Aalto University
School of Business

Intermediate Microeconomics

Market power

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Fall 2020

ECON-2100

Non-Competitive Market

A company has market power when it can raise its price without losing all of its customers.

Most companies have at least some market power. i.e., demand not fully elastic, i.e., demand curve not horizontal

- Non-strategic pricing:
  behavior of other firms is contained in the demand curve
- Basic pricing aka uniform pricing.
  Set one “take-it-or-leave-it” price for all.

Market Power or Monopoly?

- Monopoly is the only seller in a market.
  Market definition is tricky!
- Price-setting
  - Market power when demand is very elastic or demand curve almost horizontal not very useful
  - How close substitutes are there?
- Market power is often a more useful and less extreme concept.
  How much market power $\approx$ how good available substitutes
- Examples. Soft drink brands, electricity: kWh vs transmission

Basic Pricing with Market Power

- Non-strategic pricing: take demand "left over from competitors" as exogenous
- Demand may be uncertain, but the strategic interdependence of firms' demand curves is not considered
- Strategic pricing
  - Demand curve for a firm depends on what other firms do and firms take each other's actions into account
  - To be covered in Period 2 (oligopoly, game theory)

Profit-maximizing price

Example with linear demand

Data:

Demand $P^d(q) = 200 - 2q$

Costs $\mathrm{TC}(q) = \underbrace{1000}_{\mathrm{FC}} + \underbrace{10q + \frac{1}{2}q^2}_{\mathrm{VC}(q)}$

From data we obtain:

Revenue $\mathrm{TR}(q) = P^d(q)q = 200q - 2q^2$

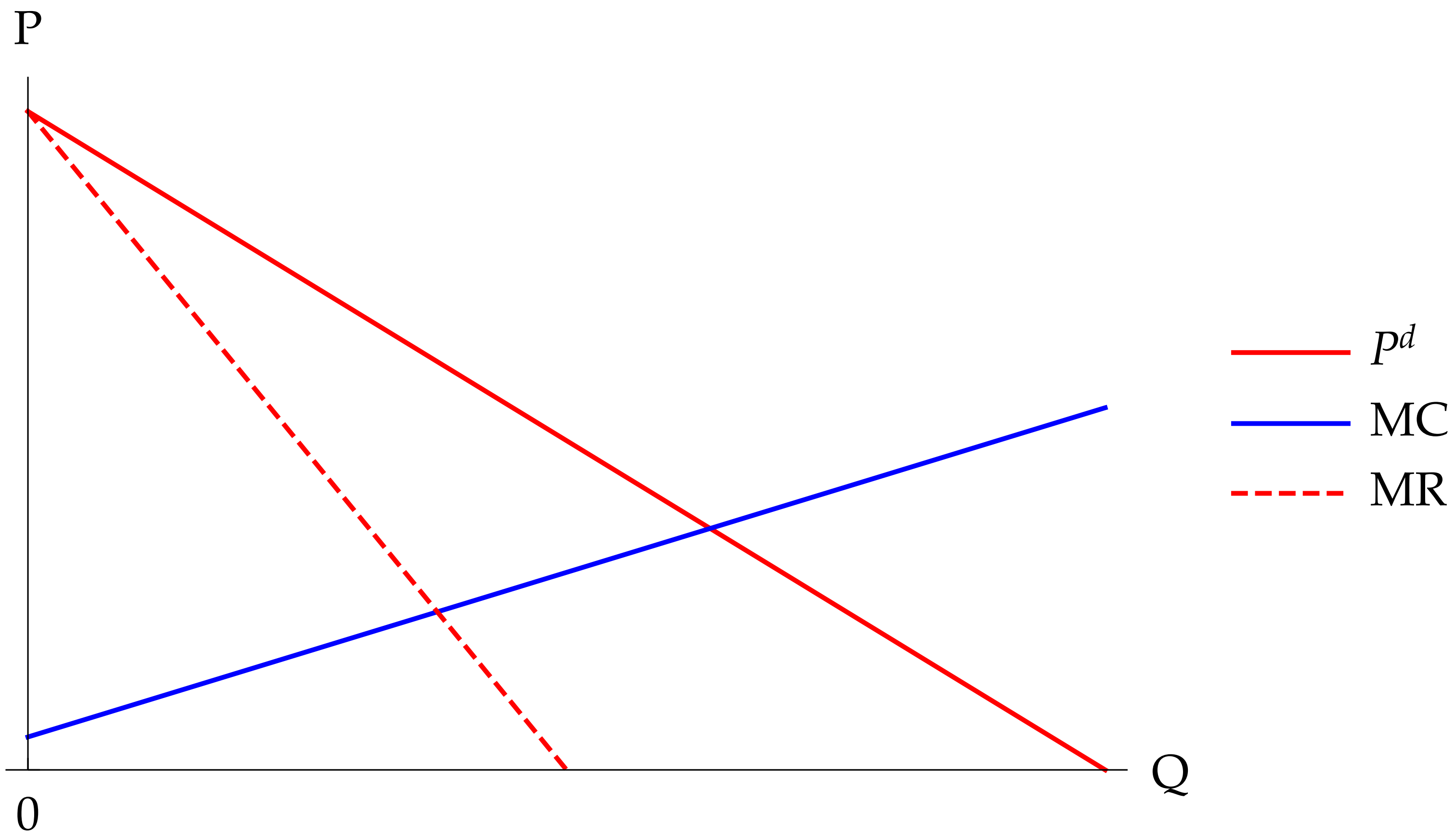
Marginal revenue $\mathrm{MR}(q) = \partial \mathrm{TR}(q)/\partial q = 200 - 4q$

Marginal cost $\mathrm{MC}(q) = \partial \mathrm{TC}(q)/\partial q = 10 + q$

Profit $\Pi(q) = \mathrm{TR}(q) - \mathrm{TC}(q) = \cdots = -\frac{5}{2}q^2 + 190q - 1000$

