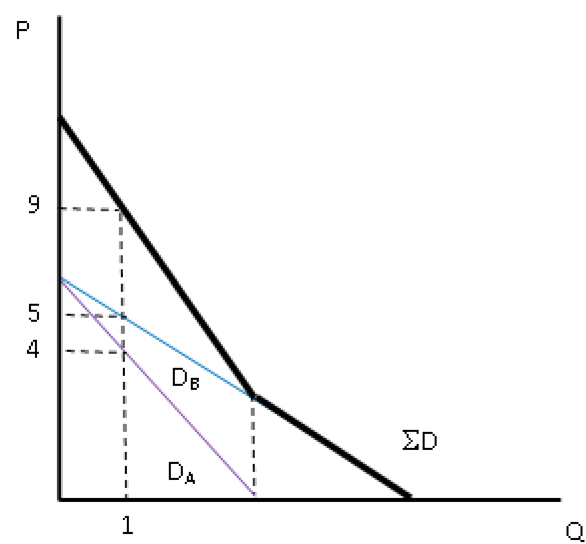
Lecture # 20 – Public Goods

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.

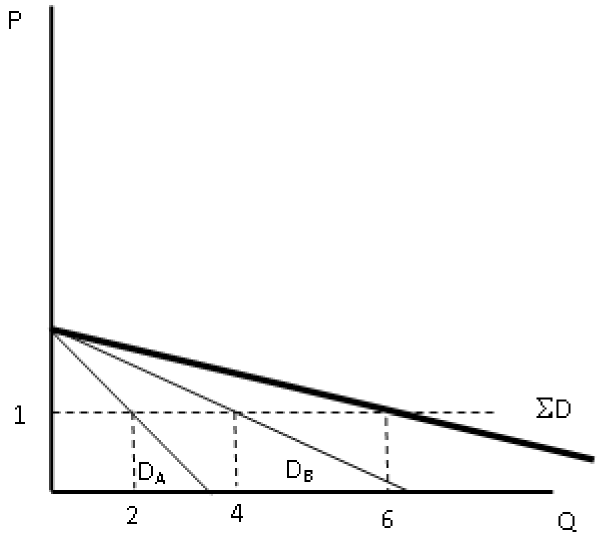
II. Efficient Allocation of a Public Good

- 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

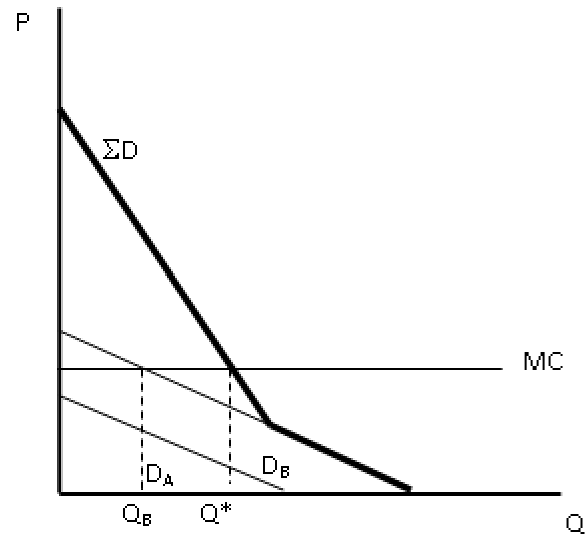


- In the figure above, D_A (purple line) represents the demand curve for person A, and D_B (blue line) is the demand curve for person B.
    - One unit of the public good is worth \$4 to person A, and \$5 to person B.
    - Since both can enjoy the good at the same time, the total marginal benefit of 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 = ΣD.
- 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: ΣMB = MC.
  - Private market provision: MB = MC.
    - But ΣMB > MB. Thus, the result is that ΣMB > 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. 3 units of pollution are cleaned up.
    - 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 a 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.
    - 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 know from the last lecture, 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.

III. The Role of Voting

- Will voting lead to a stable outcome that reveals true preferences?
- 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.

- There are other limitations to voting, known as the paradox of voting.
    - For example, the final outcome can depend on how choices are presented.
    - Consider the example in the chapter from the text, which considers a vote for a school budget.
        - Society consists of three groups, with different preferences for spending on education
        - If each vote considers one of two options, with the winner then taking on the remaining option, the outcome will depend on the order in which these choices are presented.
            - Even worse if we allow for strategic voting, or 'sophisticated voting' when people realize that voting against one's own preferences in early rounds can lead to a more desired outcome in the final round.
    - This phenomenon, known as cycling (e.g. inconsistency of outcomes depending on order), occurs because of double-peaked preferences
        - Effective schoolers in the text are an example of double-peaked preferences.
        - Rather than preferring high, medium, low, they prefer low spending to a mid-range outcome
            - Why might this occur?
                - They prefer high spending on education. If the community doesn't provide it, they can enroll their children in private schools. If they do, they won't want to pay much in taxes for public schools.
- 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).