Topic 14 Part 1

Externalities (Chapter 17)

Externalities

Externality is the "effect" imposed on the third party, as a result of an action by any decision maker.

The effect can be **negative (cost) or positive (benefit)**.

The action of an agent can be **production or consumption**.

Externality is one cause of market failure.

Market Failure is a situation in which the allocation of goods and services by a free market is not Pareto efficient.

Externalities

Examples

1) **Negative Consumption Externality**
Consumption of cigarettes harms nearby people.

2) **Positive Consumption Externality**
Consumption of vaccine helps prevent contagious diseases.

3) **Negative Production Externality** (We will focus on this one.)
Production of some goods creates pollution.

4) **Positive Production Externality**
Bees from beekeeping help pollinate surrounding trees.

Key Terms (Production Side)

Marginal Private Cost (MPC) is the MC of private firms. Hence, MPC can be considered as the supply curve in a competitive market.

Marginal External Cost (MEC) is the MC on the third party.

Marginal Social Cost (MSC) is the MC of the society (private firms + the third party).

Thus, **MSC = MPC + MEC**.

Without production externality, MSC = MPC = S.

Key Terms (Consumption Side)

Marginal Private Benefit (MPB) is the MB of private consumers. Hence, MPB can be considered as the demand curve in a competitive market.

Marginal External Benefit (MEB) is the MB on the third party.

Marginal Social Benefit (MSB) is the MB of the society (private consumers + the third party).

Thus, **MSB = MPB + MEB**.

Without consumption externality, MSB = MPB = D.

Social Efficiency

The point where D = S is the market equilibrium.
This is where the market is currently operating.

The point where MSC = MSB is the socially optimal equilibrium.
This is where the market should be in the society's POV.

At MSC = MSB, we have **social efficiency**. This is the optimal allocation of resources in society, taking into account all external costs and benefits on the third party.

Here, the society enjoys the maximum "net" benefit.

Negative Production Externalities

Consider the case of firms polluting the environment

Given NO "consumption" externality, we have **D = MPB = MSB**.

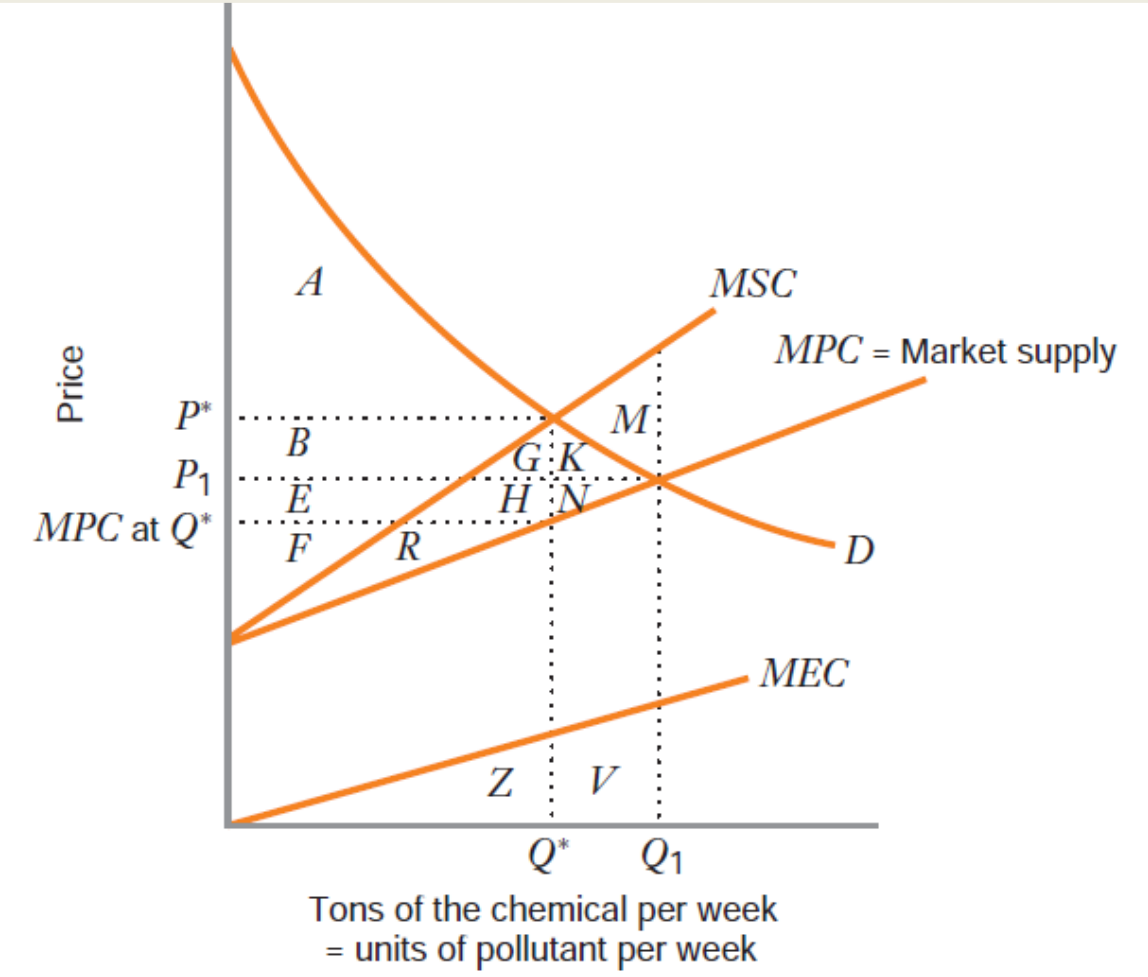
Because of the pollution, there is now cost to the third party.

