

Cost Volume Profit

LO 1: Types of Costs

Terms

Variable Costs
Fixed Costs
Relevant Range
Mixed Costs

	In Total	Per Unit	Examples
Variable	Change in proportion to activity level: if volume increases then total cost will increase, if volume decreases then total cost will decrease	Remain the same	Direct materials Direct labor Cost of goods sold
Fixed	Remain the same	Have an inverse relationship with activity level: if volume increases then per unit cost will decrease, if volume decreases then per unit cost will increase	Taxes Insurance Rent Supervisor salary Depreciation

The above data is consistent as long as level of activity remains within the relevant range.

Mixed Costs: Have an element of both variable and fixed costs. Therefore, costs change in total, but not in proportion with activity level changes. Example: The total cost of a cell phone contract which charges a fixed amount for a certain number of minutes per month and then an additional amount per minute for additional minutes used in the month is a mixed cost.

LO 2: High-Low Method

- Mixed costs must be separated into their variable and fixed elements so that their behavior can be predicted when the activity level changes.

Step 1: Determine variable cost per unit

- Pick out the highest and lowest levels of activity in given data set
- Note the total cost that is given with each level of activity

- Put into the following equation to determine variable cost per unit

$$\text{Change in Total Costs} \quad / \quad \text{Change in Activity} \quad = \quad \text{Variable Cost per Unit}$$

(Cost of high level activity – Cost of low level activity)	Divided by	(High level of activity-low level of activity)	Equals	Variable Cost per Unit
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Step 2: Determine Fixed Costs

- Pick the high or low level used
- Multiply the variable cost per unit determine is step 1 by the activity level to get total variable cost
- Take total cost and subtract total variable cost to equal fixed cost

$$\text{Total Cost} - \text{Total Variable Cost} = \text{Fixed Cost}$$

Total cost from data point selected	-	Variable Cost per unit (step 1) * activity level from data point selected	=	Fixed Cost
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Practice # 1

T Company employed several maintenance engineers to keep the equipment running in peak condition. Over the past eight months, Travis incurred the following maintenance cost for these engineers. Plant activity is best measured by direct labor hours.

<u>Month</u>	<u>Direct Labor Hours</u>	<u>Maintenance Cost</u>
January	1,700	\$14,300
February	1,900	\$15,200
March	1,800	\$16,700
April	1,600	\$14,000
May	1,500	\$14,300
June	1,300	\$13,000
July	1,100	\$12,800
August	1,400	\$14,200

Required: Using the high-low method, determine the fixed and variable components of the maintenance costs.

LO 3: Cost-Volume-Profit

Terms

Cost-Volume-Profit Analysis
 Cost-Volume-Profit Income Statement
 Contribution Margin

Unit Contribution Margin
 Breakeven Point
 Contribution Margin Ratio

CVP is a critical planning piece for decision-making. The following assumptions must be made:

1. Behavior of costs and revenues is within relevant range
2. Costs can be classified as variable or fixed
3. Changes in activity are the only factors affecting cost
4. All units produced are sold
5. Sales mix is constant when more than one product is sold

CVP income statement

- Distinguishes costs between variable and fixed
- Shows contribution margin, usually both in total and for a per unit basis

$$\text{Sales} - \text{Variable Expenses} = \text{Contribution Margin}$$

$$\text{Sales per unit} - \text{Variable cost per unit} = \text{contribution margin per unit}$$

Contribution Margin

- Unit contribution margin shows how much every unit sold will increase net income
- Determines how many units will need to be sold to cover fixed costs (break-even)

Contribution Margin Ratio

- Contribution Margin presented as a percentage of sales
- Contribution margin divided sales by OR Unit contribution margin divided by unit selling price
- Shows how much a company earns for each dollar of sales

Example:

	Total	Per Unit	Ratio
Sales	\$500,000	\$500	100%
Variable Costs	<u>-200,000</u>	<u>200</u>	<u>40%</u>
Contribution Margin	300,000	<u>300</u>	<u>60%</u>
Fixed Costs	<u>-125,000</u>		
Net Income	<u>\$175,000</u>		

