

# MONOPOLY

# Key points

- ▶ some markets have only one seller.
- ▶ a monopoly determines the quantity to produce or the price to charge, but not both.
- ▶ A monopoly's decisions affect economic well-being.
- ▶ the various public policies aimed at solving the problem of monopoly.
- ▶ why monopolies would like to charge different prices to different customers.

# Monopoly

- ▶ While a competitive firm is a *price taker*, a monopoly firm is a *price maker*.
- ▶ A firm is considered a *monopoly* if . . .
  - it is the **sole seller** of its product.
  - its product does **not** have close **substitutes**.

# WHY MONOPOLIES ARISE

- ▶ The fundamental cause of monopoly is *barriers to entry*.

# WHY MONOPOLIES ARISE

- ▶ Barriers to entry have two main sources:
  - The government gives a single firm the **exclusive right** to produce some good.
  - **Costs** of production make a single producer more efficient than a large number of producers.

# Government-Created Monopolies

- ▶ Governments may restrict entry by giving a single firm the exclusive right to sell a particular good in certain markets.

# Government-Created Monopolies

- ▶ Patent and copyright laws are two important examples of how government creates a monopoly to serve the public interest.
  - Ex Covid-19 vaccine, software, specific medicine vs generic drug

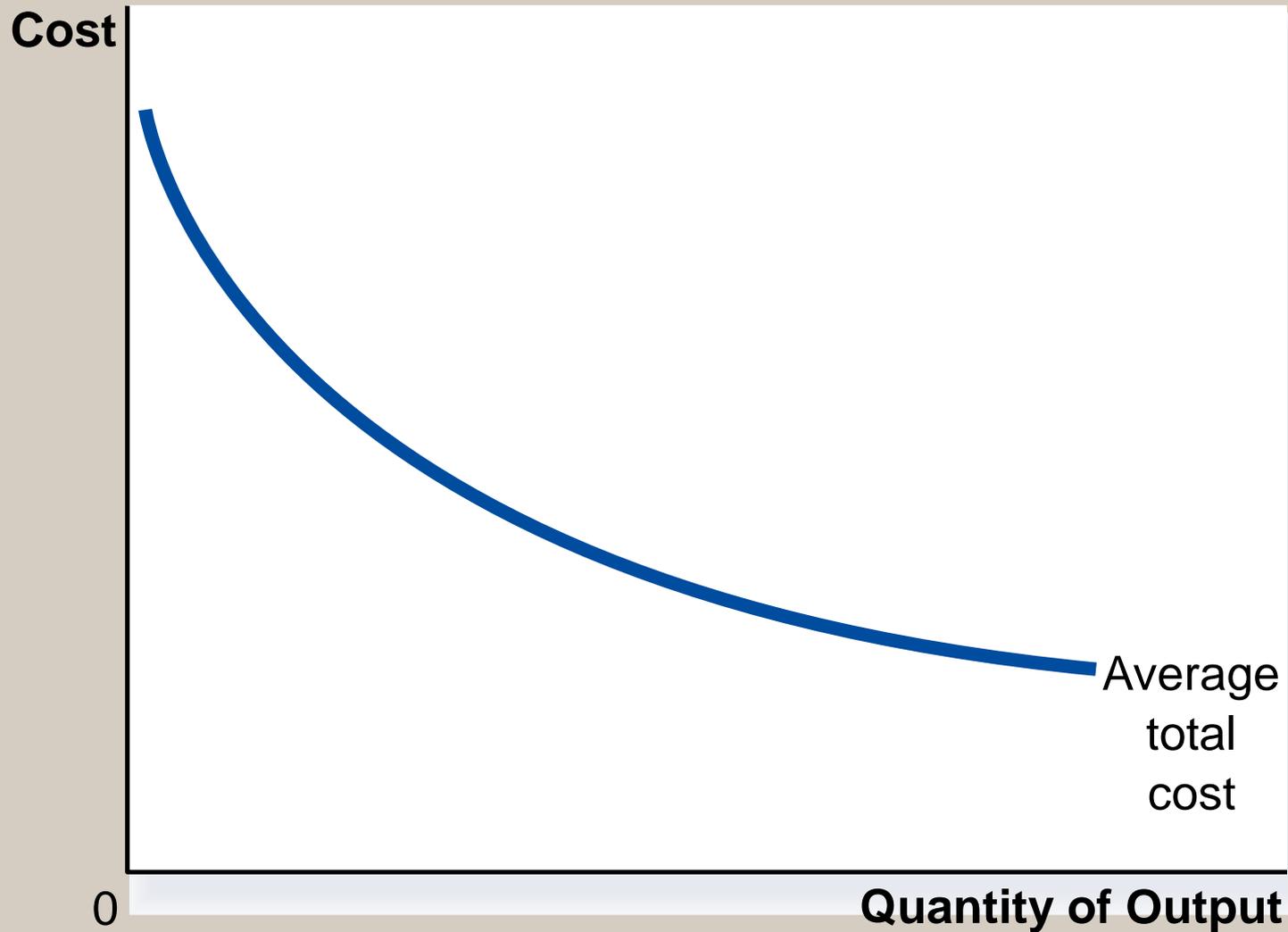
# Natural Monopolies

- ▶ An industry is a *natural monopoly* when a single firm can supply a good or service to an entire market at a **smaller cost** than could two or more firms.

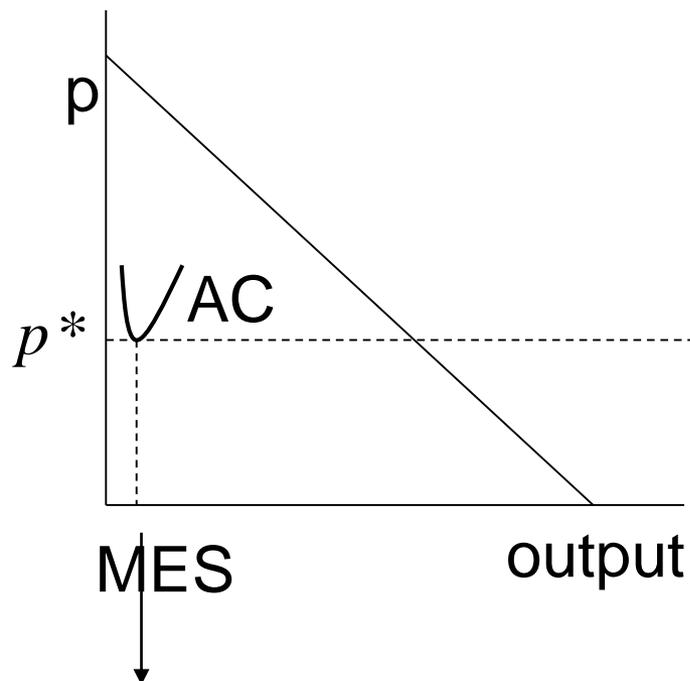
# Natural Monopolies

- ▶ A *natural monopoly* arises when there are economies of scale over the relevant range of output.
- ▶ We have NM when **fixed cost are higher and marginal cost are lower**, then **AC is decreasing in the output**
  - Gas
  - Telecommunication
  - Public Transport as subway or railway