Profit-maximizing price

Example with linear demand



Profit-maximizing price

Example with linear demand

Profits maximized when $\mathrm{MR} = \mathrm{MC}$

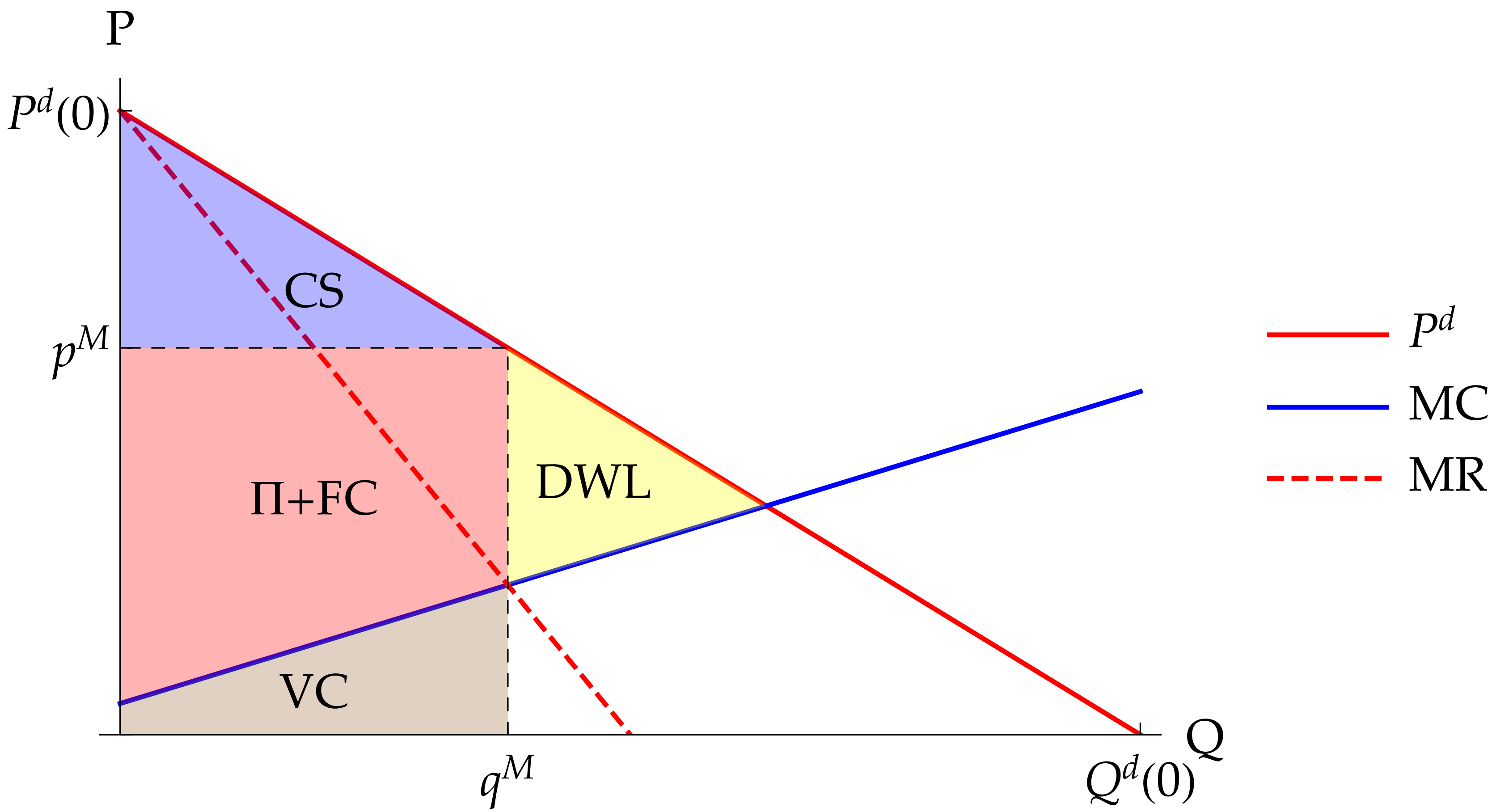
$$200 - 4q = 10 + q \Longrightarrow q^M := 38$$

$$p^M := P^d(q^M) = 200 - 2 \times 38 = 124$$

Profits $\Pi(q^M) =$

$$\underbrace{p^M q^M}_{\mathrm{TR}(q^M)} - \mathrm{TC}(q^M) = 124 \times 38 - (1000 + 10 \times 38 + 0.5 \times 38^2) = 2610$$

