Chapter

7

Limited factor and break-even analysis

Syllabus Content

D - Marginal costing and decision-making – 15%

Contribution concept.

Limiting factor analysis.

Break-even charts, profit/volume graphs, break-even point, profit target, margin of safety, contribution/sales ratio.

7.1 Limiting factors

A **limiting factor** (or principle budget factor) is a scarce resource which is in short supply. Limiting factor analysis is a technique which will maximise contribution for an organisation, by allocating a scarce resource that exists to producing goods or services that earn the highest contribution per unit of scarce resource available.

Examples of limiting factors

- Shortage of material
- Shortage of labour hours
- Shortage of machine hours
- Shortage of money

Steps to maximise contribution given the existence of a limiting factor

1. Work out the contribution per unit for each product produced.

Contribution per unit =

Sales price less variable cost per unit.

2. Divide the contribution per unit for each product, by the quantity of scarce resource required to make it.

Contribution earned per unit of scarce resource for each product =

$$\frac{\text{Contribution per unit for each product}}{\text{Quantity of scarce resource required to make it}}$$

3. Rank the different products in order of how much contribution they earn per unit of scarce resource. Produce first the products that earn the highest contribution per unit of scarce resource, subject to the constraint of maximum demand.

Example 7.1

Cosmetics R Us perform three types of cosmetic surgery, face jobs, gut tucks and lipo suction.

	FJ	**GT**	**LS**
Estimated maximum demand for one year	10000	2000	3000
Average consultancy fee	£3,000	£1,500	£2,000
Surgeon cost per hour (paid £500 per hour)	£1,500	£250	£750
Variable cost per operation	£600	£100	£300

Fixed overhead is incurred at £750,000 a month. Unfortunately due to most surgeons working within the NHS, Cosmetics R Us can only currently employ 20 consultants working a 42 week year, performing operations up to a maximum of 40 hours a week.

Calculate the number of operations that Cosmetics R Us must perform each year to maximise contribution? What would be the profit earned?

Example 7.2

Because of intense competition, there is huge pressure on waiting lists for FJs and therefore Cosmetics R Us must fulfil all of these operations first (before undertaking any GT or LS operations), otherwise the reputation of the business could suffer.

Calculate the number of operations that Cosmetics R Us would perform if this were the case?

7.2 Break even analysis or cost volume profit (CVP) analysis

Break even or CVP analysis calculates a physical quantity of units or sales value that would earn no profit and no loss for an organisation. This will help the organisation to understand how many units of a product or service they would need to sell before they can earn profit. There are a number of formulae within this chapter that you need to be able to learn and apply.

To break even would mean an organisation would be earning no profit and no loss.

Sales revenue = Variable + Fixed cost

A variable cost is a cost that can be avoided if a unit is not produced or would be incurred if a unit was produced. A fixed cost remains constant whether a unit is or is not produced.

Assumptions of break even analysis

1. Single product or single mix of products being sold
2. Fixed cost, variable cost per unit and selling price per unit are constant
3. Production equals sales or stock levels do not change significantly
4. The volume sold is the only factor effecting variable cost and sales
5. Linearity of sales and costs

Formulae to learn

Contribution per unit = Sales price less variable cost per unit

Break-even volume = $\frac{\text{Fixed overhead}}{\text{Contribution per unit}}$

The number of units you would need to sell in order to earn enough contribution to cover fixed overhead e.g. contribution equals fixed overhead.

Contribution to sales ratio (C/S ratio)

A contribution to sales ratio would calculate how much contribution a product would earn for every £1 of sales, expressed as a decimal e.g. a 0.4 C/S ratio would mean 40 pence of contribution is generated or earned for every £1 of sales.

C/S ratio = $\frac{\text{Contribution per unit}}{\text{Sales price per unit}}$

C/S ratio = $\frac{\text{Total contribution}}{\text{Total sales revenue}}$

Break-even revenue

The sales revenue earned that would give no profit and no loss. It can be calculated by multiplying the break-even volume by the product selling price, or using the following formulae;

= $\frac{\text{Fixed overhead}}{\text{C/S ratio}}$

Margin of safety

The sensitivity of the forecast or budgeted sales compared to the break-even point.

