

Energy and Resource Economics (IKT3610)
Study questions (1)
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1. **Static efficiency:** The demand curve for a product is given by $Q_D = 400 - 20P$ and the supply curve for a product is given by $Q_S = 16P - 32$.
 - a- Illustrate the demand curve and the supply curve on the same graph.
 - b- Find the equilibrium price and quantity.
 - c- Find numerical values for the consumer surplus and the producer surplus.
 - d- Identify consumer surplus and producer surplus on your graph.
 - e- Find numerical values for the total willingness to pay for the equilibrium quantity and the total variable cost of supplying the equilibrium quantity. Identify these areas on your graph.

2. **Externalities:** The demand curve for a product is given by $P = 100 - 2Q = MB$ and the supply curve for a product is given by $P = 10 + 0.5Q = MC_P$.
 - a- Find the equilibrium price and quantity and illustrate graphically.
 - b- Suppose that the marginal cost of externality is given by $MC_E = 0.5Q$. What happens to the marginal external cost (the marginal increase in damages from pollution) as more of the good is produced?
 - c- Find the marginal social cost $MC_S = MC_P + MC_E$. Illustrate this new cost curve on your graph.
 - d- Find the socially optimal equilibrium price and quantity.
 - e- Which area on the graph represents the net gain from moving to the socially optimal equilibrium point?

3. **Common Property:** Five fishermen live in a village and have no other employment or income earning possibilities besides fishing. They each own a boat that is suitable for fishing, but does not have any resale value. Fish are worth 50TL per kilo and the marginal cost of operating the boat is 5000TL per month. They all fish in a river next to the village, and they have determined that when there are more of them out there on the river fishing, they each catch less fish per month according to the following schedule:

Boats	Fish Caught per Boat (kilos)
1	200
2	190
3	175
4	155
5	130

- a- If each fisherman acts in his own best interest, will he continue to operate his boat each month? If so, how much income will he earn per month?

- b- If the fishermen band together and act as a group, how many boats will they choose to operate? If income is divided evenly, how much will each fisherman make?
4. **The Coase Theorem:** There is a factory that is dumping toxic waste into a river where a resort is located downstream. At the moment the factory is not filtering the water that it dumps into the river. There is a filter it could install that would remove a significant amount of the toxic elements from the water before it is dumped in the river. The factory and the resort have each assessed the situation and come up with the following data:

Gains to:	No Factory	Factory with filter	Factory with no filter
Factory	0 TL/day	7000 TL/day	8000 TL/day
Resort	4000 TL/day	2500 TL/day	1000 TL/day

- a- If the factory is given ownership of the river, what choice will it make? How much would the resort be willing to pay to get the factory to make another choice? Will the factory accept?
- b- If the resort is given ownership of the river, what choice will it make? How much would the factory be willing to pay to get the resort to make another choice? Will the resort accept?
5. **Public good** Suppose the state is trying to decide how many miles of a very scenic river it should preserve. There are 100 people in the community, each of whom has an identical inverse demand function given by $P = 100 - 1.0q$, where q is the number of miles preserved and P is the per-mile price he or she is willing to pay for q miles of preserved river.
- a- If the marginal cost of preservation is 500 TL per kilometers (km), how many km would be preserved in an efficient allocation?
- b- How large is the economic surplus?

6. **The Cost-Effectiveness Equimarginal Principle**

Suppose you want to remove ten fish of an exotic species that have illegally been introduced to a lake. You have three possible removal methods. Assume that q_1, q_2 , and q_3 are, respectively, the amount of fish removed by each method that you choose to use. The goal will be accomplished by any combination of methods such that $q_1 + q_2 + q_3 = 7$.

- a- If the marginal costs of each removal method are, respectively, $\$10q_1$, $\$5q_2$, and $\$2.5q_3$, how much of each method should you use to achieve the removal cost-effectively?
- b- Why isn't an exclusive use of method 3 cost-effective?
- c- Suppose that the three marginal costs were constant (not increasing as in the previous case) such that $MC_1 = \$10, MC_2 = \5 , and $MC_3 = \$2.5$. What is the cost-effective outcome in that case?

7. **Benefits and Costs - discounting**

According to the table below,

- a- Should the project be implemented with a discount rate of 5%: $r=0.05$?
- b- Answer the same question but this time with $r=0.10$.

Project: Alpha Coral Mining

	Years					
	0	1	2	3	4	5
Costs (x1000\$)						
Extraction costs	3000					
Costs of coastal erosion	300	300	300	300	300	300
Benefits						
Revenues from limestone	4500					

8. *Dynamic Efficiency*

Consider a two-period problem where the available amount of the resource is 20. The resource needs to be allocated between two periods. Let the total willingness to pay and total cost be given by $\int_0^q (a - \frac{b}{2}x)dx$ and $\int_0^q cdx$, respectively. Let $a = 12, b = 0.4, c = 4$. Assume that the discount rate is $r = 0.4$.

- a- In a dynamic efficient allocation how much would be allocated to the first period and how much to the second period?
- b- What would be the efficient price in the two periods?
- c- What would be the marginal user cost in each period? Explain in detail what marginal user cost stands for.
- d- Using the marginal net benefit curves, show the dynamically efficient allocation in a figure (cf. Figure 5.2 in our book. Marginal net benefits on the vertical axes and quantities on the horizontal axis).
- e- In the following, assume that $r=0.00$. How much would be allocated to each period?
- f- Given that the discount rate is zero ($r=0$), what would be the efficient price in the two periods?
- g- What would be the marginal user cost in each period?