3 THE THEORY OF PUBLIC GOODS

Public Finance, 10th Edition

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Adapted by Chairat Aemkulwat for Theory of Public Expenditures 2943410

Outline: **Lecture 3 The Theory of Public Goods**

1. The Characteristics of Public Goods
2. Provision of Private Goods and Public Goods: Markets and Government
3. The Demand for a Pure Public Good
4. **Efficient Output of a Pure Public Good**
5. The Free-Rider Problem

Public Goods

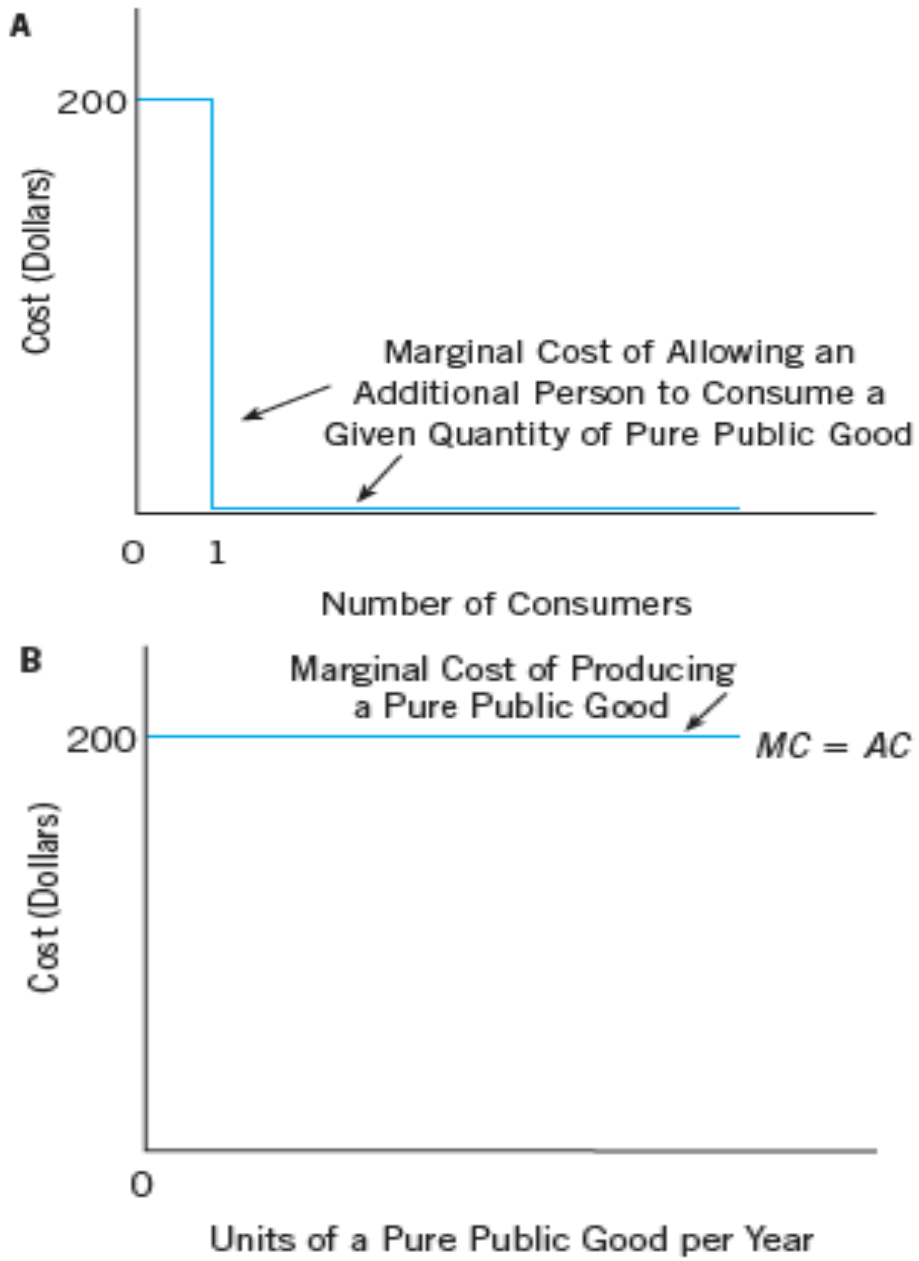
1. The Characteristics of Public Goods

- Definition: *Public Goods* are goods with benefits that cannot be withheld from those who do not pay and are shared by large groups of consumers

- Two Properties:
  - Are *nonrival in consumption*, meaning that a given quantity of a public good can be enjoyed by more than one consumer without decreasing the amounts enjoyed by rival consumers
    - ✓ Zero marginal cost of accomodating an additonal consumer.
  - Are *nonexclusive*, meaning it is too costly to exclude those who refuse to pay from enjoying the benefits

Marginal Costs of Consuming a Pure Public Good

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



The diagram in **A** shows that the marginal cost of allowing an additional person to consume a given quantity of a pure public good falls to zero after it is made available to any one person.

The graph in **B** shows that the marginal cost of producing the good is always positive. In this case, the marginal cost of each extra unit of the good is $200.

Range of Benefits

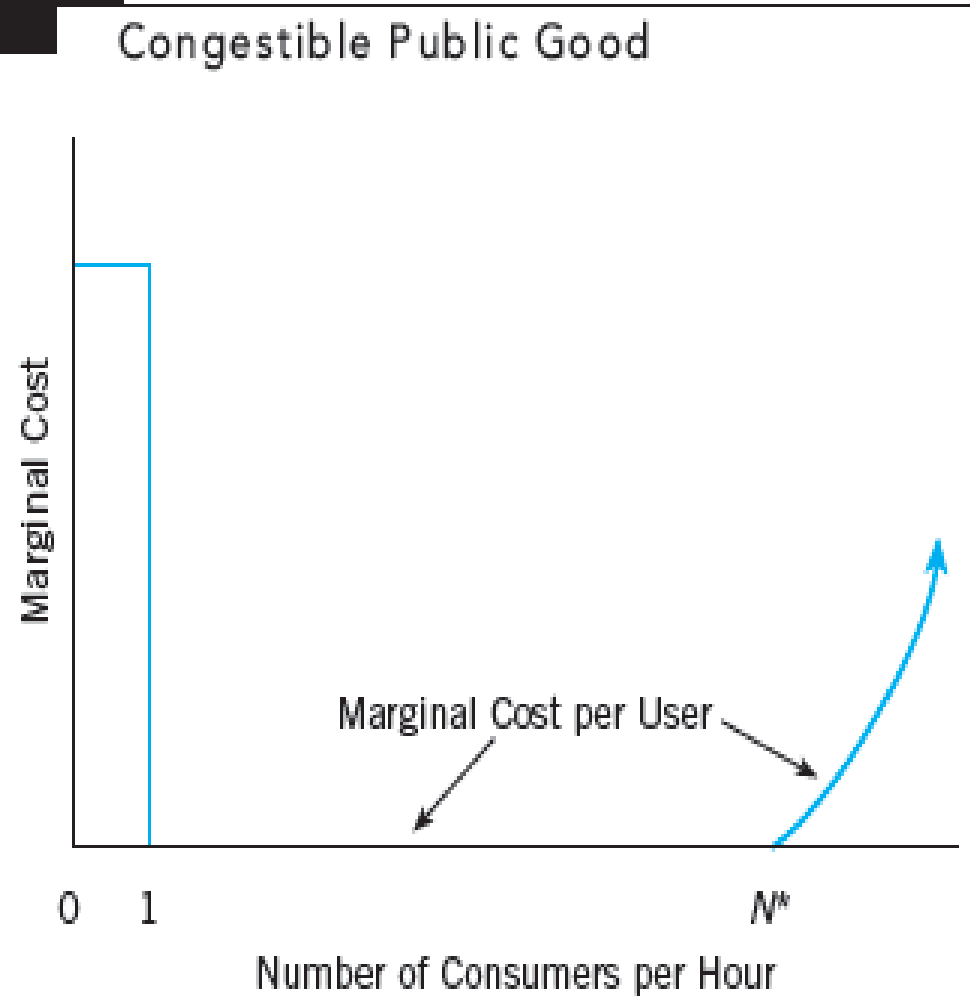
- Some public goods, such as world peace, may provide collectively consumed benefits to every individual on earth.
- Some are collectively consumed within given nations, others locally consumed
- Geographic range of shared benefits influences the desirability of having public goods supplied by various levels of government:
  - Federal, state, local

