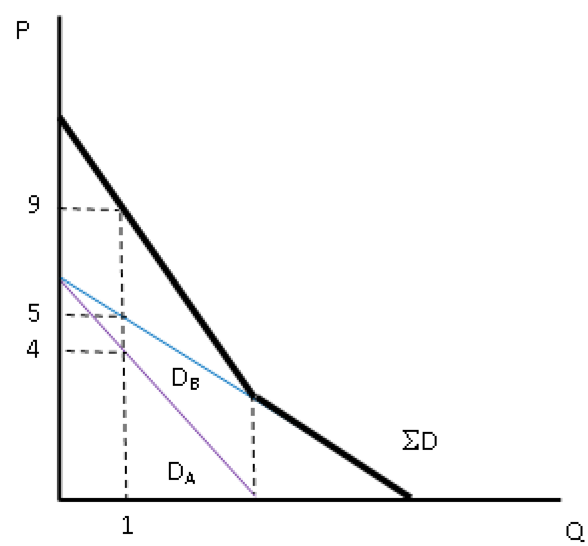
Lecture # 20 – Public Goods

I. Public Goods

- Public goods are goods that can benefit everyone, and from which no one can be excluded.
- Two characteristics:
  1. non-rival -- one person's enjoyment or consumption of the good does not prevent others from using it.
  2. non-excludable -- people cannot be prevented from using the good.
     - Thus, it is difficult to collect money for the good.

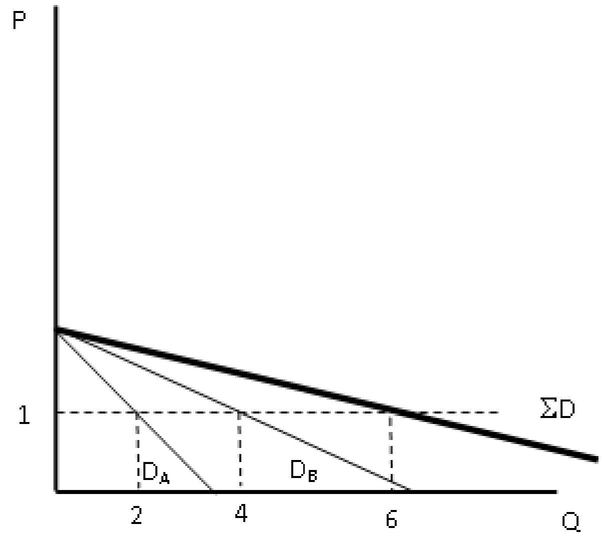
II. Efficient Allocation of a Public Good

- Because public goods can be enjoyed by everyone, we need the summation of each individual's marginal benefit.
  - A *vertical summation* is used, since the goods are non-rival



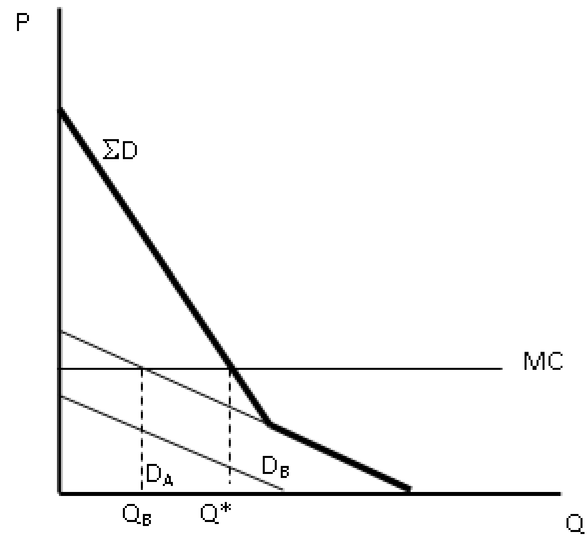
- In the figure above, D_A (purple line) represents the demand curve for person A, and D_B (blue line) is the demand curve for person B.
  - One unit of the public good is worth $4 to person A, and $5 to person B.
  - Since both can enjoy the good at the same time, the total marginal benefit of one unit of the good is $9.
    - We get this by summing vertically -- adding A's valuation on top of B's.
    - The dark line represents the combined demand.
      - In this case, with just two people, once A's valuation of the good goes to 0, only B's demand matters.

- Contrast with private goods, for which we use *horizontal summation*.



- In the figure above, D_A represents the demand curve for person A, and D_B is the demand curve for person B.
- Here, each person needs to have their own unit of the good. They cannot share.
  - At a price of \$1, person A wants 2 units of the good, and person B wants 4 units.
  - Thus, we need a total of 6 units at a price of \$1.
  - We get this by adding the quantity demanded of each person across to get the darker black line.

