Microeconomics

Lecture 6

Public Goods -- Definition

- **A good is purely public if it is both nonexcludable and nonrival in consumption.**
  - **Nonexcludable -- all consumers can consume the good.**
  - **Nonrival -- each consumer can consume all of the good.**

Public Goods -- Examples

- **Broadcast radio and TV programs.**
- **National defense.**
- **Public highways.**
- **Reductions in air pollution.**
- **National parks.**

Reservation Prices

- A consumer's reservation price for a unit of a good is his maximum willingness-to-pay for it.
- Consumer's wealth is w.
- Utility of not having the good is $U(w,0)$.
- Utility of paying p for the good is $U(w-p,1)$.
- Reservation price r is defined by $U(w,0)=U(w-r,1)$.

Reservation Prices; An Example

Consumer's utility is $U(x_1, x_2) = x_1(x_2 + 1)$.

Utility of not buying a unit of good 2 is

$$V(w,0) = \frac{w}{p_1}(0+1) = \frac{w}{p_1}.$$

Utility of buying one unit of good 2 at price p is

$$V(w-p,1) = \frac{w-p}{p_1}(1+1) = \frac{2(w-p)}{p_1}.$$

Reservation Prices; An Example

Reservation price r is defined by

$$V(w,0) = V(w-r,1)$$

I.e. by

$$\frac{w}{p_1} = \frac{2(w-r)}{p_1} \Rightarrow r = \frac{w}{2}.$$

When Should a Public Good Be Provided?

- **One unit of the good costs c.**
- **Two consumers, A and B.**
- **Individual payments for providing the public good are g_A and g_B.**
- **$g_A + g_B \geq c$ if the good is to be provided.**

When Should a Public Good Be Provided?

- **Payments must be individually rational; i.e.**

  $$U_A(w_A, 0) \leq U_A(w_A - g_A, 1)$$

  and

  $$U_B(w_B, 0) \leq U_B(w_B - g_B, 1).$$

- **Therefore, necessarily**

  $$g_A \leq r_A \quad \text{and} \quad g_B \leq r_B.$$

When Should a Public Good Be Provided?

- And if $U_A(w_A,0) < U_A(w_A - g_A,1)$ and $U_B(w_B,0) < U_B(w_B - g_B,1)$

  then it is Pareto-improving to supply the unit of good, so $r_A + r_B > c$ is sufficient for it to be efficient to supply the good.

Private Provision of a Public Good?

- Suppose $r_A > c$ and $r_B < c$.
- Then A would supply the good even if B made no contribution.
- B then enjoys the good for free; **free-riding**.

Private Provision of a Public Good?

- Suppose $r_A < c$ and $r_B < c$.
- Then neither A nor B will supply the good alone.
- Yet, if $r_A + r_B > c$ also, then it is Pareto-improving for the good to be supplied.
- A and B may try to free-ride on each other, causing no good to be supplied.

Free-Riding

- Suppose A and B each have just two actions -- individually supply a public good, or not.
- Cost of supply c = $100.
- Payoff to A from the good = $80.
- Payoff to B from the good = $65.
- $80 + $65 > $100, so supplying the good is Pareto-improving.

Free-Riding

Player A \ Player B	Buy	Don't Buy
Buy	-$20, -$35	-$20, $65
Don't Buy	$80, -$35	$0, $0

[Don't' Buy, Don't Buy] is the unique NE (inefficient)

Free-Riding

- **Now allow A and B to make contributions to supplying the good.**
- **E.g. A contributes $60 and B contributes $40.**
- **Payoff to A from the good = $20 > $0.**
- **Payoff to B from the good = $25 > $0.**

Free-Riding

Player A \ Player B	Contribute	Don't Contribute
Contribute	$20, $25	-$60, $0
Don't Contribute	$0, -$40	$0, $0

Two NE: (Contribute, Contribute) and (Don't Contribute, Don't Contribute).