Congestible Public Goods

- Goods for which crowding or congestion reduces the benefits to existing consumers when more consumers are accommodated
- Marginal cost of accommodating an additional consumer is not zero after the point of congestion is reached
- E.g., a user of a congested road decreases the benefits to existing users by slowing traffic, increasing accident risk

Congestible Public Goods

4.2



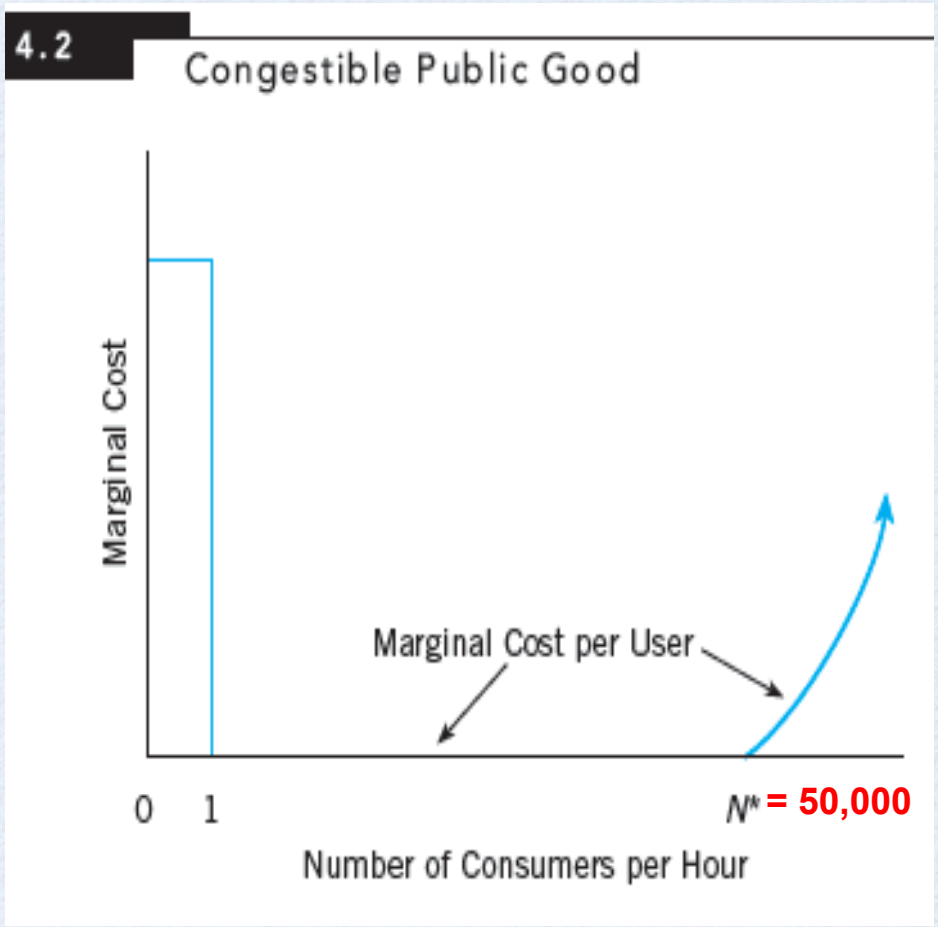
The marginal cost of allowing additional users to consume the congestible public good falls to zero after the good is made available to any one user

but then rises above zero after N^* users are accommodated per hour.

2. Suppose the services of a road are subject to congestion after 50,000 vehicles per hour enter the road. Assume that it is feasible to price road services on an hourly basis. Use a graph like that drawn in Figure 4.2 to show how the services of the road should be priced per hour when fewer than and more than 50,000 vehicles per hour are expected so as to achieve efficiency.

ANSWER

- At less than 50,000 vehicles per hour, no toll is required to achieve efficiency.
- When traffic rises above 50,000 vehicles per hour, the toll should be set at the marginal congestion cost.



Price-excludable Public Goods

- Goods with benefits that can be priced
  - Membership rights to private clubs
  - Schools, hospitals
- Can be individually consumed and are subject to exclusion, but their production and consumption is likely to generate externalities.

TABLE 4.1 Alternative Means of Producing, Distributing, and Financing Goods and Services

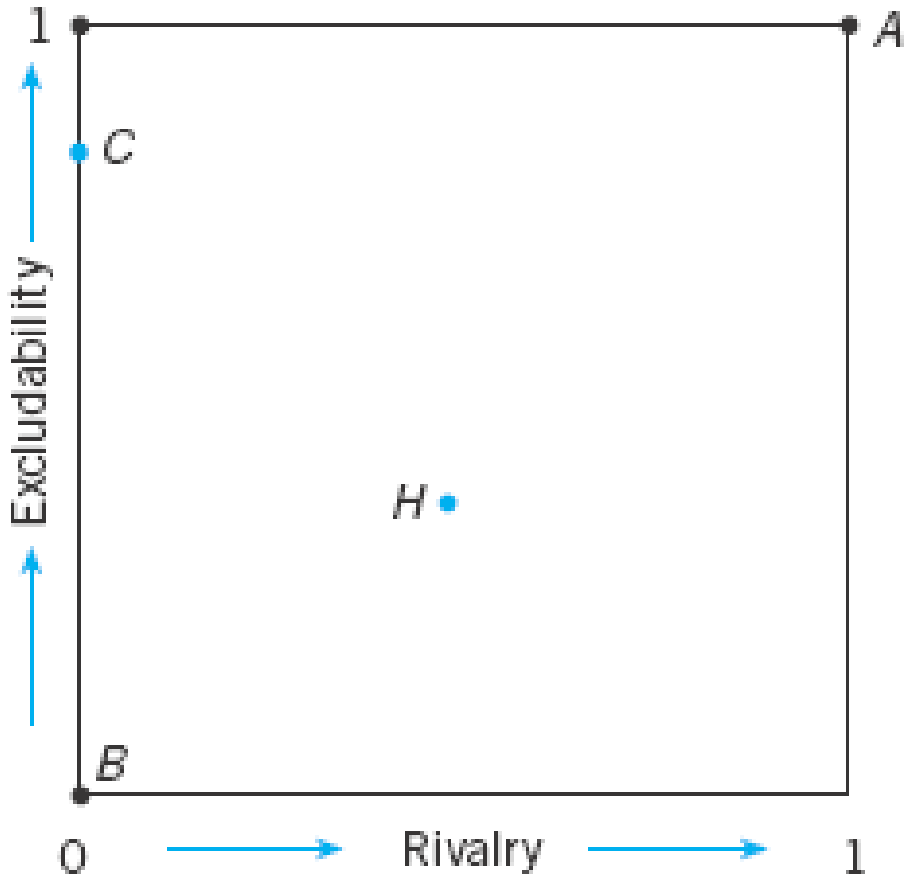
CHARACTERISTICS OF THE GOOD OR SERVICE	MEANS OF PRODUCTION	METHODS OF DISTRIBUTION	METHODS OF FINANCE	EXAMPLES	
				PRIVATE	PUBLIC
Pure Private Goods No externality; low-cost exclusion	1. Private firms; government	Markets; direct unit charge	Revenue from sales	Food; clothing; cars	Government liquor stores; government tobacco monopoly
	2. Government; private firms under contract with government	No direct unit charge; eligibility to consume various amounts determined politically	Taxes		Government distribution of medical services and food to low-income citizens
Price-Excludable Public Goods External benefits when produced or consumed; low-cost exclusion	1. Private firms; government	Markets; direct unit charge (may be subsidized)	Revenue from sales; taxes	Schools; hospitals; transportation	Transit facilities; public hospitals
	2. Government; private firms under contract with government	No direct unit charge; consumption available or required only at collectively chosen quantity and quality	Taxes		Public schools; public sanitation; inoculations
Congestible Public Goods Collectively consumed benefits subject to crowding; possibility of exclusion	1. Private firms; government	Fees for the right to use the facility sold in markets	Revenue from sales	Clubs; theaters; amusement parks sporting events	Public golf courses; roads
Pure Public Goods Collectively consumed benefits not subject to crowding; high-cost exclusion	1. Private firms; government	No direct unit charge; quantity dependent on amount collected	Fees; contributions	Private charity	Public television and radio
	2. Government; private firms under contract with government	No direct unitcharge; quantityand quality of service collectively chosen	Taxes		National defense; environmental protection