MEC > 0, and thus we have **MSC > MPC = S**.

MSC lies above MPC.

We assume that MEC is increasing, i.e. the more the firms produce, the higher the MC is on the third party.

Negative Production Externalities



Negative Production Externalities

	Equilibrium (price = P_1)	Social Optimum (price = P^*)	Difference between Social Optimum and Equilibrium
Consumer surplus	$A + B + G + K$	A	$-B - G - K$
Private producer surplus	$E + F + R + H + N$	$B + E + F + R + H + G$	$B + G - N$
−Cost of externality	$-R - H - N - G - K - M$	$-R - H - G$	$M + N + K$ (external cost savings)
Net social benefits (consumer surplus + private producer surplus − cost of externality)	$A + B + E + F - M$	$A + B + E + F$	M (increase in net benefits at social optimum)
Deadweight loss	M	Zero	M

Negative Production Externalities

Consider the case of firms polluting the environment

MPC = S intersects D at Q_1. This is the market quantity.

MSC intersects D = MSB at Q*.
This is the socially optimal quantity.

Since $Q_1 > Q^*$. This shows "**overproduction**" of the good.
At Q_1, MSC > MSB, thus the social welfare is not maximized.

That is, most polluters is now producing too much. To increase social welfare, the government should intervene this free market to lower production of the good.

Exercise

LEARNING-BY-DOING EXERCISE 17.1

The Efficient Amount of Pollution

Problem Evaluate the following argument: "Since pollution is a negative externality, it would be socially optimal to declare illegal the use of any production process that creates pollution."