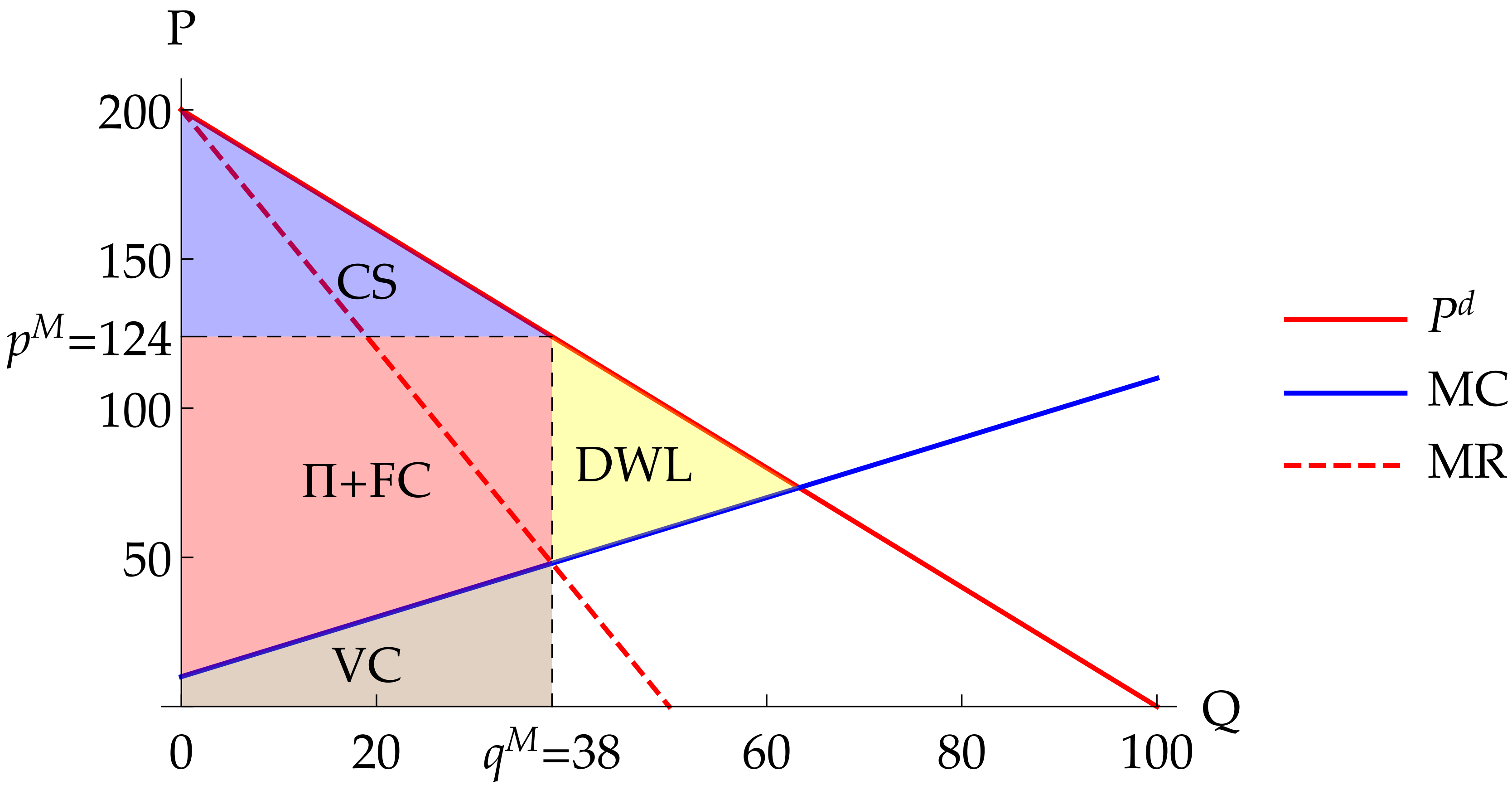
Monopoly pricing and welfare



$$\Pi = p^M q^M - \mathrm{VC} - \mathrm{FC} \implies \Pi + \mathrm{FC} = \mathrm{TR} - \mathrm{VC}$$

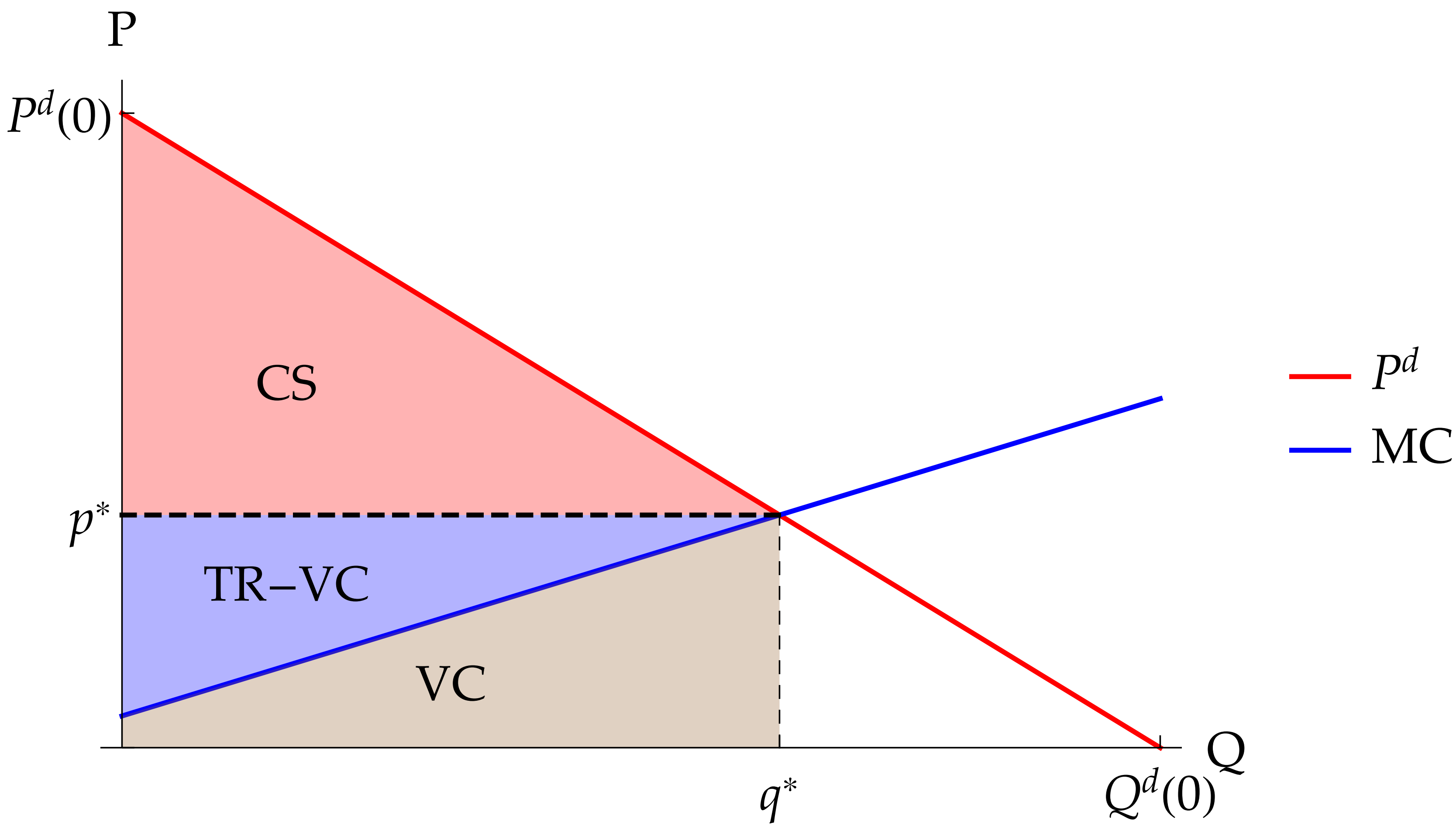
Deadweight Loss (DWL): amount of surplus not realized due to $p > \mathrm{MC}$

