Environmental Economics

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Master semester 2 or 4

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Exercises

PUBLIC GOODS

Use value of a state park - travel cost method

A state park is located 10 minutes from city A, with 100,000 inhabitants, and 15 minutes from city B, with 200,000 inhabitants. On average, the inhabitants of city A visit the park 10 times a year and those of city B 5 times. The park costs USD 1,500,000 per year to operate.

Assumptions for the calculations:

- The inhabitants of both cities have similar incomes and preferences for natural parks
- The cost of a visit is equal to the cost of the time needed to get there and back (round trip), as there is no entrance fee
- The value of time is USD 0.50 per minute for residents of both cities
- Only residents of the two cities visit the park
- The social discount rate used by the state is 5%
- The park lasts forever, and the state is infinitely patient. Possible inflation of prices and costs is ignored.

1) Calculate the cost of visiting the park for an inhabitant of each city; then, calculate and draw the common individual demand function for the inhabitants of both cities.
2) Calculate the consumer surplus for the inhabitants of each city and the total consumer surplus.
3) A forestry company would like to buy the state park to exploit its timber. It offers USD 100 million. Should the state sell the park? *Justify your answer*

Locusts

In a valley infested with $\mathbf{S_0}$ locusts, there are two neighbouring farms. By spreading pesticide in the valley in quantity **Q**, the locust population can be reduced to $\mathbf{S = S_0 - Q}$. The cost of the pesticide is 4 per unit.

The damage caused by the locusts to farm 1 amounts to $\mathbf{D_1 = (a_1 - S_0)S + \frac{1}{2}S^2}$. For farm 2, the damage amounts to $\mathbf{D_2 = (a_2 - S_0)S + \frac{1}{2}S^2}$. $\mathbf{a_1}$ and $\mathbf{a_2}$ are positive parameters ($\mathbf{S_0 < a_1 < a_2}$).

(a) The benefit to each farm when pesticide is sprayed is equal to the difference between the damage it would suffer from the maximum locust population ($\mathbf{S_0}$) and the damage it actually suffers. Show that this benefit takes the form

$\mathbf{B_i = a_i Q - \frac{1}{2}Q^2}$ for i = 1,2

(b) Calculate the marginal willingness to pay of each farmer for a decontamination effort **Q**. Plot the marginal willingness to pay and the cost of the pesticide. Use $\mathbf{a_1}$ = 8 and $\mathbf{a_2}$ = 10.

(c) What is the efficient amount of pesticide to be spread? How could the corresponding cost be efficiently distributed between the two farmers, if the damage functions are known to all? Calculate the total surplus and the surplus of each farmer when the cost is distributed efficiently.

(d) Assume that farmer 1 acts alone. How much pesticide will he spread? Compare two alternative responses for farmer 2: (i) do nothing extra, (ii) spread pesticide himself.