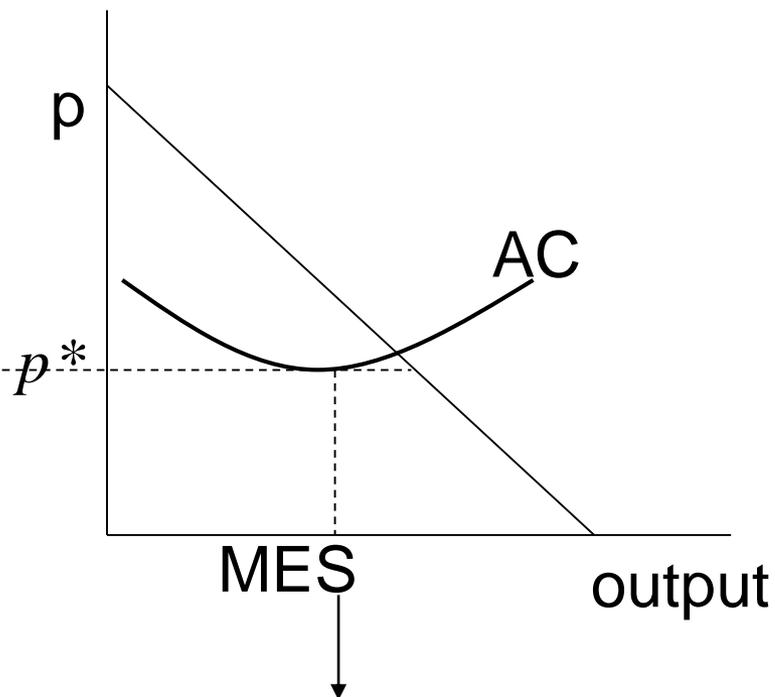
# Economies of Scale as a Cause of Monopoly



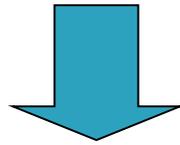
minimum efficient scale (MES): output minimizing the AC



Other firms may enter and produce a quantity equal to the MES and setting  $p^*$

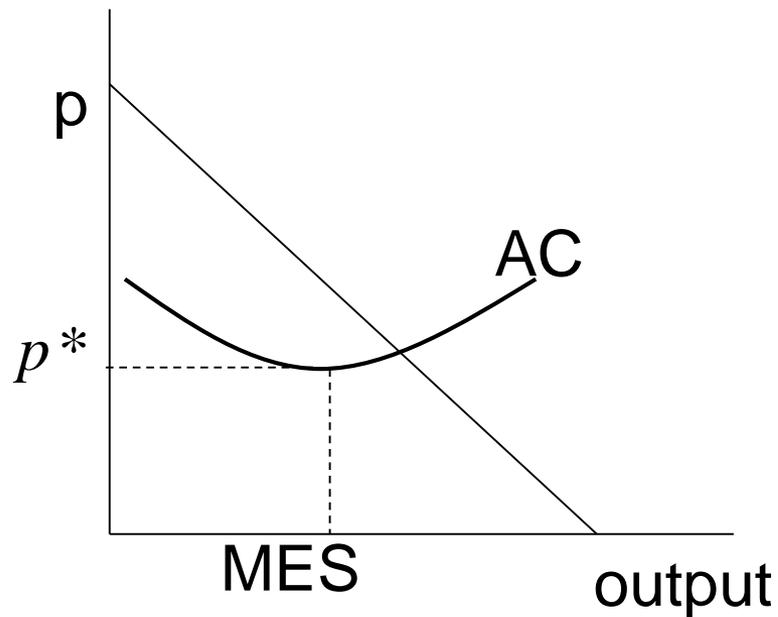


Only one firm can produce the SME and set  $p^*$ , other firms entering this market will make negative profit



There exists a **Natural Monopoly** when the *MES* is **high** with respect to the (dimension of) market demand

Only one firm makes non-negative profit at  $p^*$

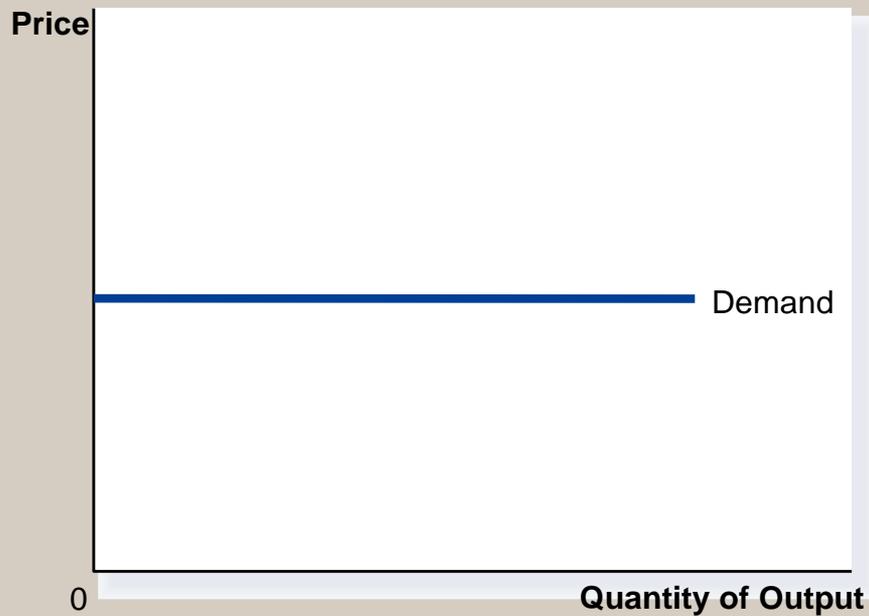


# HOW MONOPOLIES MAKE PRODUCTION AND PRICING DECISIONS

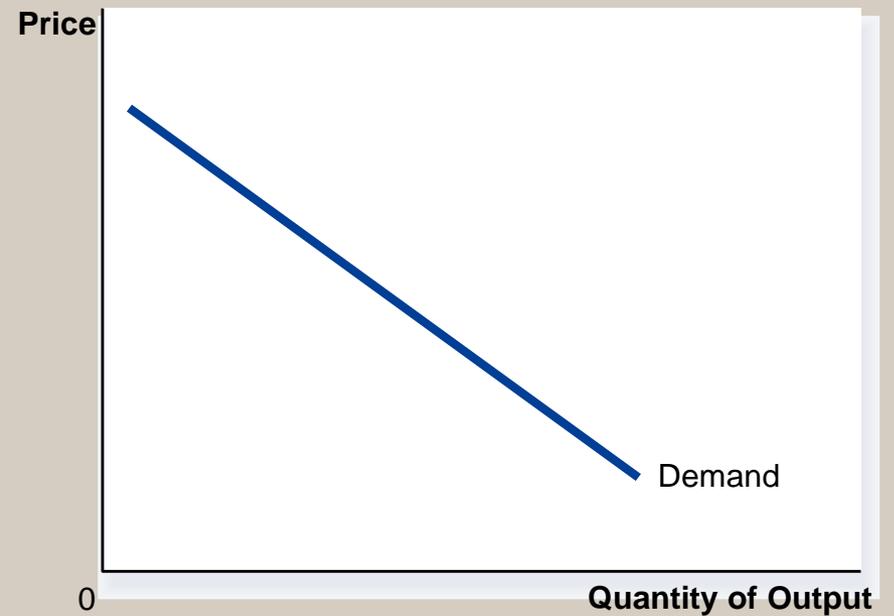
- ▶ Monopoly versus Competition
  - Monopoly
    - Is the sole producer
    - Faces a downward-sloping demand curve
    - Is a price maker
    - Reduces price to increase sales
  - Competitive Firm
    - Is one of many producers
    - Faces a horizontal demand curve
    - Is a price taker
    - Sells as much or as little at same price

# Demand Curves for Competitive and Monopoly Firms

(a) A Competitive Firm's Demand Curve



(b) A Monopolist's Demand Curve



# A Monopoly's Revenue

- ▶ Total Revenue

$$P \times Q = TR$$

- ▶ Average Revenue

$$TR/Q = AR = P$$

- ▶ Marginal Revenue

$$\Delta TR/\Delta Q = MR$$

# Table 1 A Monopoly's Total, Average, and Marginal Revenue

Quantity of Water	Price	Total Revenue	Average Revenue	Marginal Revenue
(Q)	(P)	(TR = P × Q)	(AR = TR/Q)	(MR = ΔTR/ΔQ)
0 gallons	\$11	\$ 0	—	\$10
1	10	10	\$10	8
2	9	18	9	6
3	8	24	8	4
4	7	28	7	2
5	6	30	6	0
6	5	30	5	-2
7	4	28	4	-4
8	3	24	3	