Monopoly pricing and welfare



$$\Pi = p^M q^M - \mathrm{VC} - \mathrm{FC} \Longrightarrow \Pi + \mathrm{FC} = \mathrm{TR} - \mathrm{VC}$$

Efficient pricing



Total surplus (Profits + CS) maximized when $P^d(q) = \text{MC}(q) \implies q^*$
…unless FC so high that total surplus negative — in that case, $q^* = 0$

Efficient pricing and Technology

Total costs are increasing in q ($\mathrm{MC} \geq 0$) but marginal costs could be any shape ($\partial MC/\partial q >=< 0$), depending on technology.

If $\partial MC/\partial q < 0$ or if FC is sufficiently high, then efficient pricing would lead to negative profits. We will return to this issue later.

Basic Pricing with Market Power: The 5 Step Plan

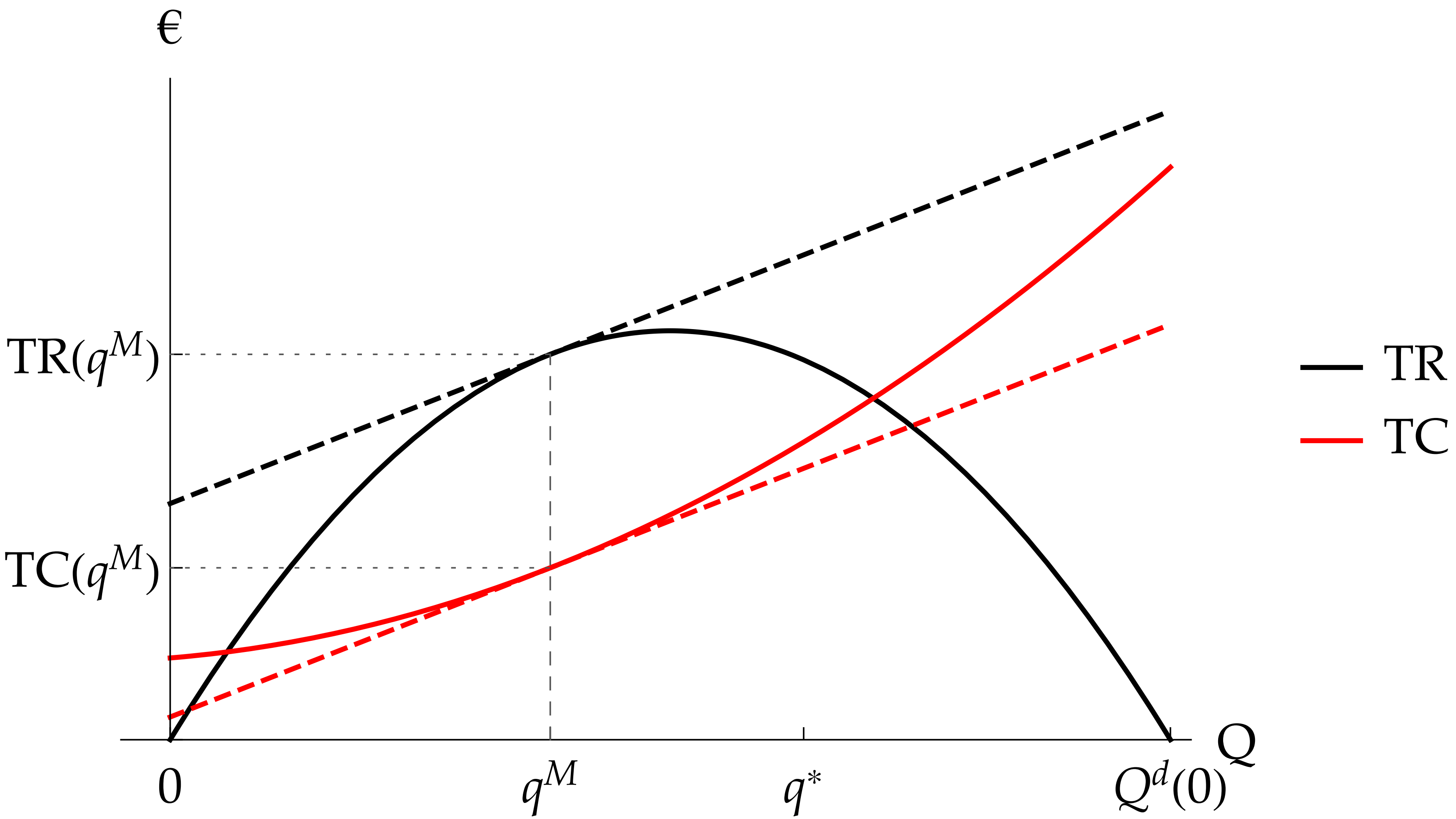
The required data is total costs TC and demand (P^d or Q^d):

Total Revenue $\mathrm{TR}(q) = P^d(q)q$

Profits $\Pi(q) = \mathrm{TR}(q) - \mathrm{TC}(q)$

1. Obtain marginal cost $\mathrm{MC}(q) = \partial \mathrm{TC}(q)/\partial q$
2. Obtain marginal revenue
$$\begin{aligned}\mathrm{MR}(q) &= \partial \mathrm{TR}(q)/\partial q \\ &= (\partial P^d(q)/\partial q) \times q + P^d(q)\end{aligned}$$
3. Choose profit-maximizing quantity:
$$\boxed{\mathrm{MR}(q) = \mathrm{MC}(q)} \implies q^M$$
4. Profit-maximizing price $p^M := P^d(q^M)$
5. Are profits positive? Don't produce anything if $\Pi(q^M) < 0$

Basic pricing rule $\mathrm{MC} = \mathrm{MR}$



Cost and Revenue functions are tangent where their difference is maximized

Basic pricing rule $\mathrm{MC} = \mathrm{MR}$

Discrete intuition: You are currently selling 50 widgets per week at $P =$ €1000, while $MC =$ €600.