Semipublic Goods

- Exist in a continuum ranging from pure private goods to pure public goods
- Goods are categorized according to the degree of rivalry in consumption and the degree of excludability

Semipublic Goods

FIGURE 4.3
Classifying Goods According to the Degree of Rivalry and Excludability of Benefits from Their Use



A pure public good corresponds to point *B,* where there is no rivalry for benefits and excludability from benefits is impossible. A pure private good corresponds to point *A* on the graph.

A nonrival good, such as TV transmissions, for which exclusion is possible, corresponds to a point like *C.* A congestible public good for which it is possible to charge for use, such as a limited access highway, corresponds to a point like *H*.

Education as a Public Good

- Has characteristics of a public good in that it creates positive externalities
- Price to families set at zero; funding by government tax revenues
- The idea that some citizens would purchase less than the efficient amount of education for their children if it were provided in a competitive market is behind the principle of free and compulsory public education
- However, has characteristics of a public good in that government cannot guarantee that all children receive an equal amount of education

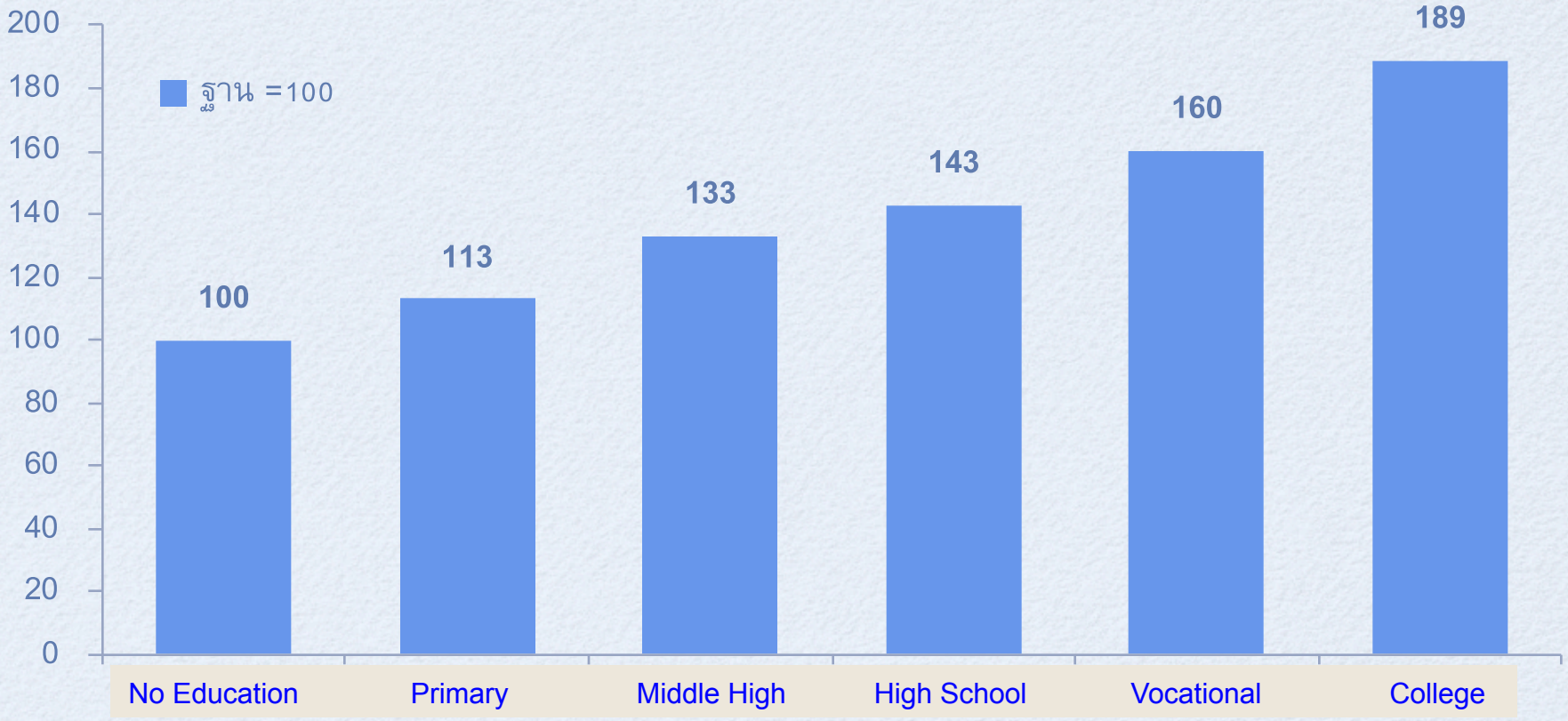
Is Education a Public Good?

- The Conventional Wisdom
  - Social mobility, political stability (democracy).
- Primary and secondary education – Literate and well-informed populace.