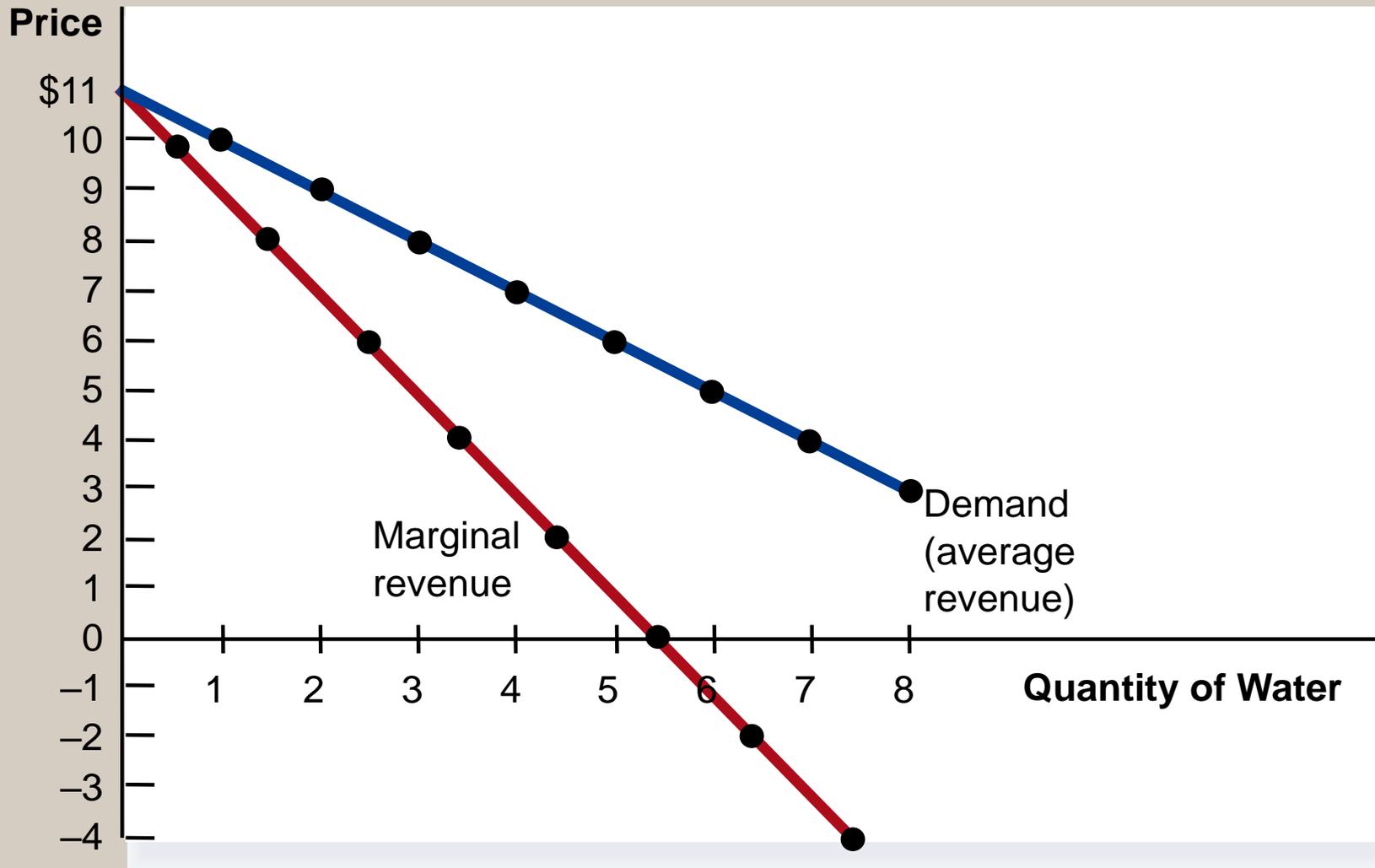
# A Monopoly's Revenue

- ▶ A Monopoly's Marginal Revenue
  - A monopolist's marginal revenue is always *less than the price* of its good.
  - The demand curve is downward sloping.
  - When a monopoly drops the price to sell one more unit, the revenue received from the previously sold units also decreases.

# A Monopoly's Revenue

- ▶ A Monopoly's Marginal Revenue
  - When a monopoly increases the amount it sells, it has **two effects** on total revenue ( $P \times Q$ ).
    - The output effect—more output is sold, so  **$Q$  is higher**.
    - The price effect—price falls, so  **$P$  is lower**.

# Demand and Marginal-Revenue



## Marginal Revenue: a formal analysis

$$\Delta R = P\Delta Q + Q\Delta P + \Delta P\Delta Q$$

For very small values of  $\Delta P$  and  $\Delta Q$  we get:

$$\Delta R = P\Delta Q + Q\Delta P$$

$$MR = \frac{\Delta R}{\Delta Q} = P + Q \frac{\Delta P}{\Delta Q} \longrightarrow MR = \frac{\partial R(Q)}{\partial Q} = P + Q \frac{\partial P(Q)}{\partial Q}$$

Then.....marginal revenue can be written as:

$$R'(Q) = P \left[ 1 + P'(Q) \frac{Q}{P} \right] \rightarrow \frac{1}{\varepsilon} = P'(Q) \frac{Q}{P}$$

$$R'(Q) = P(Q) \left[ 1 + \frac{1}{\varepsilon(Q)} \right]$$

to avoid problems with the sign of the elasticity there is the absolute value

$$R'(Q) = P(Q) \left[ 1 - \frac{1}{|\varepsilon(Q)|} \right]$$

•If  $|\varepsilon(Q)| = 1$  the marginal revenue is zero

•If demand is inelastic  $|\varepsilon(Q)| < 1$  then  $1 - \frac{1}{|\varepsilon(Q)|} < 0$

to increase demand it is necessary a **significant reduction** in the **price**, then marginal revenue becomes negative (revenue decreases)

• If demand is elastic  $|\varepsilon(Q)| > 1$  then  $1 - \frac{1}{|\varepsilon(Q)|} > 0$

Marginal revenue is positive. The **monopolist finds it always profitable producing in the elastic part of the demand** (in the inelastic part MR is negative)

