EE441
Public Goods (1)

1

PURE

Characteristics of Public Goods

- Nonrivalry: The characteristic that if one person "consumes" a good, another person's pleasure is not diminished, nor is another person prevented from consuming it.

2

Characteristics of Public Goods

- Nonexclusion: The inability of a seller to prevent people from consuming a good if they do not pay for it.

3

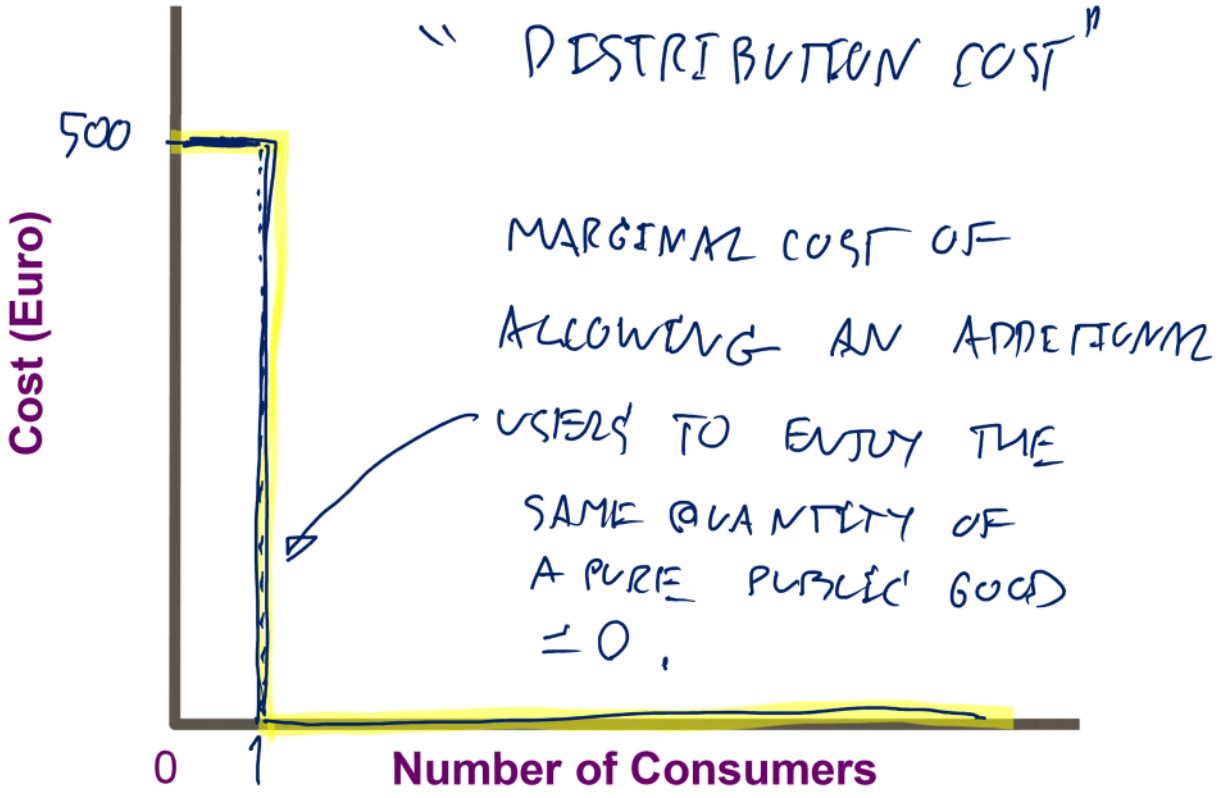
Pure Public Goods and Pure Private Goods

- Pure Public Good: No ability to exclude and no rivalry for benefits.

- Pure Private Good: Clear ability to exclude and rivalry for benefits.