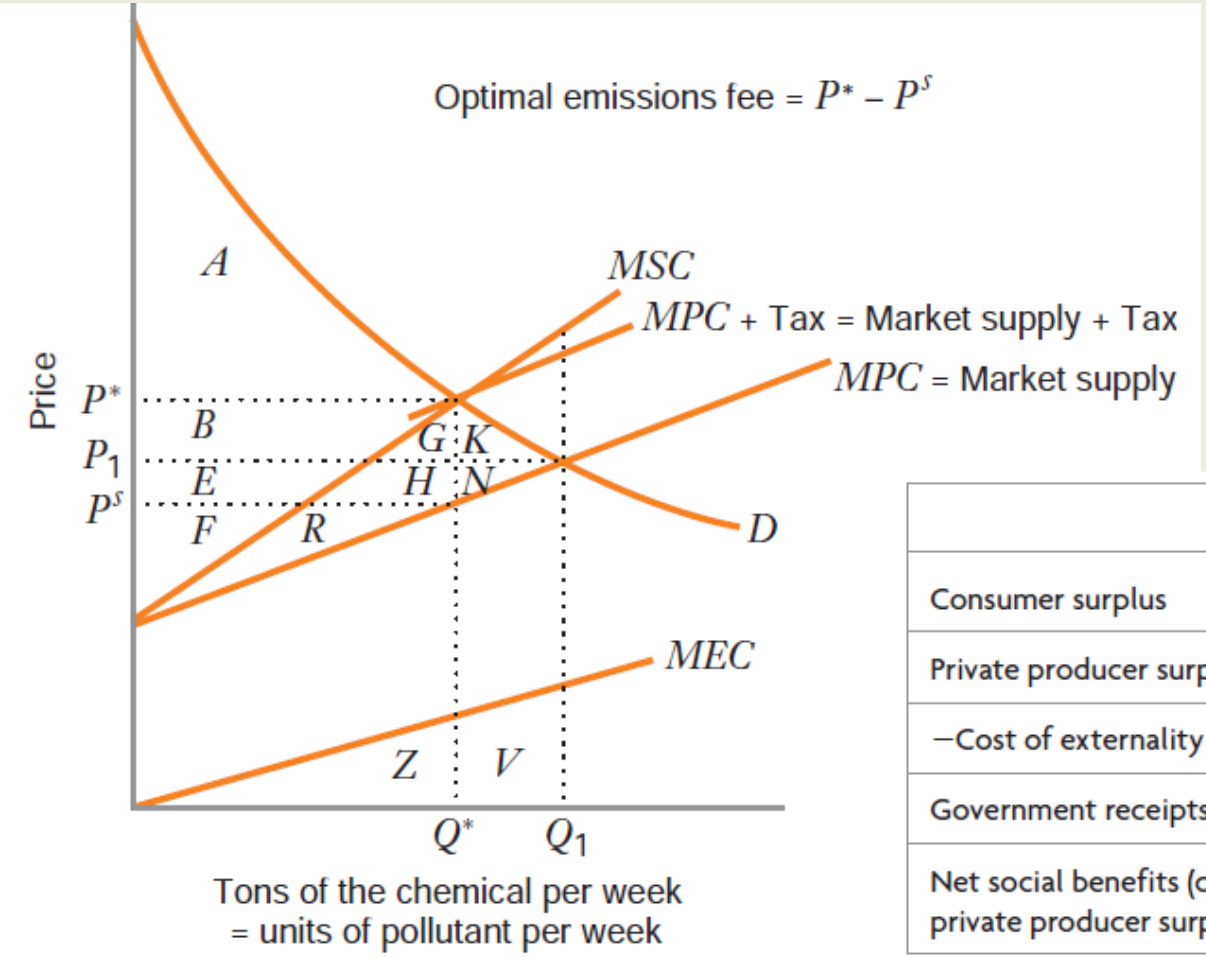
Solutions to Pollution

To correct externalities, the government should intervene the free market. Solutions to pollution include:

1) **Emissions Standards**
   An official limit on the amount of pollution emission.
2) **Emissions Fees** (We will focus on this one.)
   A tax on pollution released into the environment.
3) **Emissions Permits** (also called "Cap and Trade")
   The government sets a fixed number of permits to emit pollution. Polluting firms can sell and buy these permits.

A **Pigovian tax** (also spelled **Pigouvian tax**) is a **tax** on any market activity that generates negative externalities.

Emission Fees / Pigouvian Tax



	Equilibrium (with tax)
Consumer surplus	A
Private producer surplus	$F + R$
−Cost of externality	$-R - H - G$
Government receipts from emissions tax	$B + G + E + H$
Net social benefits (consumer surplus + private producer surplus − cost of externality)	$A + B + E + F$

Emission Fees / Pigouvian Tax

Tax on firms means they face higher cost of production.

This will shift the supply curve or MPC to the left.

The optimal tax/fee will make supply curve or MPC intersect demand curve at Q* (where MSC = MSB = D).

To find the optimal tax, TAX = MEC(Q*).

At Q*, the market now becomes socially efficient.

LEARNING-BY-DOING EXERCISE 17.2

Emissions Fee

Consider a variation of the chemical manufacturing example. Suppose the inverse demand curve for the chemical (which is also the marginal benefit curve) is $P^d = 24 - Q$, where Q is the quantity consumed (in millions of tons per year) when the price consumers pay (in dollars per ton) is P^d.

The inverse supply curve (also the marginal private cost curve) is $MPC = 2 + Q$, where MPC is the marginal private cost when the industry produces Q.

