Integrated course „Energy Economics“
- Microeconomics: basic concepts -

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Outline

- Economics and particularities of energy sector
- Supply and demand
- Welfare effect of markets
- Tax effect – deadweight loss
- Price elasticity
- Costs terminology
- Pricing in competitive markets
- Pricing in monopoly
- Cournot competition

Price elasticity

Elasticity is a measure of how much buyers and sellers respond to changes in market conditions (e.g. prices – price elasticity).

Price elasticity of demand is a measure of how much the quantity demanded of a good responds to a change in the price of that good.

$$\text{Price elasticity of demand} = \frac{\text{\% change in quantity demanded}}{\text{\% change in price}}$$

$$\eta_{P,Q} = \frac{dQ}{dP} \cdot \frac{P}{Q}$$

Price elasticity (continued)

$-1 < \eta_{p,Q} \leq 0$	inelastic demand
$-\infty < \eta_{p,Q} \leq -1$	elastic demand
$\eta_{p,Q} = -1$	if price increases by 1%, demand decreases by 1%

Convention to operate with absolute values $|\eta_{p,Q}|$:

$\eta_{p,Q} > 1$	elastic demand
$0 \leq \eta_{p,Q} \leq 1$	inelastic demand

Price elasticity of demand: Electricity

Demand for electricity is largely inelastic.

General reasons for inelastic demand (0 – 1):

- Buyers do not perceive the price changes
- Switching to alternative products (substitutes) is cumbersome
- Lack of substitutes

- Time:

Goods tend to have more elastic demand over longer time horizons

Task 2) Price elasticity

The price for electricity is 0.2 €/kWh. The demand function of a private household (per month) is given by:

Demand $q_{Di}(p) = 625 - 625p$ *q [kWh], p [€/kWh]*

a) How much electricity does the single household consume per month? How much does it pay?

$Q_D\ (p = 0{,}2\ €/kWh) = 625 - 625 \cdot 0{,}2 = 500\,kWh$

$C = p \cdot Q_D = 500\,kWh \cdot 0{,}2\ €/kWh = 100\,€$

Task 2) Price elasticity

The price for electricity is 0.2 €/kWh. The demand function of a private household (per month) is given by:

Demand $q_{Di}(p) = 625 - 625p$ *q [kWh], p [€/kWh]*

b) What is the price elasticity at this point? Is it elastic or inelastic?

$$\eta_{P,Q} = \frac{dQ}{dP} \cdot \frac{P}{Q}$$

Elasticity

$0 < \eta < 1$ inelastic

$1 < \eta < \infty$ elastic

$$\frac{dQ}{dp} = -625$$

$$\eta = -625 \cdot \frac{0,2}{500} = -0,25$$

$\Rightarrow$ inelastic

Task 2) Price elasticity

The price for electricity is 0.2 €/kWh. The demand function of a private household (per month) is given by:

Demand $q_{Di}(p) = 625 - 625p$ *q [kWh], p [€/kWh]*

c) How will the single household react if price doubles? How do demand, price and price elasticity change?

$Q_{D,2}\left(p = 0{,}4 \frac{€}{kWh}\right) = 625 - 625 \cdot 0{,}4 = 375\,kWh$

$C_2 = 150\,€$

$\varepsilon_2 = -625 \cdot \frac{0{,}4}{375} = -0{,}67$

still inelastic, but a little more elastic

Supply side: Cost of production

The price at which a seller is willing to sell their goods is determined by their cost of production:

- explicit cost: out-of-pocket expenses - money actually paid
- opportunity cost: potential benefit or income that is foregone as a result of selecting one alternative over another

Terms and definitions of cost accounting

- **Fixed Costs** are the share of the total costs that do not change with a variation of the produced quantity

- **Variable Costs** are the share of the total costs that do change with a variation of the produced quantity

- **Total Costs** are the sum of fixed and variable costs

Terms and definitions of cost accounting (continued)

- **Average costs** are total cost per unit: TC divided by the produced quantity Q.
- **Marginal costs** are costs incurred for producing one additional unit of production volume.
- **Contribution margin** is selling price minus variable cost per unit.

