

Industrial & Management Engineering Department

Industrial Relations

IM 111

Lecture 6: Break-Even Analysis

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Break-even analysis predicts when...

- ... Your business is going to start making profit.
- Break-Even Point is when Sales Revenue equals Total Costs
- at this point no profit or loss is incurred
- the firm merely covers its total costs



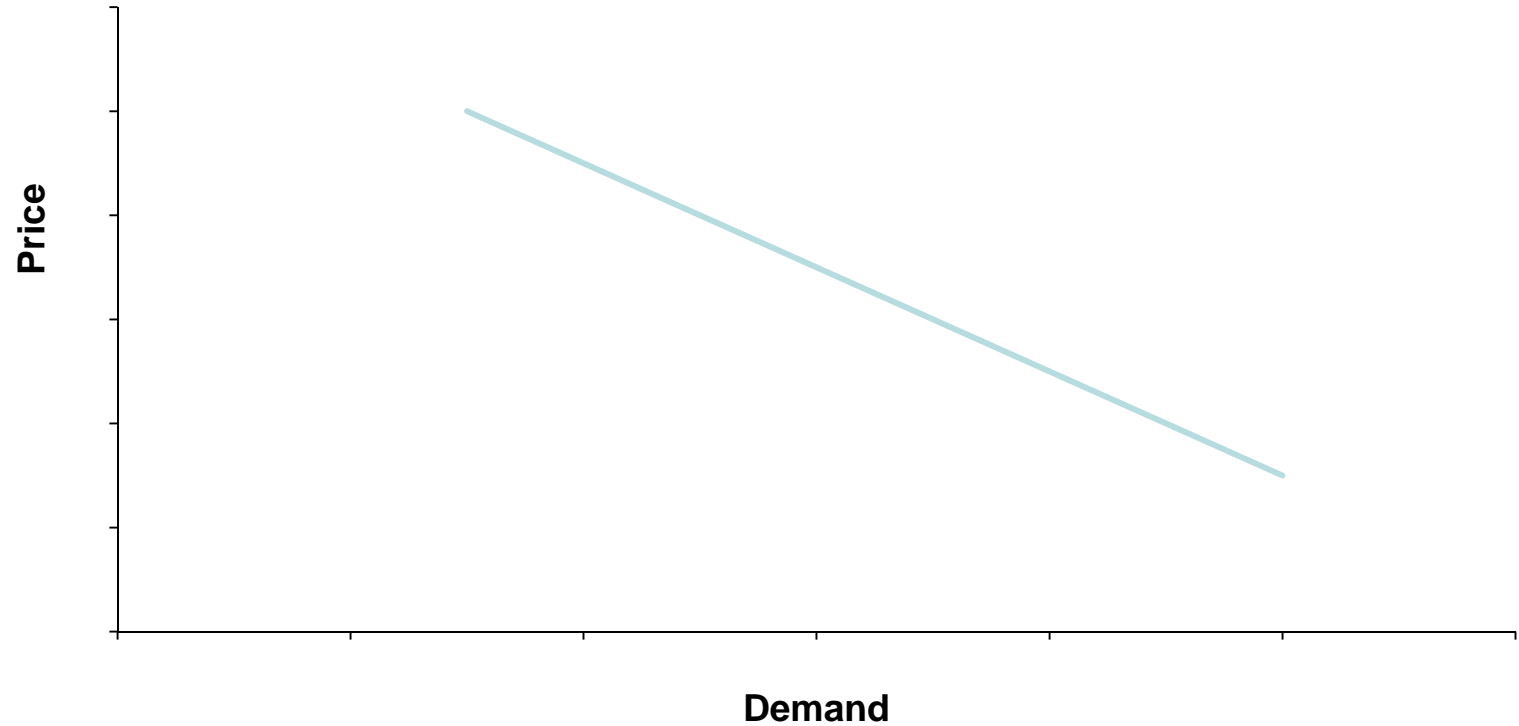
It can also be used to:

- Evaluate a start-up idea
- Assess the impact of new costs
- Project profitability for a new product



Price and Demand

Relationship between Price and demand



Start with your costs...