Positive Externality

- College education
  - Positive externality versus Increased productivity
  - In US, an additional year of education contributes to an increase in annual earnings between 5-11 percent
  - No Education vs College graduate
    - return differential = 89%

Thailand's Wage Premiums
(Total Returns Relative to Workers with No Education)



ที่มา: Economic Intelligence Center, SCB, 2011

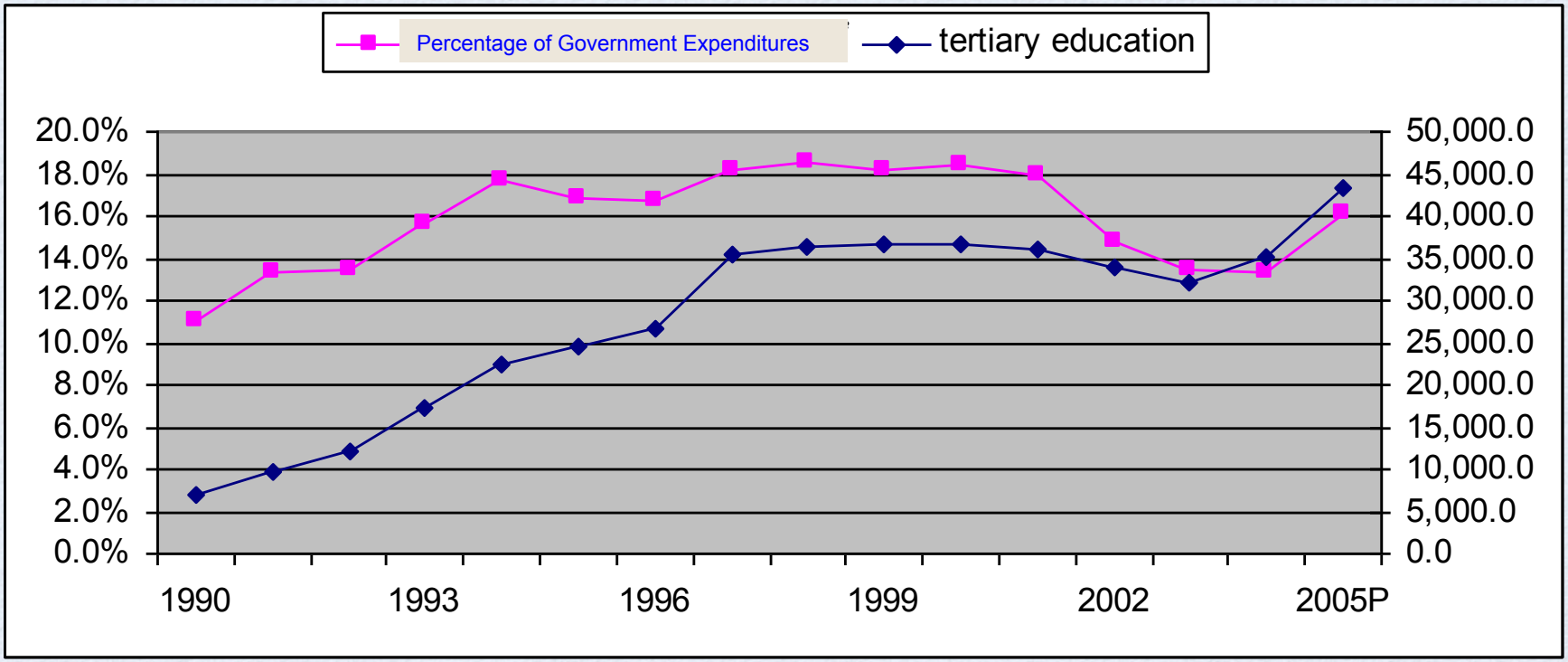
Return to Education

- Aemkulwat (2014)
  - Return to private employees = 9.4%
  - Return to private employees = 7.4%

Aemkulwat, Chairat, 2014,"Labor Supply of Married Couples in the Formal and Informal Sectors in Thailand" *Southeast Asian Journal of Economics,* Vol. 2 No. 2 December 2014

- As long as the earnings of college graduates reflect their higher productivity; there is no externality

Education as a Percentage of Government Expenditures



Positive Externality vs. Private Good

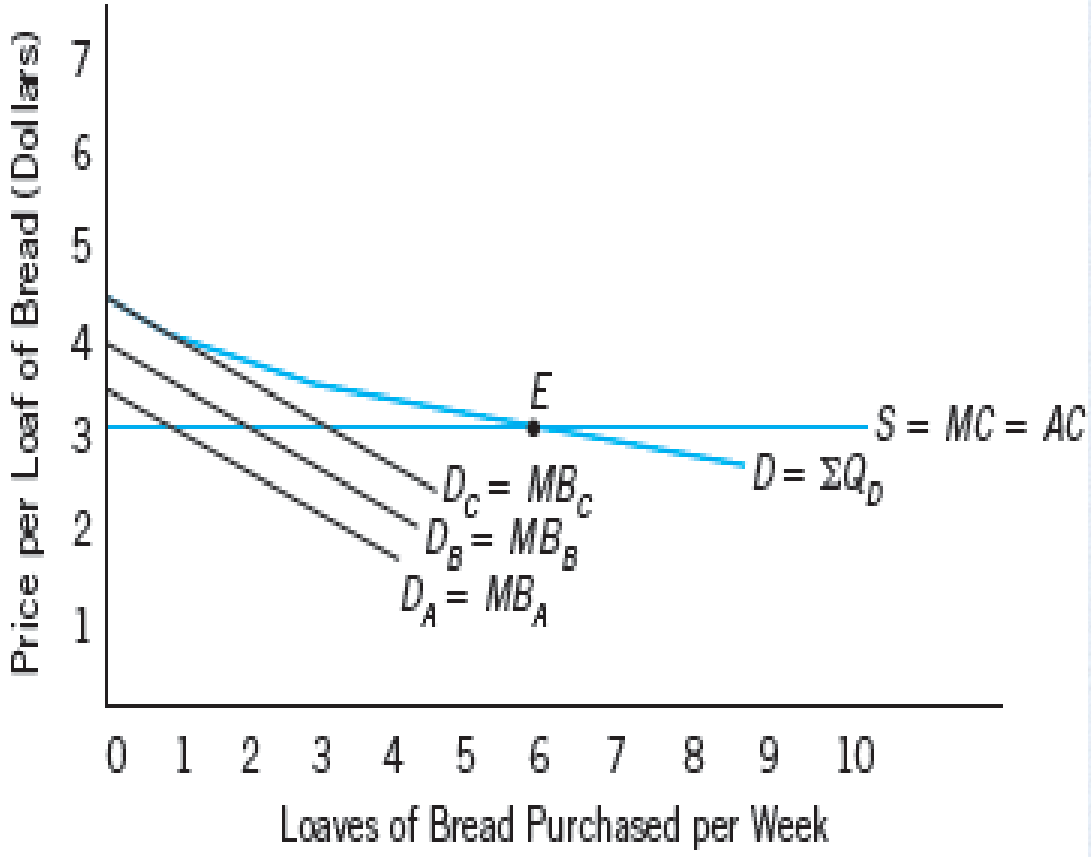
- Investment or Consumption
- Human Capital Theory
  - similar to investment in machinery (capital)
  - More education, higher income
  - Eduction is a private good? Rival and exclusion

Social vs Private Returns

- Canton (2007)
- Short run private return = 7.5%
- LR social return = 11-15%
  - social returns due to college and secondary education are more than those from returns due to lower than high-school education.

Demand for a Pure Private Good

RE 4.4 Demand for a Private Good



- The demand for a private good is obtained by adding the quantities demanded by each consumer at each possible price.
- The efficient output is six units per week, which corresponds to point *E*.
- At a price of \$3 per loaf, $MB_A = MB_B = MB_C = MC$.