- The efficient allocation is where the sum of the marginal benefit curves equals marginal cost.
- However, both characteristics of a public good keep us from getting to the efficient solution. First, consider non-rivalness.
  - Since each individual is concerned with his or her own marginal benefit, underprovision results.
  - This results from the non-rival nature of a public good. When deciding how much of a public good to purchase, each person considers their own benefits. However, they do not consider that their purchase also benefits others.



- The above diagram illustrates the problem. Because the MC of the good is above person A's demand, person A is unwilling to provide any of the public good.
  - Person B is willing to provide some (Q_B).
  - However, this is less than the efficient amount (Q^*), which is where $MC = \Sigma D$.
- This is because each individual only cares about the benefit that they get from purchasing the good. They don't consider benefits to others.
  - Efficient provision: $\Sigma MB = MC$.
  - Private market provision: $MB = MC$.
    - But $\Sigma MB > MB$. Thus, the result is that $\Sigma MB > MC$.
      - So in the private market, we have *underprovision*.
    - Because individuals do not provide enough of a public good on their own, government intervention is necessary.

- The following numerical example illustrates
    - Consider a lake with three homes along a polluted lake
    - Each of the homeowners is willing to pay a certain amount to clean up the lake

	Marginal willingness to pay ($ per year)				
Q	**Homeowner A**	**Homeowner B**	**Homeowner C**	**Total**	**MC**
1	110	60	50	220	55
2	85	40	40	165	60
3	70	20	30	120	75
4	55	10	20	85	85
5	45	0	10	55	110
6	30	0	5	35	140
7	15	0	0	15	180

    - Each cleans up as long as MB ≥ MC for them
        - A willing to pay for 2 units of cleanup
        - B willing to pay for 1 unit of cleanup
        - C won't pay for anything on their own
    - Efficient solution is where $\Sigma MB = MC$
        - This would be where 4 units of pollution are cleaned up.
- The above inefficiency occurs because of non-rivalness. Non-excludability leads to ta second problem: the free rider problem:
    - A <u>free rider</u> is a consumer or producer that benefits from the actions of others without paying.
        - Even if we could come up with a way to overcome the non-rival problem by sharing the cost of a public good, we still need a way to ensure that everyone pays their share. The ability of people to free ride makes this difficult.
        - For example, since B is only willing to pay for one unit of cleanup, they could simply free-ride on what A provides.
        - But if A knows this, why should A bother to pay for cleanup? Thus, *A can also free ride*
    - Because of the free rider problem, public goods are usually provided by the government, which levies taxes to pay for the goods.
        - The free rider problem also makes it difficult to determine how much value any one individual places on a public good.
            - Unfortunately, as we will see below, majority rule voting may not help us here.

- What can be done about the free rider problem?
  - Compulsory provision – the government can collect taxes from everyone to make them pay a share of the cost.
  - Social pressure – pressure people into contributing "voluntarily."
    - Most likely to work for small groups (e.g. stores in a mall contributing to a security guard's salary).
  - Mergers – if individuals combine into a single entity, the free rider problem is no longer relevant.
  - Privatization – if exclusion is possible, the free rider problem no longer exists.
    - E.g. turning a road into a toll road

III. The Role of Voting

- Unfortunately, finding everyone's true valuation can be difficult. Consider the problem of the median voter.
  - Governments often use the results of votes to determine how much value the public places on a public good.
    - A voter will vote yes for a project if their valuation is greater than their share of the payment (e.g. their tax payment).
    - The median voter is the person for whom half of society has a higher valuation, and half has a lower valuation.
    - The median voter theorem states that a project will pass if the median voter's valuation is greater than the cost to that voter.
    - Example
      - Consider a vote on three traffic signals, each of which will cost $300:

Value to each voter ($)

Signal Location	**Bart**	**Maggie**	**Lisa**	**Value to Society**	**Outcome of Vote**
Corner A	50	100	150	300	Yes
Corner B	50	75	250	375	No
Corner C	50	100	110	260	Yes

      - The first two projects are efficient (Value >= cost).
        - However, only the first will pass.
      - Moreover, the second is inefficient, but will pass anyway.
    - *Key point*: simple yes-no majority rule voting does not calculate the full value of a public good, and thus does not guarantee that an efficient outcome will occur.
      - The problem is that *intensity of preferences* is ignored.

- Leads to Arrow's general possibility theorem
    - Any rule of voting that satisfies a basic set of four fairness conditions can lead to an illogical result. The four are:
        - Each person has transitive preferences over the options (axiom of unrestricted domain). Recall the principle of transitivity; if A is preferred to B and B is preferred to C, then A is preferred to C as well.
        - If one alternative is unanimously preferred to a second, then the rule of choice will not select the second (axiom of Pareto choice).
        - The ranking for any two alternatives should not change if a third alternative is introduced (axiom of independence).
        - The rule should not allow one person dictatorial power over the other members deciding (axiom of non-dictatorship).