4

Figure 4.1 Marginal Costs of Consuming and Producing a Pure Public Good



5

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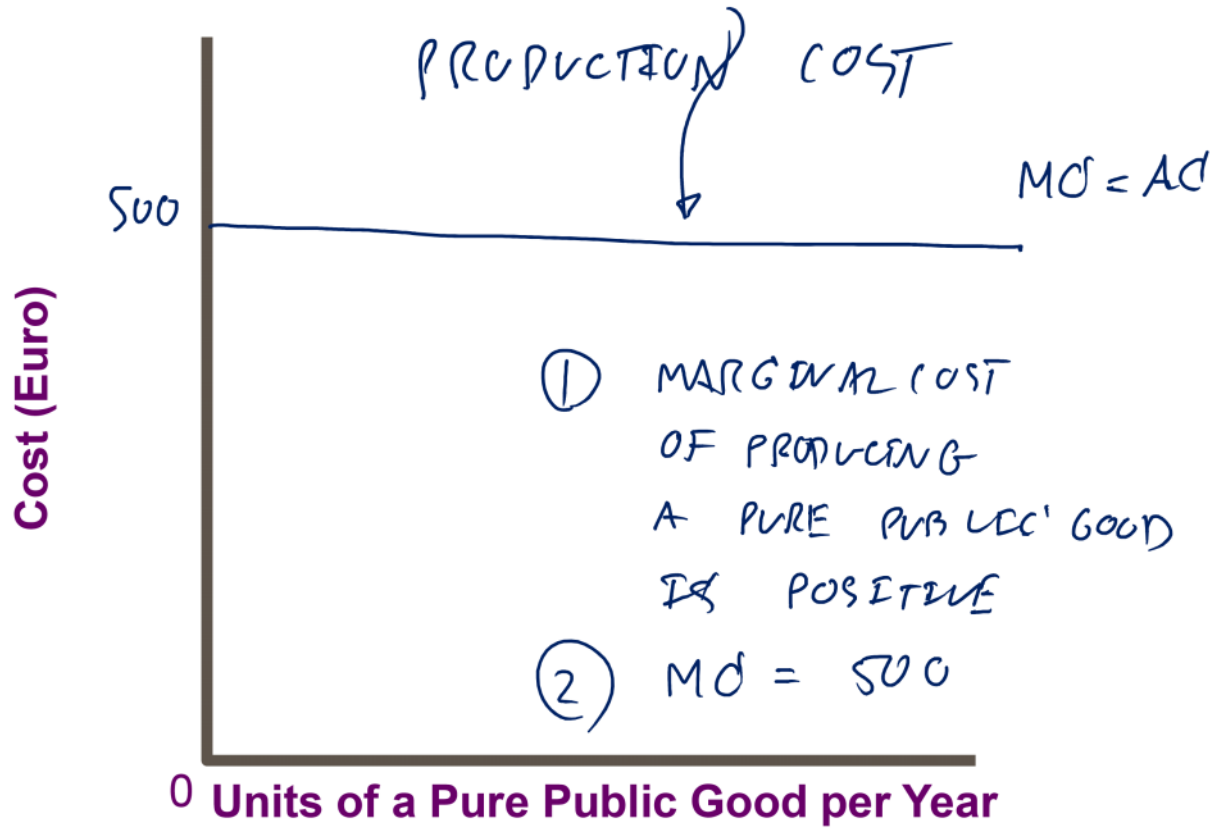


6

Price Excludable Public Goods

- Price-excludable public good: there are external benefits when produced or consumed but exclusion is easy.

RIVALNESS : NO

Examples:

EXCLUDABLE : YES

7

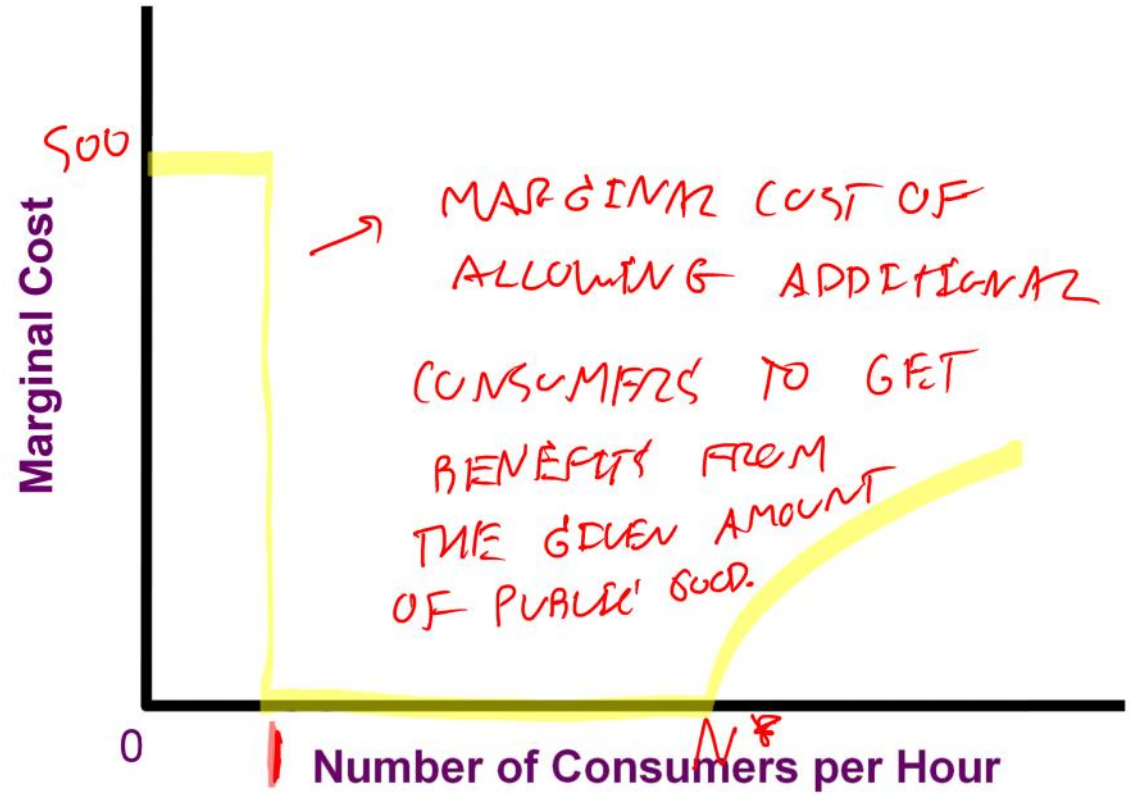
Congestible Public Goods

- There are public goods where, after a point, the enjoyment received by the consumer is diminished by crowding or congestion. These are called Congestible Public Goods.