Sales – Variable Expenses = Contribution Margin

$$500,000 - 200,000 = 300,000$$

Sales per unit – Variable cost per unit = contribution margin per unit

$$500 - 200 = 300$$

Unit contribution margin divided by unit selling price

$$300 / 500 = 60\%$$

LO 4: Breakeven

At the breakeven point:

- Operating Income = 0
- Total revenue = total expenses

- Fixed Expenses = Contribution Margin

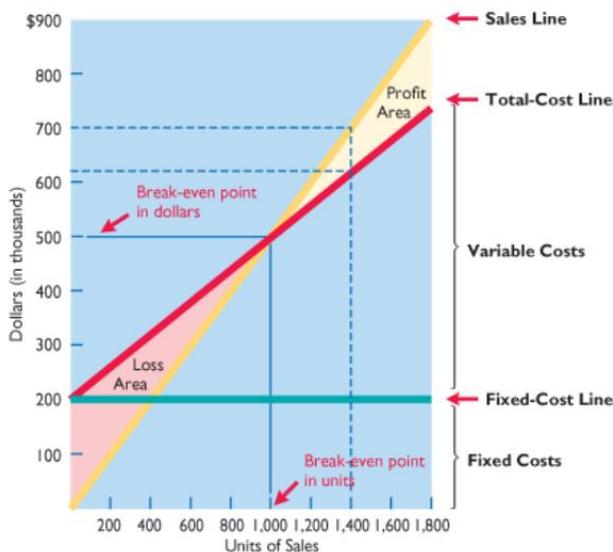
1) Mathematical Equation:

- Sales – Variable Costs – Fixed Costs = Net Income
 - At Breakeven, net income = zero
- In units: (Sales price per unit * Q)- (Variable cost per unit* Q)- Fixed Cost = Zero
 - Solve for Quantity (Q) to determine number of units needed to sell to break even
 - Use Break-even Quantity (Q) multiplied by sales price per unit to determine sales dollars to breakeven

2) Contribution Margin Technique

- To Determine Breakeven in units:
Fixed Costs divided by Unit Contribution Margin= Breakeven in units
- To Determine Breakeven in Sales Dollars:
Fixed Costs divided by Contribution Margin Ratio= Breakeven in dollars

3) Graphic Presentation



Where the Total Cost Line (Red) meets the Total Sales Line (Yellow), this is the breakeven point. Follow this point down to determine breakeven in units, and follow across to determine breakeven in sales dollars.

Any area above the breakeven point reflects a profit. Any area below the breakeven point reflects a loss.

Practice #2

W Company sells only one product with a selling price of \$200 and a variable cost of \$80 per unit. The company’s monthly fixed expense is \$60,000.

Required: Determine the contribution margin per unit and contribution margin ratio Determine breakeven point in units sold and sales dollars using each of the three methods.

LO 5: Determining Required Sales

Terms

Target Net Income

Margin of Safety

Target Net Income

- Rather than setting operating income = 0, target profit calculations assume a certain operating income and calculate the sales dollars and units sold necessary to achieve it.
 - The same equations are used as to calculate the breakeven point, except that a non-zero operating income term is included.
- 1) Mathematical Equation:
 - Required Sales – Variable Costs – Fixed Costs = Target Net Income
 - In units: (Required Sales price per unit * Q) - (Variable cost per unit* Q)- Fixed Cost = Target Net Income
 - Solve for Quantity (Q) to determine number of units needed to sell to break even
 - Use Break-even Quantity (Q) multiplied by sales price per unit to determine sales dollars to breakeven
 - 2) Contribution Margin Technique
 - a. To Determine Breakeven in units:
(Fixed Costs + Target Net Income) divided by Unit Contribution Margin= Breakeven in units
 - b. To Determine Breakeven in Sales Dollars:
(Fixed Costs+ Target Net Income) divided by Contribution Margin Ratio= Breakeven in dollars
 - 3) Graphic Presentation
 - a. Find target profit on graph and corresponding units to meet that profit