Terms and definitions of cost accounting

- **Fixed Costs** are the share of the total costs that do not change with a variation of the produced quantity
- **Variable Costs** are the share of the total costs that do change with a variation of the produced quantity
- **Total Costs** are the sum of fixed and variable costs
- **Average Costs** are the total costs C divided by the produced quantity Q
- **Contribution margin** is price minus variable costs
- **Marginal Costs** are the costs that incur due to an increase of the produced quantity by one

Total cost consideration

	A	B	C
Turnover	800	500	700
Variable Cost	350	150	400
Fixed Cost	150	150	500
Total Cost	500	300	900
Operating income	300	200	- 200
Overall outcome		**300**	

Total cost consideration without product C

	A	B	C
Turnover	800	500	0
Variable Cost	350	150	0
Fixed Cost	150	150	500
Total Cost	500	300	500
Operating income	300	200	- 500
Overall outcome		**0**	

Variable cost

	A	B	C
Turnover	800	500	700
Variable Cost	350	150	400
Contribution margin	450	350	300
Total contribution margin		1100	
Fixed cost		800	
Overall outcome		**300**	

Cost considerations

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short term it's better to partly cover fixed cost instead of stopping production

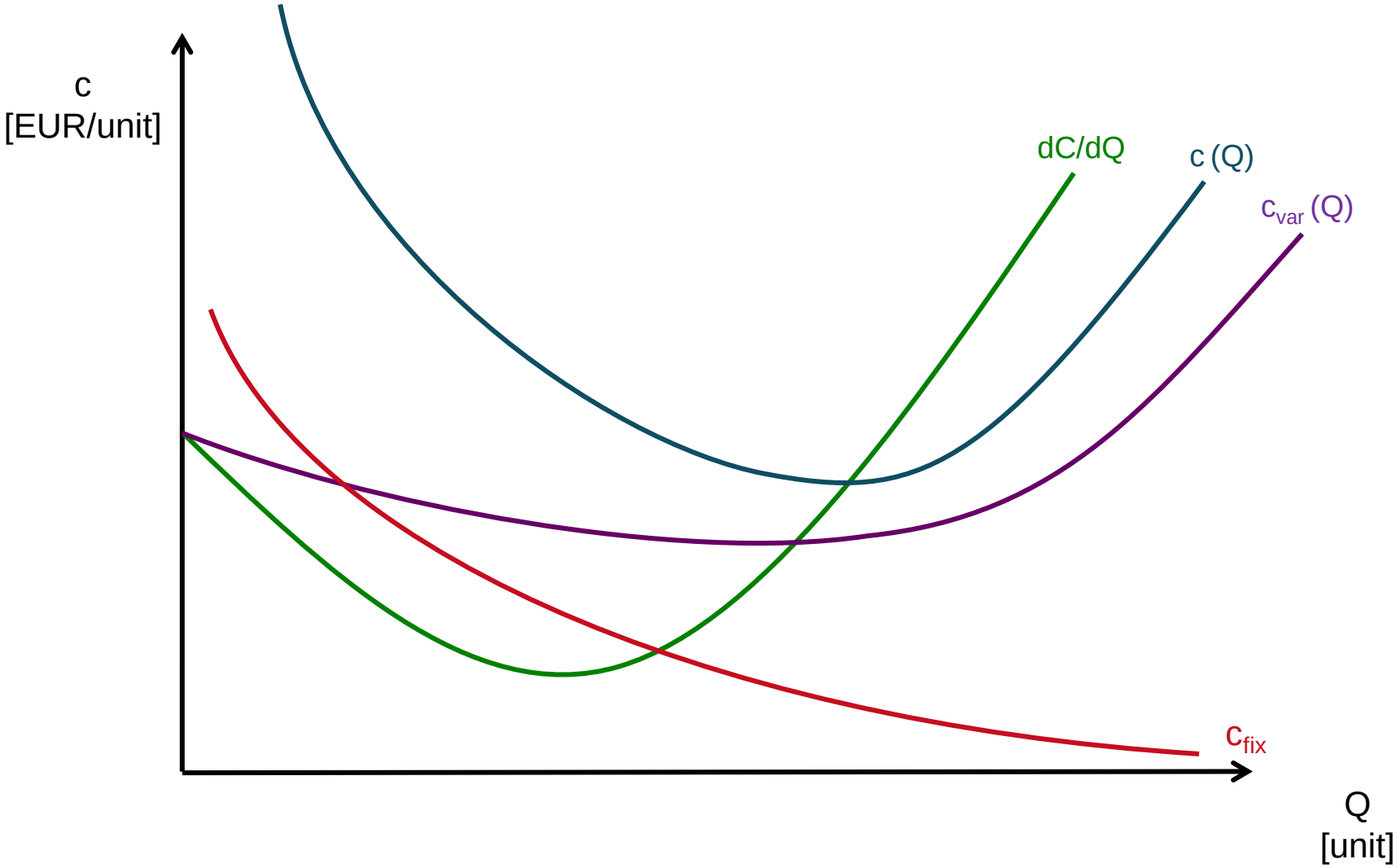
→ fixed cost remain a cost item

→ variable cost can change in the short term (gas, oil, etc.)

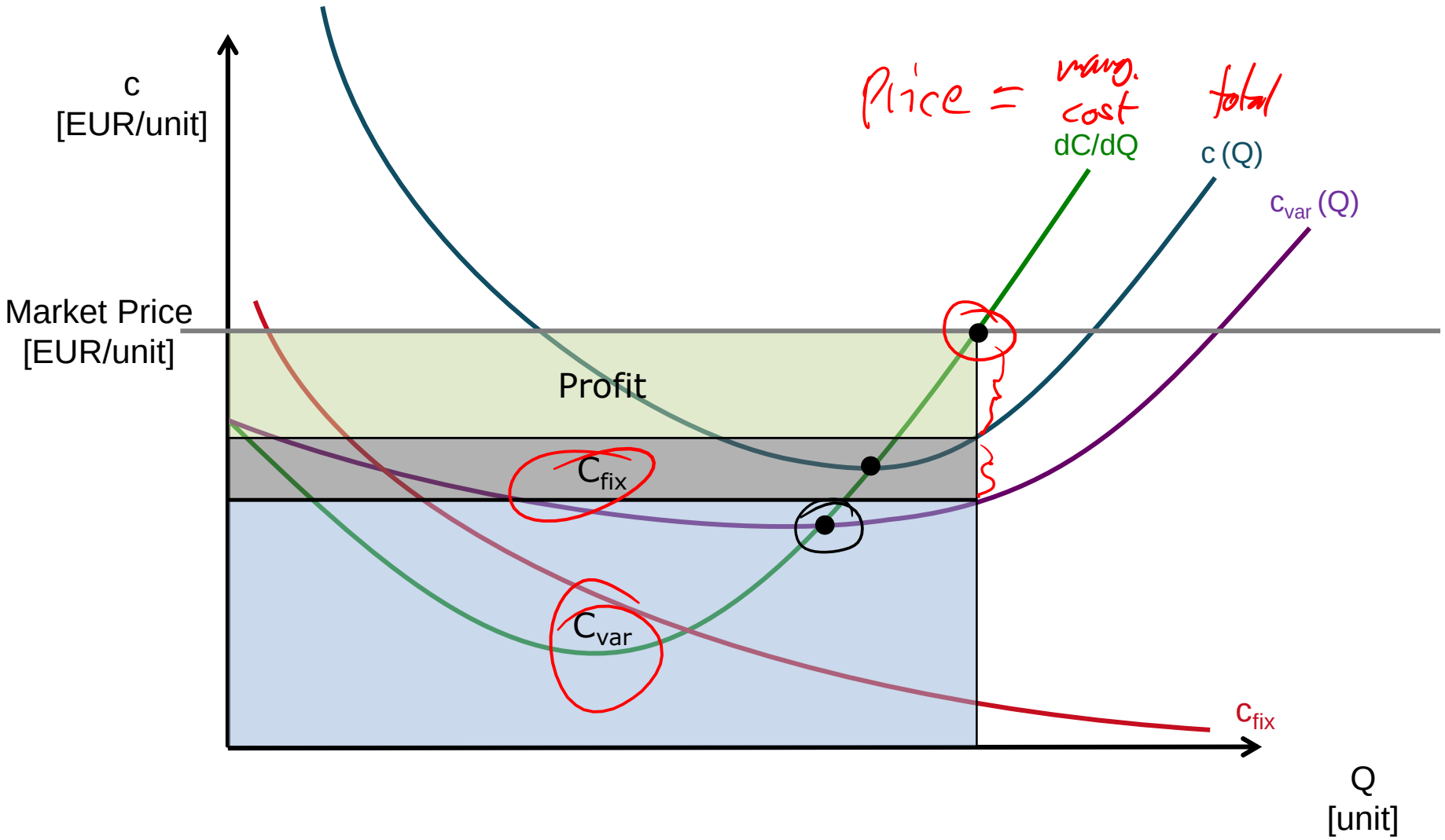
⇒ difference of income and variable cost is positive

