Microeconomics, 2nd Edition

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Chapter 17: Externalities and Public Goods

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Outline

1. Motivation
2. Inefficiency of Competition with Externalities
3. Allocating Property Rights to Restore Optimality: The Coase Theorem

   - Problems with the Coase Approach
   - Other methods to restore optimality: standards and fees

4. Public Goods

   - A Taxonomy
   - Demand for Public Goods
   - Free Riders and the Supply of Public Goods

Definition: If one agent's actions imposes costs on another party, the agent exerts a **negative externality**, while if the agent's actions have benefits for another party, the agent exerts a **positive externality**.

Network externalities, snob effects
Wind chimes

When externalities are present, the competitive market may not attain the Pareto Efficient outcome.

Let's see why…

The Inefficiency of Competition with Externalities

Competitive firms and consumers do not have to pay for the harms of their negative externalities, they produce too many…

Since they are not compensated for the benefits of their positive externalities, they create too little…

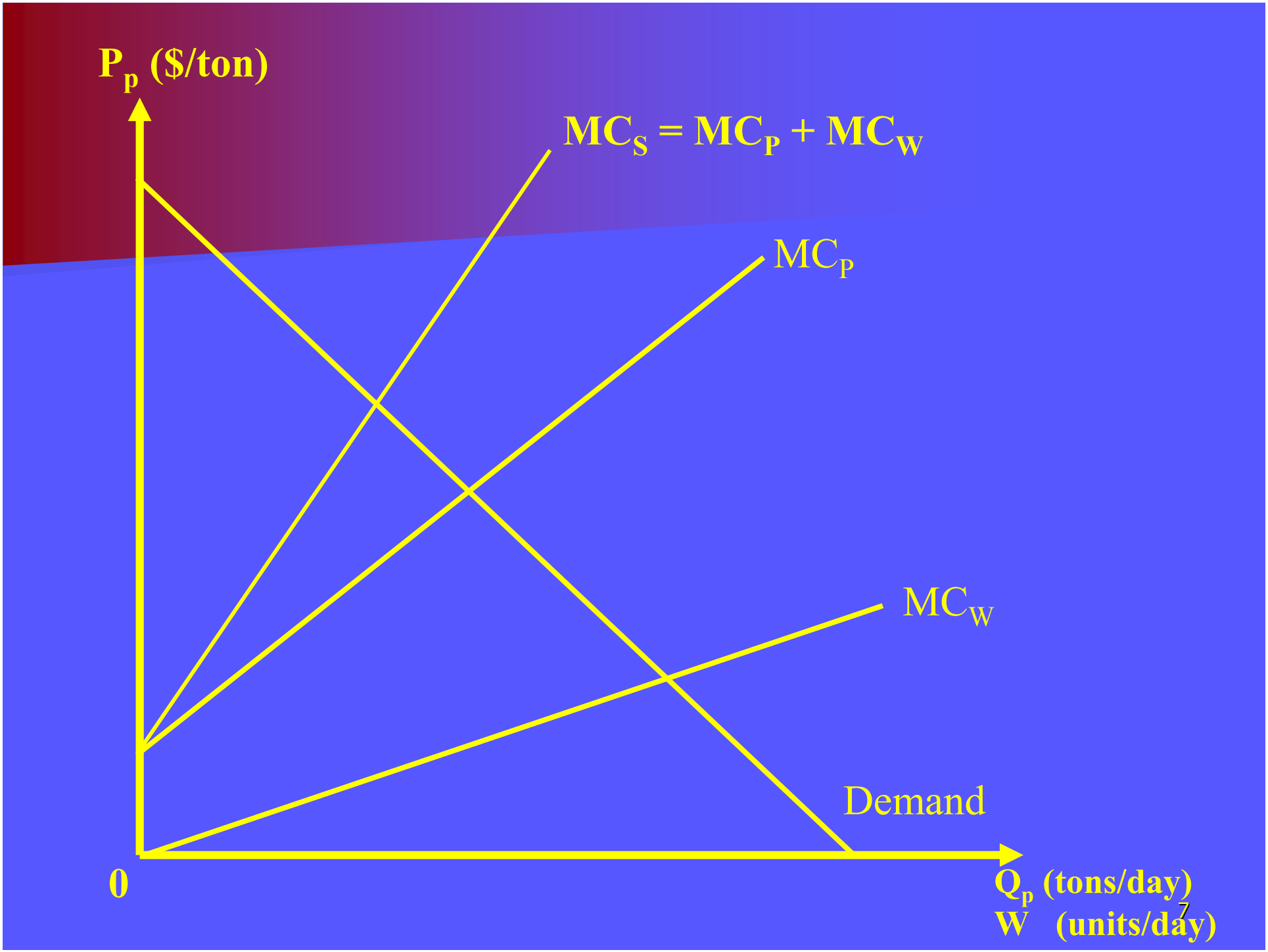
Example

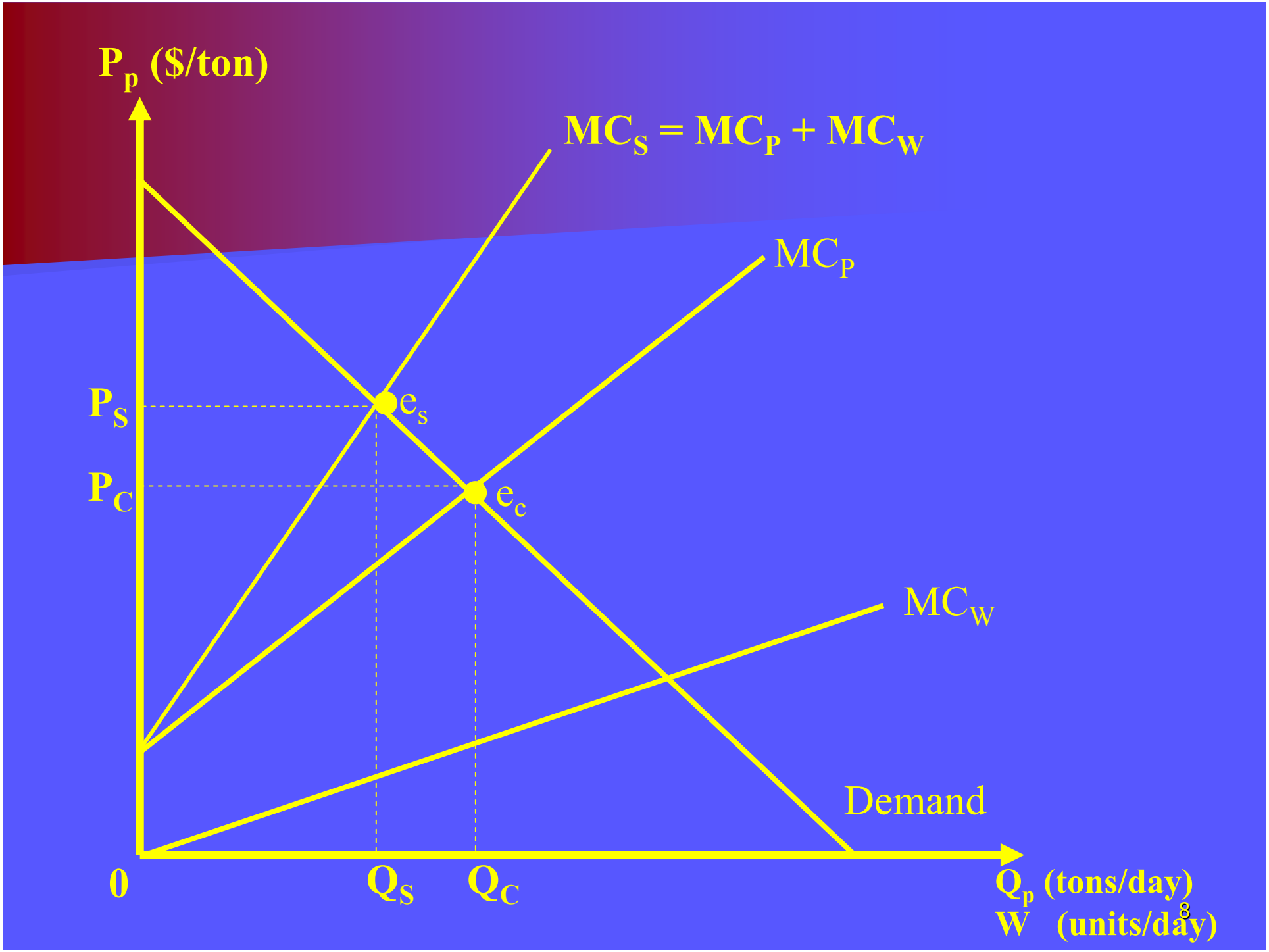
Firm produces paper and harmful by-products