Remark: for  $Q=0$  elasticity is infinite, then

$$R'(Q) = P(Q) \left[ 1 - \frac{1}{\infty} \right] = P$$

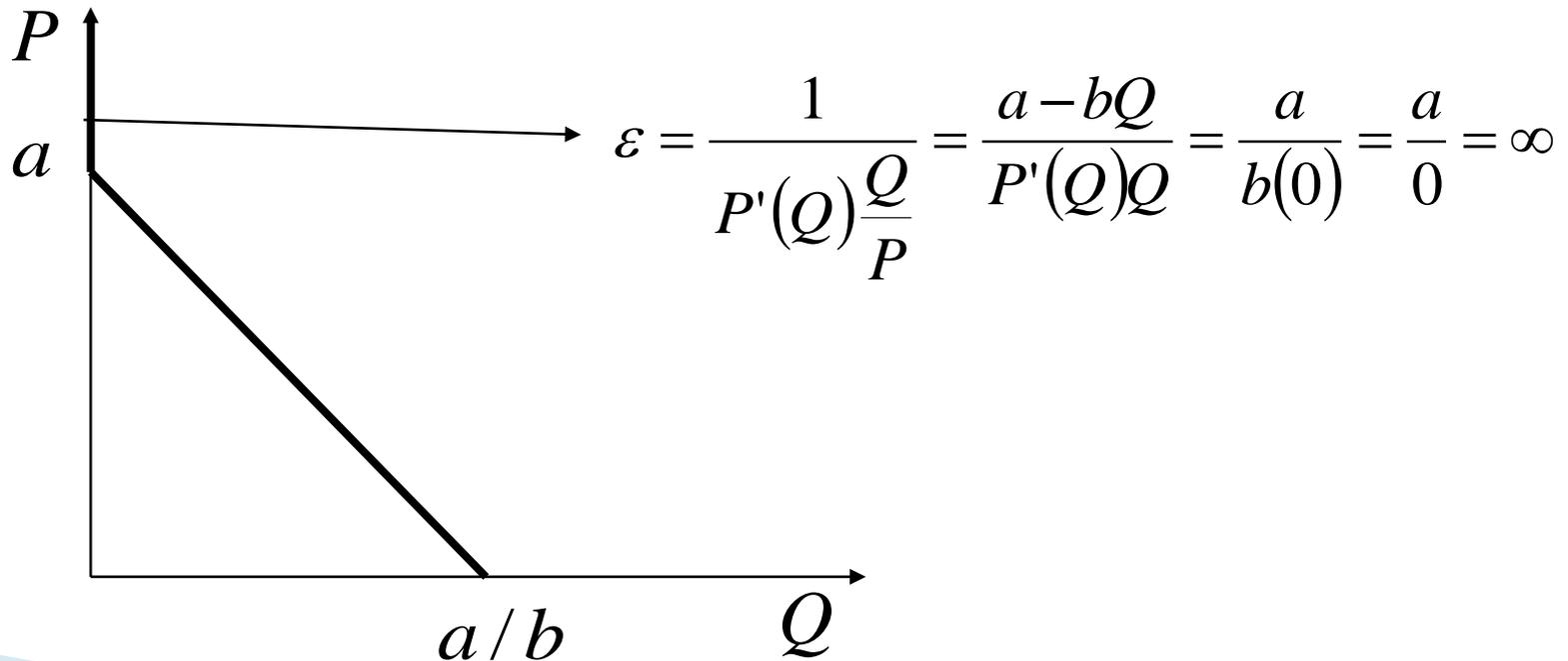
For the first unit sold the marginal revenue is equal to the price

## Linear Demand

$$P(Q) = a - bQ$$

The slope of the inverse demand curve is constant:  $P'(Q) = -b$

We now set up the marginal revenue curve:



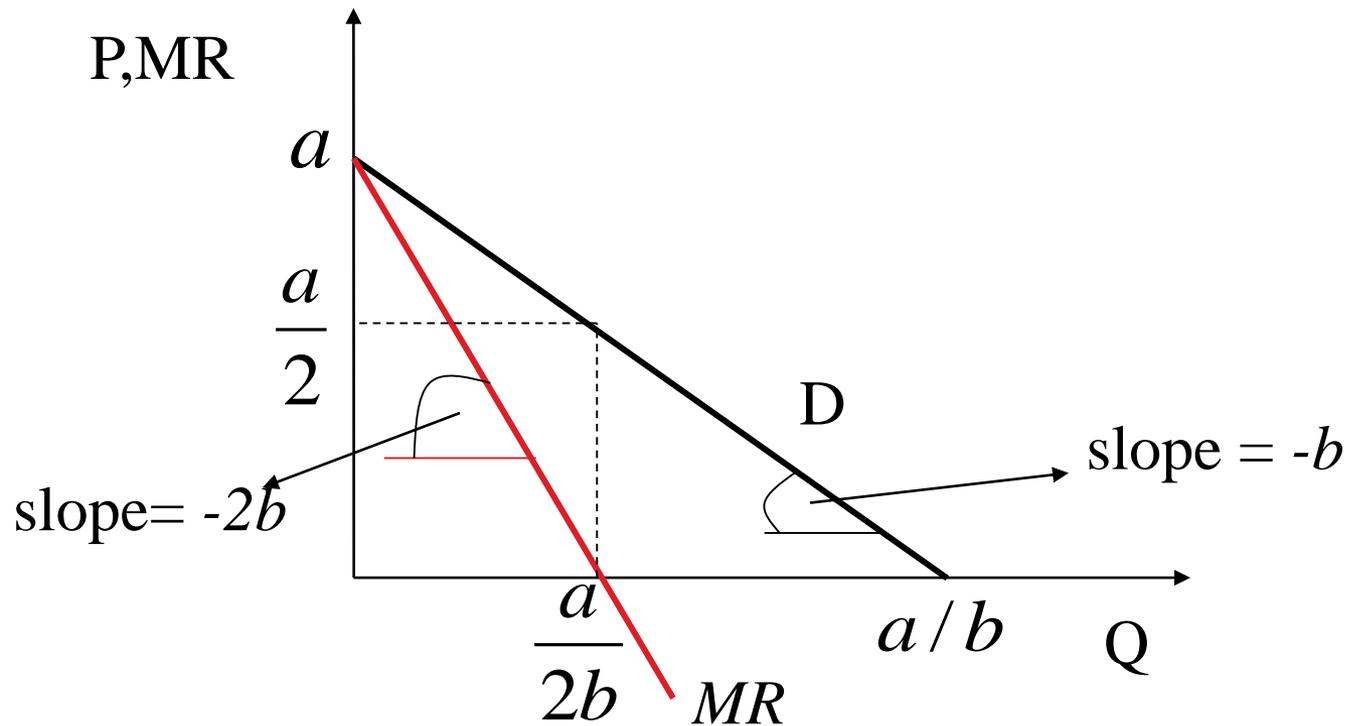
From: 
$$\frac{\partial R(Q)}{\partial Q} = P(Q) \left[ 1 - \frac{1}{|\varepsilon(Q)|} \right]$$

Then:

$$\frac{\partial R(Q)}{\partial Q} = P(Q) + \frac{\partial P(Q)}{\partial Q} Q = P(Q) - bQ = (a - bQ) - bQ = a - 2bQ$$

**Marginal Revenue Curve**





for  $Q > \frac{a}{2b}$  the demand is inelastic,  $|\varepsilon| < 1$ , then  $MR < 0$

# A Monopoly's Profit

- ▶ Profit equals total revenue minus total costs.
  - Profit =  $TR - TC$
  - Profit =  $(TR/Q - TC/Q) \times Q$
  - Profit =  $(P - ATC) \times Q$