The industry emits one unit of pollutant for each ton of chemical it produces. As long as there are fewer than 2 million units of pollutant emitted each year, the external cost is zero. But when the pollution exceeds 2 million units, the marginal external cost is positive. The marginal external cost curve is

$$MEC = \begin{cases} 0, & \text{when } Q \leq 2 \\ -2 + Q, & \text{when } Q > 2 \end{cases}$$

where MEC is marginal external cost in dollars per unit of pollutant when Q units of pollutant are released.

Also suppose the government wants to use an emissions fee of $\$T$ per unit of emissions to induce the market to produce the economically efficient amount of the chemical.

Problem

(a) Construct a graph and a table comparing the equilibria with and without the emissions fee:

- Graph the demand, supply (with no emissions fee), marginal external cost, and marginal social cost curves. Label two points on the graph: the point that represents the equilibrium price and quantity when there is no correction for the externality (i.e., no emissions fee) and the point that represents the amount of the chemical the market should supply at the social optimum. Indicate the actual price and quantity at each point.
- Graph the supply curve after the imposition of an emissions fee that induces the production of an economically efficient amount of the chemical. Indicate the price consumers will pay and the price producers will receive.
- In the table, indicate the amount of the emissions fee (dollars per unit) that will lead to the economically efficient production of the chemical. Fill in the table with the following information for the equilibria with and without the fee (indicate both the areas on the graph and the actual dollar amounts): consumer surplus, private producer receipts from the fee, net social benefits, and deadweight loss.

(b) Explain why the following sum is the same with and without the fee: consumer surplus + private producer surplus − external cost + government receipts from the fee + deadweight loss.

Positive Consumption Externalities

Consider the case of consumers using vaccine

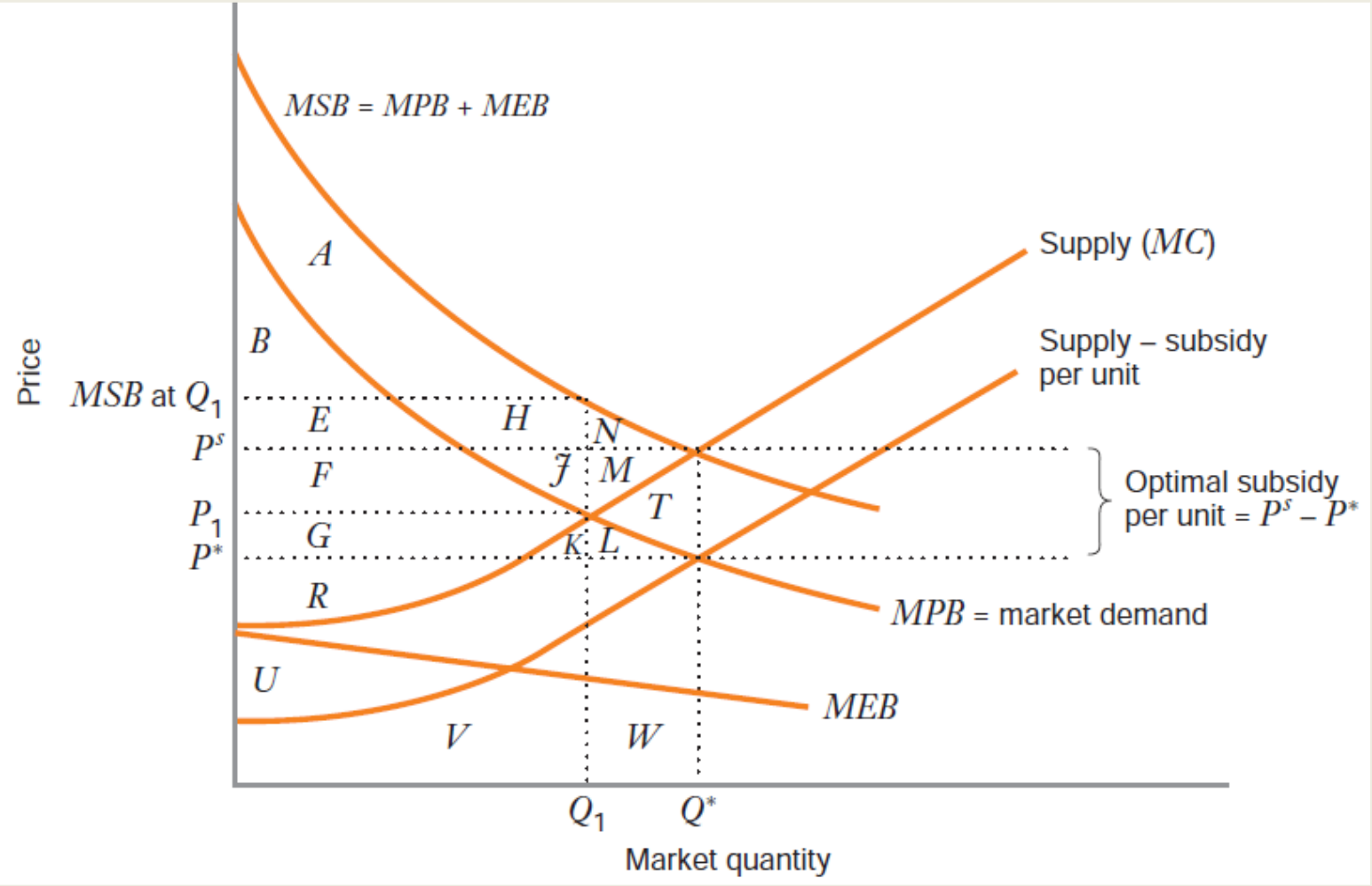
Given NO "production" externality, we have **S = MPC = MSC**.