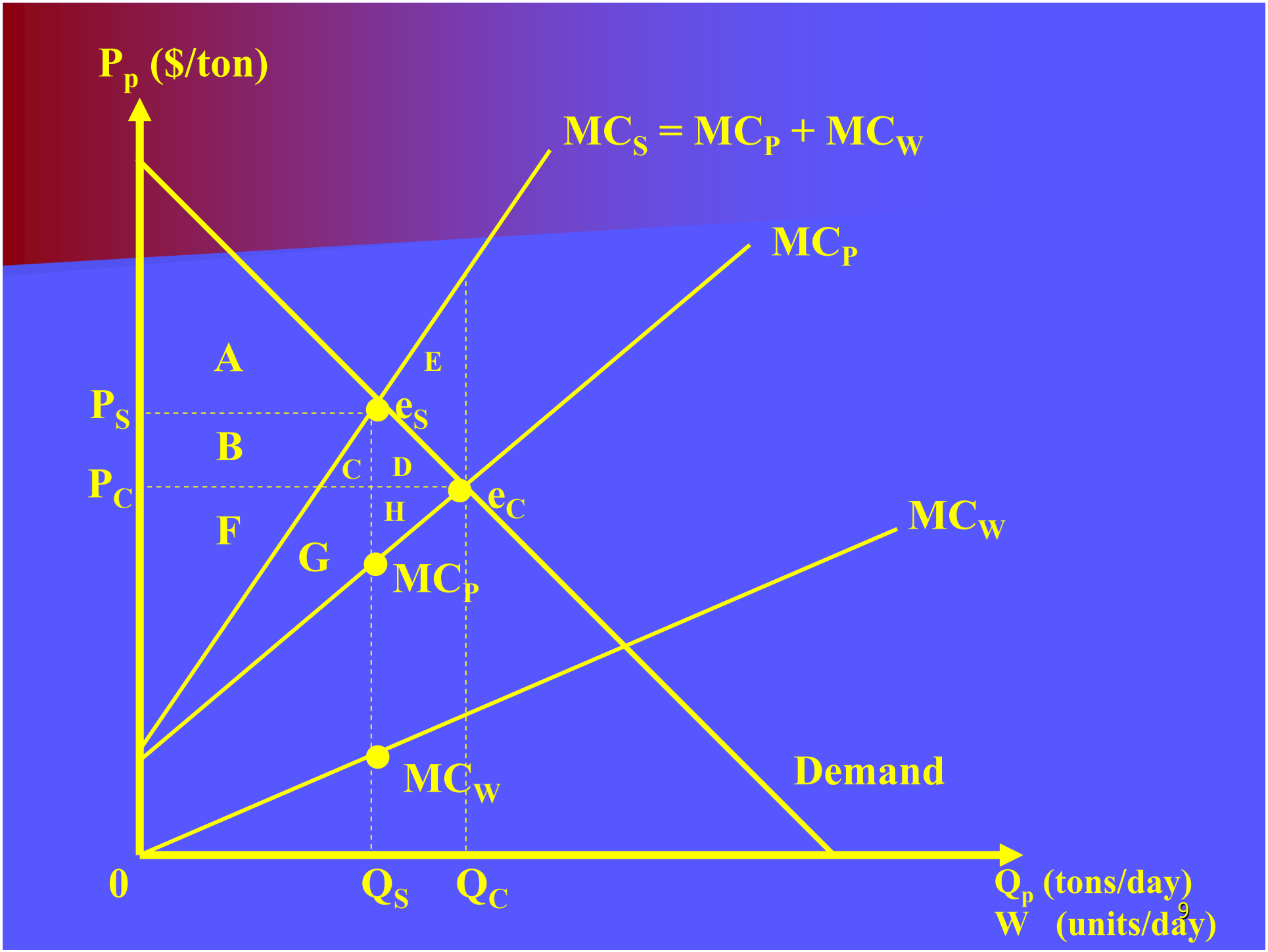
1 ton paper ➔ 1 unit waste

private cost of production does not include harm from waste.

Social cost of production includes the harm from the externality and is, then, greater than the private cost.


P_p ($/ton)
$MC_S = MC_P + MC_W$
MC_P
MC_W
Demand
0
Q_p (tons/day)
W (units/day)


P_p ($/ton)
$MC_S = MC_P + MC_W$
MC_P
P_S
e_s
P_C
e_c
MC_W
Demand
0
Q_S
Q_C
Q_p (tons/day)
W (units/day)


P_p ($/ton)
$MC_S = MC_P + MC_W$
MC_P
A
E
P_S
e_S
B
C
D
P_C
e_C
H
F
G
MC_W
MC_P
MC_W
Demand
0
Q_S
Q_C
Q_p (tons/day)
W (units/day)

	Social Optimum	Private	Change
Consumers Surplus, CS	A	A+B+C+D	B+C+D
Private Producers Surplus, PS_P	B+C+F+G	F+G+H	H-B-C
Externality Cost, C_G	C+G	C+D+E+G+H	D+E+H
Social Producers Surplus $PS_S = PS_P - C_G$	B+F	F-C-D-E	-B-C-D-E
Welfare $W = CS + PS_S$	A+B+F	A+B+F-E	-E=DWL

Competitive market: $p = MP^P$
Social optimum: $p = MC^S$

⇨Competitive market creates a dead-weight loss (socially *excessive* negative externalities)

⇨This is because the polluter does not have to pay for pollution

⇨Socially optimal amount of waste is non-zero.

How can we restore optimality?

Allocating Property Rights to Restore Optimality

Definition: A **property right** is a legal rule that describes what economic agents can do with an object or idea.