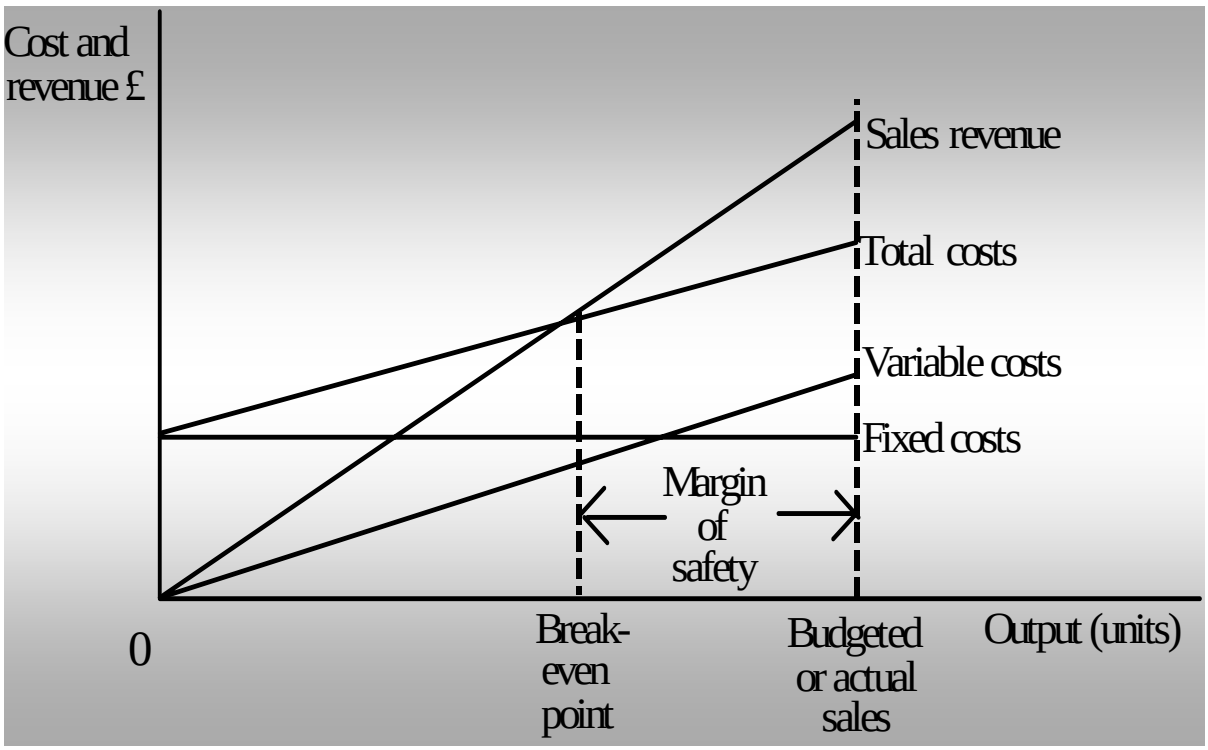
Margin of safety (units) = Budgeted sales volume less Break-even sales volume

Margin of safety (%) = $\frac{\text{Budgeted sales less Break-even sales volume}}{\text{Budgeted sales volume}} \times 100$

