Lecture 12: Public goods

Economics 336

Content Quiz

1. Prior to Samuelson (1954), economists knew that the efficient level of public goods provision occurs where the (vertical) sum of MRS curves equals the marginal cost of provision. According to Samuelson, that theory is misleading because it assumes:
    1. the number of consumers is fixed;
    2. the income distribution is fixed;
    3. there is only a single good.

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- Would we want them to?

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Snow removal is a *public good*. *Private provision* of snow removal can lead to a *free-rider problem*.

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- non-excludability $\implies$ private provision is not profitable (free-riding)
- non-rivalry $\implies$ even excludable private provision is inefficient

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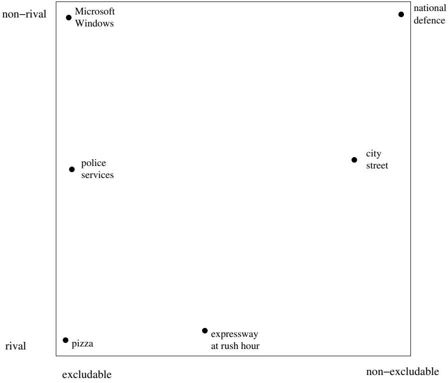

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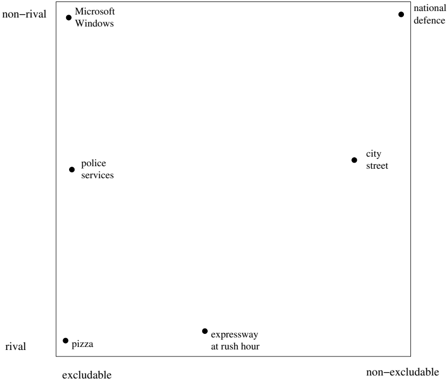

Where would you place:

- broadcast television and cable television?
- a WiFi network?
- a university education?

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For an individual commodity, we can have with public provision, public production, or both.

In public debates over *privatization* of government services, the two issues often get confused.

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The case for public production is mixed. Private producers may have better incentives to reduce costs due to competition, the profit motive. Public production may be necessary where the *quality* of production is difficult to observe. (Examples?)

Classroom exercise: Voluntary contributions

Often we rely on voluntary private contributions to provide public goods (examples). How well can this work?
An exercise:

- class is divided in two groups
- each student secretly decides how much between \$0 and \$5 to contribute to a collective pot for the group
- I will add 20% to the total in each pot
- total is divded equally among students in that group
- group B can discuss strategy before choosing; group A cannot

Voluntary contributions: The Nash equilibrium

Model this as a simultaneous move game.

If each student i contributes g_i, her payoff is

$$U_i = 1.2 \times \frac{1}{N} \sum_{j=1}^{N} g_j - g_i$$

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- Altruism
- "Warm glow" of giving

Efficient provision of public goods

With private goods, we know Pareto efficiency is attained by setting $p_i = MC_i$ in all markets, and producing $X_i = \sum_h D_i^h(p_i)$ of all goods. This ensures for any two goods i, j and two consumers A, B,

$$\frac{\partial U^A / \partial x_i}{\partial U^A / \partial x_j} = \frac{MC_i}{MC_j} = \frac{\partial U^B / \partial x_i}{\partial U^B / \partial x_j}$$

or

$$MRS_{ij}^A = MRT_{ij} = MRS_{ij}^B$$

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For public goods this can't work:

- all consumers consume the same quantity G (non-rival);
- no prices to equilibrate market (non-excludable)

Samuelson conditions

Paul Samuelson solved the efficient provision problem in an elegant 1954 paper.

Two consumers A, B, one private good (x_A, x_B), and one public good G.