Deed to parcel of land; patent on a method

Example: Paper mill and fishermen

Suppose that paper mill may reduce its emissions of gunk by installing filters and fishermen can reduce emissions by installing a water treatment plant…

Specifically, assume following payoffs…

		Fishermen	
		No treatment	Treatment
Mill	No filter	500,100	500,200
	filter	300,500	300,300

Specifically, assume following payoffs…

Fishermen

	No treatment	Treatment
No filter	500,100	500,200
filter	300,500	300,300

Mill

Case 1: No explicit rights allocation

Nash outcome: no filter, treatment plant

Joint payoff = 700 (not Pareto efficient)

Case 2: Fishermen have property right to no Pollution (and so, set a fee of, say, $500 for receiving pollution)

Fishermen →

	No treatment	Treatment
No filter	0,600	0,700
Filter	300,500	300,300

Mill ↓ ↓

←

Nash Outcome: Filter, No treatment

Joint Payoff = 800 (Pareto Efficient)

Case 3: Mill has right to pollute

Suppose the mill "sells" right to fresh water (i.e. obligation to install filter) for $250:

Fishermen →

Mill ↓

	No treatment	Treatment
No filter	500,100	500,200
filter	550,250	550,50

←

Nash Outcome: Filter, No Treatment
Joint Payoff = 800 (Pareto Efficient)

The Coase Theorem:

- *If there are no impediments to bargaining, assigning property rights results in the efficient outcome (at which joint profits are maximized).*

- *Efficiency is achieved regardless of who receives the property rights.*

- *Who gets the property rights affects the income distribution: the property rights are valuable. (The party with the property rights is compensated by the other party.)*

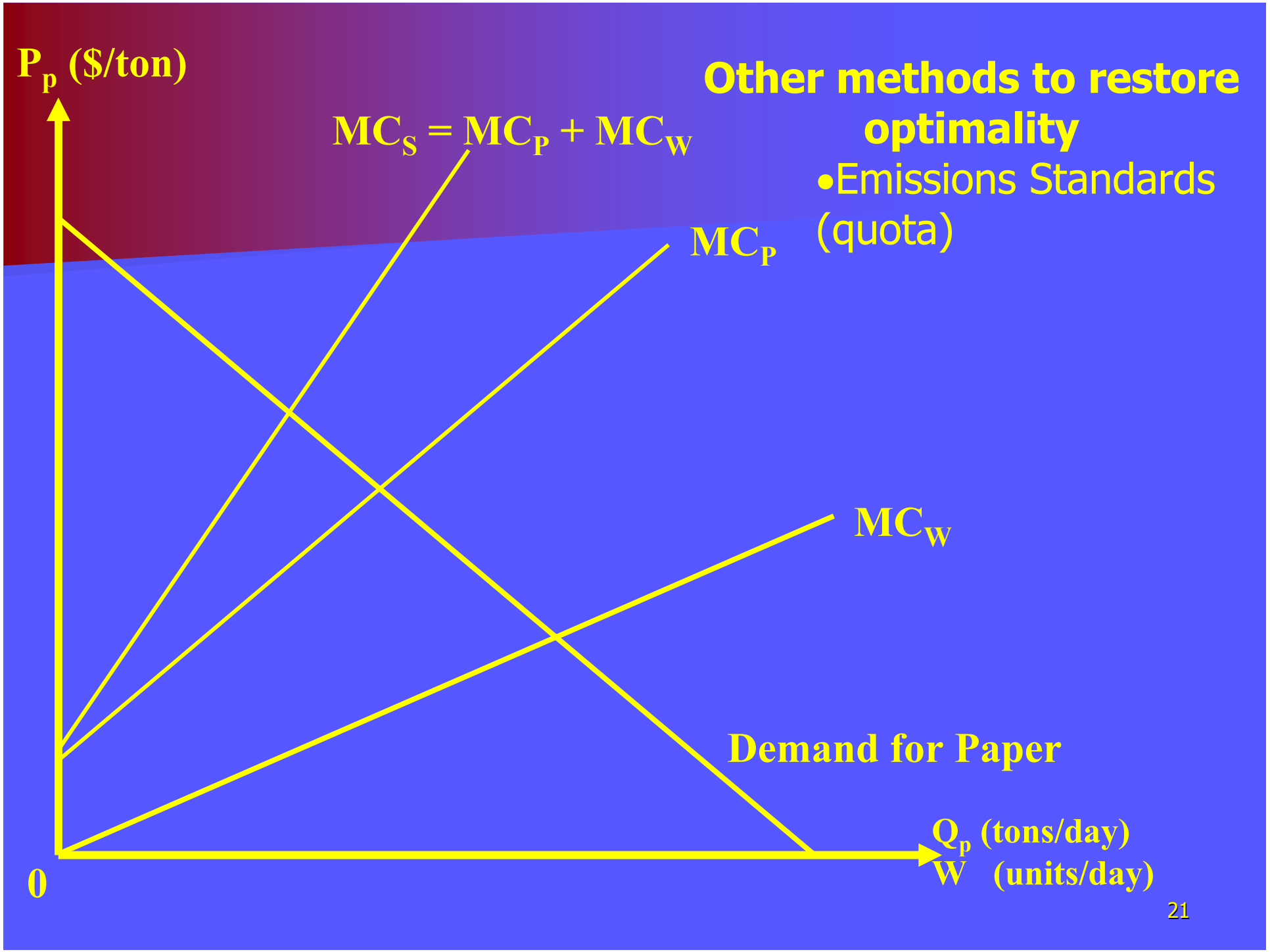
Problems with the Coase approach:

