the correct version of the correct answer,** and to allocate time to upload your answers to Inspera.
- When your answer is uploaded, you will see that the exam is uploaded and saved.
- To submit your answer, please see https://www.uio.no/english/studies/examinations/submissions/submit_answer/. You can either choose the “submit now” or the “Automatic submission”.
- Make sure your submission is anonymous - do not use your name in your assignment or in the file name.
- You can make changes in your exam until the deadline.

- If you have questions during the exam, or if you have technical problems, you must **immediately** send an email from your UiO-address to hjemmeeksamen@sv.uio.no. Write the course code in the subject field.
- If any information is given to all candidates during the exam, this information will be posted in Canvas. Make sure that you receive Canvas notifications.
- If you have questions before the exam day or after you have submitted your exam, please contact post@econ.uio.no.
- You will find your answer under Archives (Check that this is the right answer).
- Send an e-mail **immediately** to hjemmeeksamen@sv.uio.no if you do not see your submission. Attach your exam answer if you have this as a file.

Do you need technical support, or do you have any questions during the exam?

Please send an e-mail, titled "ECON4910" to hjemmeeksamen@sv.uio.no from your university email.

Grading: The grades given: A-F, with A as the best and E as the weakest passing grade. F is fail.

Grades are given: 10 June 2021

1 Questions

ECON4910 - problem set

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Maximum marks: 0

1. **Coase - 35 points**

(Each sub-question is given equal weight)

Suppose each of firm 1 and firm 2 benefits $B(g_i)$ units by emitting g_i, $i \in \{1,2\}$, where $B(g_i)$ is concave and increasing iff $g_i \in [0, g^M]$. A representative consumer is harmed $(g_1 + g_2)\, h$ by the pollution. The firms and the consumer have a payoff function that is linear in money

(a) What is a Coasian solution to the environmental problem?

(b) Suppose the consumer has the right to clean air. The consumer can, however, reach out to the firms, and the consumer. What will the consumer propose?

(c) Suppose, instead, that the firms have the right to emit, but that each firm can reach out to the consumer. What will each firm propose?

(d) What is the Pigouvian solution to the environmental problem?

(e) If the environmental policy, (a), (b), or (c) can be determined in a political process, then how does the consumer rank the three options? How will the firms rank the three alternative policies?

2. **Repeated game - 35 points**

(Each sub-question is given equal weight)

Suppose there are N countries and each country, $i \in \{1, 2, ...N\}$ benefits $B(g_i)$ from emitting g_i, but the harm is $h \sum_{j \in \{1,...,N\}} g_j$ in every period the countries emit.

(a) What is the noncooperative business-as-usual solution?

(b) What is the first-best solution?

(c) Suppose the countries seek to implement the first best in a repeated game where δ is the discount factor, and where the punishment, if one country emits too much, is the noncooperative solution forever. What is the range for the discount factor so that the first best is sustainable as an equilibrium?

(d) From now on, suppose $B(g) = bg - g^2/2$. For which δ is the first best possible to implement? How does the threshold for δ depend on N, h, and b, and what is the intuition for this relationship?

(e) If the discount factor falls, and is smaller than the threshold you just derived, then what can the countries do instead? Explain with your own words (no math).

Problem 3 (30 points)

The so-called Stern Review finds much higher abatement and a much higher carbon tax than Nordhaus' base specification of the DICE model. Relate to the graph below and discuss the main reason(s) why their results differ so much. Is there a difference in the underlying perspective on some major model inputs? If so, give a brief critical discussion. Please use and explain especially one equation that might help your discussion.

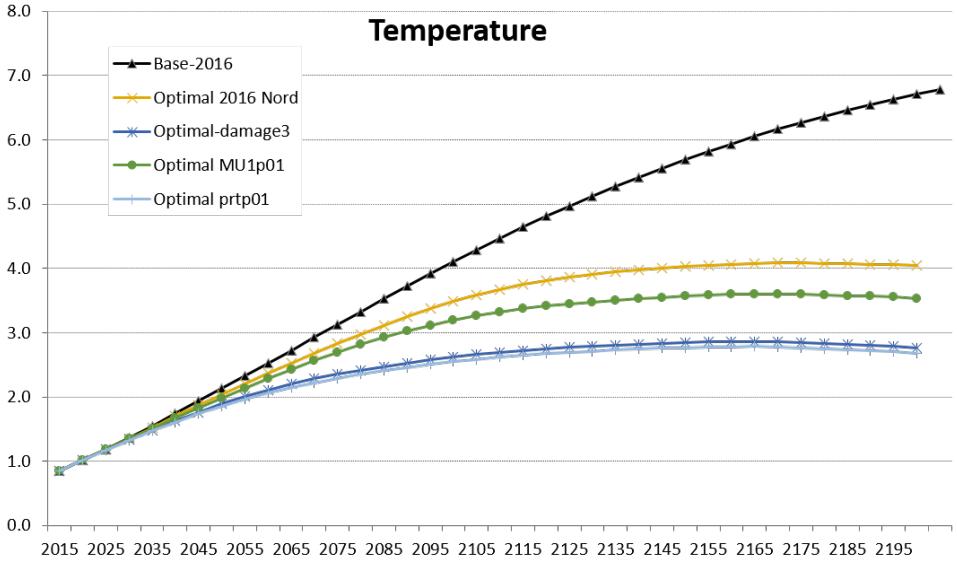

Figure 1: DICE 2016 results for Nordhaus' optimal parametrization, a scenario with cubic instead of quadratic damages, a reduced elasticity of marginal utility (1.01 instead of 1.45), and a reduced rate of pure time preference (0.1% instead of 1.5%).