Demand for a Pure Public Good

- All consumers must consume the same quantity of the good, as pure public goods cannot be divided into individual units (nonrival and nonexclusion)

- Therefore, on the demand curve, the variables on the vertical axes are the maximum amounts that people would pay per unit of the pure public good as a function of the amount of the good actually available

Demand for a Pure Public Good

4.5 Demand for a Pure Public Good

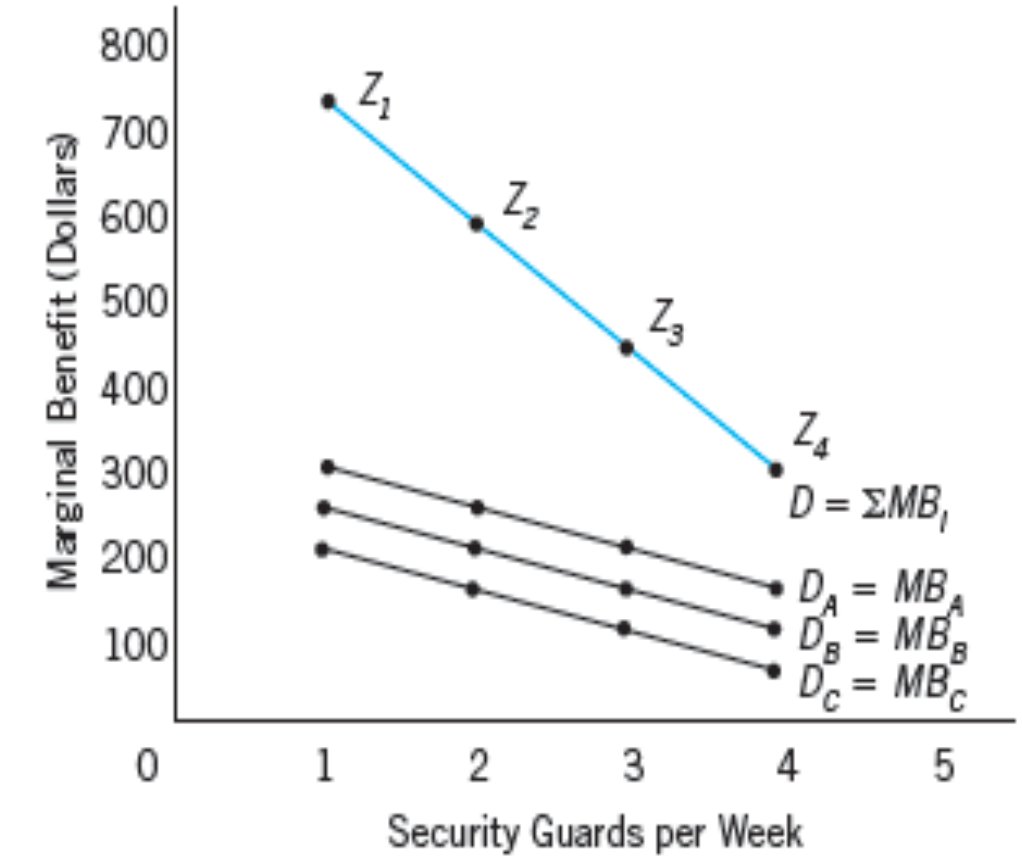


TABLE 4.2 Hypothetical Marginal Benefits of Security Protection for a Community of Three People

	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_i	$750	$600	$450	$300

The demand curve for a pure public good is obtained by summing the individual marginal benefits at each quantity.

Efficiency of a Pure Public Good

- The marginal social benefit of any given amount of a pure public good is the sum of the individual marginal benefits received by all consumers
- Efficient quantity per time period corresponds to the point at which output is increased; sum of marginal benefits to consumers equals marginal social cost of the good
- Efficiency conditions are:

$$MSB = \sum MB = MSC$$

Efficiency of a Pure Public Good

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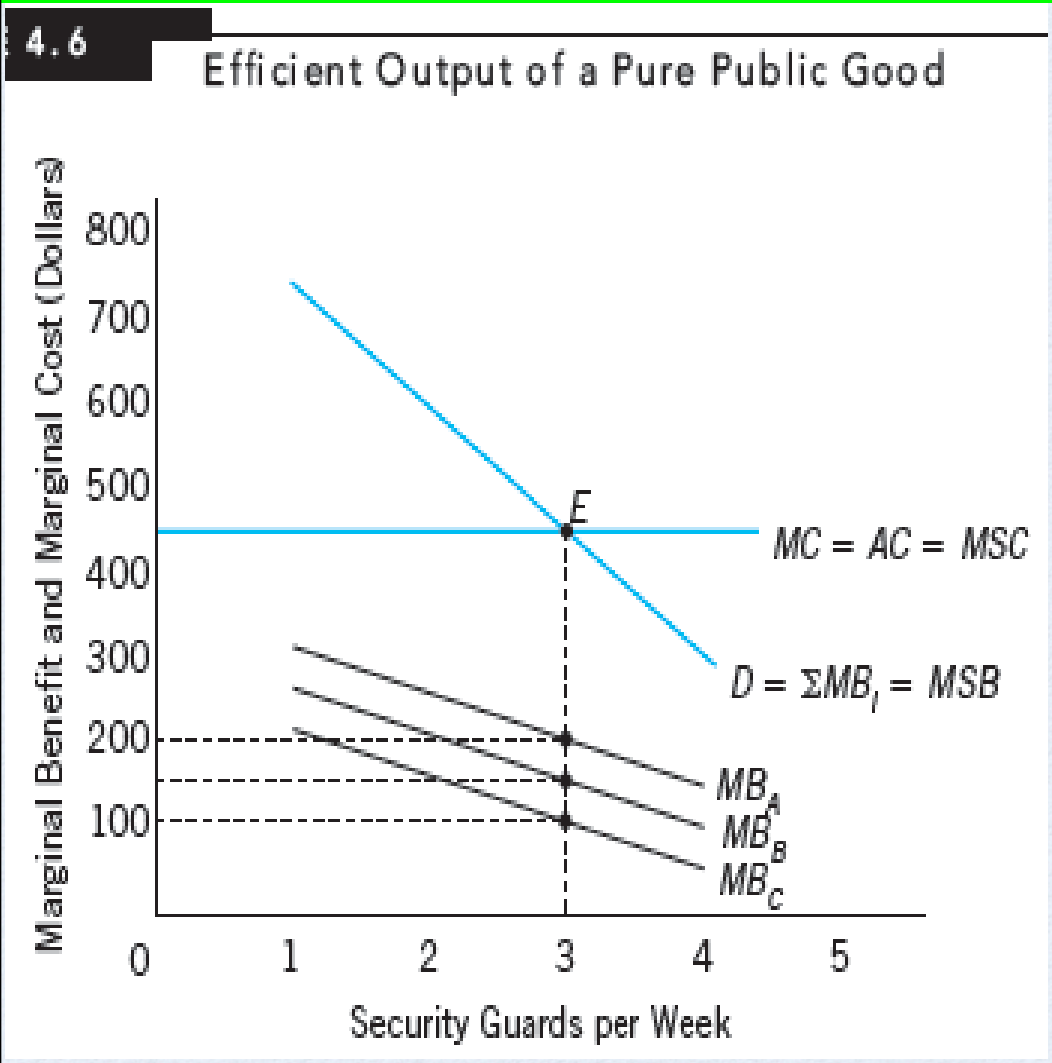
Efficiency of a Pure Public Good



- The efficient output occurs at point *E,* which corresponds to three security guards per week.
- At that point, $\sum MB_i = MSC$. The Lindahl equilibrium is also at point *E.*
- At that point, voluntary contributions of the three people would cover the cost of the public good.
- Each person would demand three security guards per week at a price per unit equal to the marginal benefit received from three guards per week.

7. The following table shows how the marginal benefit enjoyed by John, Mary, Loren, and all other consumers of outdoor rock concerts varies with the number made available by a city government per summer.

Marginal Benefit of Number of Rock Concerts per Consumer (in Dollars)

CONSUMERS	NUMBER OF CONCERTS			
	1	2	3	4
John	150	125	100	75
Mary	125	100	75	50
Loren	100	75	50	25
All Others	600	400	200	100

a. Derive the demand curve for rock concerts assuming that it is a pure public good.

CONSUMERS	NUMBER OF CONCERTS			
	1	2	3	4
ΣMRS	975	700	425	250

ANSWER

The demand curve shows how the sum of the marginal benefits of all consumers varies with the number of concerts.