In order to calculate how profitable a product will be, we must firstly look at the Costs involved -

- There are two basic types of costs a company incurs.
- Variable costs
- Fixed costs

Fixed Costs

- Fixed costs are those costs that are not directly related to volume of production or output.
- Examples:
 - Rent costs
 - Administration costs
 - Research & Development

Variable Costs

- Variable costs are those costs which vary directly with the volume of production.
- Costs related to direct raw materials, direct labor, and fuel.

Break-Even Analysis

- TOTAL COSTS

- Total Costs is simply Fixed Costs and Variable Costs added together.

$$TC = FC + VC$$

- As Total Costs include some of the Variable Costs then Total Costs will also change with any changes in output/sales.
- If output/sales rise then so will Total Costs.
- If output/sales fall then so will Total Costs.

Break-Even Analysis

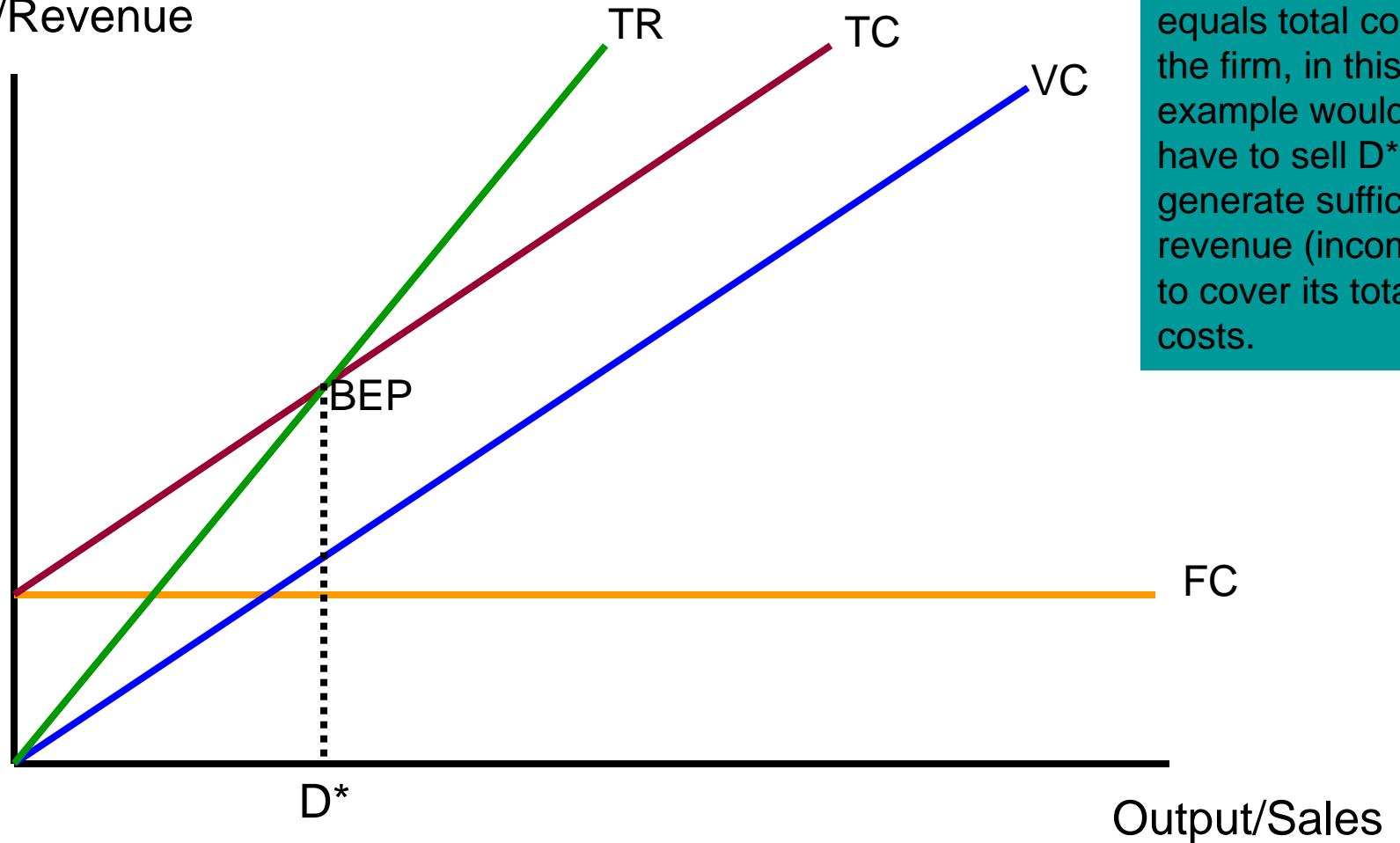
The Break-even point occurs when Total Costs equals Revenue (Sales Income)