Examples: PUBLIC PARK & FREE ROADS

8

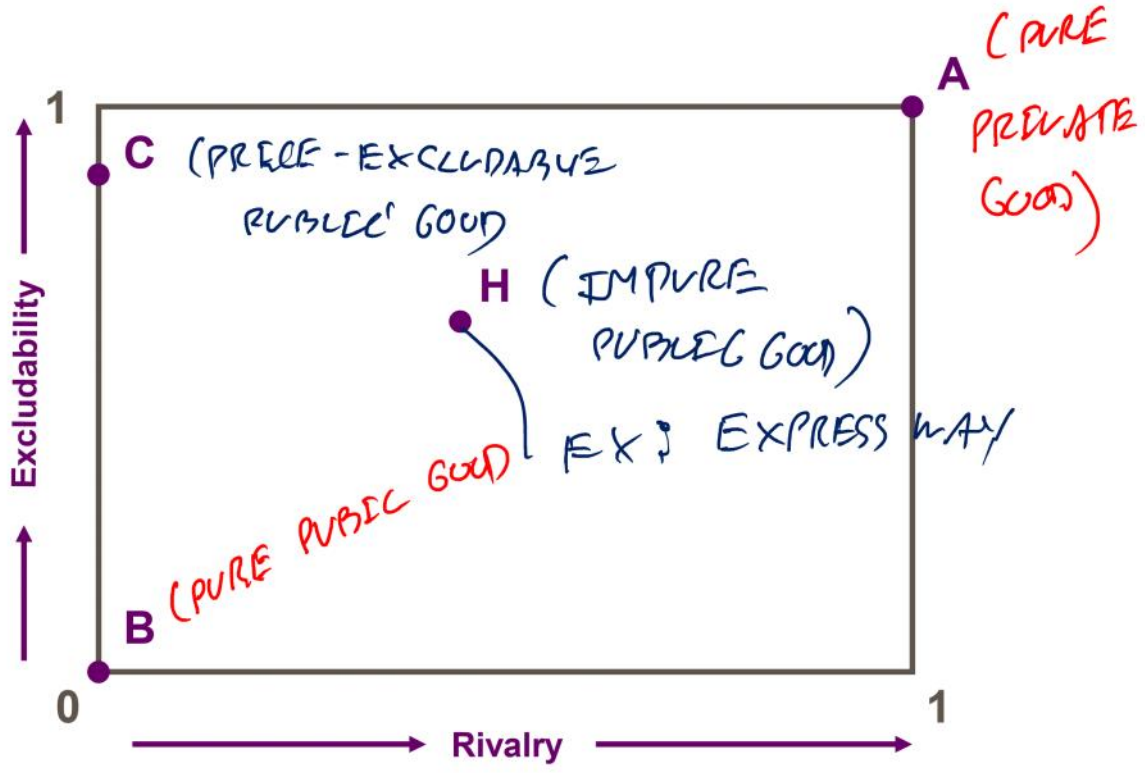
Figure 4.2 A Congestible Public Good



9

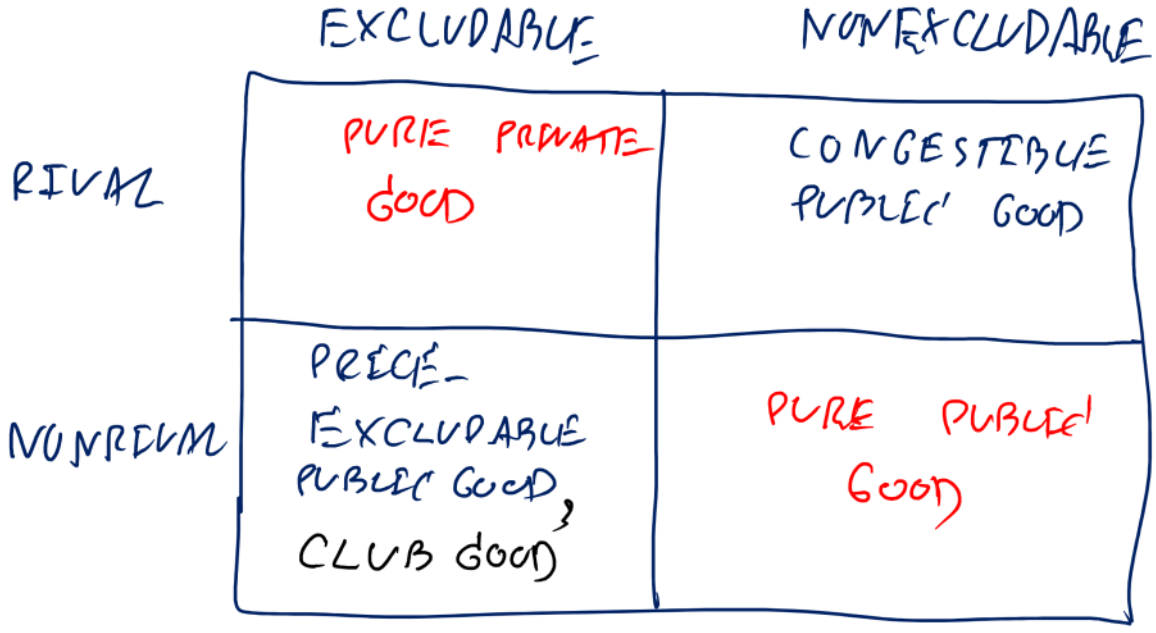
Thursday, September 10, 2015 11:01 AM

Classifying Goods According to the Degree of Rivalry and Excludability of Benefits from Their Use



10

A TAXONOMY OF GOODS



11

SOME REMARKS ABOUT PUBLIC GOODS

(1) EVEN THOUGH EVERYONE CONSUME THE SAME QUANTITY, BUT IT IS NOT NECCESSARY THAT EVERYONE WILL "VALUED" IT EQUALLY.

(2) CLASSIFICATION AS A PUBLIC GOOD IS NOT AN ABSOLUTE: IT DEPENDS ON MARKET CONDITIONS & STATE OF TECHNOLOGY.

EX: LIGHTHOUSE { PAST, PRESENT

12

(3) "PUBLIC GOOD" MIGHT BE PRODUCED EITHER BY PRIVATE OR BY PUBLIC SECTORS

EX: CHUA CHU KANG PARK, FLY OVER BRIDGE

(4) "PRIVATE GOOD" MIGHT BE PRODUCED EITHER BY PRIVATE OR PUBLIC SECTORS

EX: PUBLIC HOSPITALS
PUBLIC SCHOOLS
PUBLIC UNIVERSITIES
MRT

13

(5) SOMETHING THAT ARE NOT CONVENTIONALLY THOUGHT AS COMMODITIES' HAVE PUBLIC' GOOD CHARACTERISTICS

EX) HONESTY, JUSTICE

PURE PUBLIC GOODS

PURE PRIVATE GOODS

- PRICE-EXCLUDABLE PUBLIC GOODS
- CONGESTIBLE PUBLIC GOODS

} "IMPURE" PUBLIC' GOODS

14

Efficient Provision of Private Goods

- Derivation of aggregate demand
- Each person's demand curve represents the willingness-to-pay for an additional unit of a good
- Private good: holding P constant, add together individual quantities to get Q
- Horizontal summation

