# Candidate instructions

**ECON4910**

This is some important information about the postponed exam in ECON4910. Please read this carefully before you start answering the exam.

**Date of exam:** Friday 21 June, 2019

**Time for exam:** 09.00 - 12.00 (3 hours)

**The problem set:** The problem set consists of 3 questions with several subquestions. They will be given equal weight in the evaluation.

**Sketches**: You may use sketches on all questions. You are to use the sketching sheets handed to you. You can use more than one sketching sheet per question. See instructions for filling out sketching sheets below. It is very important that you make sure to allocate time to fill in the headings (the code for each problem, candidate number, course code, date etc.) on the sheets that you will use to add to your answer. You will find the code for each problem under the problem text. You will NOT be given extra time to fill out the "general information" on the sketching.

**Access:** You will not have access to your exam right after submission. The reason is that the sketches with equations and graphs must be scanned in to your exam. You will get access to your exam within 2-3 days.

**Resources allowed:** No written or printed resources - or calculator - is allowed (except if you have been granted use of a dictionary from the Faculty of Social Sciences).

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

**1. Discounting.**

Assume a CRRA utility function with $u_t = 4\sqrt{c_t}$ and suppose consumers maximize $\sum_{t=1}^{\infty} \delta^t u_t$ with $\delta = 0.95$.

(i) What is the difference between discounting utility and discounting consumption in this example? Please derive both and discuss the difference.

(ii) How much should one discount future consumption, if the growth rate of consumption is 3% a year?

(iii) Please discuss arguments for and against using this discount rate when evaluating climate change policies.

**2. Prices vs. quantities**

Suppose that $q \geq 0$ measures a firm's/industry's abatement level, and that the cost of abating $q$ is $C(q) = q(\theta + cq)$, where $\theta = 3$ with 40% chance, and $\theta = 6$ with 60% chance. Suppose the society's benefit from abating $q$ is $B(q) = q(10 - q)$. A planner seeks to maximize $B(q) - C(q)$. The planner sets a policy without knowing the realization of $\theta$, but $\theta$ is known by the firm/industry when they make their decision.

(i) Suppose the planner specify a quantity requirement (quota), $q$. What is the optimal $q$?

(ii) Suppose the planner instead introduces an emission tax. What is the optimal level of the tax?

(iii) What is the best of these two instruments?

(iv) Can you propose regulatory instruments that are better than both alternatives considered above?

**3. Supply-side policies**

Consider $n$ countries and that in each country $i$, the demand for fossil fuel consumption $y_i$ is $y_i = D(p) = D - 2p$, where $D > 0$ is a constant while $p$ is the fossil fuel price. The supply in country $i$ is $x_i = S(p) = 2p$. Suppose only country $i = 1$ sets a climate policy while all the other countries (or, the consumers and the producers in these other countries) take the price $p$ as given. Fossil fuel is tradable globally. Suppose country 1 internalizes the harm $H(.)$, as a function of all emissions. The other countries do not care about the harm, for simplicity.

(i) What is the main concern (or, what are the main concerns) if country 1 intends to set its policies in order to reduce global emission?

(ii) Can you derive a formula for how another country responds, when country 1 reduces its supply?

(iii) What is the carbon leakage rate in this case? What do you think can make the actual real-world leakage rate different from this number?