PUBLIC GOODS

BASIC CONCEPTS AND DISTINCTIONS (P-R pp. 665-666)

Exclusion – can non-payers be excluded from consumption of good or service?
- If not, then (a) free-riding usage, (b) low or no incentive for private firms to supply
- Example of non-exclusion – anti-missile defense

Rivalry – does one person's use of the good or service preclude simultaneous use by others?
- If not, then MC of added users is zero, so MC-pricing problematic
- Example of non-rivalry – broadcast signal

A pure public good or service : non-excludable and non-rivalrous
- Pure cases are rare, but useful to focus attention

In reality we have mixed cases with degrees of exclusion and rivalry
- Exclusion costly but not impossible, so matter for decision
- Technology of exclusion can change – scrambling of broadcast signals
- One person's use may partly reduce quality of other's use (congestion)

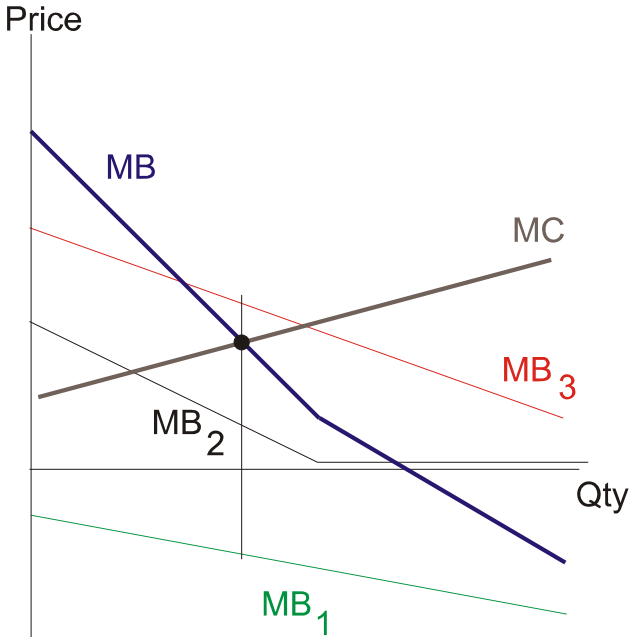
Important special case – Club good, excludable, but partially rival (i.e. with congestion)
- Then groups of the right size can provide such goods for their own members

Scope – a good may be "public" over a small group, e.g. roads
- Others excluded by distance, and unaffected by the group's consumption

But scope is also a matter of degree – trails off gradually with distance, not abrupt drop

EFFICIENT PROVISION OF PUBLIC GOOD – SAMUELSON CONDITION (P-R 666-667)

Pure, non-rival public good or service
Consider three-person economy with marginal benefit curves as shown
Quantity is same for all. Add MB curves vertically to get total MB = MB_1 + MB_2 + MB_3
This is the market demand curve for the public good
Efficient solution is at intersection with MC
This is called the Samuelson condition



Then individuals may be charged their
MB's, but that is a distribution issue

Problem – Individuals don't have incentive
to reveal willingness to pay

Need cleverer mechanism to elicit truth (not in P-R)
One such comes from Vickrey, Clark, Groves (VCG)
Explain the idea using case of a single discrete good
Cost C, true valuations of individuals B_1 , B_2 , B_3 , ...
Ask people to declare willingnesses to pay
They don't have to tell the truth; suppose they answer X_1 , X_2 , X_3 , ...
Decision rule – Produce the good if, and only if, $X_1 + X_2 + X_3$ ... > C
Then charge the individuals amounts C – ($X_2 + X_3$ + ...), C – ($X_1 + X_3$ ...), ...
So each pays Cost minus the sum of EVERYONE ELSE's declared willingness to pay

Claim – This produces truthful revelation and efficient production decision

Proof – Suppose you are person 1. You don't know 2, 3, ... 's B_2 , B_3 , ... or X_2 , X_3 , ...

