

Exam - environmental economics, Make up, 2020 **ANSWERS included:**

Each subquestion can give at most 5 points.

If you believe the text is imprecise and that you need to make additional assumptions, please state your assumptions clearly as "Assumption 1:...", etc. Write clearly.

1. International capital flow and the environment. (Verbal reasoning)

Consider a small country that is liberalizing capital flows while its industry generates local environmental problems. (As in the article by Oates and Schwab.)

a. The government can set a tax on capital and a standard on the emission level. When is it reasonable that the emission level that is chosen will be first best? **ANSWER: if gov can use all types of instruments, then no reason to distort.**

b. When is it reasonable that the emission level will be too high? **ANSWER: if gov cannot use all instruments, then, if one cannot subsidize capital or need to tax capital, so that capital is beneficial on the margin, then can reduce emission tax to attract capital.**

c. When is it reasonable that the emission level will be too low? **ANSWER: if don't take into account the fact that the high emission tax will reduce the return to capital. fex because labor decides, or capital less mobile.**

d. How would the answers change if the environmental problem was international, instead of local? **ANSWER: with global, one does not take into account externality on others and tax likely to be too small. can be too high, however, so that emission level is too low, if, again, labor decides or capital immobile.**

2. Tropical Deforestation

Suppose there are two countries, A and B , and each $i \in \{A, B\}$ has a stock X_i of forest. If an amount $x_i \in [0, X_i]$ is illegally extracted, it is supplied to a market and sold at price $p = \bar{p} - ax$, where $x = x_A + x_B$.

a. What is the price for timber if both countries protect their forests? What is the price if none of them protects? What explains the difference? **ANSWER: $p = \bar{p}$ and $p = \bar{p} - a(X_A + X_B)$. no protection leads to lower price.**

b. Is it more or less expensive for A to conserve, if B conserve than if B does not conserve? What assumptions will you make to answer this question? What is the intuition for this answer? **ANSWER: more, because higher price and pressure. assumptions: cost increases in p .**

c. To discourage illegal logging on one unit of the forest, the expected penalty must be at least as large as the price p , but the cost of raising the expected penalty is c . Each country value both forests, and v_i is how much A values either forest. **ANSWER: no question?**

d. Write A 's payoff (i.e., utility) as a function of x_A and x_B . **ANSWER:**

$$-c[\bar{p} - a(x_A + x_B)](X_A - x_A) + v_A(X_A - x_A) + v_B(X_B - x_B)$$

or

$$-c [\bar{p} - a(x_A + x_B)] (X_A - x_A) + v_A (X_A - x_A + X_B - x_B)$$

or

$$-c [\bar{p} - a(x_A + x_B)] (X_A - x_A) + v_A^A (X_A - x_A) + v_B^A (X_B - x_B)$$

e. What is the Nash equilibrium for x_A and x_B , if both countries decide on how much to protect $(X_i - x_i)$ at the same time? **ANSWER: FOC if interior:**

$$\begin{aligned} c [\bar{p} - a(x_A + x_B)] + ca(X_A - x_A) - v_A^A &= 0 \\ [\bar{p} - a(x_A + x_B)] + a(X_A - x_A) - v_A^A/c &= 0 \end{aligned}$$

$$\begin{aligned} ax_A &= [\bar{p} - a(x_A + x_B)] + aX_A - v_A^A/c \\ ax_B &= [\bar{p} - a(x_A + x_B)] + aX_B - v_B^B/c \\ 3a(x_A + x_B) &= 2\bar{p} + aX_B - v_B^B/c + aX_A - v_A^A/c \\ ax_A &= \bar{p} - \frac{2\bar{p} + aX_B - v_B^B/c + aX_A - v_A^A/c}{3} + aX_A - v_A^A/c \\ &= \frac{\bar{p} + 2(aX_A - v_A^A/c) - (aX_B - v_B^B/c)}{3} \text{ or} \\ &= \frac{\bar{p} + 2(aX_A) - (aX_B) - v^A/c}{3} \end{aligned}$$

f. How does your answer change if country i only valued its own value forest, and not both forests? What is the intuition for your answer?

$$= \frac{\bar{p} + 2(aX_A) - (aX_B) - 2v_A/c}{3}$$

which is less. So, A cuts more if A values both forests, because then A takes into account that cutting here leads to less cutting in B.

g. If the countries cooperate (and maximize the sum of payoffs): What is the difference between the x 's when the countries only care about their own forests, than if they care about both forests equally much? **ANSWER: Suppose v is the value for either forest. if one cares about both forests then FB is:**

$$2ax_A = \bar{p} + a(X_A + X_B) - v/c$$

if cares about only half of the forest then

$$2ax_A = \bar{p} + a(X_A + X_B) - v/2c$$

then cut more.

h. Compare the answers in f and in g and explain the difference.
Opposite. because here no externality. above, externality .