Unit 9
Break Even Analysis

ILO1. Break Even Point
ILO2. The Margin of Safety
ILO3. Operating Leverage

ILO1. Break Even Point

We can use simple equations to calculate the unit sales, and dollar sales necessary to break even; achieve zero net profit. We'll use the following example to help illustrate this process.

Imagine our company ABC desires to know how many units it needs to sell to break even.

Contribution Income Statement For the Month of June	Total	Per Unit	CM Ratio
Sales (500 bicycles)	$ 250,000	$ 500	100%
Less: Variable expenses	150,000	300	60%
Contribution margin	100,000	$ 200	40%
Less: Fixed expenses	80,000		
Net operating income	$ 20,000		

Fig 9.1 Break Even Analysis

To calculate the break even amount, we use the formula of (fixed costs ÷ contribution margin per unit). In this case, it would be 80,000 ÷ 200. Indicating that ABC needs to sell 400 bicycles to achieve its zero profit. We can also use the following formula to determine the sales dollars amount necessary to break even.

$$\text{Dollar sales to break even} = \frac{\text{Fixed expenses}}{\text{CM ratio}}$$

Fig 9.2 Dollar Sales Break Even Formula

Applying this equation proves that sales of $200,000 are needed to break even. We can extend this theory to calculate for target profit. We can determine the target profit in two ways. Through the volume of sales needed to attain a certain level of profitability, or by the number of units that must be sold. To find the number of units, we use the figure below.

$$\text{Profit} = \text{Unit CM} \times Q - \text{Fixed expenses}$$

Fig 9.3 Unit Quantity to Break Even

In this equation the variable "Q" means the number of units needed to be sold in order to reach the necessary profit. If we substitute a profit amount of $100,000 into the equation we will find that ABC needs to sell 900 bikes to achieve that profit. We can also shift our focus, with the attention drawn to the amount sales dollars needed for a target profit.

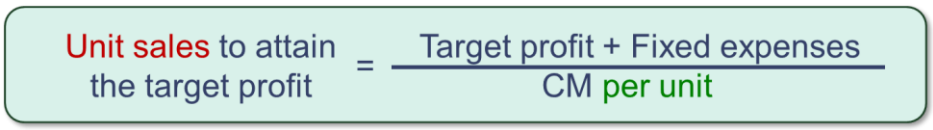

Fig 9.4 Unit Sales

We can also use a variation of these formula to investigate the target profit measured in dollar sales. For this we need the (fixed costs + target profit) ÷ contribution margin ratio. So if we consider company ABC wishes to make $100,000 profit, and the manager's task is to measure the volume of dollar sales needed to achieve this, then by substituting into the formula we would arrive at a total of $450,000.

ILO2. The Margin of Safety

The margin of safety is the third part of the cost volume profit analysis. This analysis looks at the surplus of sales over the break even volume. Its description is below.

Fig 9.5 Margin of Safety

If we apply this model to our company ABC we can see its usefulness. Lets assume that ABC has sales of $250,000. We've already seen break even sales of $200,000, so the margin of safety must be $50,000. We can highlight this amount either as a percentage of sales; in this case 20%, or in term of number of units sold, which would be 100.

	Break-even sales 400 units	Actual sales 500 units
Sales	$ 200,000	$ 250,000
Less: variable expenses	120,000	150,000
Contribution margin	80,000	100,000
Less: fixed expenses	80,000	80,000
Net operating income	$ -	$ 20,000

Fig 9.6 Margin of Safety

As our cost volume profit analysis includes fixed and variable costs we can look at cost structure and profit stability. The cost structure is the proportion of fixed and variable costs. The structure itself is a mix of these proportions. For example, a company could have high fixed costs with low variable cost, or the opposite; low fixed costs and high variable cost structures. There are a number of characteristics that follows. High fixed costs structures will generate higher income during periods of increase demand or company growth, compared to those with low fixed costs. However, this same high fixed cost results in a reduced income during a downturn compared to those of lower fixed cost. Finally, a lower fixed cost structure generates increased profit stability.

ILO3. Operating Leverage

Operating leverage refers to the degree of sensitivity net operating income is to the changes of percent of sales. In essence, this measure how a percent change in sale will impact profit. We will apply the formula below with our company ABC to demonstrate this.

$$\text{Degree of operating leverage} = \frac{\text{Contribution margin}}{\text{Net operating income}}$$

Fig 9.6 Operating Leverage

	Actual sales 500 Bikes
Sales	$ 250,000
Less: variable expenses	150,000
Contribution margin	100,000
Less: fixed expenses	80,000
Net income	$ 20,000

Fig 9.7 Operating Leverage Analysis

Using our formula we can calculate the degree of leverage of 5 (100,000 ÷ 20,000). With this amount of sensitivity if company ABC increased its sales volume by 10%, the impact on its net operating income would increase it to 50%.

	Actual sales (500)	Increased sales (550)
Sales	$ 250,000	$ 275,000
Less variable expenses	150,000	165,000
Contribution margin	100,000	110,000
Less fixed expenses	80,000	80,000
Net operating income	$ 20,000	$ 30,000

Fig 9.8 Operating Leverage Analysis Application

We can verify this claim using ABC's contribution approach income statement below.

	Bicycle		Carts		Total	
Sales	$ 250,000	100%	$ 300,000	100%	$ 550,000	100.0%
Variable expenses	150,000	60%	135,000	45%	285,000	51.8%
Contribution margin	100,000	40.0%	165,000	55%	265,000	48.2%
Fixed expenses					170,000	
Net operating income					$ 95,000	
Sales mix	$ 250,000	45%	$ 300,000	55%	$ 550,000	100%

Fig 9.9 Sales Mix Analysis

If 45% of ABC's total sales revenue is generated from bikes, and the remaining 55% through the sale of carts, then we can determine a contribution margin ratio for both items at 48.2%. Some further analysis would reveal a break even sales amount of $352,697. As stated, bikes contributed 45% of this amount, or $158,714. While carts supported 55% or $193,983. WE attribute rounding error for the remaining $176. Please see the construction below.

	Bicycle		Carts		Total	
Sales	$ 158,714	100%	$ 193,983	100%	$ 352,697	100.0%
Variable expenses	95,228	60%	87,293	45%	182,521	51.8%
Contribution margin	63,486	40%	106,690	55%	170,176	48.2%
Fixed expenses					170,000	
Net operating income			Rounding error		$ 176	
Sales mix	$ 158,714	45%	$ 193,983	55%	$ 352,697	100.0%

Fig 9.10 Sales Mixed Analysis Application

References:

1. Managerial accounting, Ray Garrison-Eric Noreen-Peter Brewer - McGraw-Hill Education, 16 ed., 2018
2. Managerial accounting, John Wild-Ken Shaw - McGraw-Hill Education, 7ed, 2019
3. Management accounting, Will Seal-Carsten Rohde-Ray Garrison-Eric Noreen - McGraw-Hill Education, 6ed. - 2019