7. The following table shows how the marginal benefit enjoyed by John, Mary, Loren, and all other consumers of outdoor rock concerts varies with the number made available by a city government per summer.

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All Others	600	400	200	100

b. If the marginal cost of producing rock concerts is $1,000 no matter how many are produced, then what is the efficient number of concerts to have each summer? What would be the efficient number of concerts to produce if the marginal cost of production were $425 instead of $1,000?

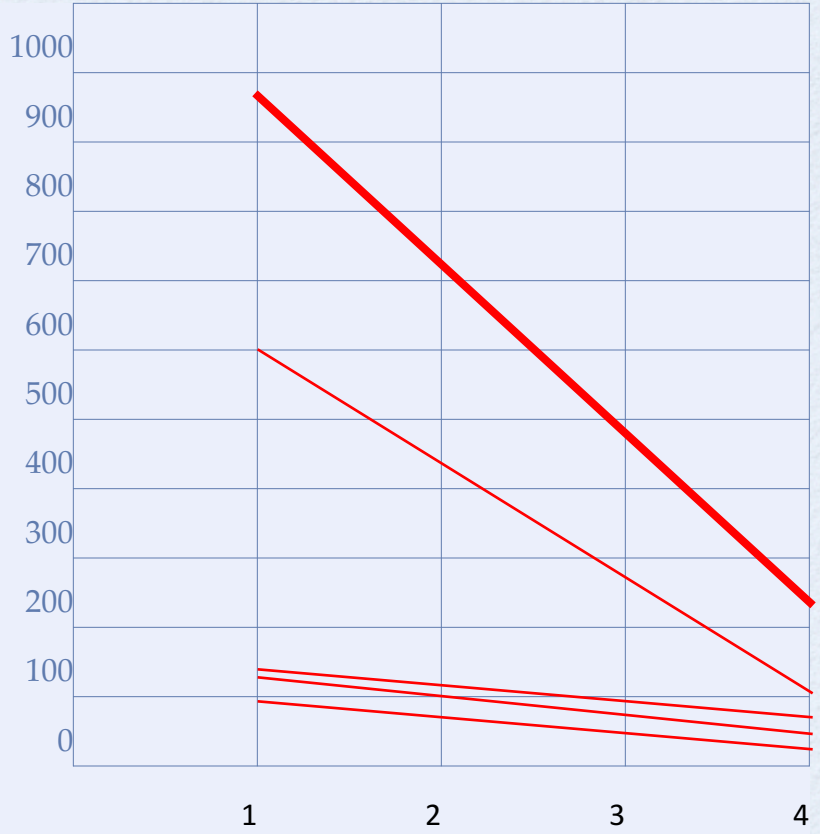
ANSWER

CONSUMERS	NUMBER OF CONCERTS			
	1	2	3	4
ΣMRS	975	700	425	250
MC=1000	1,000	1,000	1,000	1,000
MC=425	425	425	425	425

At a marginal cost of $1,000, it is efficient not to hold any outdoor rock concerts at all.

At a marginal cost of $425, the efficient number of concerts per summer is three.

CONSUMERS	NUMBER OF CONCERTS			
	1	2	3	4
John	150	125	100	75
Mary	125	100	75	50
Loren	100	75	50	25
All Others	600	400	200	100
Demand for Public Good	975	700	425	250



6. The following table shows how the marginal benefit of a service varies for four consumers:

Marginal Benefit (in Dollars)				
QUANTITY	ALICE	BEN	CAROLYN	DON
1	1000	800	600	400
2	800	600	400	200
3	600	400	200	100
4	400	200	100	50

a. Suppose the service is a pure private good and is sold in a competitive market with the only buyers being the four people whose marginal benefits are shown in the table. If the market price of the product is $400, what is the quantity demanded?

ANSWER a) 10

	ALICE	BEN	CAROLYN	DON	Total
Quantity	4	3	2	1	10

b. Suppose the service is a pure public good with the only consumers being the four people whose marginal benefits are shown in the table. What is the marginal social benefit of two units of the service?

ANSWER b. $2,000

QUANTITY	MC	ΣMB
1	400	2,800
2	400	2,000
3	400	1,300
4	400	750

6. The following table shows how the marginal benefit of a service varies for four consumers:

Marginal Benefit (in Dollars)				
QUANTITY	ALICE	BEN	CAROLYN	DON
1	1000	800	600	400
2	800	600	400	200
3	600	400	200	100
4	400	200	100	50

c. If the marginal social cost of the good is $2,000, what is the efficient output assuming that it is a pure private good?

ANSWER c. zero

	ALICE	BEN	CAROLYN	DON	Total
Quantity	0	0	0	0	0

d. If the marginal social cost of the good is $2,000, what is the efficient output assuming it is a pure public good?

ANSWER d. 2

QUANTITY	MC	ΣMB
1	2000	2,800
2	2000	2,000
3	2000	1,300
4	2000	750

5. National defense is a pure public good. Yet members of the public disagree about the appropriate size of the Defense Department. Use a diagram similar to Figure 4.6 to find the appropriate amount of total spending for national defense. (For this example, assume that there only are three members of the public.)

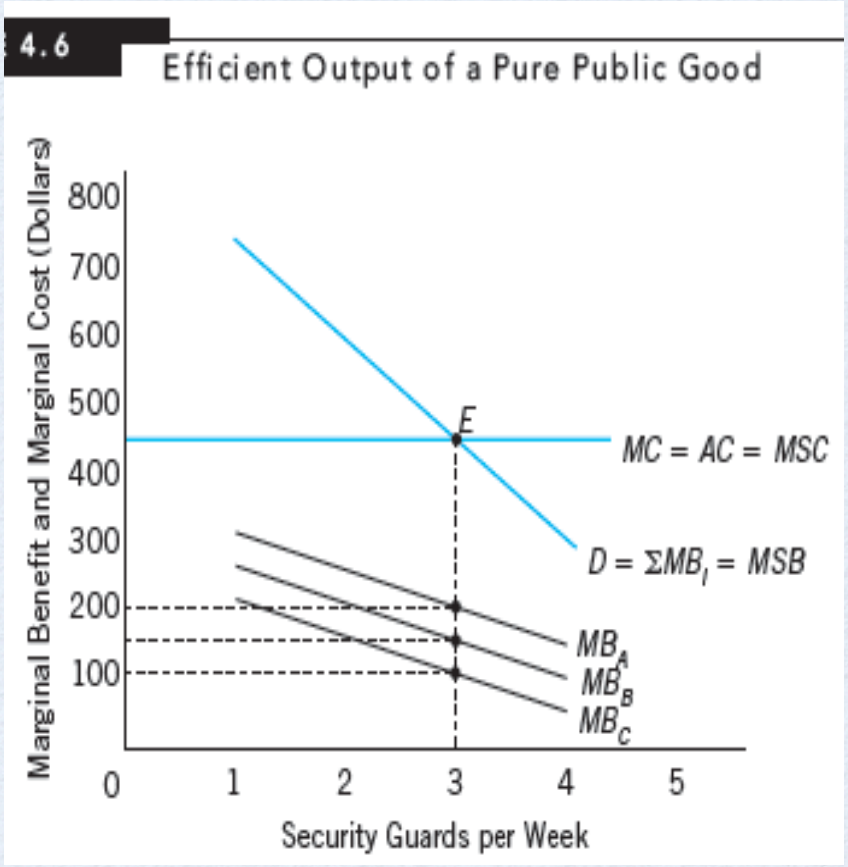
Peter the Peacenik thinks that all national defense is unimportant. Add Peter's demand curve (MBp) to Figure 4.6. Has the optimal amount of national defense changed? Explain.