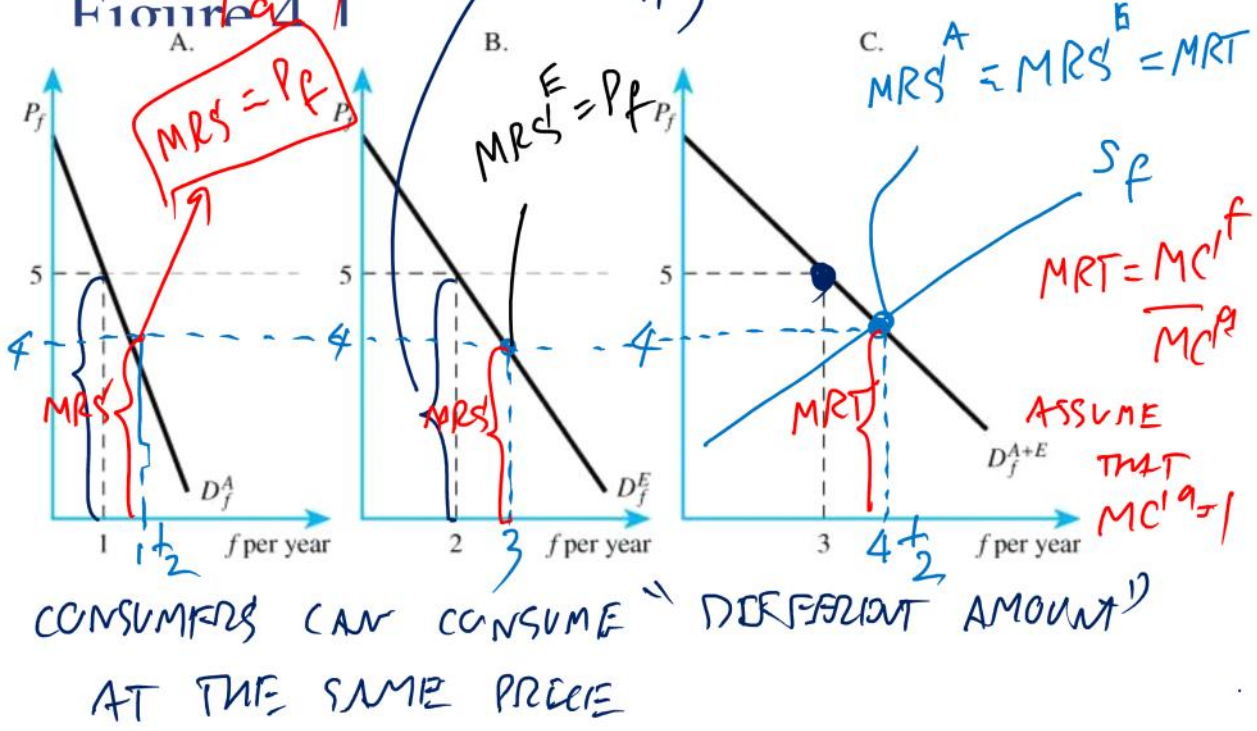
15

2 Goods: fig Leaves (f) & apple (a)

$MRS = \frac{P_f}{P_a}$

WILLINGNESS TO PAY (WTP)

Figure 1



$MRT = MC^f$

MC^a

ASSUME THAT $MC^a = 1$

CONSUMERS CAN CONSUME "DIFFERENT AMOUNT" AT THE SAME PRICE

Equilibrium in Private Goods Market

- Equilibrium where supply curve intersects aggregate demand curve
- Everyone pays the same price, P
- Individuals consume different quantities, Q
- Pareto efficient ; $MRS^A = MRS^B = MRT$

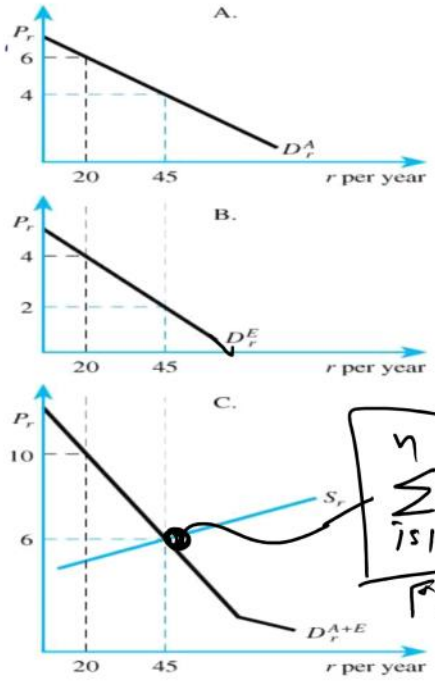
17

Efficient Provision of Public Goods

- Consider a fireworks display as a public good – it is nonrival and nonexcludable.
- Bigger displays give higher benefit.
- Public good: holding Q constant, add together individual willingness-to-pay to get P.
- Vertical summation.

18

Figure



R = ROCKET

DISPLAY

AT THE MOMENT, BOTH CURRENT CONSUME 19 UNITS OF R.

$\sum_{i=1}^{n} MB_i = MC$

FROM VERTICAL SUMMATION

Efficiency in Public Goods Market

- Everyone consumes the same quantity, Q.
- Individual's marginal benefit varies.
- Efficiency requires that the *sum* of individual marginal benefits equals the marginal cost.