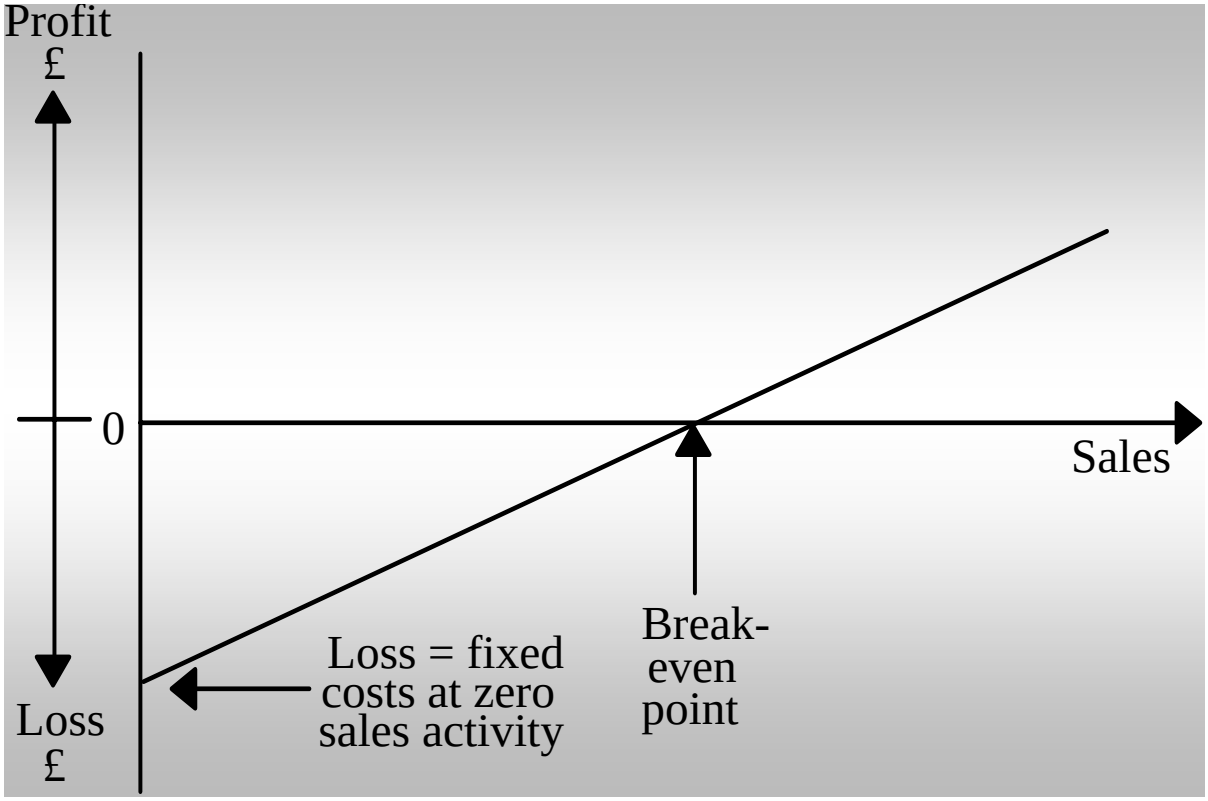
Number of units sold to achieve a target profit

= $\frac{\text{Fixed cost + Target profit}}{\text{Contribution per unit}}$

Break-even charts



Profit volume charts



Example 7.3

Z-Boxes sell for £299 and the variable cost of production is £99 a unit. Fixed production overhead for the year is £1.2 million.

a) Calculate the break-even level of sales for both volume and revenue?
b) Calculate the break-even revenue using the C/S ratio?
c) The budgeted sales revenue is £2.99 million; calculate the margin of safety in units and as a percentage?
d) Produce a break-even chart and profit-volume chart using the information above?
e) How many Z-Boxes must be sold in order to achieve £500,000 profit?

Solutions to lecture examples

Example 7.1

	FJ	GT	LS
Labour hours per operation*	3.0	0.5	1.5
Contribution per operation (£)	900	1,150	950
Contribution per hour (£)	300	2,300	633
RANKING	**3rd**	**1st**	**2nd**

***** Surgeon cost per hour for each operation ÷ £500 per hour

To maximise contribution and therefore profit the quantities of each service performed would be as follow;

1st GT 0.5 Hrs x 2000 max demand =	1000 Hrs
2nd LS 1.5 Hrs x 3000 max demand =	4500 Hrs
3rd (28100 Hrs remaining/3 Hrs an operation	
9367 operation performed x 3 Hrs =	28100 Hrs
	33600 Hrs

Budgeted profit will be £4.58 million

	£000s
FJ 9367 x (£3,000-£2,100) =	8,430.3
GT 2000 x (£1,500-£350) =	2,300.0
LS 3000 x (£2,000-£1,050) =	2,850.0
Contribution	13,580.3
Fixed cost (£750,000 x 12 months)	(9,000.0)
Profit	4,580.3

Note: An alternative method could have been used above for the calculation of budgeted profit e.g. on the basis of total surgeon hours x contribution per hour for each service.

