

ECN 275/375 – Natural resource and environmental economics
12:15-15:15 March 2, 2021

All help aids allowed except assistance from others.

This test consists of 3 questions, for a total score of 100 points.

All questions are to be answered. You may answer in English or Norwegian.

In the case that you find a question unclear, or you are uncertain about what is meant, state your extra assumptions needed to be able to answer the question.

When I submit my answers on this exam, I confirm that I have worked alone on my answers and not cooperated with others. I am aware that cooperation with others is to be considered an attempt or a contribution to cheat.

I am aware of the consequences of cheating (Ch. 39, Academic regulations for NMBU).

Your name: NN

Question 1 (30 points)

The basic equation of monitoring and enforcement can be written as $\rho \geq \frac{\pi_N - \pi_C}{S}$, where π_N and π_C are the respective monetary payments for noncompliance and compliance, and S is the monetary fine if caught in noncompliance.

- (a) (i) Draw a decision tree for this equation. (ii) Calculate the necessary monitoring probability for compliance to be more profitable than non-compliance. when the state contingent payoff for noncompliance is 10 and compliance is 8, and the penalty for being caught in noncompliance is 10, all numbers in million NOK. **(10 points)**

Answer: Write your answer here ...

- (b) Suppose the agent deciding to comply or not has a utility function $U(Y) = \ln(1+Y)$, where Y is the state contingent payoff and “1” are expressed in million NOK. (i) Show that monitoring probability to secure compliance is approximately 0.084. (ii) Explain why this monitoring probability declines compared to the answer in (a). **(10 points)**

Answer: Write your answer here ...

- (c) Explain why maintaining the monitoring probability at the higher level in (a) is more recommended to reach universal compliance as long as decision makers do not have risk loving (risk seeking) preferences. **(10 points)**

Answer: Write your answer here ...

Question 2 (30 points)

Suppose that a market good (Q) and a public good (Z) is produced together, which for is the case for acreage based productions like agriculture and forestry. Assume that the technically efficient relationship between Q and Z per hectare is captured sufficiently well by a standard shape production possibility frontier.

- (a) (i) Show graphically why increasing the price of the market good, P_Q , in most cases will lead to a decline in the production of the public good, Z . (ii) Explain why this “most frequent” result requires that the substitution effect is larger than the income effect of the price increase for the private good Q . **(10 points)**

Answer: Write your answer here ...

- (b) Suppose that the government wants to increase the production of the public good, Z , by increasing the price of the market good, Q . Barring income effects, what appears to be the most “obvious” economic policy response to restore the production level of Z . Explain your reasoning. **(10 points)**

Answer: Write your answer here ...

- (c) Suppose that the government wants a large increase the production of Z . What would be possible cost effective ways of achieving this increase on a share of the acreage in a least way. Explain the reasoning behind your choice of policy instrument(s). **(10 points)**

Answer: Write your answer here ...

Question 3 (40 points)

The Norwegian government has just launched its climate plan 2021-2030. It is an ambitious plan that aims for reductions of climate gas emissions measured in CO₂-equivalents of about 50% from today’s emissions. A central element in the plan is strong increases in the price of carbon emissions measured in CO₂-equivalents from aprx. NOK 800 per ton to NOK 2000 per ton.

In the following questions, we simplify matters somewhat and discuss the expected impacts of substantial increases in climate gas emission taxes.

- (a) (i) Draw a principal graph clearly illustrating the *short term impacts* of a large increase in CO₂-emission taxes on emissions, increases in abatement costs, and tax payments for an aggregate economy. (ii) Write down the relevant general formulas for increases in total abatement costs and tax payments. **(10 points)**

Answer: Write your answer here ...

- (b) What will be the longer term impacts of further increases in the emission taxes?

(i) Illustrate graphically, preferably by adding the changes to a copy of your graph from sub-question (a). (ii) Write down the adjusted formulas for the aggregate increases in abatement costs and tax payments. **(10 points)**

Answer: Write your answer here ...

In a comment to the government’s proposal, Statistics Norway (SSB) remarked that the large tax increases could reduce consumer purchasing power significantly, and that the government therefore should consider redistributing (some of) the climate emission tax revenues to consumers.

- (c) (i) Explain why economists would point to reimbursing consumers, not businesses for the tax increases. (ii) Write down a formula that captures the concerns raised by SSB on the overall welfare impacts of high emission taxes in the economy for a representative consumer. Comment verbally on your formula. **(10 points)**

Answer: Write your answer here ...

- (d) What are the policy implications on the design of tax refund schemes from gradual adjustments? Explain briefly, and point to possible policy changes to meet your concerns. **(10 points)**

Answer: Write your answer here ...