14.41 Public Economics
Section Handout #3

I. Pigouvian Tax

Rosen's explanation: "A Pigouvian tax is a tax levied on each unit of a polluter's output in an amount just equal to the marginal damage it inflicts *at the efficient level of output*." In general, this is the kind of tax that a public economist thinks about.

Graphical presentation :

Mathematical example (from P.S. #1, question #2b) : driving cost and the number of axels

cost of gas $= (1/6)*A^2$ (this is a private cost)
pollution $= (1/6)*A^2$
road damage $= 20/A$

Find social optimum:
Min c(A) = min $((20/A) + (1/3)*A^2 + (1/6)*A^2)$

F.O.C = $-20/(A^2) + (2/3)A + (1/3)A = 0$
$A* = 20^{(1/3)} = 2.714$

Find Pigouvian Tax (in this case a subsidy):
The tax will equal the marginal damage at the socially optimal output level, A^*.

Tax = $-20/A^{*2} + (2/3)A^* = -(1/3) * 20^{(1/3)}$

Driver's problem now that he/she faces the Pigouvian tax :
Min $((1/6)A^2 - (1/3)* 20^{(1/3)}*A)$
F.O.C
$(1/3)A -(1/3)* 20^{(1/3)}) = 0$
$A = 20^{(1/3)} = A*$
The driver chooses the socially optimal level of A.

II. Public Goods

A. Definition
- Public goods are <u>non-rival</u> (my consuming it does not prevent you from consuming it) and <u>non-excludable</u> (I can't stop you from consuming it). Examples: national defense, lighthouse.
- Optimal level of provision of private goods: each person sets MRS = ratio of prices. Firms set MRT = ratio of prices. So $MRS_a = MRS_b = MRT$ (a and b are two individuals). Market demand curve is <u>horizontal sum</u> of individual demand curves.
- Optimal level of provision of public goods: since both people are able to consume the good, its value is $MRS_a + MRS_b$. Set <u>sum</u> of MRS = MRT. Market demand curve is <u>vertical sum</u> of individual demand curves.

B. Private provision of public goods
- <u>Public goods problem</u>: can be described as a <u>free-rider problem</u> (you prefer to let others pay since you still enjoy the benefits) or a <u>positive externality</u> (your provision benefits others, but this isn't in your utility function). The result is <u>under provision</u> by the private market.
- To find level of private provision, use <u>Nash bargaining</u> (what do I want to do, holding your actions constant). This gets us <u>reaction curves</u> (downward sloping).

C. Public Provision
- If there is some private provision, what happens if government taxes you to provide some of the good? <u>Crowdout</u>: you reduce private provision to offset increase in public provision.
- Basic principle: if you start from an individual optimum and the environment changes, <u>if you are able to undo this change to get back to the optimum, you will</u>.
- Is there always 100% crowdout? Not if: 1) you get utility from your contributions as well as from the total (warm glow model); or 2) the government taxes some people more than they were contributing.
- How much of the good to produce? Can ask people what their MRS is, then charge them that amount: <u>Lindahl equilibrium</u>. Problems: 1) truthful preference revelation (free rider problem); 2) people may not know their valuation; 3) too costly to determine everyone's preferences.

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