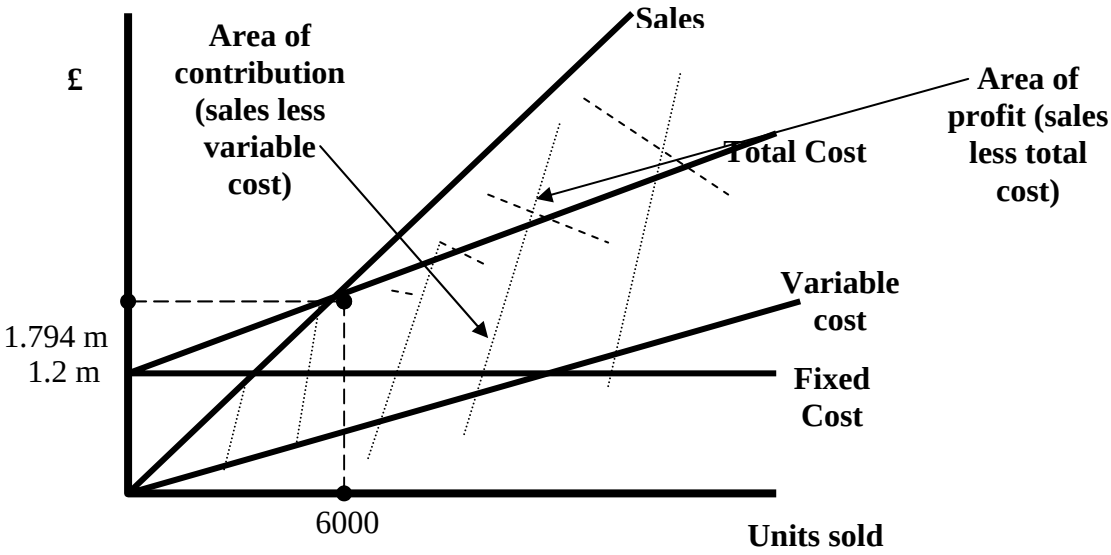
Example 7.2

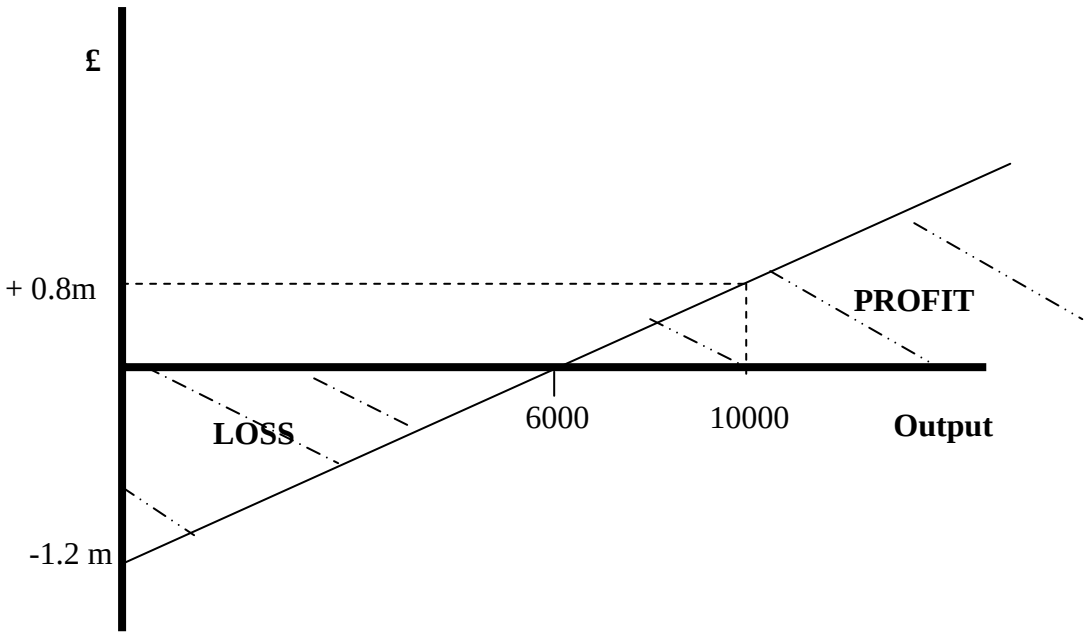
FJ (**NO CHOICE**) 10000 x 3 Hrs =	30000
GT 2000 x 0.5 Hrs **(most profitable next)**	1000
LS 2600 Hrs **(balance)**/1.5 Hrs = 1733 operations x 1.5 Hrs	
	2600
	33600

Note: if you produced a budget now, the profit would be lower due to less profitable FJ being substituted for more profitable LS.

Example 7.3

a) 1.2 million/ (£299-£99) = 6000 units break-even volume or for break-even sales revenue 6000 units x £299 = £1,794,000
b) £1.2 million/ (£200/£299 = 0.6689 C/S ratio) = £1,793,990
c) £2.99 million/£299 = budget volume 10000 units (10000 units - 6000 units) = 4000 units margin of safety or as a percentage 4000/10000 = 40% margin of safety
d) See charts below





e) (1.2m + 0.5m)/ (£299-£99) = 8500 units sold to make profit of £0.5m