-Transaction Costs may be high

-Large numbers of injured parties

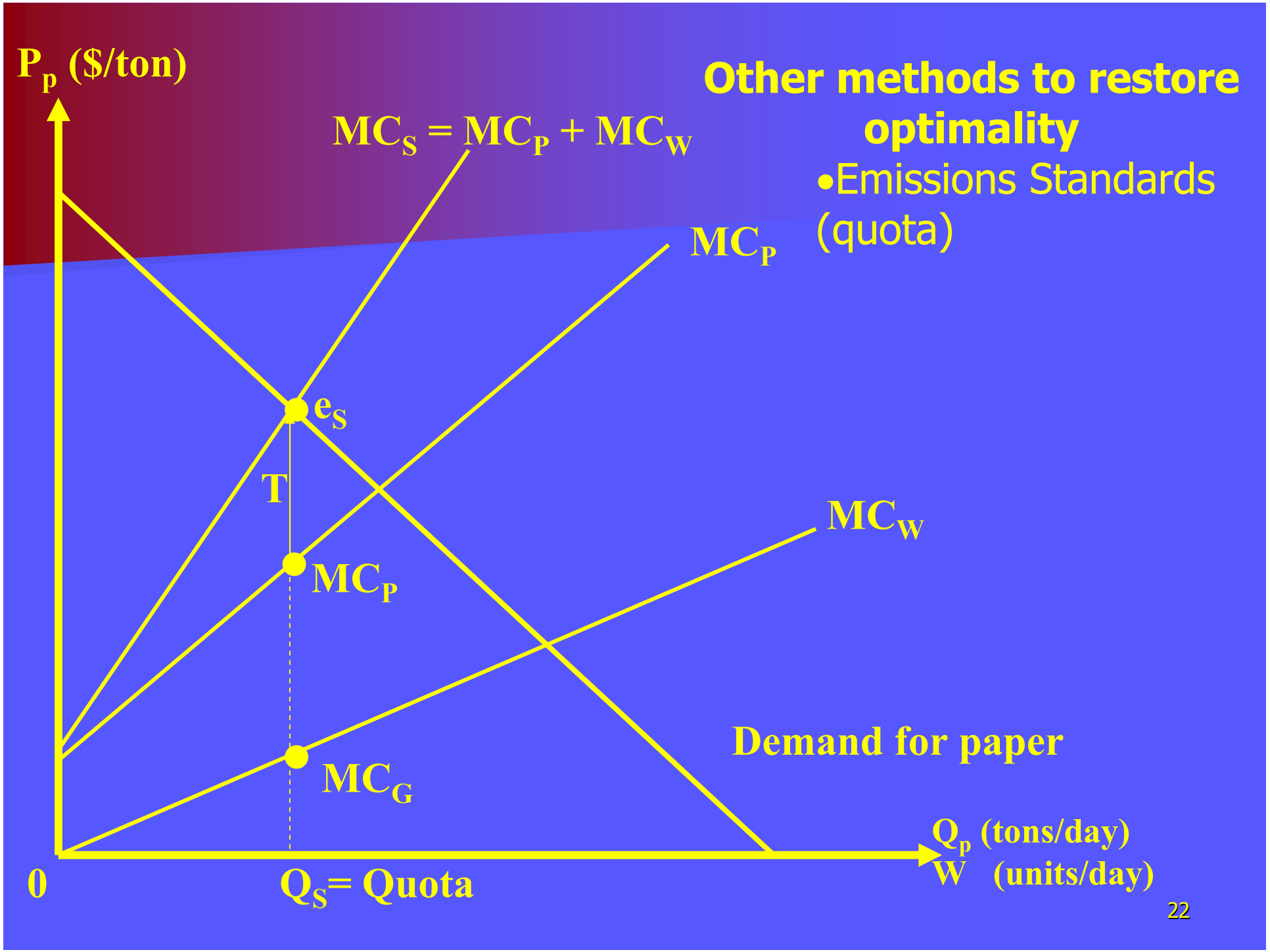
-Incomplete/Asymmetric Information

e.g. What are the long run effects of genetic engineering?



Other methods to restore optimality

- Emissions Standards (quota)



Other methods to restore optimality

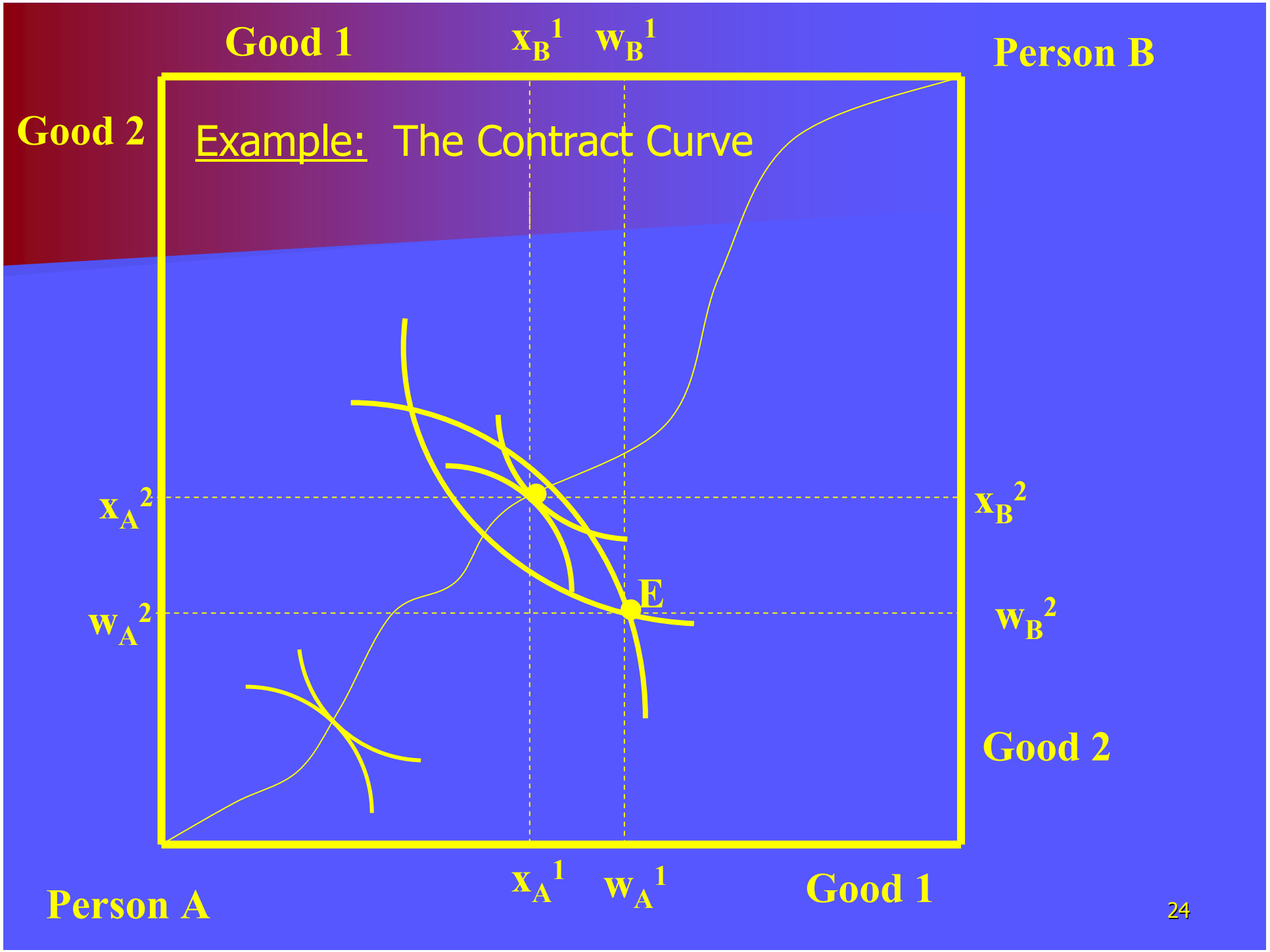
- Emissions Standards (quota)

but…information problems? Enforcement?

- Emissions Fee (tax)

Graphically…see above…

but…what is the marginal cost of pollution at the social optimum?


Good 1
x_B^1 w_B^1
Person B
Good 2
Example: The Contract Curve
x_A^2
x_B^2
E
w_A^2
w_B^2
Good 2
x_A^1 w_A^1
Good 1
Person A

Public Goods

Definition: **Rivalry** in consumption means that only one person can consume a good: the good is used up in consumption (it is depletable).

Definition: **Exclusion** in consumption means that others can be prevented from consuming a good.