Because of the vaccine, there is now benefit to the third party.

MEB > 0, and thus we have **MSB > MPB = D**.

MSB lies above MPB.

Positive Consumption Externalities



Positive Consumption Externalities

	Equilibrium (no subsidy)	Social Optimum (equilibrium with subsidy)	Difference in Benefits between Social Optimum and Equilibrium with No Subsidy
Private consumer surplus	$B + E + F$	$B + E + F + G + K + L$	$G + K + L$
Producer surplus	$G + R$	$F + G + R + J + M$	$F + J + M$
Benefit from externality	$A + H + J$	$A + H + J + M + N + T$	$M + N + T$
−Government cost from subsidy	zero	$-F - G - J - K - L - M - T$	$-F - G - J - K - L - M - T$
Net social benefits (private consumer surplus + producer surplus + benefit from externality − government cost)	$A + B + E + F + G + H + J + R$	$A + B + E + F + G + H + J + M + N + R$	$M + N$

Positive Consumption Externalities

Consider the case of consumers using vaccine

MPB = D intersects S at Q_1. This is the market quantity.

MSB intersects S = MSC at Q*.
This is the socially optimal quantity.

Since Q_1 < Q*. This shows "**underconsumption**" of the good.
At Q_1, MSB > MSC, thus the social welfare is not maximized.

That is, people are consuming too little. To increase social welfare, the government can subsidize vaccine production.

Subsidy

Subsidy on firms means they face lower cost of production.

This will shift the supply curve or MPC to the right.

The optimal subsidy will make supply curve or MPC intersect demand curve at Q* (where MSB = MSC = S).

To find the optimal subsidy, SUBSIDY = MEB(Q*).

At Q*, the market now becomes socially efficient.

Coase Theorem and Property Rights

Apart from previously mentioned solutions, the government can correct externalities by assigning property rights.

Property Right is the exclusive control over the use of an asset or resource.

Property right "**internalizes**" the MEC of the firms.

Without property right, firms can pollute the area because no one has right over that area. MEC here is external.

With property right over the area, firms cannot pollute or they must compensate for pollution. MEC is now internalized.

Coase Theorem and Property Rights

Coase Theorem suggests that when bargaining is costless (zero transaction cost), assigning property rights for an externality leads to an efficient outcome.

Efficiency is achieved regardless of who receives the property rights, but who gets the property rights affects the income distribution.

Coase Theorem and Property Rights

Consider the following example

Farm A: raise cattles **Farm B**: raise crops

Cattles of Farm A damage Crops of Farm B (Neg. Externality).

Some party can build a fence to prevent the damage.

LEARNING-BY-DOING EXERCISE 17.3

The Coase Theorem

Problem

(a) In the case of the roaming cattle just described, suppose it is costless for the parties to bargain. Verify the Coase Theorem when the cost of the fence is $2,000 and the cost of the damage is $1,000.

(b) Verify the Coase Theorem if the fence costs $2,000 and the damage cost is $4,000.