$$\text{Revenues (Sales Income)} = \text{Total Costs}$$

At this point the business is not making a **Profit** nor incurring a **Loss** – it is merely covering its Total Costs

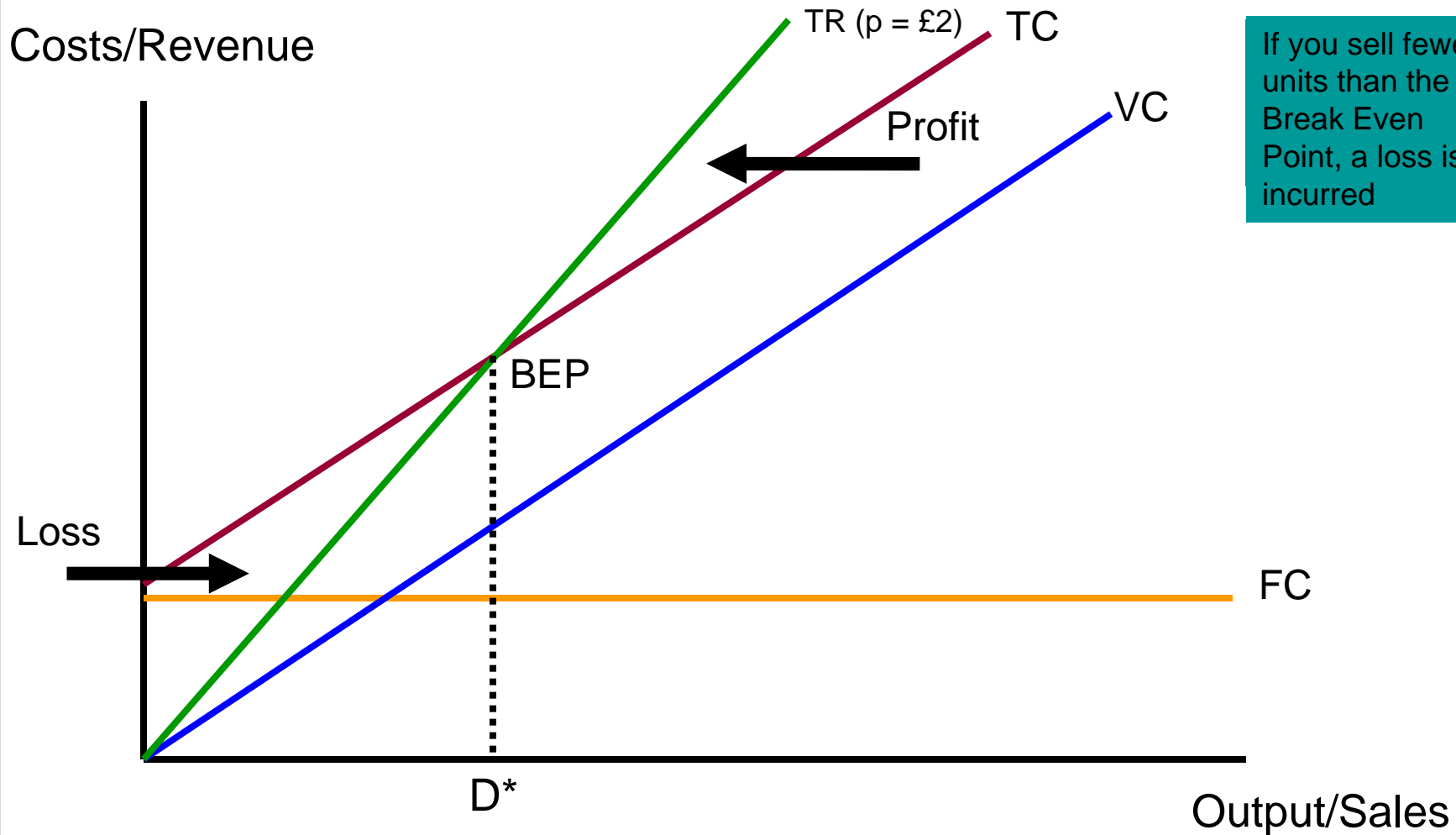
Break-Even Chart