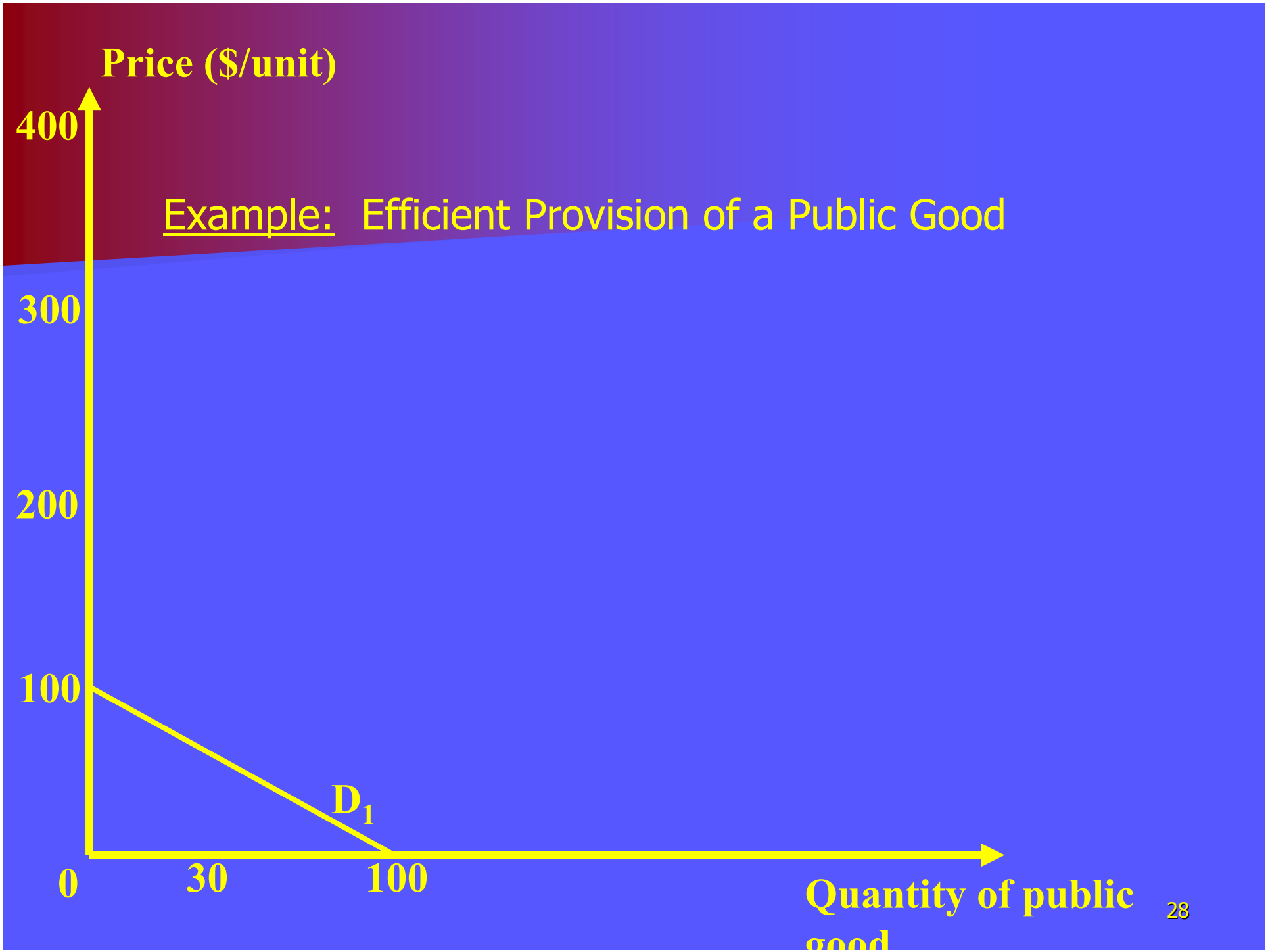
Definition: **Private goods** have properties of rivalry and exclusion. **Pure Public goods** lack both rivalry and exclusion. **Club goods** lack rivalry but have property of exclusion. **Common property** lacks exclusion but does have the property of rivalry.

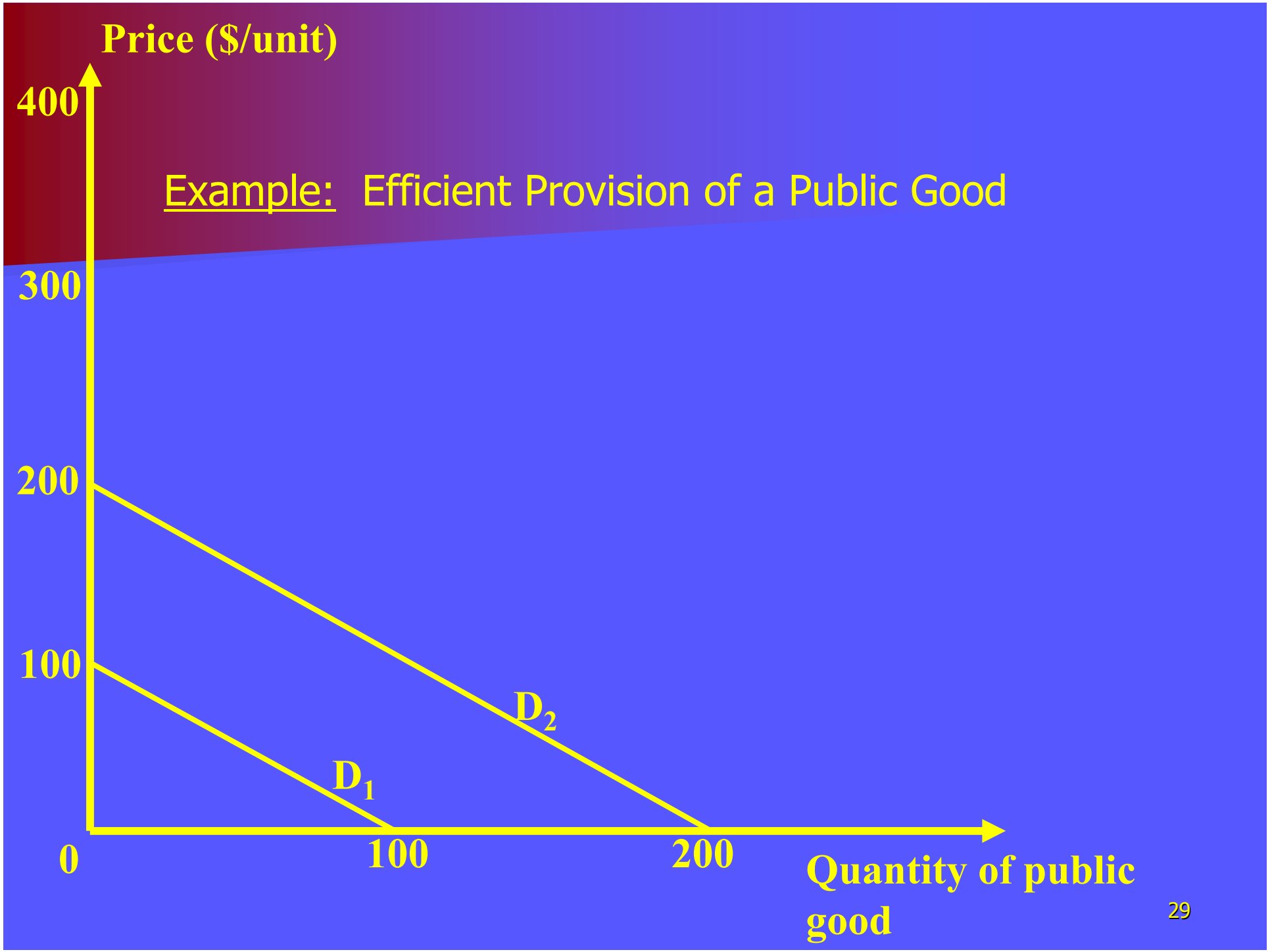
Examples:

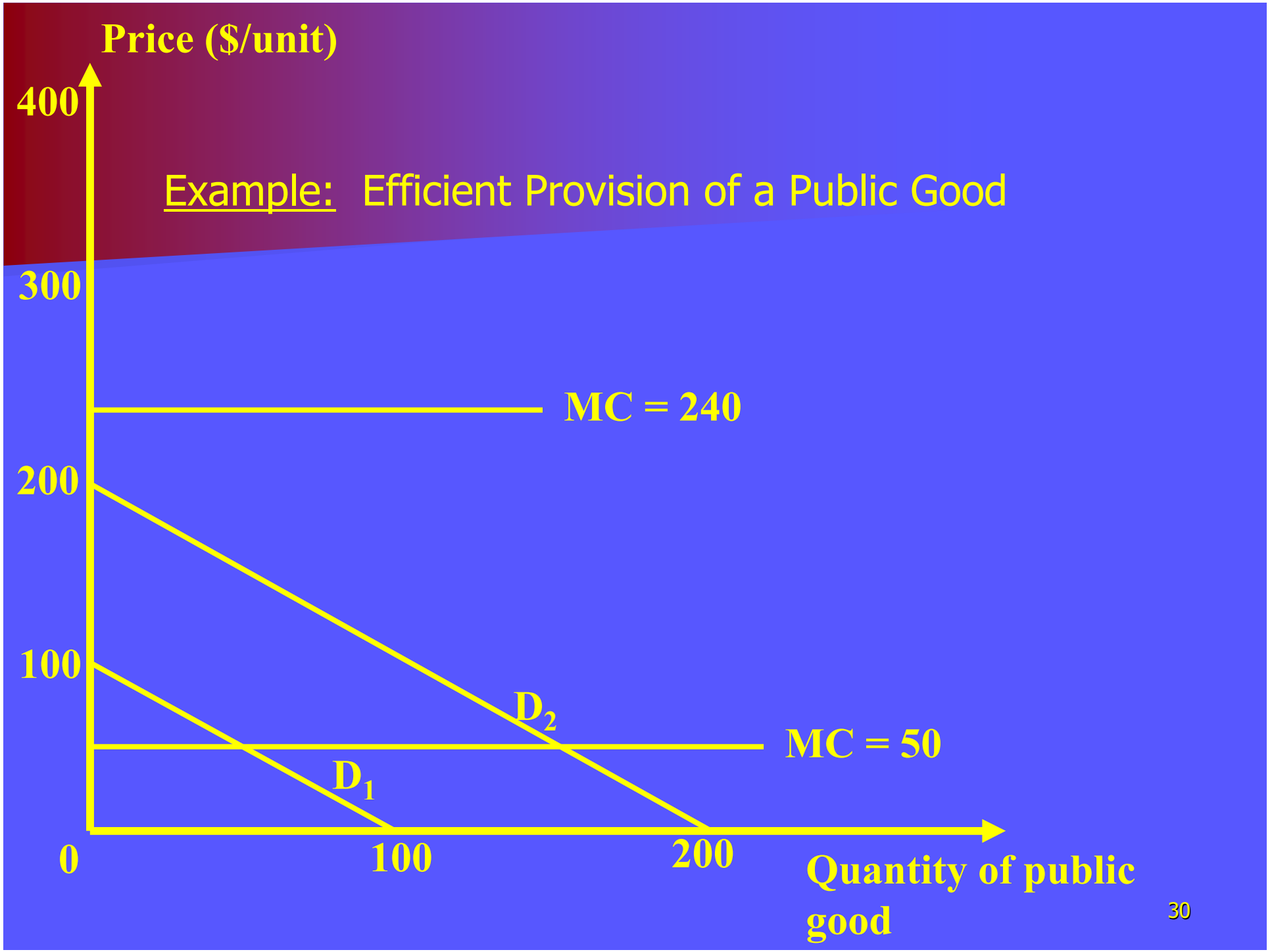
	Exclusion	No exclusion
Rivalry	Pure Private goods: *Apple*	Commons: *Fisheries*
No Rivalry	Club goods: *concert*	Pure public good: *clean air*