20

Numerical Example

- Consider 2 individuals, Adam and Eve, who have the following inverse demand curves and face a marginal cost curve below.

$$P_A = 100 - \frac{1}{2}Q_A$$

$$P_E = 200 - Q_E$$

$$MC = \frac{2}{3}Q$$

21

Numerical Example, Private Good

- If the good was a ***private good***, then the aggregate demand curve is:

$$Q = Q_A + Q_E = (200 - 2P_A) + (200 - P_E)$$

With a ***private good***, everyone pays the same price.

$$P = P_A = P_E$$

THEREFORE, $\boxed{Q = 400 - 3P}$.

22

$$P_A = 100 - \frac{1}{2}Q_A \Rightarrow Q_A = 200 - 2P_A.$$

$$P_E = 200 - Q_E \Rightarrow Q_E = 200 - P_E.$$

$$MC = \frac{2}{3}Q.$$

$$P = \frac{400 - Q}{3} = \frac{400}{3} - \frac{Q}{3}.$$

$$Q_A = 200 - 2(88.8888) = 22.2222$$

$$Q_E = 200 - 88.8888 = 111.1111$$

$$Q = Q_A + Q_B = 133.3333$$

Numerical Example, Private Good

- In a competitive market, P=MC

$P = MC \Rightarrow \frac{400}{3} - \frac{Q}{3} = \frac{2}{3}Q$

$Q = \frac{400}{3} \approx 133.$

Approximately 133 units of the ***private good*** are provided at a price of 89

Adam consumes around 22 units, and Eve consumes around 111 units.

$Q = 400 - 3P$

$133 = 400 - 3P$

$P = \frac{400 - 133}{3}$

$P = 89$

$P_A = 100 - \frac{1}{2}Q_A$

$P_E = 200 - Q_E$

23

Numerical Example, Public Good

- Suppose instead that the good is a ***public good***. The aggregate demand curve is:

BY VERTICAL SUMMATION: $P = P_A + P_E = \left(100 - \frac{1}{2}Q_A\right) + \left(200 - Q_E\right)$

With a ***public good***, everyone consumes the same quantity.

$$Q = Q_A = Q_E$$

THEREFORE, $P = \left(100 - \frac{1}{2}Q\right) + \left(200 - Q\right) = 300 - \frac{3}{2}Q$.

24

Numerical Example, Public Good

- Efficient provision would require: P=MC

$P = MC \Rightarrow 300 - \frac{3}{2}Q = \frac{2}{3}Q$

$\frac{2}{3}Q + \frac{3}{2}Q = 300$

$\frac{4Q + 9Q}{6} = 300$

$\frac{13Q}{6} = 300$

$Q = 138.4615$ UNITS / TIME PERIOD

Efficient provision would imply that Adam & Eve consume 138.46 units of the public good.

Private market may not arrive at this allocation, however.