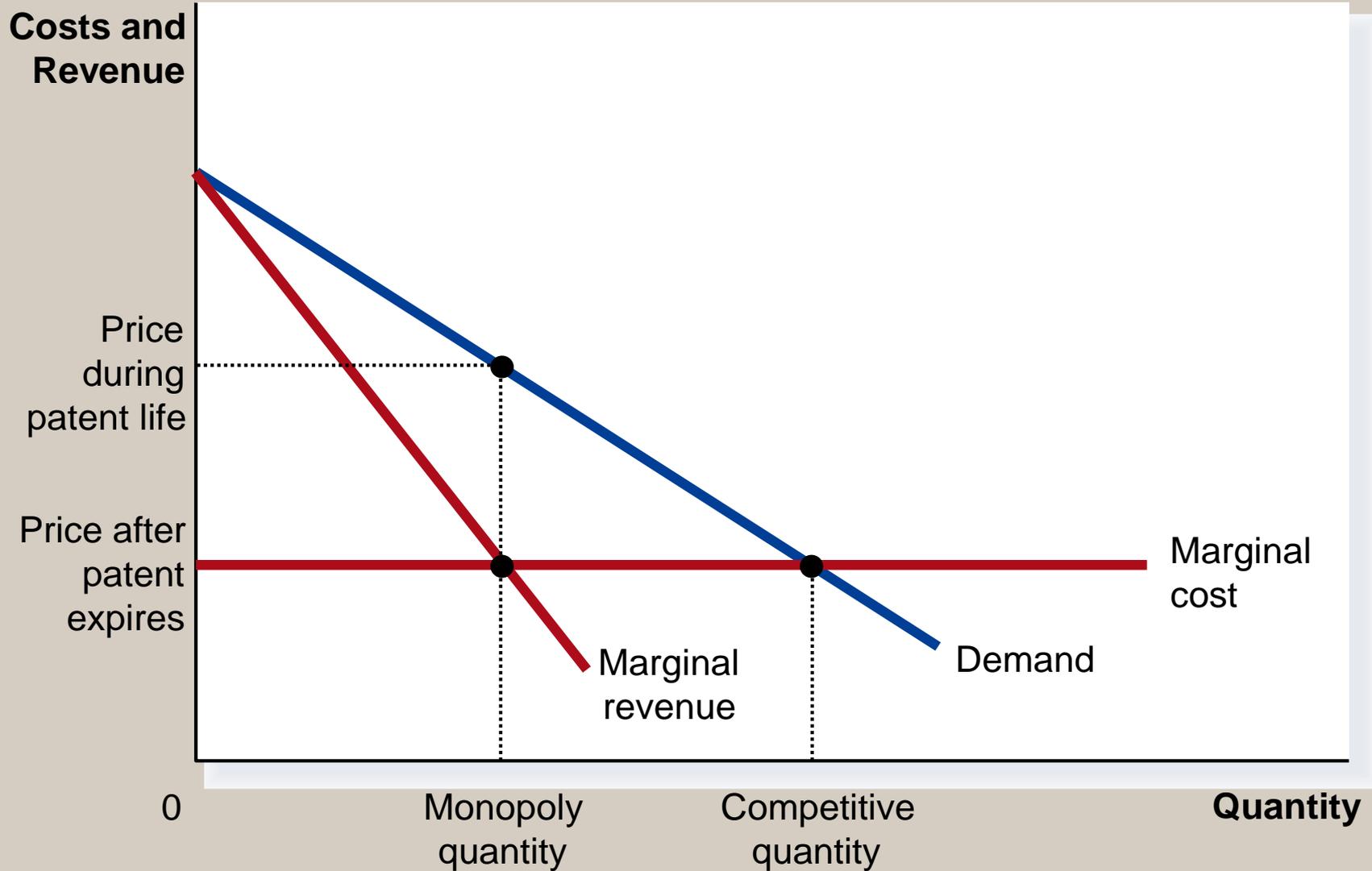
# Profit Maximization

- ▶ A monopoly maximizes profit by producing the quantity at which **marginal revenue equals marginal cost**.
- ▶ It then uses the demand curve to find the price that will induce consumers to buy that quantity.

# A Monopolist's Profit

- ▶ Note
  - Quantity on the intersection of MC and MR.
  - Price is given by the point on the demand curve on the vertical of this intersection.
- ▶ The monopolist will receive economic profits as long as price is greater than average total cost.

# The Market for Drugs



# Profit Maximization

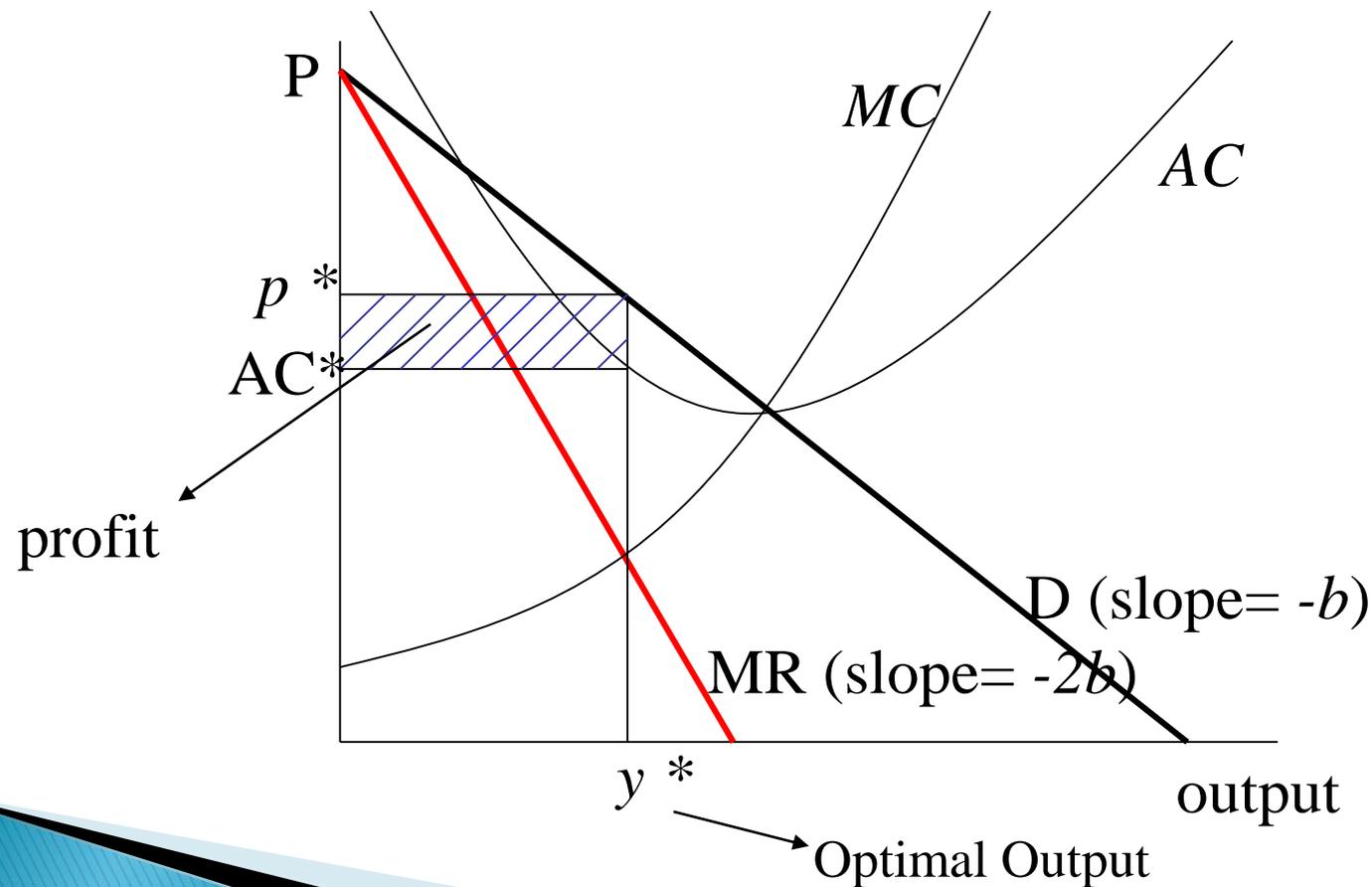
- ▶ Comparing Monopoly and Competition
  - For a competitive firm, price equals marginal cost.  
$$P = MR = MC$$
  - For a monopoly firm, price exceeds marginal cost.  
$$P > MR = MC$$

Example, still linear demand

$$P(Q) = a - bQ$$

$$R(Q) = P(Q)Q = aQ - bQ^2$$

$$MR(Q) = a - 2bQ$$



# Profit maximization: a more formal analysis

$$\Pi = R - c(Q)$$

First order condition:

$$\frac{\partial \Pi}{\partial Q} = \frac{\partial R(Q)}{\partial Q} - \frac{\partial c(Q)}{\partial Q} = 0 \Rightarrow MR = MC$$

Remind : In competitive market the price is given,  $MR=P$  and the optimal condition is  $P=MR=MC$

The increase in output has a double effect on revenue:

$$\Delta R = P\Delta Q + Q\Delta P$$

Positive effect arisen from selling more

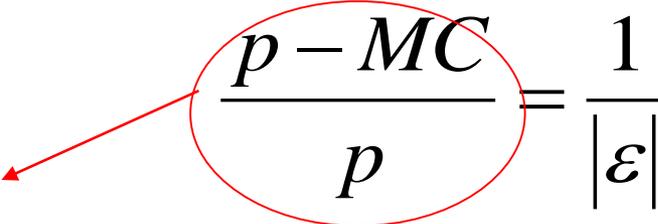
If quantity increases the price needs to decrease and all output is sold at a lower price