⇒ contribution margin is positive

Cubic cost structure – cost structure



Cubic cost structure – conclusions for a price taker



Market structures - 1

Market is a group of sellers and a group of buyers of a particular good or service.

Perfect competition:

- many buyers and many sellers > cannot influence the price
- goods at exactly the same (homogeneous)
- consumers have perfect information
- no entry or exit barriers

Monopoly:

- seller is the sole producer and can influence the price of its output

Market power is the ability to maintain a price above the price under competition.

Market structures - 2

Cournot oligopoly:

- More than one firm
- All firms produce one homogeneous product (no product differentiation)
- No cooperation among firms (no collusion)
- Firms have market power - each firm's output decision affects the good's price
- Fixed number of firms
- Firms compete in quantities, and choose them simultaneously
- Economically rational and strategically acting firms, seeking to maximize profit given their competitors' decisions

Supply and pricing – profit maximization of the firm

"profit" = "revenues" – "costs" $\Pi = R - C$

$$\frac{d\Pi}{dQ} = \frac{d(p \cdot Q)}{dQ} - \frac{dC}{dQ} = 0$$

Π	Profit (per period)
p	Sales price
Q	Output (Quantity)
C	Production costs

$\Pi = p \cdot Q - C$

Competitive markets

$$p = \frac{dC}{dQ} \longrightarrow$$ „Marginal cost = Price rule“

Monopoly markets

$$\frac{dC}{dQ} = \frac{d(p \cdot Q)}{dQ} \longrightarrow$$ „Marginal costs = marginal revenue rule“

Perfect competition - pricing

$$\pi = R - C = p \cdot Q - C$$

Which quantity maximizes profits?

$$\Rightarrow \frac{d\pi}{dQ} = \frac{d}{dQ}(p \cdot Q - C) \overset{!}{=} 0$$

$$= \frac{d}{dQ}(p \cdot Q) - \frac{dC}{dQ} = \underbrace{p \cdot \frac{dQ}{dQ}}_{=1} + \underbrace{Q \cdot \frac{dp}{dQ}}_{=0} - \frac{dC}{dQ}$$

$$= p - \frac{dC}{dQ} = 0 \Rightarrow$$

perfect comp.

$$\boxed{p = \frac{dC}{dQ}}$$

(price = marginal costs)

in a competitive market: firm is price taker