If you answer truthfully ($X_1 = B_1$), project will go ahead if $B_1 + X_2 + X_3$ ... > C, and you will pay

$C - (X_2 + X_3 + ...)$ for a net gain $B_1 - [C - (X_2 + X_3 + ...)] = B_1 + X_2 + X_3$ ... $- C > 0$

If you understate, choosing $X_1 < B_1$, there are three possibilities:

(1) $B_1 + X_2 + X_3$ ... > C and $X_1 + X_2 + X_3$ ... > C , project goes ahead,
Your understatement makes no difference to decision or what you pay

(2) $B_1 + X_2 + X_3$ ... < C and $X_1 + X_2 + X_3$ ... < C , project does not go ahead
Truth would have had the same consequence

(3) $B_1 + X_2 + X_3$ ... > C but $X_1 + X_2 + X_3$ ... < C ,
Your understatement is instrumental in killing the project
This gets you 0 payoff, when truth would have given you positive payoff

So truth dominates understatement. Similarly (prove this) truth dominates overstatement
Thus truthful revelation is your dominant strategy. Same for everyone else
The general idea is very similar to that of truthful bidding in second-price auction

Problem – The scheme makes a financial loss

Write $X = X_1 + X_2 + X_3$ ... Go-ahead rule is X > C
Suppose there are n people. 1 pays $C - (X - X_1) = C - X + X_1$ etc
Total revenue = $n C - n X + X_1 + X_2 + X_3$ ... $= n C - n X + X$ Cost of project = C
So balance $n C - n X + X - C = (n - 1) (C - X) < 0$
Need some outside funding from general taxation. Other even cleverer but more complex schemes can achieve budgetary balance and truthful revelation

FINANCING PUBLIC GOODS BY VOLUNTARY CONTRIBUTIONS

Denote total quantity of a pure public good by X.
People 1, 2, 3 ... ; Benefits $B_1(X)$, $B_2(X)$, $B_3(X)$ ...
Social optimum maxes $B_1(X) + B_2(X) + B_3(X) + ... - X$
(Samuelson) condition $MB_1(X) + MB_2(X) + MB_3(X) + ... = 1$

Try to finance the provision of the good by letting individuals choose contributions X_1 ,...
Suppose people ranked by decreasing order of MB: for any X, $MB_1(X) > MB_2(X) > MB_3(X)$ ...
Nash equilibrium: each takes others' contributions as given, chooses own

1 maximizes $B_1(X) - X_1$, condition $MB_1(X) * 1 - 1 = 0$, or $MB_1(X) = 1$

2 maximizes $B_2(X) - X_2$, condition would be $MB_2(X) = 1$, but not compatible with 1's

therefore for 2, derivative of benefit is always < 0; chooses $X_2 = 0$. Similarly 3 etc.

Result – only the highest valuer contributes, all others free-ride

Alas, well known to many dedicated workers for good causes :-(

Even if all have identical MB schedules, so all max conditions can give positive contribs.,
Nash equilibrium has $MB_1(X) = MB_2(X) = MB_3(X) = 1$
Optimum would have $MB_1(X) = MB_2(X) = MB_3(X) = 1 / n$, where n is number of people
Since MB schedules are declining, optimum has (much) larger quantity
So relying on contributions can lead to inefficiently low provision of the public good
Partial solutions – [1] Give contributors some personal returns (lotteries, auctions, prestige, "selective incentives" like members' benefits in labor unions, AARP...)
[2] Private groups can better monitor contributions, punish non-contributors with social sanctions
Can similarly control "local public bads" e.g. depletion of some common property resources

PRODUCTION OF A (PARTIALLY) PUBLIC GOOD

Who produces the good or service is a separate question from how it is financed
Alternative possibilities:

- [1] Government departments – defense, police, prisons, highways in most countries
- [2] Publicly owned enterprises – postal service, utilities, health, education,
  municipal services like snow removal and garbage collection etc. in many countries
- [3] Private firms, with bidding or other contractual arrangements –
  Increasingly used for municipal services in most countries
  Also for health services in many countries, education in some
  Rarely for highways, even more rarely for prisons

What determines the relative merits of these?
Economies of scale not the most important issue – could contract out to one large firm
Instead focus on different kinds of moral hazard
Publicly owned entities may have lower-powered incentives –
  politics may lead to flatter salary gradients, harder to fire workers, ...
Competitive bidding among private firms can create stronger incentives
But profit-maximizing private firm may shirk on dimensions like quality
  that are not easily or immediately observable
Profit-oriented firm may find it harder to attract dedicated / motivated workers
  who require less incentive
So balance not clear, and may vary from one situation to another