But remember!!!! the marginal revenue is equal to:

$$MR = P(Q) \left[ 1 - \frac{1}{|\varepsilon(Q)|} \right]$$

The first order condition  $MR=MC$  becomes:

$$P(Q) \left[ 1 - \frac{1}{|\varepsilon(Q)|} \right] = MC(Q)$$


$$\frac{p - MC}{p} = \frac{1}{|\varepsilon|}$$

**Lerner Index**: measures the market power of the monopolist

If  $|\varepsilon| < 1$   $MR$  is negative then  $MR < MC$



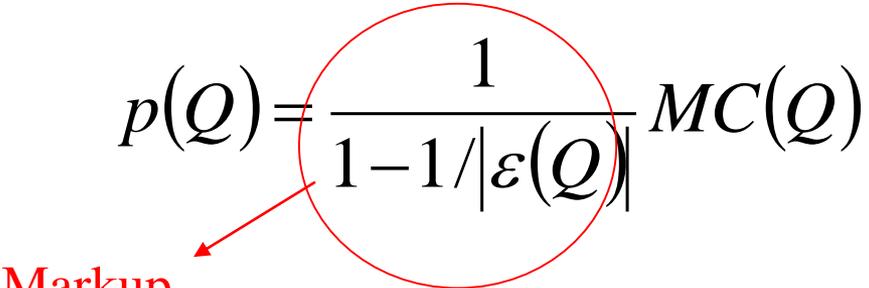
A profit maximizer **Monopolist always produces in the elastic part**

$$|\varepsilon| \geq 1$$

**Intuition:** if it produced in the inelastic part it could reduce quantity and increase its profit: with inelastic demand a small reduction of  $Q$  is obtained by a high increase in  $P$ , this means that it was not maximizing.

The optimal price policy of Monopolist is:

$$p(Q) \left[ 1 - \frac{1}{|\varepsilon(Q)|} \right] = MC(Q)$$

$$p(Q) = \frac{1}{1 - 1/|\varepsilon(Q)|} MC(Q)$$


Markup

Optimal price implies **a markup on marginal cost.**

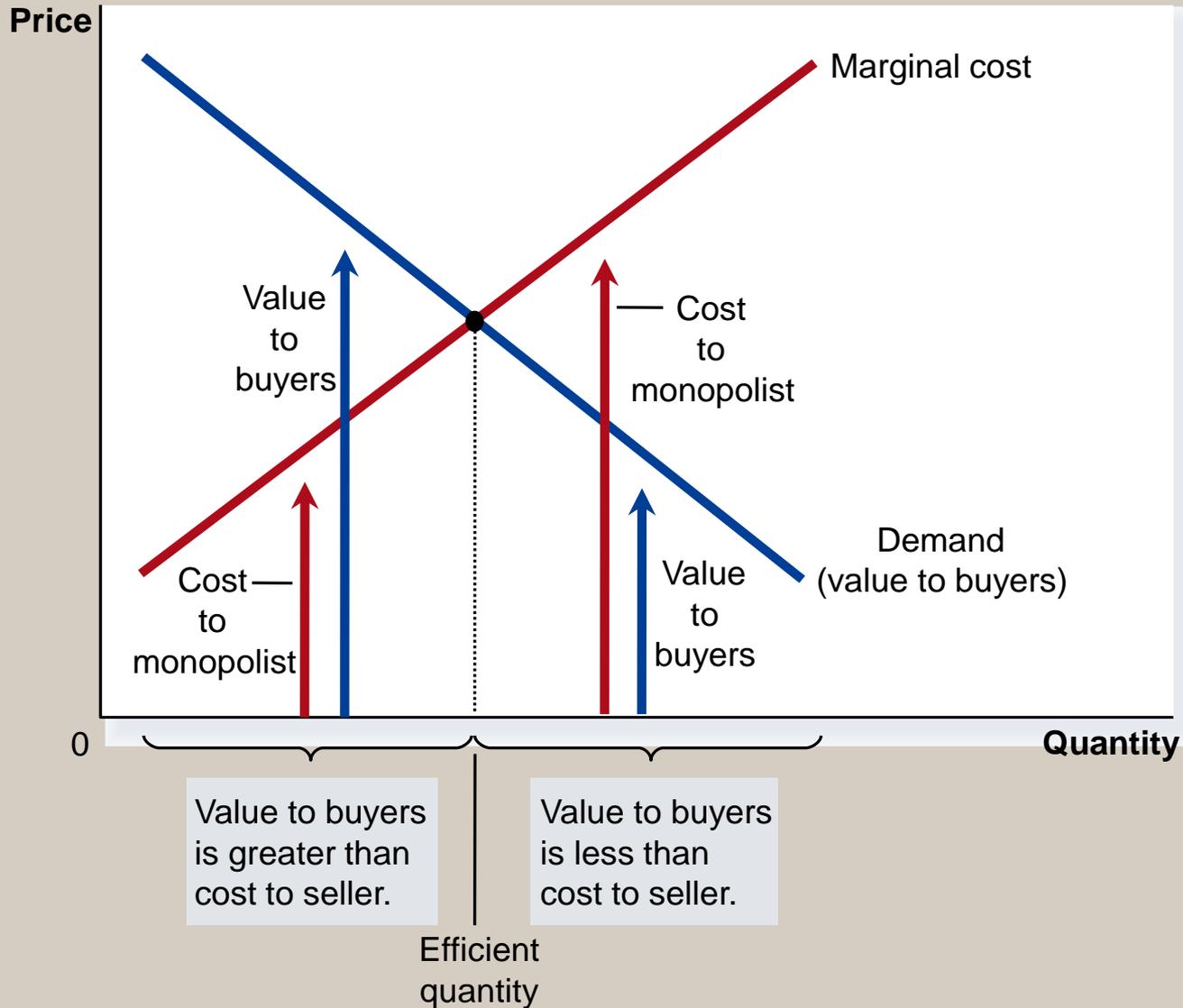
Since monopolist produces in the elastic demand  $|\varepsilon(Q)| > 1$

then the markup is **positive and higher than 1**, then a profit maximizer monopolist charges a **price higher than the marginal cost.**

# THE WELFARE COST OF MONOPOLY

- ▶ In contrast to a competitive firm, the monopoly charges a **price above the marginal cost**.
- ▶ From the standpoint of consumers, this high price makes monopoly undesirable.
- ▶ However, from the standpoint of the owners of the firm, the high price makes monopoly very desirable.