Costs/Revenue

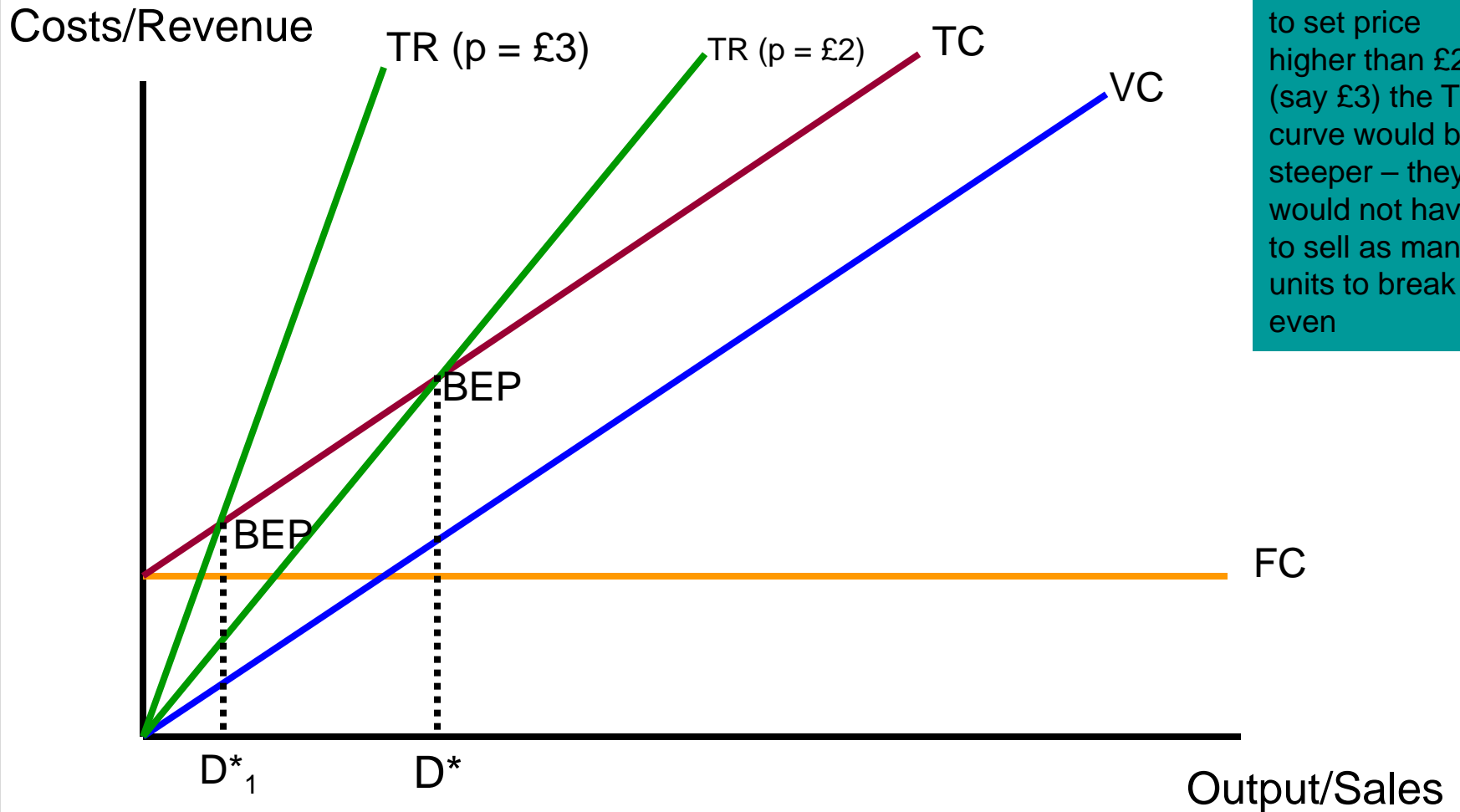


The Break-even point occurs where total revenue equals total costs – the firm, in this example would have to sell D^* to generate sufficient revenue (income) to cover its total costs.