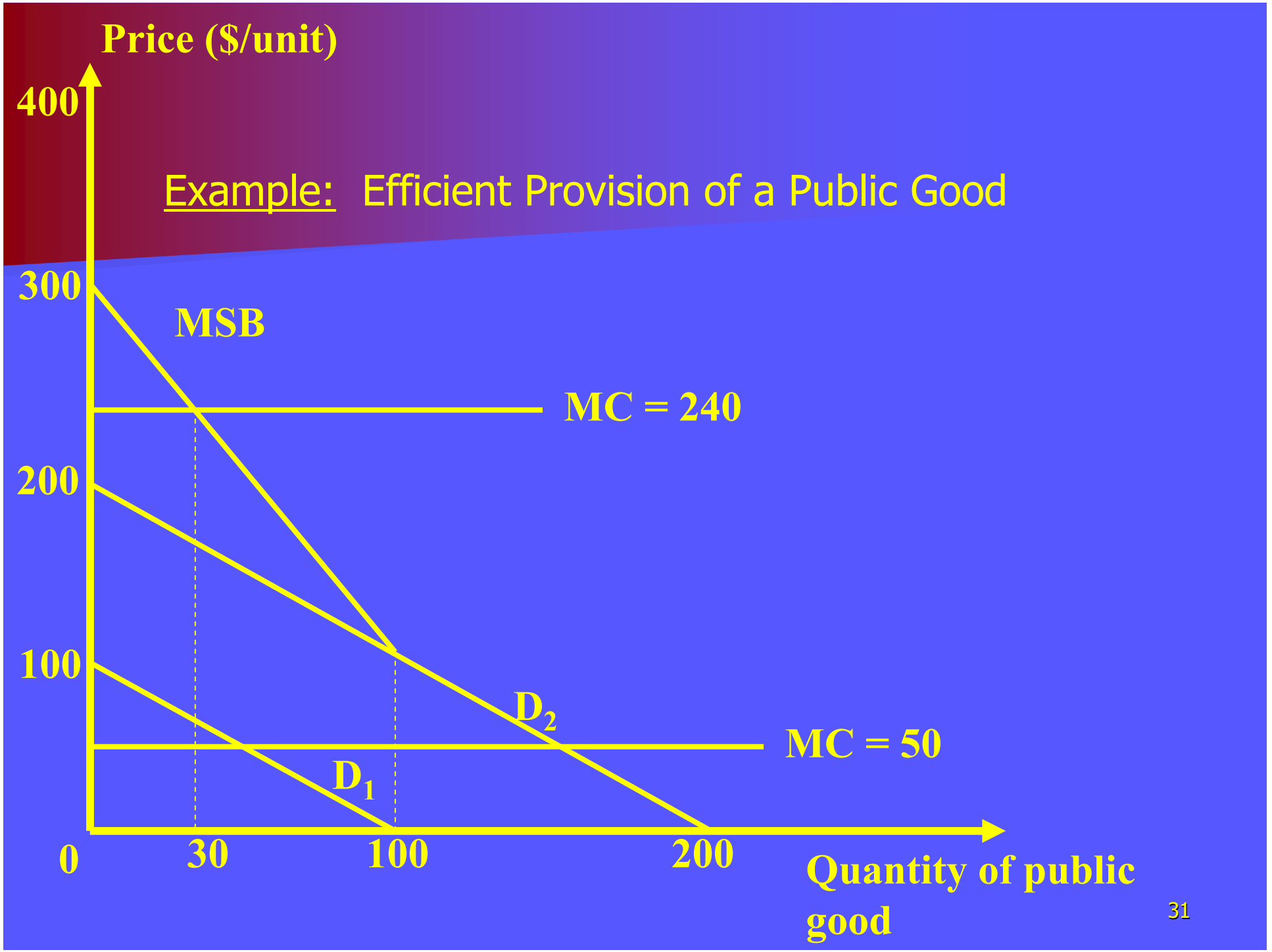
Demand for Public Goods

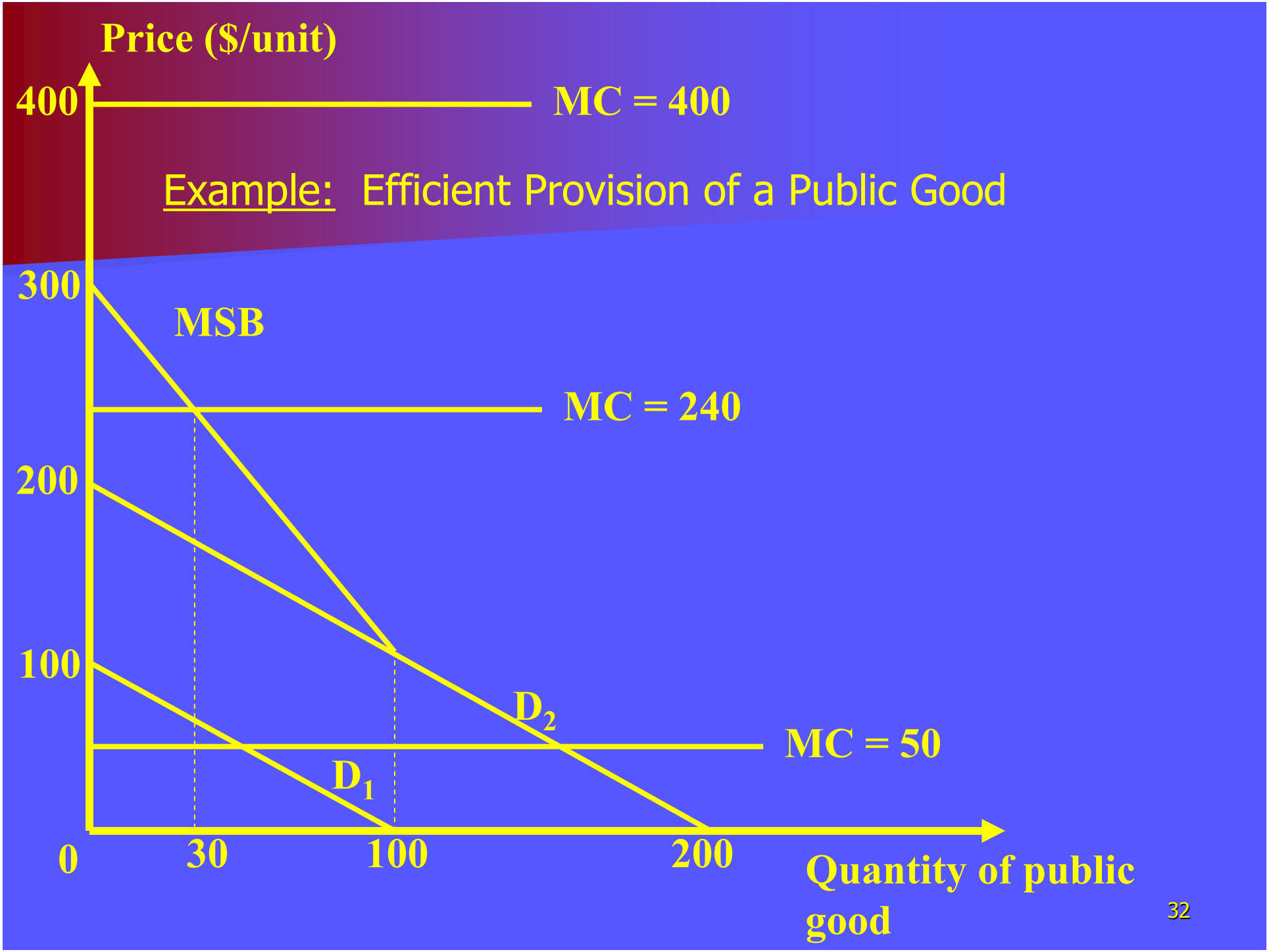
Because public goods lack rivalry, the aggregate demand is the aggregate willingness to pay curve: the *vertical* sum of the individual demand curves.


Price ($/unit)
400
Example: Efficient Provision of a Public Good
300
200
100
D1
0
30
100
Quantity of public good


Price ($/unit)
400
300
200
100
0
Example: Efficient Provision of a Public Good
D2
D1
100
200
Quantity of public good


Price ($/unit)
400
Example: Efficient Provision of a Public Good
300
MC = 240
200
100
D2
MC = 50
D1
0
100
200
Quantity of public good


Price ($/unit)
400
Example: Efficient Provision of a Public Good
300
MSB
MC = 240
200
100
D2
MC = 50
D1
0
30
100
200
Quantity of public good


Price ($/unit)
400
MC = 400
Example: Efficient Provision of a Public Good
300
MSB
MC = 240
200
100
D2
MC = 50
D1
0
30
100
200
Quantity of public good

Example

Consumer 1: $P_1 = 100 - Q$
Consumer 2: $P_2 = 200 - Q$

How would we determine the efficient level of the public god algebraically assuming the marginal cost of the public good is $240?

Summing P_1 and P_2, we obtain

$$MSB = P_1 + P_2 = 100 - Q + 200 - Q =$$

$$300 - 2Q$$

Setting MSB = MC, we have:

$300 - 2Q = 240$ … or…

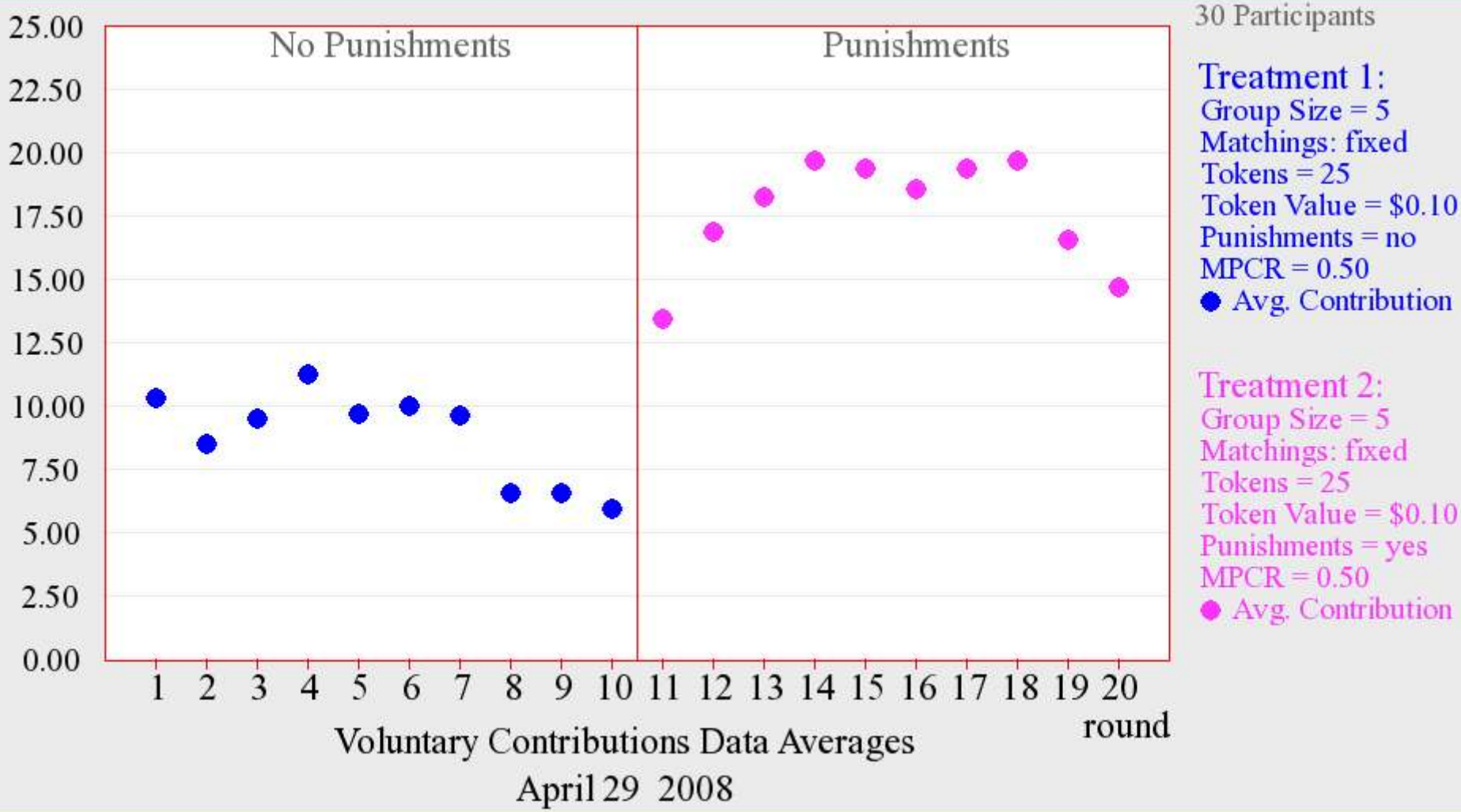
$Q^* = 30$

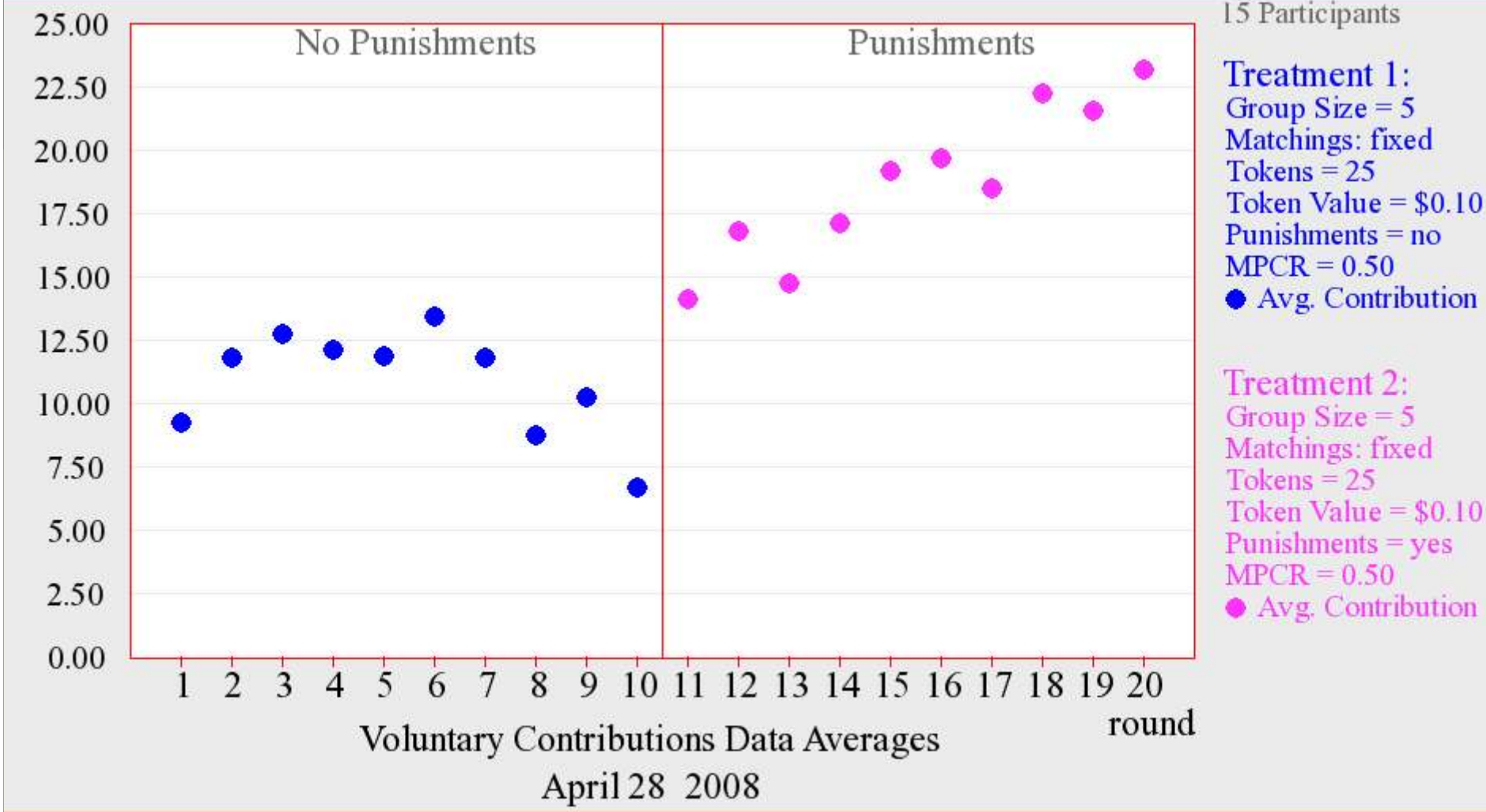
Free Riders

Definition: a **free rider** benefits from an action of other(s) without paying for that action.

Solutions to the free rider problem

- social pressure (small numbers)
- government action (compulsion)
- transformation into private good (metering)


25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
No Punishments
Punishments
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
round
Voluntary Contributions Data Averages
April 29 2008
30 Participants
Treatment 1:
Group Size = 5
Matchings: fixed
Tokens = 25
Token Value = $0.10
Punishments = no
MPCR = 0.50
Avg. Contribution
Treatment 2:
Group Size = 5
Matchings: fixed
Tokens = 25
Token Value = $0.10
Punishments = yes
MPCR = 0.50
Avg. Contribution


25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
No Punishments
Punishments
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
round
Voluntary Contributions Data Averages
April 28 2008
15 Participants
Treatment 1:
Group Size = 5
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Avg. Contribution
Treatment 2:
Group Size = 5
Matchings: fixed
Tokens = 25
Token Value = $0.10
Punishments = yes
MPCR = 0.50
Avg. Contribution

Summary

1. When one agent's actions affect another agent, the agent exerts an externality.

2. When externalities are present the competitive market may not attain the Pareto Efficient outcome.

3. We can restore optimality by assigning property rights to the cause of the externality (The Coase Theorem).

4. If we follow this approach, efficiency is achieved regardless of who receives the property rights; however, the property rights affect the income distribution.

5. When transaction costs are high or there is asymmetric or incomplete information, allocating property rights may not restore optimality.

6. Other methods of restoring optimality include standards and fees.

7. Private goods have the properties of rivalry and exclusion. Other types of goods exist that do not have these properties.

8. Goods that lack rivalry and exclusion are called pure public goods.

9. The demand for pure public goods is the vertical sum of the individual willingness to pay for the good.

10. Pure public goods tend to be undersupplied by the market.