Free-Riding

- So allowing contributions makes possible supply of a public good when no individual will supply the good alone.
- But what contribution scheme is best?
- And free-riding can persist even with contributions.

Variable Public Good Quantities

- E.g. how many broadcast TV programs, or how much land to include into a national park.
- c(G) is the production cost of G units of public good.
- Two individuals, A and B.
- Private consumptions are x_A, x_B.

Variable Public Good Quantities

- **Budget allocations must satisfy**

$$x_A + x_B + c(G) = w_A + w_B.$$

- **MRS_A & MRS_B are A & B's marg. rates of substitution between the private and public goods.**
- **Pareto efficiency condition for public good supply is**

$$|MRS_A| + |MRS_B| = MC(G).$$

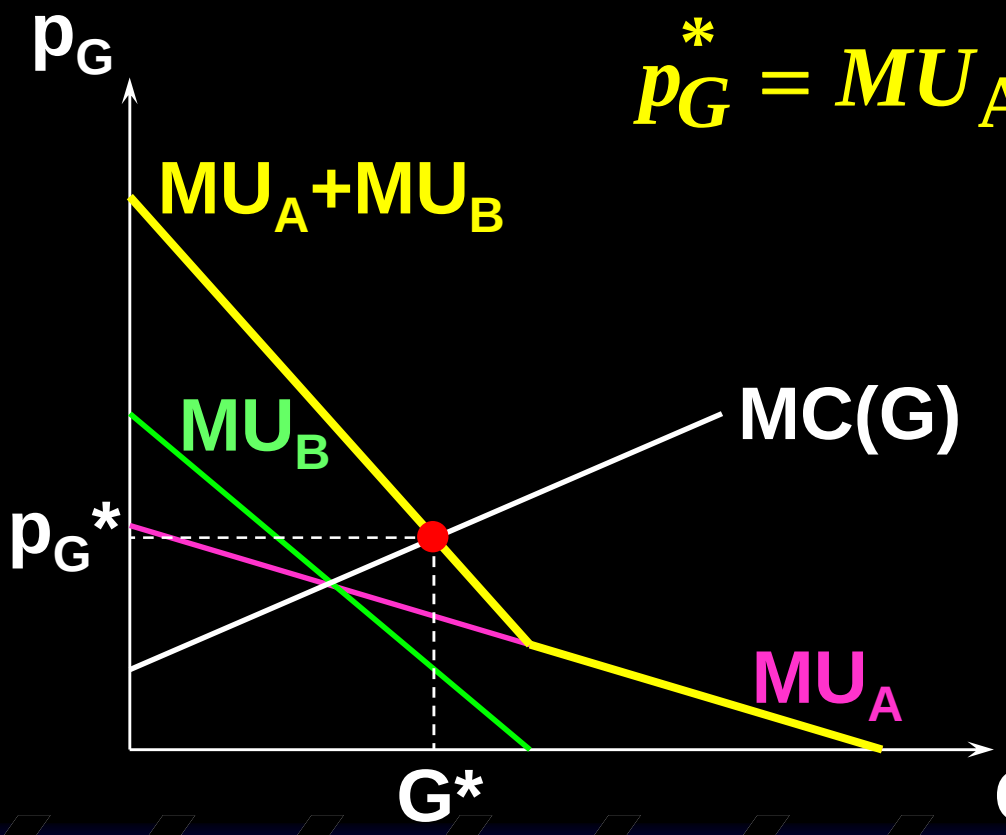
Variable Public Good Quantities

- **Pareto efficiency condition for public good supply is**

$$|\mathrm{MRS}_A| + |\mathrm{MRS}_B| = \mathrm{MC}(G).$$

- **Why?**
- **The public good is nonrival in consumption, so 1 extra unit of public good is fully consumed by both A and B.**

Efficient Public Good Supply



$$p_G^* = MU_A(G^*) + MU_B(G^*)$$

Efficient public good supply requires A & B to state truthfully their marginal valuations.