Margin of Safety

- The margin of safety is the excess of budgeted or actual sales over the breakeven volume of sales. It is expressed as both the dollar amount of the difference and as a percent of budgeted or actual sales.
- 1) In Dollars
 - a. Actual (expected) Sales – Break-even Sales = Margin of Safety in Dollars
 - 2) As a Ratio
 - a. Margin of Safety in Dollars / Actual (expected) Sales = Margin of Safety Ratio
 - i. The higher the percentage, the greater the margin of safety

Practice #3

S Company sells pillows for \$90 per unit. The variable expenses are \$63 per pillow and the fixed costs are \$135,000 per month. The company sells 8,000 pillows per month.

- Required:
- Prepare contribution margin income statements for current operating conditions showing contribution margin ratio.
 - Compute Breakeven using both the equation method and the contribution margin technique
 - What is the margin of safety?
 - If the company wants a target profit of \$200,000, how many units must they sell, and what is the dollar sales?

Solution #1

(Cost of high level activity – Cost of low level activity)	Divided by	(High level of activity-low level of activity)	Equals	Variable Cost per Unit
(15,200-12,800)	/	(1,900-1,100)	=	\$3.00

$$\frac{\text{Change in Cost}}{\text{Change in Activity}} = \frac{\$2,400}{800} = \$3.00 \text{ variable cost/unit}$$

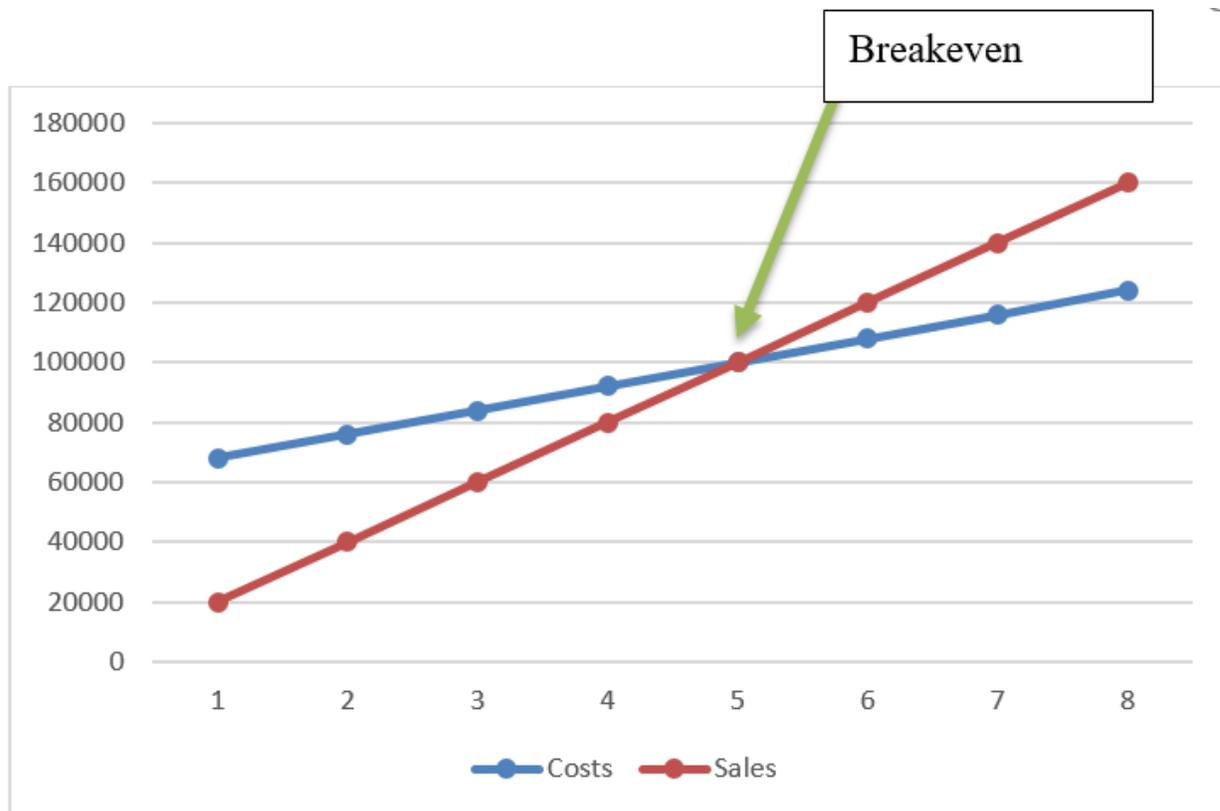
Using either the high point or low point, total fixed cost is calculated next:

Total cost from data point selected	-	Variable Cost per unit (step 1) * activity level from data point selected	=	Fixed Cost
Using High Point				
15,200	-	(\$3*1,900)= \$5,700	=	\$9,500
Using Low Point				
12,800	-	(\$3*1,100)= \$3,300	=	\$9,500

- * The high and low points are chosen by activity, not by cost.
- * It doesn't matter which point you pick, fixed costs equal the same amount

Solution #2

contribution margin per unit	Sales-Variable Cost= CM	$200-80=120$
contribution margin ratio	CM/Sales	$120/200=60\%$
	Math Equation	Contribution Margin
breakeven point in units sold	<p>Sales price per unit * Q)- (Variable cost per unit* Q)- Fixed Cost = Zero</p> <p>$200Q-80Q-60,000=0$ $120Q-60,000=0$ $120Q=60,000$ Divide each side by 120 $Q= 500$ units</p>	<p>Fixed Costs divided by Unit Contribution Margin= Breakeven in units</p> <p>$60,000/120= 500$ units</p>
breakeven point in sales dollars	<p>Use Break-even Quantity (Q) multiplied by sales price per unit to determine sales dollars to breakeven</p> <p>$Q= 500$ units $500* 200 = \\$100,000$</p>	<p>Fixed Costs divided by Contribution Margin Ratio= Breakeven in dollars</p> <p>$60,000/ 60\%= \\$100,000$</p>



Solution #3

	<u>Per Unit</u>	<u>Present %</u>	<u>Total</u>
A) Sales	\$90	100.0	\$720,000
Variable expenses	63	70.0	504,000
Contribution Margin	27	30.0	216,000
Fixed expenses			135,000
Operating income			<u>\$81,000</u>

	<u>Present</u>			<u>Breakeven</u>		
	<u>Per Unit</u>	<u>%</u>	<u>Total</u>	<u>n</u>	<u>Total</u>	
Units	1		8,000	5,000		\$450,000/\$90
Sales	\$90	100.0	\$720,000	\$450,000		\$135,000/30%
Variable expenses	63	70.0	504,000	315,000		\$450,000x70%
Contribution Margin	27	30.0	216,000	135,000		fixed + OI
Fixed expenses			135,000	135,000		stays the same
Operating income			<u>\$81,000</u>	<u>\$0</u>		Always \$0

B)

Breakeven Dollars using Contribution Margin: $135,000/30\% = 450,000$ Breakeven Units using Contribution Margin per unit: $135,000/27 = 5,000$

Equation:

$$90Q - 63Q - 135,000 = 0$$

$$27Q = 135,000$$

$$Q = 5,000$$

$$5,000 * \$90 = \$450,000$$

C) Margin of Safety = $\$720,000 - \$450,000 = \$270,000$ or 37.5%

D) Target Profit

Target Profit Dollars using Contribution Margin: $135,000 + 200,000/30\% = \$1,116,667$ Target Profit Units using Contribution Margin per unit: $135,000 + 200,000/27 = 12,407$