What happens if you want to sell one more widget per week?

1. Increase in cost of $MC = 600$
2. To sell more you have to lower the price (P^d reveals, say, to 990)
3. Change in revenue MR has two components:
   - Sell one more unit $(+)$
   - Get lower price on all units that would have sold at old price $(-)$

   $$MR = 990 - 50 \times (1000 - 990) = 990 - 500 = 490$$
4. $MR < MC \implies$ profits would decrease. Not a good idea!

Elasticity and Pricing

Encounter inelastic demand $\longrightarrow$ Raise price until no longer do

From the definition of price elasticity of demand:

$$\frac{\mathrm{d}R}{R} = \frac{\mathrm{d}P}{P}(1+\varepsilon^d)$$

For example, if $\varepsilon^d = -0.5$ then

- 1% price hike changes revenue by about $(1\%) \times (1-0.5) = +0.5\%$
- Any price rise will surely lower costs, as quantity sold is reduced

$\longrightarrow$ Profit = (Revenue - Costs) will surely increase

Elasticity and Pricing

The Mark-Up Rule of Pricing

Suppose you only know elasticity of demand ε^d and MC

The rule of thumb for profit-maximizing price: Set P such that

$$\underbrace{\frac{P - \mathrm{MC}}{P}}_{\text{mark-up}} = -\frac{1}{\varepsilon^d} \Longrightarrow P = \frac{\mathrm{MC}}{1 + \frac{1}{\varepsilon^d}}$$

Single numbers ε^d and (maybe also MC) are approximations.

What to do if the mark-up rule suggests a large change in price?

Example. $\mathrm{MC} = 10$ and $\varepsilon^d = -1.8$.

Mark-up formula suggests $P = 10/(1 - 1/1.8) = 22.5$

Elasticity and Pricing

The Mark-Up Rule of Pricing: Where does it come from?

Profits are $P \times Q - \mathrm{TC}$

Total differential wrt Q is $P \times \mathrm{d}Q + \mathrm{d}P \times Q - \mathrm{MC}\mathrm{d}Q$
At the level of Q where profits are maximized, this must be zero.
Let's divide it by $\mathrm{d}Q$ and set equal to zero:

$$P + \frac{\mathrm{d}P}{\mathrm{d}Q} Q - \mathrm{MC} = 0$$

Rearrange the definition $\varepsilon^d = \frac{\mathrm{d}Q}{Q} / \frac{\mathrm{d}P}{P}$ to obtain $\frac{\mathrm{d}P}{\mathrm{d}Q} = \frac{P}{Q\varepsilon^d}$, insert

$$P + \frac{P}{\varepsilon^d} - \mathrm{MC} = 0 \Longrightarrow P = \frac{\mathrm{MC}}{1 + \frac{1}{\varepsilon^d}}$$

Whence monopoly?

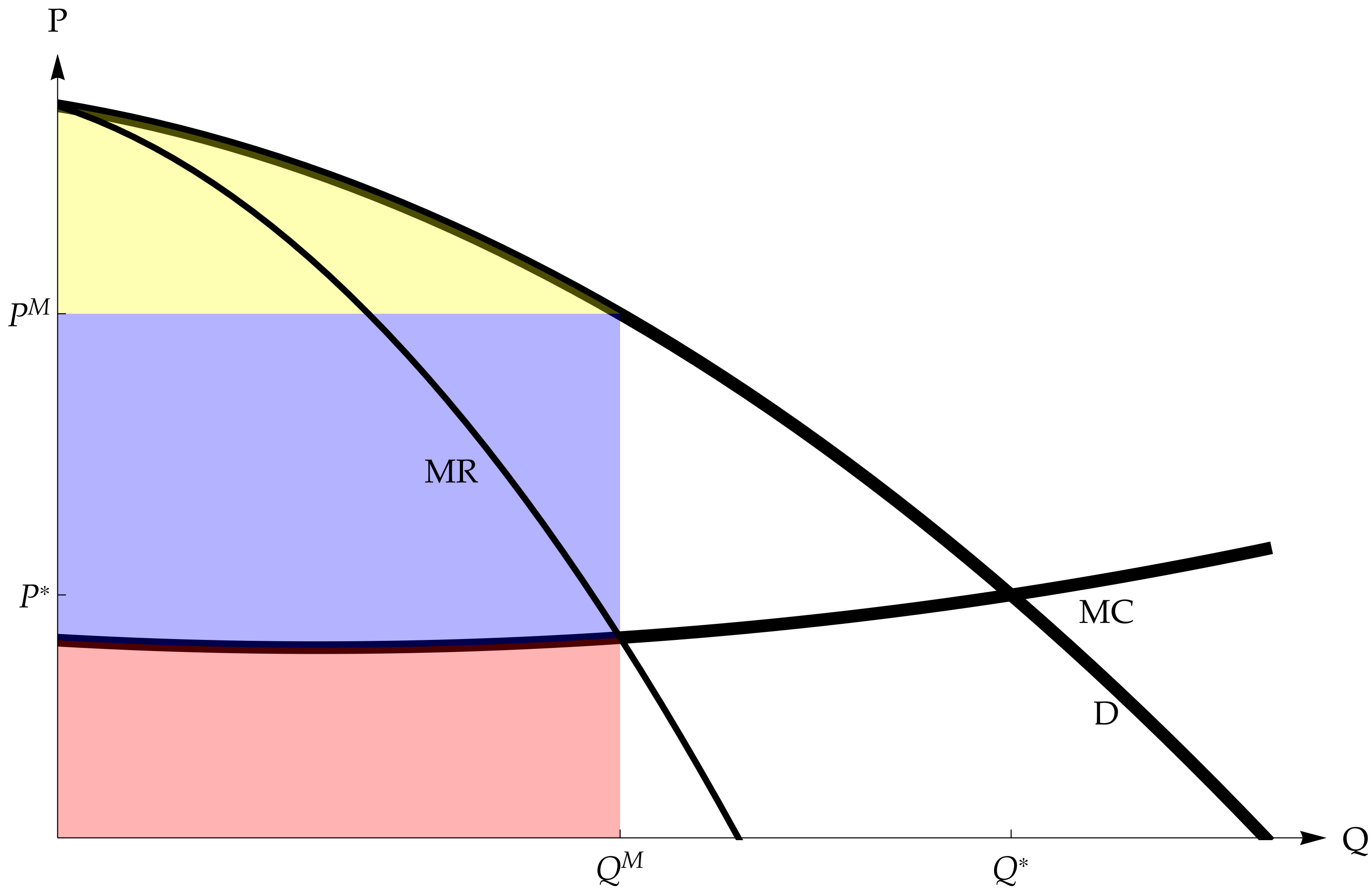
Where does long-lasting monopoly come from?