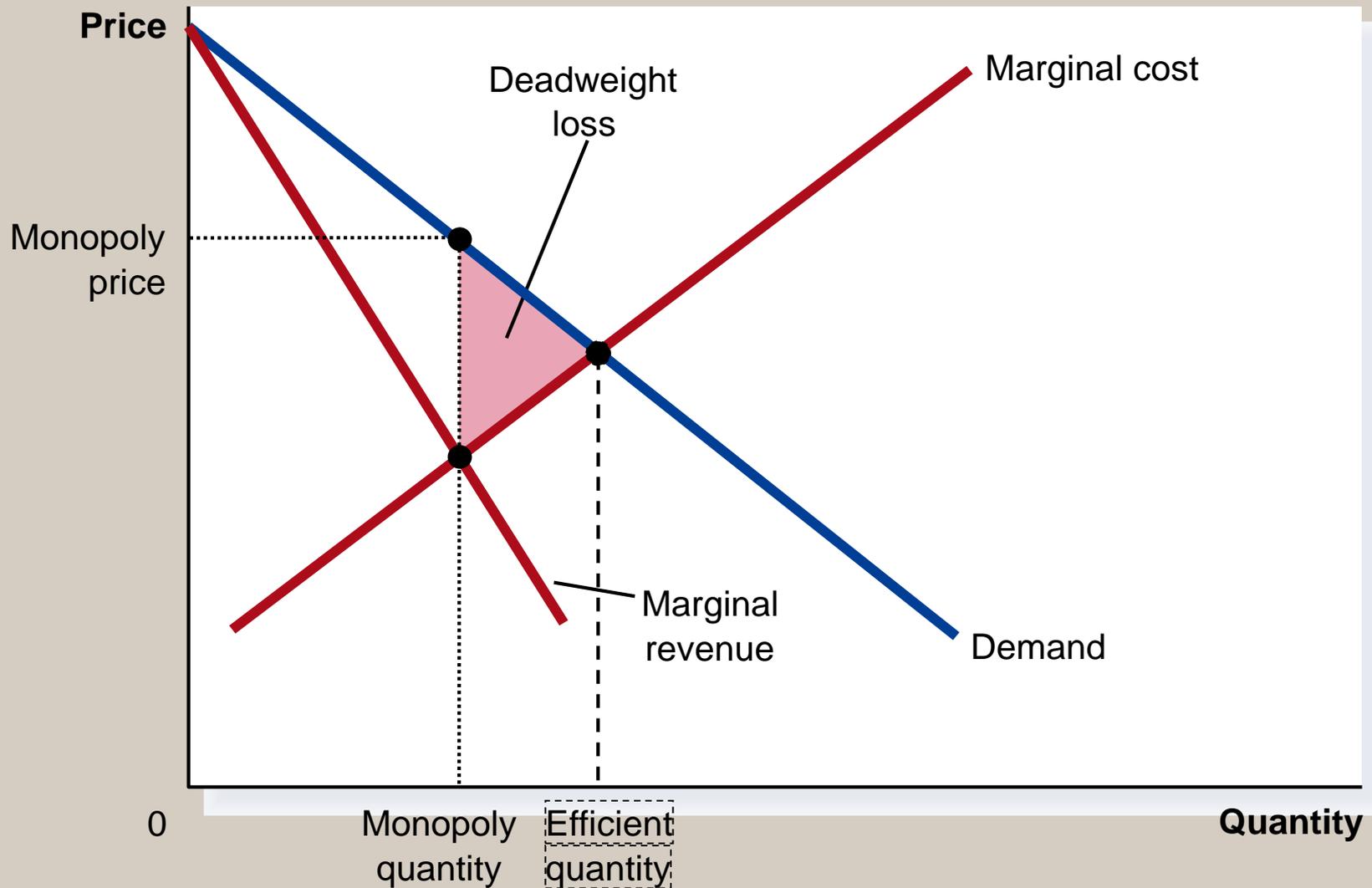
# Figure 7 The Efficient Level of Output



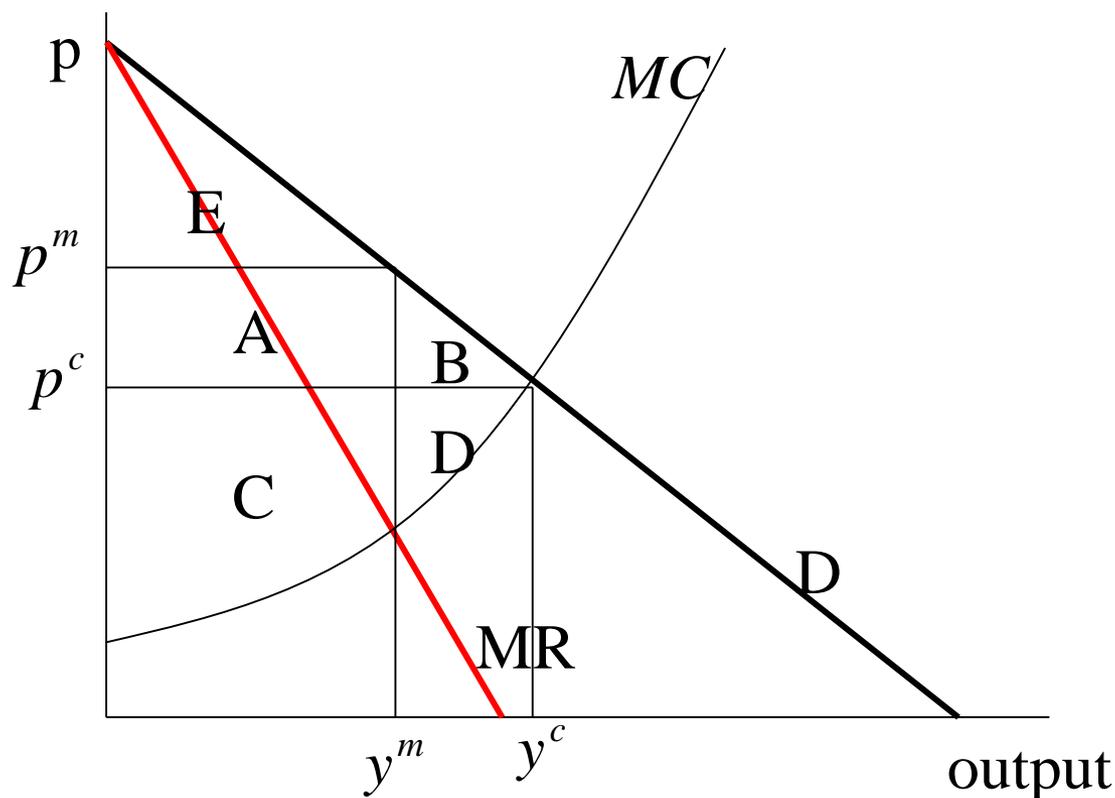
# The Deadweight Loss

- ▶ The Inefficiency of Monopoly
  - The monopolist produces *less than* the socially efficient quantity of output.

# Figure 8 The Inefficiency of Monopoly



Under monopoly **consumers are worse-off** but the **firm is better-off**: what about social welfare?



- Consumer surplus decreases of  $B+A$
- The firm increases its surplus by  $A$  but it loses  $D$  (output previously sold at a price higher than the marginal cost)

- Total Surplus in monopoly is  $SW_m = E + A + C$ , while in competition was  $SW_c = A + B + C + D + E$ , with  $SW_m < SW_c$

the reduction in consumer surplus offsets the increase in the producer surplus: **society as a whole is worse-off**

$B + C$  is the **deadweight loss**,  $B$  is the lost part of the consumer surplus (not going to the producer),  $C$  is the reduction in the producer surplus

*social loss*: it is not redistributed among groups within same economy (society)

# The Deadweight Loss

- ▶ The deadweight loss caused by a **monopoly** is **similar** to the deadweight loss caused by a **tax**.
- ▶ The difference between the two cases is that the government gets the revenue from a tax, whereas a private firm gets the monopoly profit.

# PUBLIC POLICY TOWARD MONOPOLIES

- ▶ Government responds to the problem of monopoly in one of four ways.
  - Making monopolized industries **more competitive**.
  - **Regulating** the behavior of monopolies.
  - **Turning** some private monopolies **into public enterprises**.
  - Doing **nothing** at all (**price discrimination**)

# Increasing Competition with Antitrust Laws

- ▶ Antitrust laws are a collection of statutes aimed at curbing monopoly power.
- ▶ Antitrust laws give government various ways to promote competition.
  - They allow government to **prevent mergers**.
  - They allow government to **break up companies**.
  - They prevent companies from performing activities that make markets less competitive (**dominant position**)