Break-Even Chart



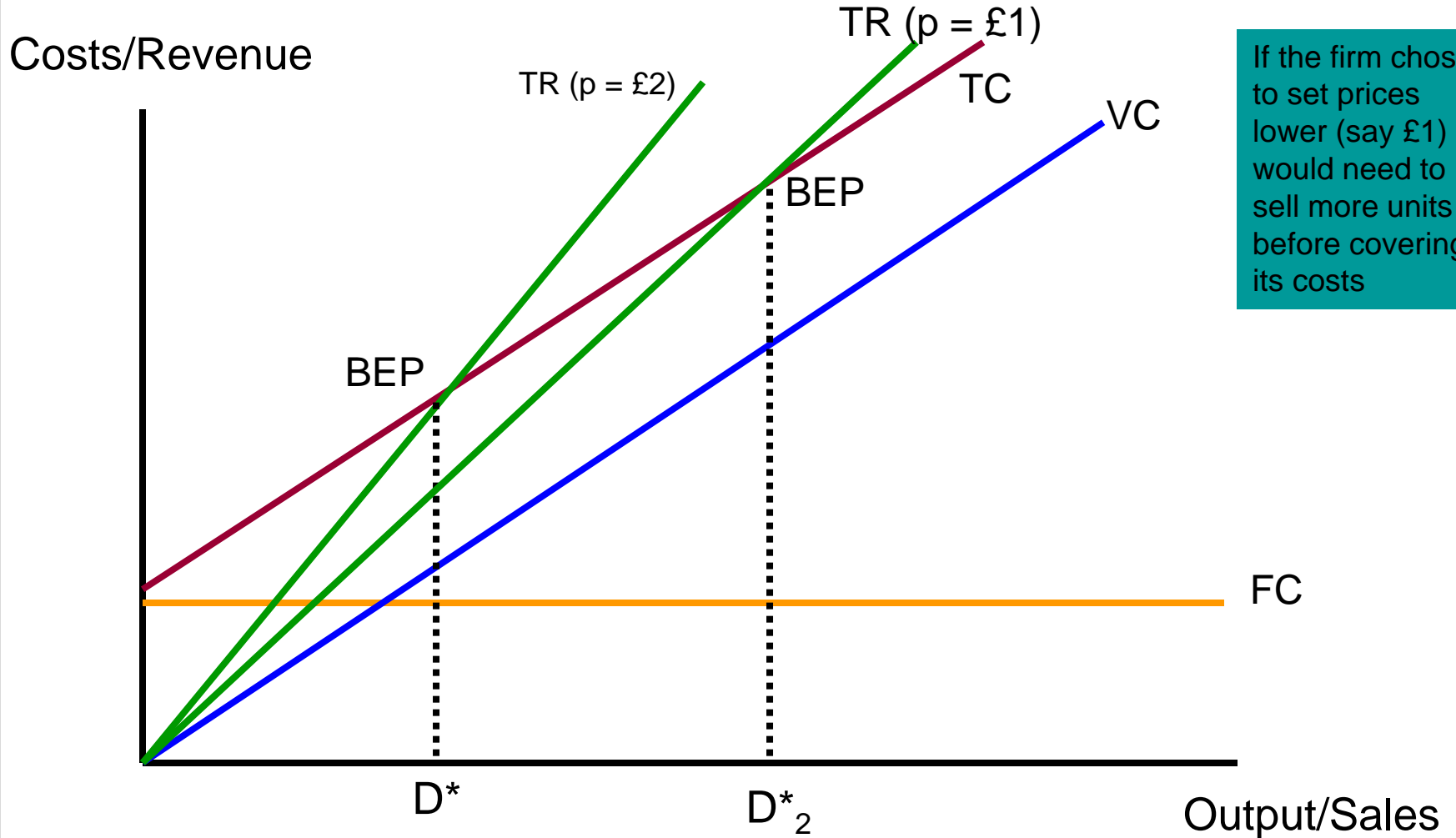
Break-Even Chart



At present, this firm sells each unit for £2 – Break Even point is at D^*

If the firm chose to set price higher than £2 (say £3) the TR curve would be