25

$P = ?$

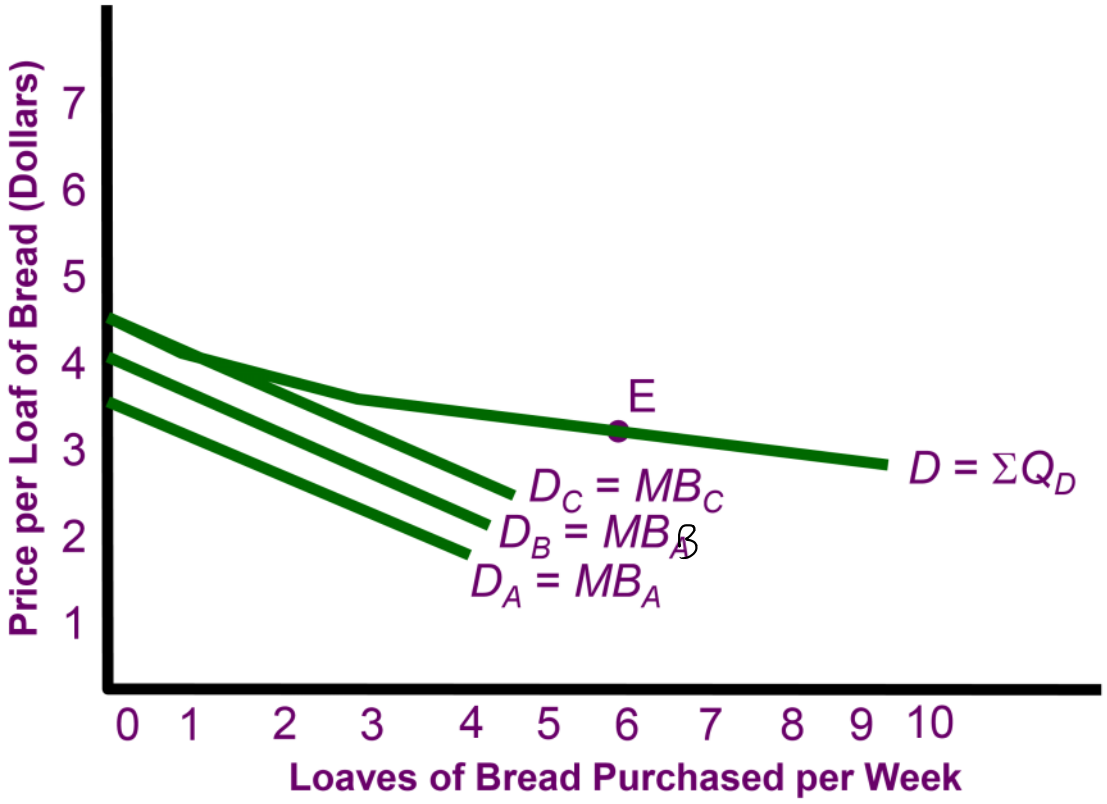
$P = 300 - \frac{3}{2}Q$

$= 300 - \frac{3}{2}(138.4615)$

$= 300 - 207.6938$

$= 92.30625$

Another example on Demand For a Private Good



26

Another Numerical Example on demand for a Pure Public Good

	Number of Security Guards per Week			
	1	2	3	4
MB_A	$300	$250	$200	$150
MB_B	$250	$200	$150	$100
MB_C	$200	$150	$100	$50
ΣMB	$750	$600	$450	$300

MARGINAL SOCIAL BENEFITS OF A PURE PUBLIC GOOD AT A GIVEN AMOUNT (MSB)

$$MSB = \sum_{i=1}^{3} MB_i$$

27

- UNIT COST FOR A SECURITY GUARD = 450 $ / GUARD
- SO, MC = AC = 450

Q=1: 750 VS. 450 → EXCESS = 750 − 450 = 300

FOR Q = 2: A WILL PAY 250 · 2 = 500
B " " 200 · 2 = 400
C " " 150 · 2 = 300
1200 VS 450 · 2 = 900

1900

FOR Q = 3: A WILL PAY 200 · 3 = 600
" " 150 · 3 = 450
" " 100 · 3 = 300
1350 VS 450 · 3 = 1350

LINDAHL PRICE @ EQUILIBRIUM (TAX PRICE) — CONTRIBUTIONS "PER UNIT" OF THE PUBLIC GOOD

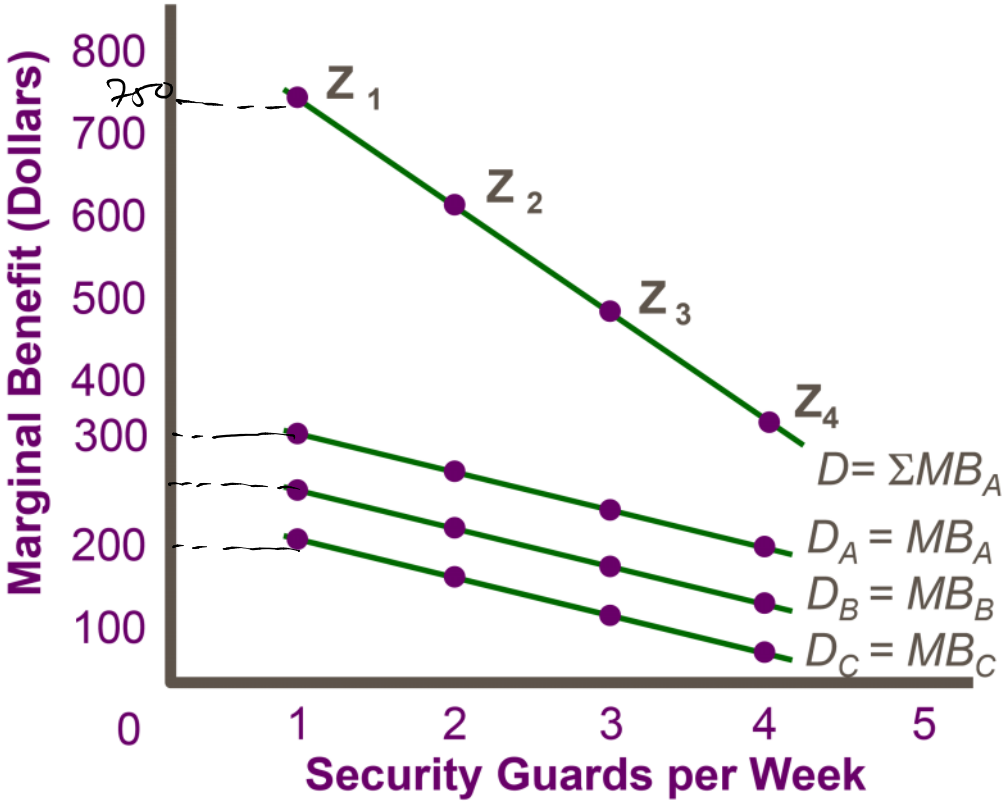
(1) NO ONE WILL HIRE ANY SECURITY GUARD IF HE OR SHE HAS TO MAKE AN INDIVIDUAL PAYMENT.