- Very large economies of scale: high fixed cost / low marginal cost (Natural monopoly)
- Very large competitive advantage
- Control of a unique resource
- Network good with a large customer base
- Patent or copyright
- Legal restrictions, lobbying
- Aggressive M&A strategy (?)

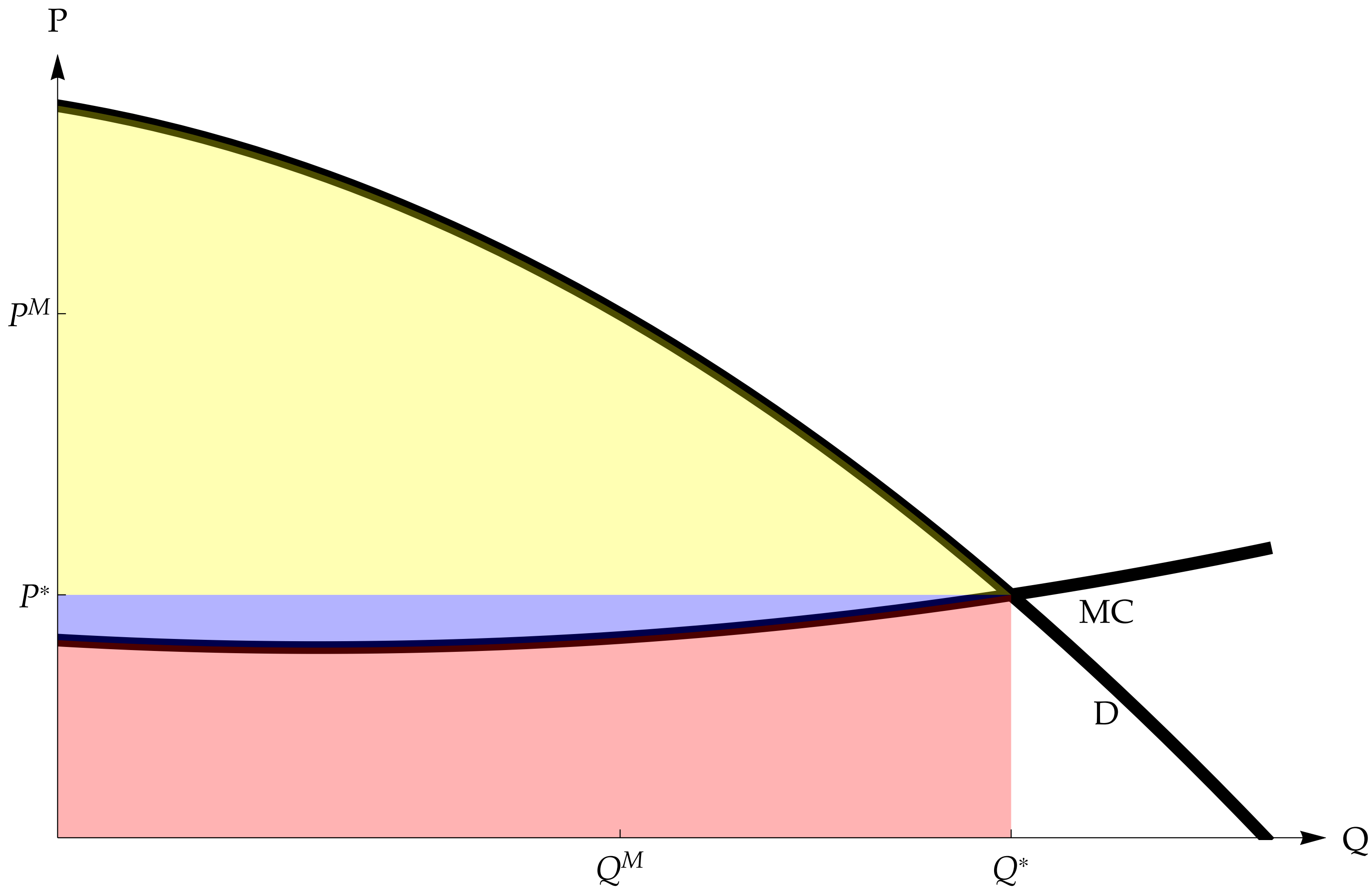
Monopoly price regulation

- Price below monopoly price could increase total surplus
- Marginal cost pricing would be efficient, but would often lead to losses and exit
- Average cost pricing allows monopolist to break even
- Problems
  - Extensive informational requirements for the regulator
    Hard to know the cost structure, too low a price cap causes exit
  - Alternatives:
    - Cost-plus regulation incentivizes high costs
    - Rate-of-return regulation incentivizes either excessive or low investment, unless rate exactly right
  - Regulatory capture