steeper – they would not have to sell as many units to break even

Break-Even Chart



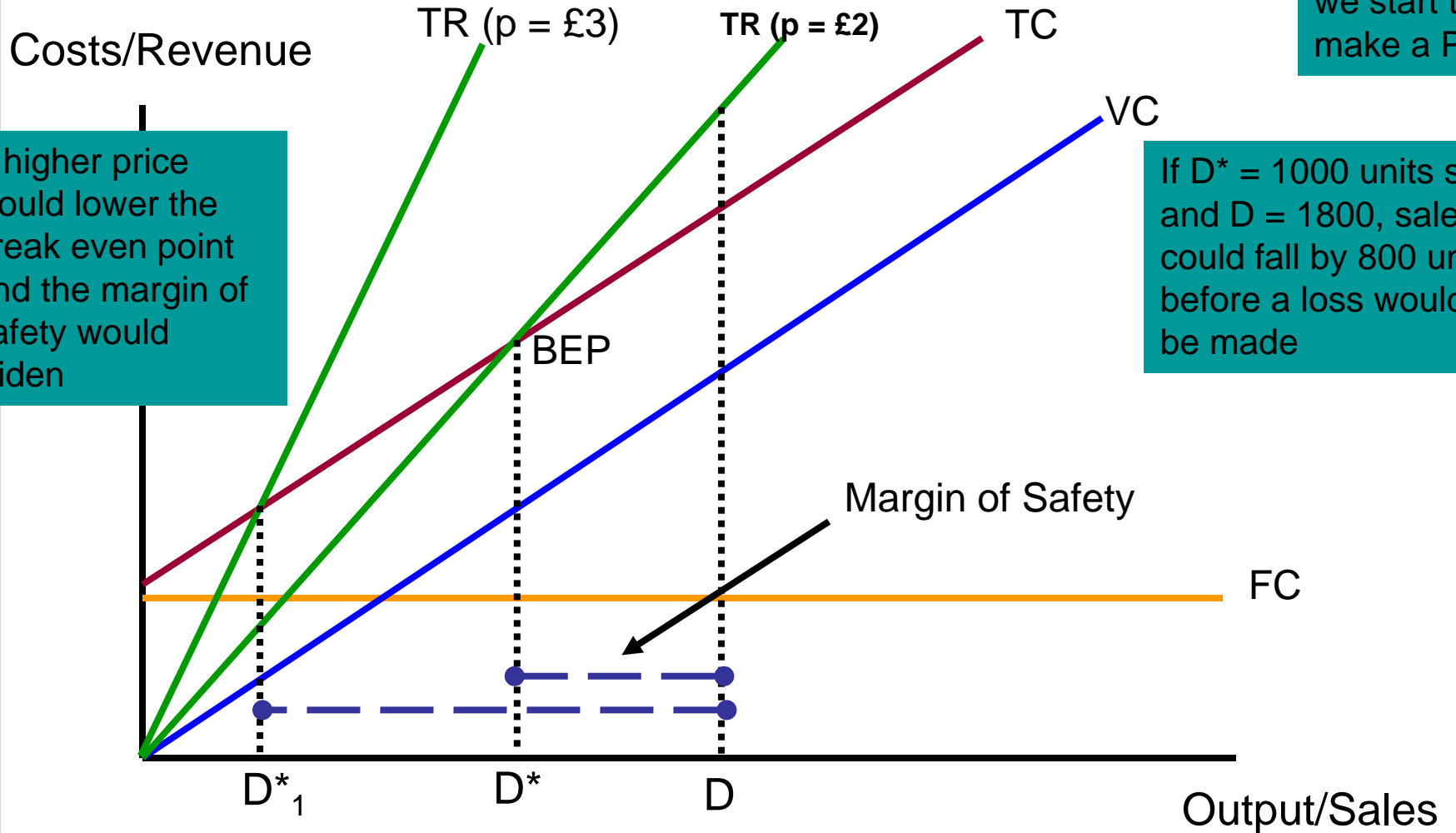
If the firm chose to set prices lower (say £1) it would need to sell more units before covering its costs