EX: EVEN MR A., HIS MB OF 1ST UNIT < MC
(300) (450)

(2) IT IS SOCIALLY INEFFICIENT IF NO SECURITY GUARD IS HIRED.

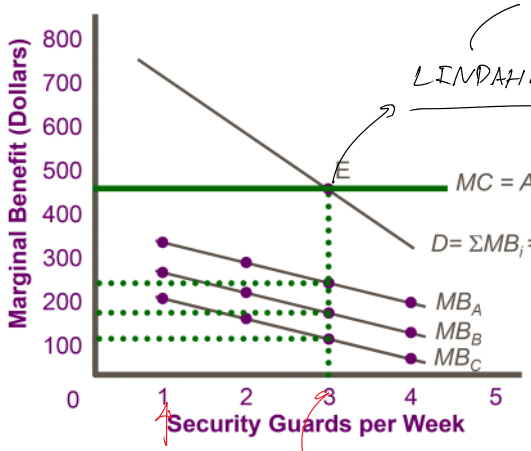
OBSERVE THAT AT Q = 1, $\sum MB > MC$
(750) (450)

Demand For A Pure Public Good



28

Figure 4.6 Efficient Output for a Pure Public Good



ERIK LINDAHL, "JUST TAXATION" TITLE OF HIS PAPER IN 1900

LINDAHL EQUILIBRIUM

(MARGINAL SOCIAL COST)

2 ISSUES
① TRUTHFUL REVELATION OF PREFERENCES
② # OF MEMBERS IN THE COMMUNITY (OR SOCIETY)

450 · 3 = 1350 $

WRONG

29

FACT #3 AN OPTIMAL QUANTITY OF A PUBLIC GOOD = 3 UNITS

$\sum_{i=1}^{3} MB_i = MSC$ AT EFFICIENT AMOUNT OF PUBLIC GOOD

WHEN Q < 3, $\sum MB > MSC$. THEN MORE OF SECURITY GUARD SHOULD BE HIRED.

WHEN Q > 3, $\sum MB < MSC$. THEN NO FURTHER AMOUNT SHOULD BE HIRED.

$$MSB = MB_i + \sum_{j=1}^{n-1} MB_j$$

MARGINAL BENEFIT RECEIVING BY ANY ONE IN THE COMMUNITY

MARGINAL BENEFIT RECEIVING BY REMAINING MEMBERS OF THE COMMUNITY

REFLECTS NATURES OF PUBLIC GOOD: NONRIVAL IN CONSUMPTION + NONEXCLUDABLE IN CONSUMPTION

Efficient Output of a Pure Public Good

- The socially optimal level of the public good requires that we set the Marginal Social Benefit of that good equal to its Marginal Social Cost. $MSB = MSC$

- $MSB = MB_i + \sum_{j-1}^{n-1} MB_j = MSC$

30

Mathematically: Lindahl Pricing

Recall from Figure 4.5 that the marginal social benefit for a pure public good is the sum of the individual marginal benefits.

That is: $MSB = \Sigma MB.$

Efficient output is therefore:

$$MSB = \Sigma MB = MSC.$$

31

Lindahl Equilibrium

- The amount each person contributes, t_i, depends on individual desires for the public good.
- The sum of the contributions equals the total cost of the public good.
  - $\Sigma t_i Q^* = MC(Q^*) = AC(Q^*)$
  - $\Sigma t_i = MC = AC$
- All individuals agree to pay their shares.

32

Freeriding

- Freeriding occurs when people are not honest in stating their Marginal Benefit, because if they understate it, they can get a slightly reduced level of the public good while paying nothing for it.

33

Freeriding is easier with

- Anonymity: If everyone knows who contributes, there can be powerful social stigmas applied to shirkers.

- Large numbers of people:

34