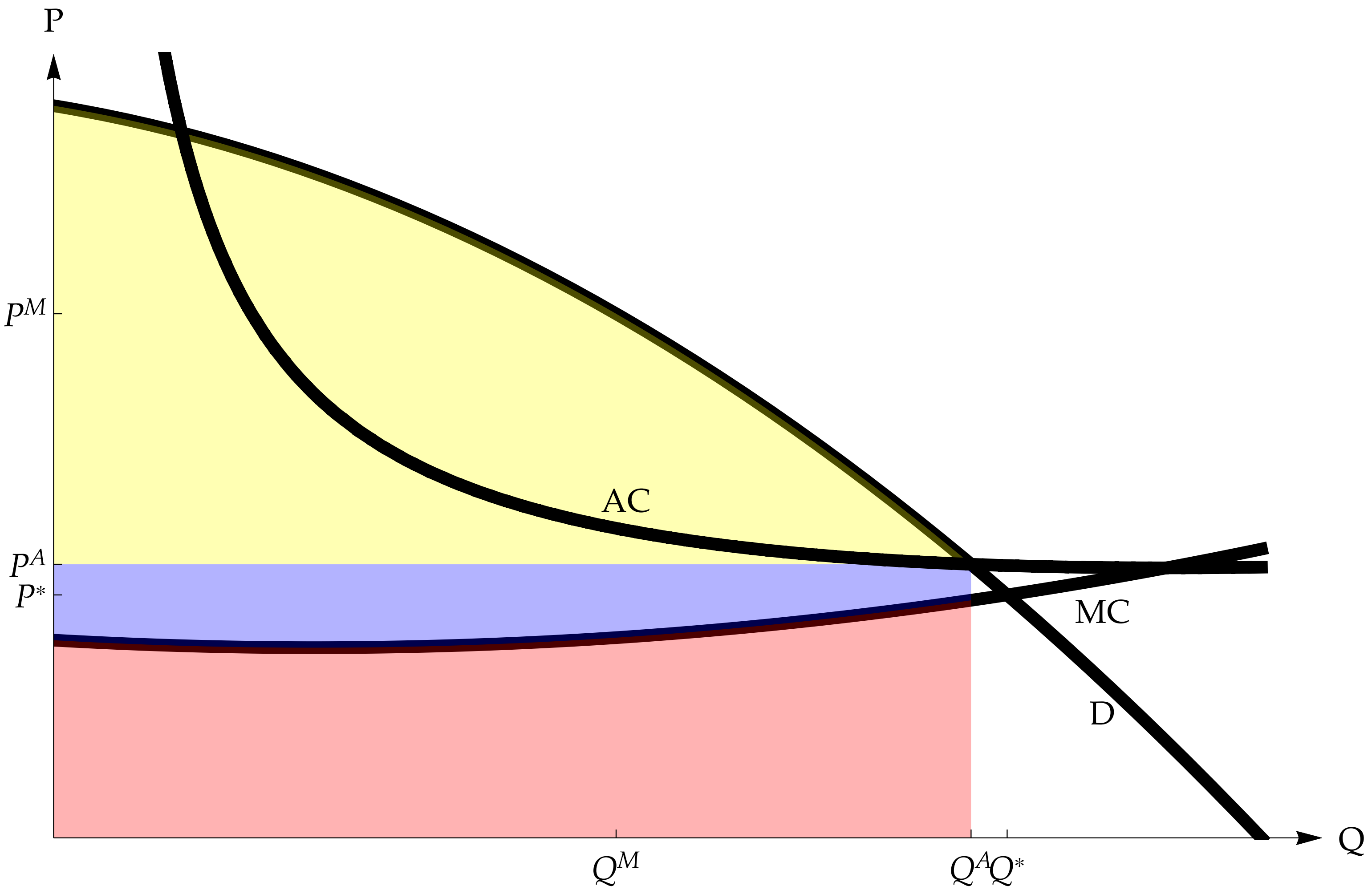
Monopoly: Profit-Maximizing



Monopoly: Marginal Cost Pricing



Monopoly: Average Cost Pricing



Monopsony

Market with only one buyer, analogous to monopoly

- Monopsony limits its purchases to keep the price low
- Monposonist price < competitive price
- Results DWL. Larger “buyer surplus” CS, smaller PS
- Monopsonists’ optimization: MB = ME
  (Marginal Benefit = Marginal Expenditure)

$$P^d(q) = \frac{\partial P^s(q)q}{\partial q}$$

Monopsony pricing: Example

Buyer demand $P^d(q) = 50 - 2q \quad$ (Marginal Benefit)

Competitive supply $P^s(q) = 10 + q$

Marginal Expenditure $ME(q) = \frac{\partial P^s(q)q}{\partial q} = \frac{\partial}{\partial q}(10q + q^2) = 10 + 2q$