Feasible allocations:

$$x_A + x_B + C(G) = W \quad \text{(fixed)}$$

A Pareto efficient allocation solves

$$\begin{aligned} \max U_B(x_B, G) \ \text{ s.t. } \ U_A(x_A, G) &= \bar{U}_A \\ x_A + x_B + C(G) &= W \end{aligned}$$

Form the Lagrangean

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First-order conditions are:

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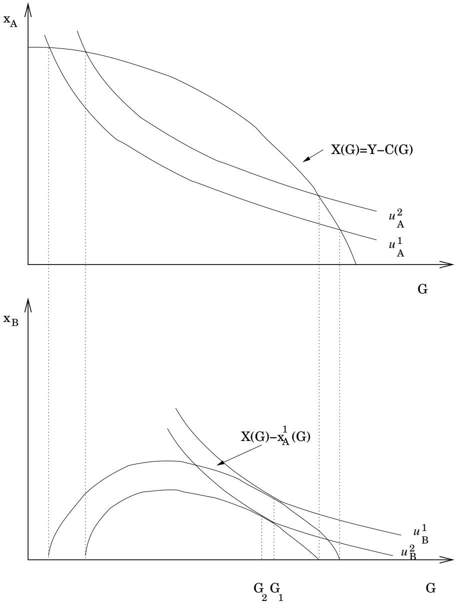
Divide the second equation by $\lambda \partial U_A / \partial x_A$ and use the first equation to get

$$\frac{\partial U_B/\partial G}{\partial U_B/\partial x_B} + \frac{\partial U_A/\partial G}{\partial U_A/\partial x_A} = C'(G).$$

or $MRS_A + MRS_B = MRT$.


x_A
X(G)=Y−C(G)
u 2 A
u 1 A
G
x_B
X(G)−x 1 A (G)
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G

Allocation and distribution

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Normally we think the questions of efficient allocation and of equitable distribution are separate. But Samuelson's graph shows this is not the case for public goods.

When the planner wishes to redistribute more from B to A, their willingness to pay for the public good changes (by different amounts), so the efficient quantity changes as well.

So we cannot speak of "*the* efficient provision of public goods".

Efficient provision: Exercises

Let $C(G) = G$ and:

1.
$$U_A(x_A, G) = x_A + 2\log G$$
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2. $$U_A(x_A, G) = x_A G^\beta \qquad (\beta > 0)$$
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3. $$U_A(x_A, G) = x_A G^2$$
   $$U_B(x_B, G) = x_B G$$

Lindahl prices

One problem with the Samuelson solution is that it requires the planner to know people's preferences for the public good.

Lindahl (1919) pointed out that we could use prices to elicit this information just as in private goods markets – only with *tax prices* that differ among people.

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The Samuelson conditions are satisfied and the budget is balanced by charging each consumer a *tax price* t_h such that:

$$V_h'(G^*) = t_h \qquad \text{(all } h\text{)}$$

$$\sum_h t_h = 1$$

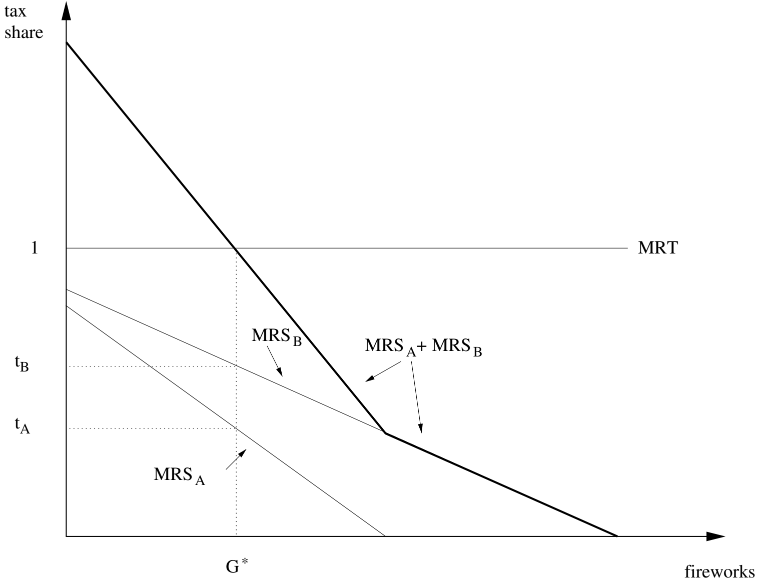

Figure : Lindahl equilibrium

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Note that there is a *preference revelation problem*: truthtelling under Lindahl pricing is not *incentive compatible*.