# Increasing Competition with Antitrust Laws

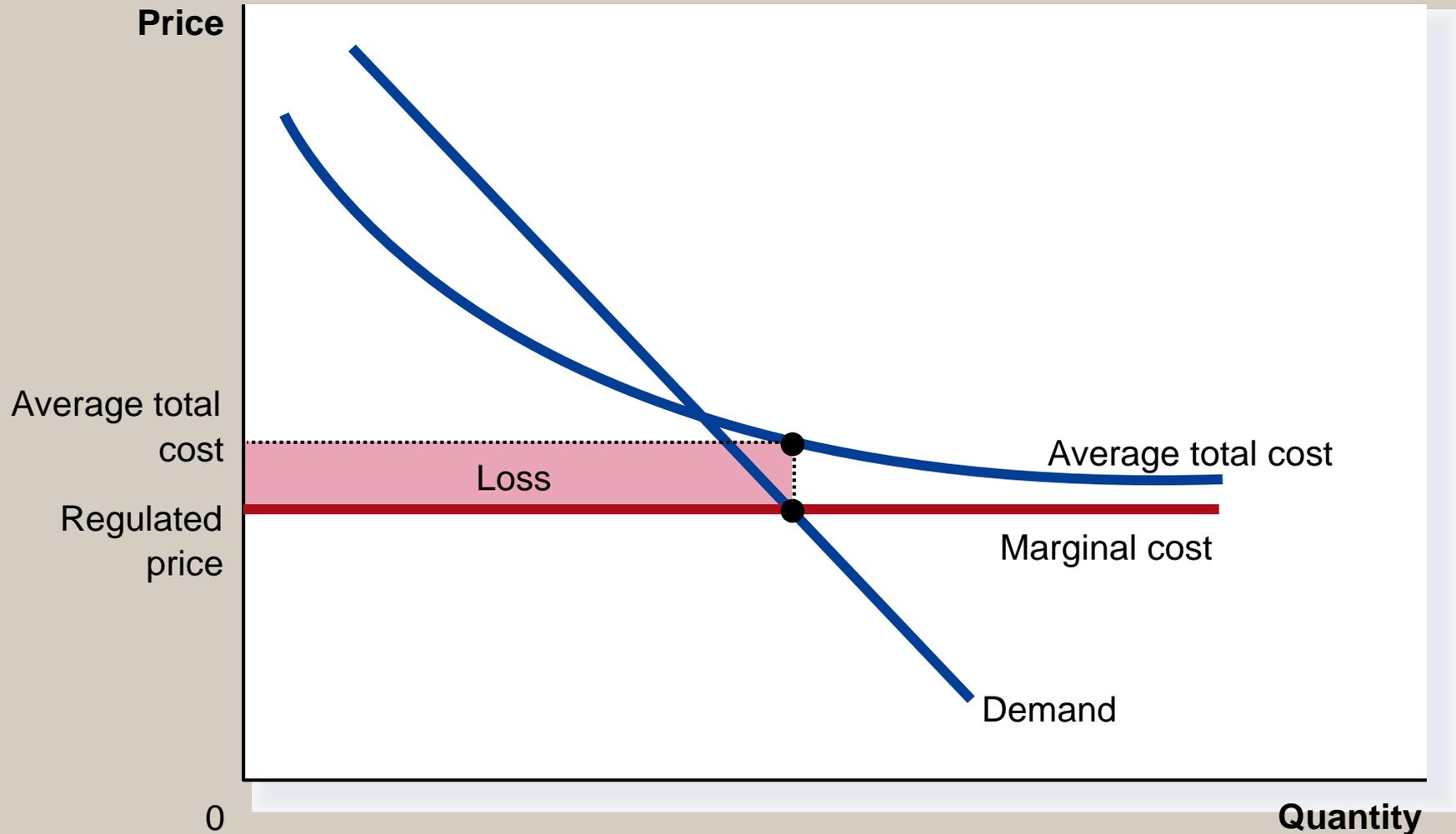
- ▶ Two Important US Antitrust Laws
  - Sherman Antitrust Act (1890)
    - Reduced the market power of the large and powerful “trusts” of that period.
  - Clayton Act (1914)
    - Strengthened the government’s powers and authorized private lawsuits.
- ▶ EU competition commissioner
  - Firms in a **dominant position** may **not abuse** of that position (Article 82 of the EC Treaty).

# Regulation

- ▶ Government may regulate the prices that the monopoly charges.
  - The allocation of resources will be **efficient** if **price is set to equal marginal cost**.

# Regulating Natural Monopoly

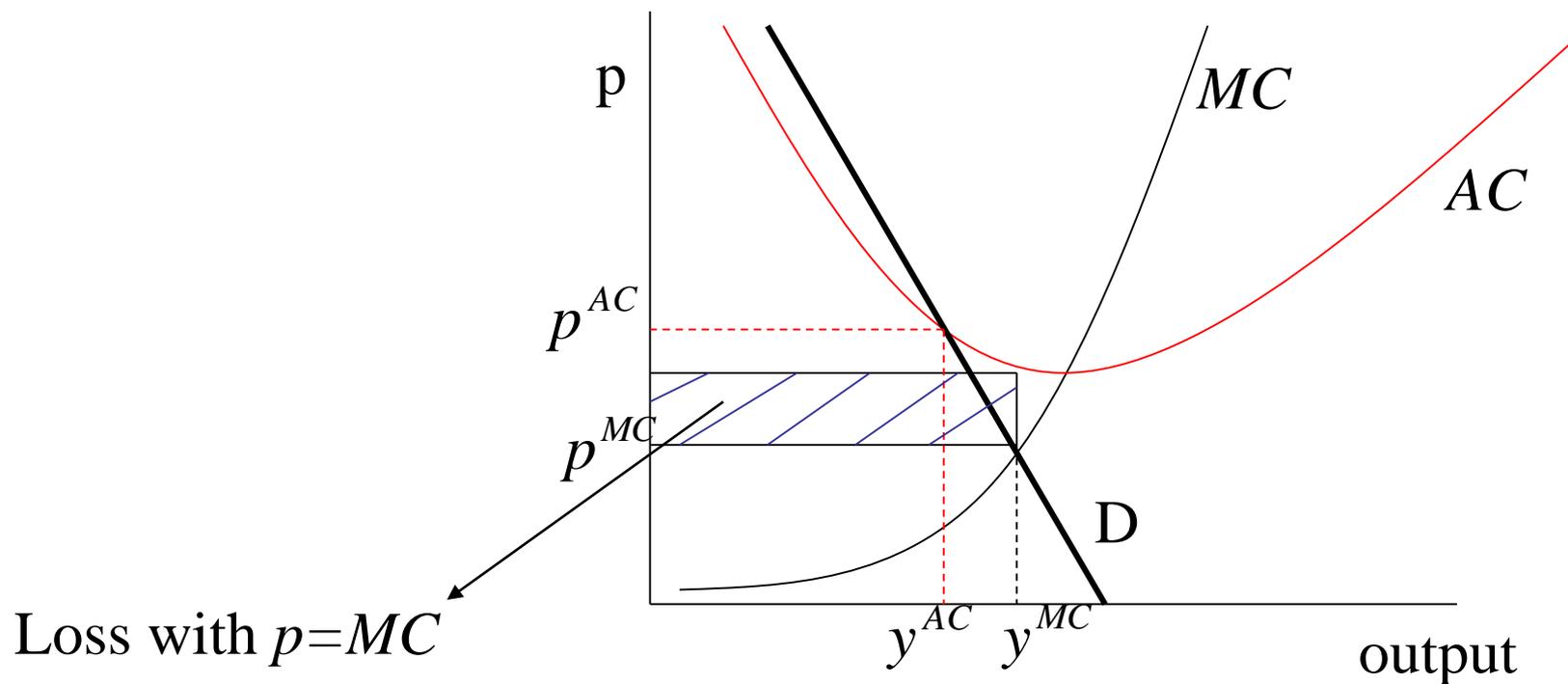
- I. Producing an efficient quantity by charging  $P=MC$  would imply a negative profit



# Regulation

- ▶ In practice, regulators will allow monopolists to keep some of the benefits from lower costs in the form of higher profit, a practice that requires some **departure from marginal-cost pricing**.

II. Producing a quantity with  $P=AC$  would cover the costs but the quantity is lower than the efficient one.



Then, allowing the monopolist to set its optimal price *is not socially efficient*, but imposing  $P = MC$  would induce shutting down, any solutions?

1) sub-optimal pricing (second best) under *private ownership*:

- Regulator accepts that prices must cover costs,  $P=AC$  (USA gas, Italy: electricity, telephone services, mail services)
- *ROR system*
- Imposes  $P=MC$  and allows a *subsidy* to the firm (subway, public bus)

# Public Ownership

- ▶ Rather than regulating a *natural monopoly* that is run by a private firm, the government can run the **monopoly itself**
  - Rare in the United States (Postal Service).
  - In UK very common pre-privatisation;
  - More in continental Europe (i.e. Italy: national railways system (ex Ferrovie dello Stato), Telecommunication Provider (ex SIP)..)