

Exam SØK1101 May 2019, 4 hours

Answer all 4 questions. Weights given next to each question.

Question 1 (30%)

- a. What is meant by the term externality? Provide examples of externalities.

*Standard definition of externality, any example.*

*Very good if they clearly explain why it is an externality. Even better if they explain the source of the externality (the lack of property rights)*

- b. How do negative production externalities affect total economic surplus?

*Standard diagram showing over production and too low price due to an externality relative to social optimum (see slide 1)*

*A brilliant answer would compare economic surplus explicitly with and without externality.*

- c. Illustrate and discuss how assigning property rights can, in principle, solve problems related to negative production externalities. What are some of the difficulties in practice in doing this?

*Discuss Coase theorem*

*See slide 2 for answer. Brilliant if they show it from other perspective (right to clean resource model)*

*Also great if they explain that for efficiency initial assignment of rights does not matter – but matters for wealth*

*Problems with negotiation based solution:*

*-Transaction costs when number of parties gets large*

*- Hold up and free riding problems when n is large*

*- Endowment effects – who gets the rights initially may affect their willingness to pay or accept.*

Question 2 (20%)

- a. What is the difference between a stock pollutant and a flow pollutant

**Absorptive Capacity:** Ability of the environment to absorb pollutants

**Stock pollutants:** pollutants for which the environment has little or no absorptive capacity.

– Examples include lead at emission sites, discarded non-biodegradable plastic

**Fund pollutants:** pollutants for which the environment has some absorptive capacity.

*Importance of distinction relates to the need for discounting etc. I.e. Stock pollutants have implications for future generations welfare*

- b. Discuss and demonstrate the socially optimal level of pollution? When would this level of pollution be zero?

See Slide 3

- c. In the case of uniform pollutants, demonstrate how either pollution charges or emission permits can generate efficient reductions in pollution? Why might a regulator or government prefer taxes or permits?

*Need to think about this as the optimal allocation of a pollution reduction. This should equal marginal abatement costs of polluters (standard model has 2). See slide 4*

*Question is also about how to get there. See slide 5 for charges.*

*What is the problem – how to set these charges?*

*Advantage of permits is that market should work this out (Slide 6)*

*Why prefer or not? Taxes raise revenue (can be used to mitigate externalities) – Permits don't – although they can if auctioned initially*

*Permits need less information*

*Both incentivize improvements in pollution abatement technology.*

*An economic shock will be reflected in the price of pollution permits (price adjusts) – for taxation it will be reflected in quantity (quantity adjusts)*

#### Question 3 (20%)

- a. How can a lack of property rights lead to over harvesting of natural resources?

*Tragedy of the commons – any description of how individuals / firms do not incorporate effect on outcomes of other individuals /firms and this drives production to where average cost equals average revenue- See slide 7 for standard model, but there are a few other ways of showing this*

- b. Why does freeriding make binding international climate agreements more difficult? How can 'issue-linkage', where access to other resources are tied to climate agreements, potentially reduce this problem?

*Essentially a prisoners dilemma problem. Countries have incentive to commit to reductions but then 'renege' on contract. An exceptional answer might explain that standard repeated game strategies (grim trigger etc) might not work here due to need to get all countries to reduce pollution in long run.*

*Issue-linkage works by taking something we cannot contract on due to its public good nature (global climate) and link it to something we can contract on that is a private good (transfer of specific R&D to poorer countries). If countries renege from pollution abatement contract we can then withdraw the private good provision.*

#### Question 4 (30%)

Consider a depletable resource stock of  $Q=20$  to be allocated across two periods.

The marginal willingness to pay (demand curve) is given by  $P=10-0.5Q$

Where  $P$  is the price and  $Q$  is the amount extracted.

The demand curve is identical in both periods

The marginal cost is constant and equal to 2

- a. Determine the extraction amount in two periods that maximises the present value for both periods. Set the discount rate equal to 0.05. Illustrate and explain graphically.
- b. Is this allocation fair? Why or why not?
- c. What is the market price in period 1? What is the marginal user cost in period 1?
- d. What is the market price in period 2? What is the marginal user cost in period 2?

*First standard diagramme showing intertemporal extraction.*

*For A it must be that there is higher consumption in first period and that the intercept on RHS Y-axis must be below 8 (due to discounting and they need to remove marginal cost from both) Standard diagram is Slide 7 (note allocation must equal 20 in total)*

*B- Is it fair? This is a little 'open ended'. It is efficient but not necessarily fair as the second period pays more for less consumption (and gets lower surplus, although discounted surplus is the same across both periods). An exceptional answer might highlight that the first period could invest their excess surplus and transfer this surplus to second period (i.e. like sovereign wealth funds are meant to do)*

*C and D are computations*

$Q_1 + Q_2$  must equal 20

Discounted marginal benefits need to equate across both.

$$MNB_1 = 8 - 0.5Q_1 \quad (1)$$

$$MNB_2 = 7.5 - 0.475Q_2 \quad (2)$$

$$Q_1 = 20 - Q_2 \quad (3)$$

$$Q_2 = 20 - Q_1 \quad (4)$$

Substitute (3) into (2=1)

$$8 - 0.5(20 - Q_2) = 7.5 - 0.475Q_2$$

Gather

$$0.975Q_2 = 9.5$$

$$Q_2 = (\text{approx.}) 9.74$$

$$Q_1 = (\text{approx.}) 10.26$$

$$P_1 = 4.87 \quad P_2 (\text{not discounted}) = 5.13$$

MUC is Price minus marginal cost (what would be paid in the absence of discounts)

MUC should always be higher in period 2