Efficient price would satisfy

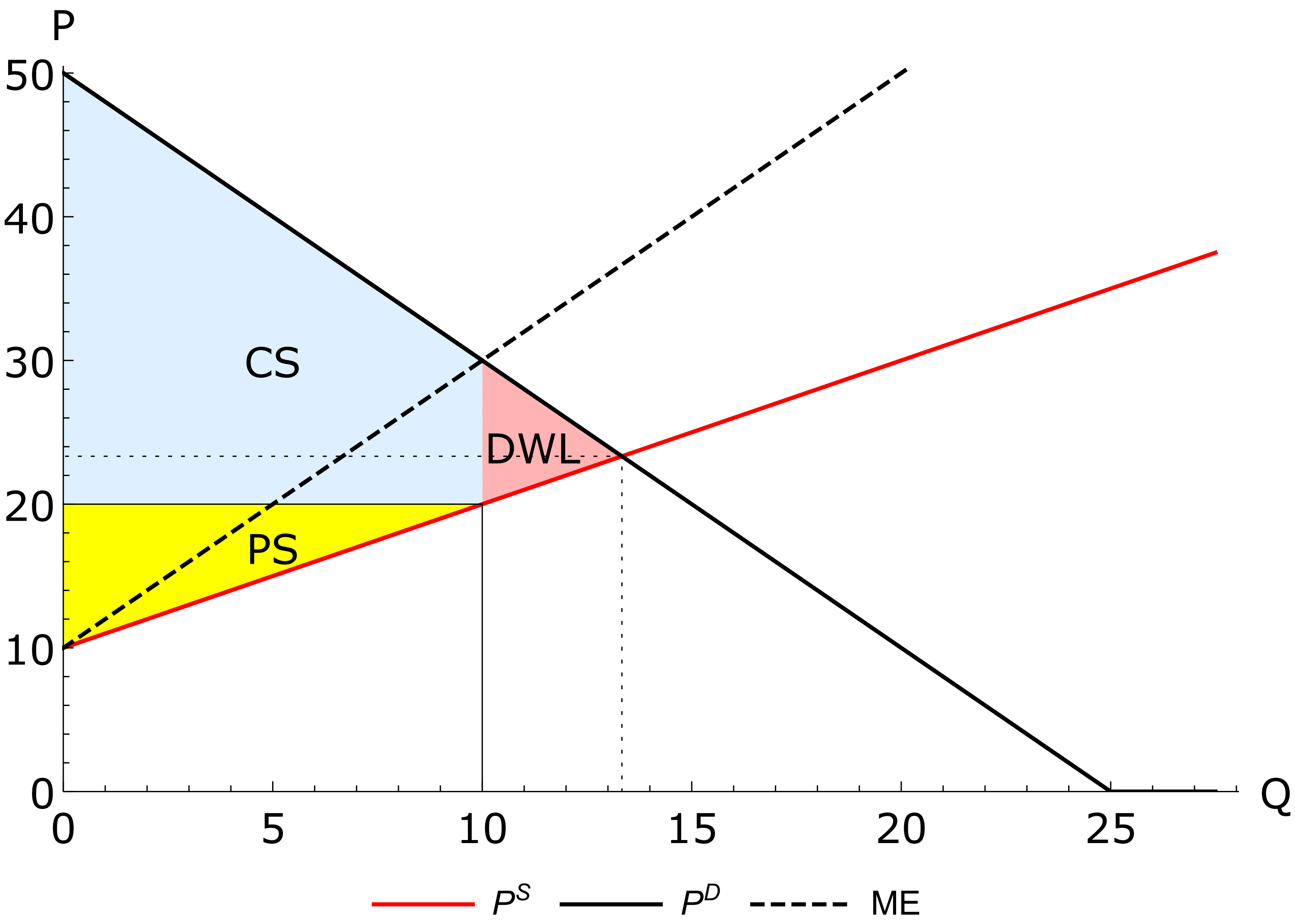
$P^d(q) = P^s(q) \Longrightarrow q^* = 13.3, p^* = 23.3$

Monopsony sets $MB = ME$

$50 - 2q = 10 + 2q \Longrightarrow q^m := 10$

$p^m = p^s(q^m) = 20$

Monopsony pricing



Price customization

Pricing by customer group / market segment

- If market can be segmented to groups with different elasticities of demand, then profits higher if they are charged different prices
- How could segmentation be possible?
  - Geographically separated markets
  - Targeted distribution channels
  - Targeting via different brands for essentially the same product
  - Discount IDs, e.g. students, senior citizens
- If secondary market gets too big it defeats price customization

This is the simplest pricing strategy beyond uniform pricing

Set $\mathrm{MR}_g = \mathrm{MC}$ for every group g

Price customization

- If customer groups differ by demand they differ by $\mathrm{MR} \rightarrow$ profit-maximizing prices differ
- A firm's MC depends on its total output q
  Pricing decisions interact via their impact on MC
- With two groups, optimal customized prices from

$$\mathrm{MR}_1(q_1) = \mathrm{MC}(q_1 + q_2)$$
$$\mathrm{MR}_2(q_2) = \mathrm{MC}(q_1 + q_2)$$

  Solve for $q_A^m, q_B^m \Longrightarrow p_g^m = P_g(q_g^m)$
- If MC constant then pricing problems separate by group

Price customization: Example

Demand

$$P_A(q) = 100 - 4q$$

$$P_B(q) = 120 - 3q$$

Costs

$$\mathrm{TC}(q) = 1200 + 2q + (1/4)q^2$$

Marginal revenue by group

$$MR_A(q) = \frac{\partial P_A(q)q}{\partial q} = \frac{\partial}{\partial q}(100q - 4q^2) = 100 - 8q$$

$$MR_B(q) = \frac{\partial P_B(q)q}{\partial q} = \frac{\partial}{\partial q}(120q - 3q^2) = 120 - 6q$$

Marginal Cost

$$\mathrm{MC}(q) = \frac{\partial \mathrm{TC}(q)q}{\partial q} = 2 + \frac{1}{2}q$$

Price customization: Example

Solve the pair of equations $\mathrm{MR}_g(q_g) = \mathrm{MC}(q)$, where $q = q_A + q_B$

$$100 - 8q_A = 2 + \frac{1}{2}(q_A + q_B)$$
$$120 - 6q_B = 2 + \frac{1}{2}(q_A + q_B)$$

Two equations, two unknowns. Solution:

$q_A^m = 10.51, q_B^m = 17.35 \Longrightarrow$

$p_A^m = P_A(q_A^m) \approx 58, P_B(q_B^m) = p_B^m \approx 68$

Less elastic group ends up paying a higher price.