Margin of Safety

- The difference between the actual quantity sold and the break even quantity.
- Shows how far sales can fall before losses are made.
- Increasing the price would lower the break even point and then widen the margin of safety.

Margin of Safety

If we sell more than Break Even Point i.e. D^* , we start to make a Profit



A higher price would lower the break even point and the margin of safety would widen

If $D^* = 1000$ units sold and $D = 1800$, sales could fall by 800 units before a loss would be made

Revenues and profit

- Total Revenue = price x demand ($P \times D$)
- Total Costs = Fixed Costs + Variable Costs
- $TC = FC + VC$
- $TC = FC + (vc) \times D$
- Profit = $TR - TC$
- Break-even quantity (D^*):
 - Profit = $TR - TC = \text{Zero}$ then $P \times D^* = FC + (vc) \times D^*$
 - $FC = [P - (vc)] \times D^*$

$$D^* = FC / [P - (vc)]$$

Break-Even Analysis

- Remember:
- A higher price or lower price does not mean that break even will never be reached!
- The BE point depends on the number of sales needed to generate revenue to cover costs – the BE chart is NOT time related!

Break-Even Analysis

- **Higher prices** might mean fewer sales to break-even but those sales may take a longer time to achieve.
- **Lower prices** might encourage more customers but higher volume needed before sufficient revenue generated to break-even

BE Example

- A factory manufactures a certain product with a rate of 20,000 unit per month. The selling price is LE 15. the direct costs are:
- Direct material costs= 135,000
- Direct labor costs=65,000
- Manufacturing overhead costs=40,000
- Administrative overhead costs=12,000
- Marketing costs= 8,000

BE Example

- Calculate:
- The total cost of production.
- Profit per unit
- Draw the break even point chart and determine the break even volume
- Determine also the margin of safety

BE Example

- $VC = 135,000 + 65,000 = 200,000$
- $FC = 40,000 + 12,000 + 8,000 = 60,000$
- $TC = 200,000 + 60,000 = 260,000$
- $TR = 15 * 20,000 = 300,000$
- $\text{Profit} = 300,000 - 260,000 = 40,000$
- $\text{Profit per unit} = (40,000 / 20,000) = 2$

BE Example

- **Break Even Volume:**

- $P=15$
- $FC=60,000$
- $VC= (vc)*D$
- At 20,000 units the $VC=200,000$
- $(vc)=VC/D$
- $(vc)=200,000/20,000=10$
- $D^* = FC / [P-(vc)] = 60000/(15-10)$
- $D^* = 12000$ units
- Margin of safety = actual sales (D) – BEP (D^*) = 8000 units

BE Example

- A firm produces product with a price of LE 10 per unit. The variable cost per unit is LE 3/unit. The total fixed costs are 21,000. calculate:
- 1- break even point
- 2- Revenue at BEP
- 3- Total costs at BEP
- 4- if the demand = 15,000 unit what is the company total profit?
- 5- if the company reduces the price to LE8 per unit, how this will affect the BEP.