

Public Economics

Optional intermediary exam

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The exam lasts 90 minutes. Documents are not allowed. You can answer either in French or in English. Answer questions below and 3 out of the 4 exercises. Please indicate clearly the exercises you choose.

Questions 5 points

Answer briefly (3 or 4 lines per question) to the following questions.

1. Why is income more taxed than wealth? 1
2. Discuss how television technology can turn a public good into a private good. 1.5
3. Are the following statements true or false? Explain very briefly why. 0.5 × 5
 - a) If the supply of public good is determined by majority vote, then the outcome must be Pareto-efficient.
 - b) If preferences are single-peaked, then everyone will agree about the right amount of public goods to be supplied.
 - c) Public goods are those goods that are supplied by the government.
 - d) If a public good is provided by voluntary contributions, too little will be supplied relative to the efficient level.
 - e) The theory of optimal commodity taxation argues that equal tax rates should be set across all commodities so as to maximize efficiency by “smoothing taxes”.

Exercise 1 5 points

Let there be N identical consumers indexed by $i = 1, \dots, N$. Each of them has the same utility function:

$$U^i = \log(x^i) + \log(G),$$

where x^i is the consumption of a private good by individual i , and G is a pure public good. Each consumer is endowed with income 1. Let 1 be the unit price of the private good, such that each consumer's budget constraint can be written as:

$$x^i + g^i \leq 1,$$

where g^i is individual i 's contribution to the public good. Total available quantity of the public good is the sum of individual contributions, i.e.:

$$G = \sum_{i=1}^N g^i.$$

1. Calculate G^d , the equilibrium public good provision when individuals take decentralized decisions. 2
2. Calculate G^o , the optimum public good provision when a social planner chooses the level of public good such as each individual contributes equally and the following social welfare function is maximized: 2

$$\mathbb{W} = \sum_{i=1}^N U^i.$$

3. Comment on the effect of changing N on the difference between the decentralized equilibrium and the social optimum. 1

Exercise 2

5 points

A competitive refining industry produces a refined product. The inverse demand function for the refined product is:

$$p^d = 20 - q,$$

where q is the quantity consumed when consumers pay price p^d . The inverse supply curve for the refined product is:

$$p^s = 2 + q,$$

when the industry produces q units sold at price p^s .

1. What are the market equilibrium price and quantity for the refined product? 1

The industry releases one unit of waste into the atmosphere for each unit of refined product. The marginal cost of pollution is:

$$MC = q,$$

when the industry releases q units of waste.

2. Express the social marginal cost of production. 1

3. Calculate the price and quantity for the refined product at the social optimum. 1.5
4. Assume that the government imposes an emission fee of T per unit of emissions. How large must the emission fee be to let the market produce the socially efficient amount of the refined product? 1.5

Exercise 3

5 points

Consider a society made of three individuals indexed by A , B , and C . Let $G \in [0, +\infty[$ be the number of hours of television broadcast each day. Television broadcast is financed through a tax shared equally among individuals, i.e. if G is supplied, each individual has to pay $\frac{G}{3}$. Assume the individuals have the following before tax utilities over G :

$$\begin{aligned} U^A &= G, \\ U^B &= 2 - G, \\ U^C &= \frac{4}{3}G - \frac{G^2}{2}, \end{aligned}$$

and that these utilities can be directly compared to the tax cost.

1. Show that the three individuals have single-peaked preferences. 1.5
2. If the government is choosing G from the range $0 \leq G \leq 2$, what is the majority voting outcome G^v ? 2

Aggregate social welfare can be expressed as:

$$\mathbb{W} = U^A + U^B + U^C - G.$$

3. Does the majority voting outcome maximize social welfare? Comment. 1.5

Exercise 4

5 points

Total tax revenue raised by a government is given by:

$$\mathbb{R}(t) = t \times \mathbb{B}(t),$$

where $t \in [0, 1]$ is the tax rate and $\mathbb{B}(t)$ is the tax base, with $\frac{\partial \mathbb{B}}{\partial t} < 0$. Suppose that the elasticity of the tax base can be expressed as:

$$\varepsilon = -\frac{\gamma t}{1 - \gamma t},$$

with $\gamma \in [0, 1]$.

1. Explain what is the elasticity of the tax base. 1
2. What is the tax rate that maximizes total tax revenue? Let us call it t^* . 2
3. How does t^* vary with γ ? Explain the intuition behind it. 2