ANSWER

1. Draw three downward sloping demand curves and a cumulative demand curve with a horizontal supply curve similar to Figure 4.6.

2. Peter's demand curve is a horizontal line at zero (he views defense as unimportant and consequently has no demand because there is no benefit).

- Peter's demand curve will not affect the cumulative demand curve and consequently will not change the existing optimal amount of national defense.



Voluntary Contributions and Cost Sharing

- By sharing costs, members of a community can pool their resources to enjoy public goods that they could not afford if they had to purchase them on their own in a market.
- In small communities, pure public goods could be made available in efficient amounts, financed by voluntary contributions.
- In larger communities, financing by voluntary contributions may not be feasible, because the sum of the marginal benefits of the good would likely fall short of the marginal cost.

The Lindahl Equilibrium

- Named for Swedish economist Erik Lindahl
- States that the voluntary contribution per unit of the public good of each member of the community equals his or her marginal benefit of the public good at the efficient level of output
- Equilibrium contributions per unit of the public good sometimes called *Lindahl prices*
- Lindahl equilibrium could be achieved by assigning each participant a Lindahl price per unit of the public good

The Lindahl Equilibrium

Equilibrium under voluntary cooperation meets the following conditions:

1. Amount contributed per unit of public good by each person must be adjusted so that each individual desires the identical amount of the public good
2. Sum of amounts contributed by each member of the community per unit must equal the marginal social cost of producing the public good
3. All individuals must agree voluntarily, with no coercion, on the cost-sharing arrangement and the quantity of the good

3. Suppose the marginal cost of producing rock concerts is only $250 per concert no matter how many are produced. Use the data from the previous question to calculate the efficient number of concerts. If a Lindahl scheme is used to finance the concerts, what prices of admission should be charged to John, Loren, and Mary?

Marginal Benefit of Number of Rock Concerts per Consumer (in Dollars)

CONSUMERS	NUMBER OF CONCERTS			
	1	2	3	4
John	150	125	100	75
Mary	125	100	75	50
Loren	100	75	50	25
All Others	600	400	200	100

ANSWER

CONSUMERS	NUMBER OF CONCERTS			
	1	2	3	4
ΣMRS	975	700	425	250
MC	250	250	250	250

3. The efficient number of concerts would be four; John would be charged $75, and Mary would be charged $50, while Loren would pay $25 for each concert.

CONSUMERS	NUMBER OF CONCERTS			
	1	2	3	4
John	150	125	100	75
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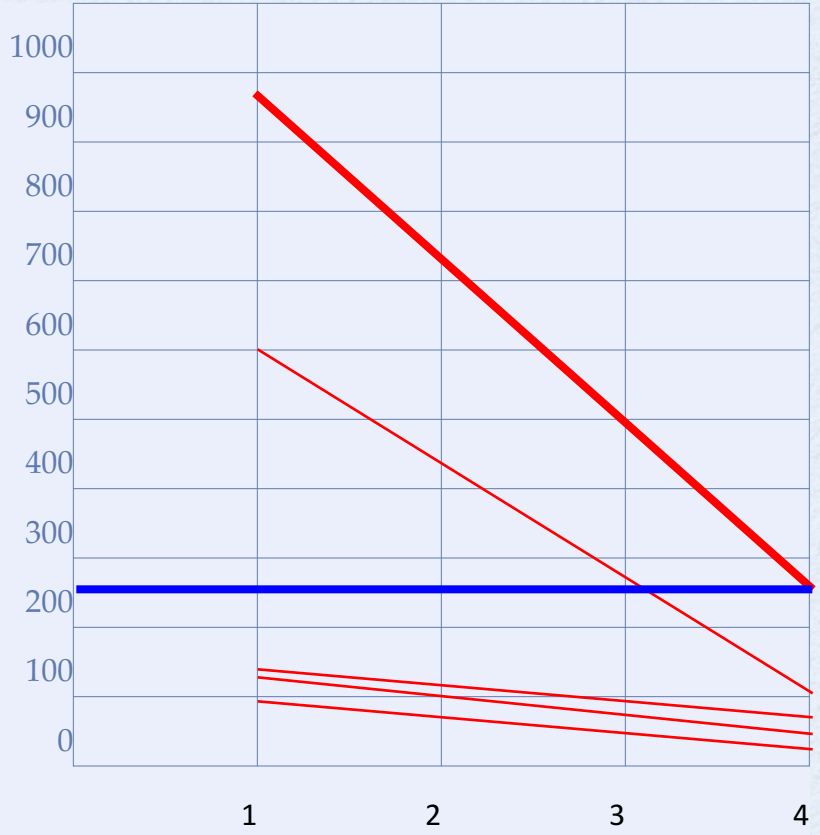
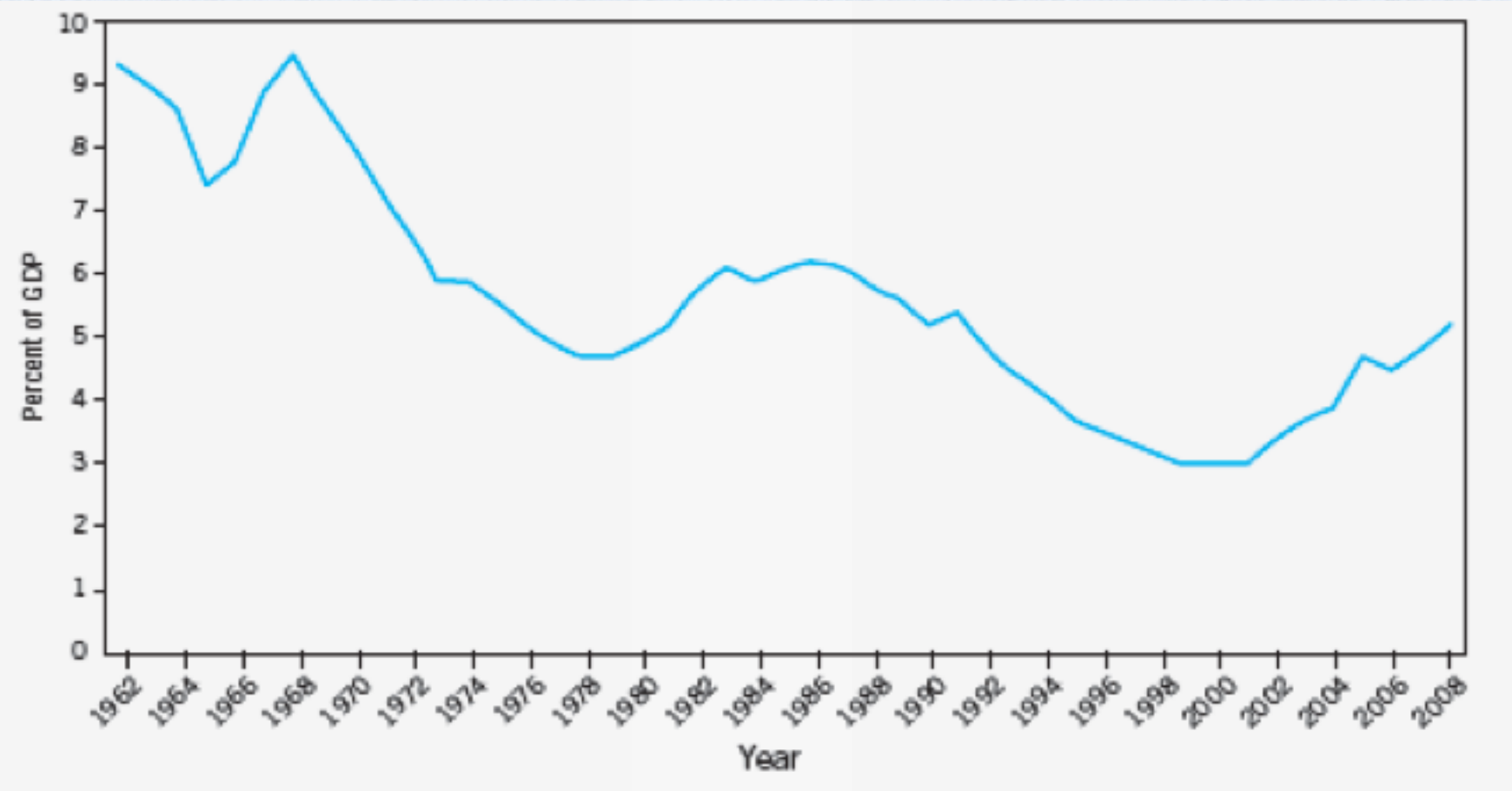


4. Suppose the marginal cost of pure public good increases as more is purchased by a community. Prove that the Lindahl equilibrium will result in a budget surplus at the efficient annual output of the pure public good.

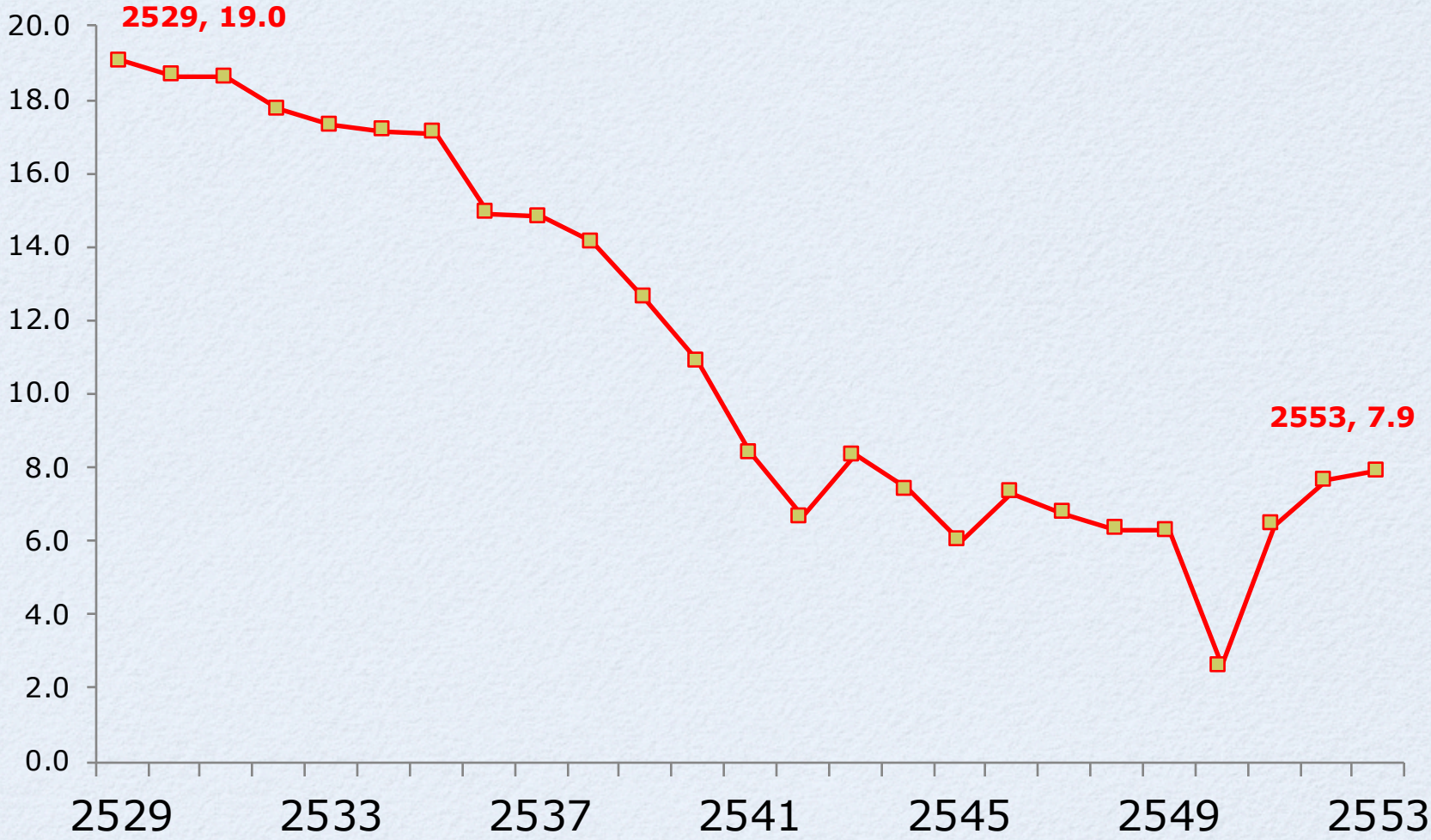
ANSWER

- The sum of the marginal benefits must equal the marginal cost in the Lindahl equilibrium.
- When MC is increasing, MC > AC for any given quantity supplied. At the efficient level of output, the sum of the contributions will be greater than AC.
- Because contributions per unit exceed cost per unit, the total revenue collected will exceed the cost of making the good available, which is AC(Q).
- Thus, there is a budget surplus.

USA -Defense Expenditure as a Share of GDP, 1962-2005



Thailand - Defense Expenditure as a Share of GDP, 1962-2010: 1960 (2503)=20.6%, 2010 (2553)=6.2%



The Free-Rider Problem

- A *free rider* is a person who seeks to enjoy the benefits of a public good without contributing anything to the cost of financing the amount made available.
- This strategy almost guarantees that the equilibrium amount of a pure public good will be less than the efficient amount.
- Problems become more acute in large groups, where a free rider reasons that their contribution is less likely to be needed or missed.

Public Goods are goods with benefits that cannot be withheld from those who do not pay and are shared by large groups of consumers

Voluntary Contribution

Voluntary Contribution to Finance the Marginal Social Cost of Operation Desert Shield and Desert Storm (Billions of Dollars)

NATION	CONTRIBUTION
Saudi Arabia	$17
Kuwait	16
Japan	11
Germany	7
United Arab Emirates	4
Total Pledged	54
U.S. Share	7
Total	61

Source: Office of Management and Budget and Congressional Budget Office.

Compulsory Finance

- The free-rider problem is partially remedied by compulsory finance
  - Taxation
  - Payment for schooling, roads, postal services
- One may decide how to vote by comparing tax share per unit of a public good with the marginal benefit at the proposed output

1. Only 10% of viewers of public television make contributions to public television stations. Yet the Congress approves budgets that subsidize public television. Why would the typical voter/taxpayer contribute nothing to public television, yet simultaneously want more tax money given to public television? Also explain this voter's overall strategy.

ANSWER

1. The voluntary funding of public television is an example of a free-rider problem where those who do not fund a public good receive the benefit of the public good.

2. By voting for taxpayer contributions to public television, the cost is distributed among all potential beneficiaries in the form of tax and alleviates the free-rider problem (i.e. no one member of the tax-paying community can avoid not funding public television).

- In Thailand, Thai PBS is sponsored by sin taxes (0.5% of the excise tax revenues on sin products).

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Recap: **Lecture 3 The Theory of Public Goods**

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