COURSE: BUSINESS MODEL INNOVATIONS

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Breakeven Analysis in Strategy and the Margin-SalesRate Matrix (MSM)

Learning Objectives

What is the break-even point (BEP) and why is it important?

How is the BEP determined and what methods are used to determine BEP?

What is cost-volume-profit (CVP) analysis and how do companies use CVP information in decision making?

How do BEP and CVP analyses differ for single-product and multiproduct firms?

How are margin of safety and operating leverage concepts used in business?

What are the underlying assumptions of CVP analysis?

Cost-Volume-Profit Analysis

Relationship of

- Revenue
- Costs
- Volume changes
- Taxes
- Profits

Applies to

- Manufacturers
- Wholesalers
- Retailers
- Service industries

Variable Costing and CVP

Variable costing

- Separates costs into fixed and variable components
- Shows fixed costs in lump-sum amounts, not on a per-unit basis
- Does not allow for deferral/release of fixed costs from/to inventory when production and sales volumes differ

Use CVP Analysis to…

Compute the BEP

Study interrelationships of

- Prices
- Volumes
- Fixed and variable costs
- Contribution margins
- Profits

Calculate the level of sales necessary to achieve a target profit

Set sales price

Answer “what-if” questions to influence current operations and predict future operations

CVP Assumptions

Company is operating within the relevant range

Revenue per unit remains constant

Variable costs per unit remain constant

Total fixed costs remain constant

Mixed costs are separated into variable and fixed elements

Important Equations

Break-even point

Total Revenues = Total Costs

Total Revenues – Total Costs = Zero Profit

Contribution Margin (CM)

Sales Price – Variable Cost per unit = CM per unit

Revenue – Total Variable Costs = CM in total

Contribution Margin Ratio (CM%)

$$\frac{\text{Sales Price} - \text{Variable Cost}}{\text{Sales Price}}$$

Break-Even Formula—Units

$$\frac{\text{Total Fixed Costs}}{\text{Sales Price (per unit)} - \text{Variable Cost (per unit)}}$$

Contribution Margin

$$\frac{\$100{,}000}{\$12 - \$4} = 12{,}500 \text{ units}$$

If fixed costs are $100,000, unit sales price is $12, and unit variable cost is $4, the BEP is 12,500 units.

Break-Even Formula—Dollars

$$\frac{\text{Total Fixed Costs}}{\dfrac{\text{Sales Price (per unit)} - \text{Variable Cost (per unit)}}{\text{Sales Price (per unit)}}}$$

$$\frac{\$100{,}000}{\dfrac{\$12 - \$4}{\$12}} = \$150{,}000$$

Contribution Margin Ratio

If fixed costs are $100,000, unit sales price is $12, and unit variable cost is $4, the BEP is $150,000.

Income Statement Proof

	Sales	$ 150,000	(12,500 * 12)
Less	Total variable costs	(50,000)	(12,500 * 4)
	Contribution Margin	$ 100,000	
Less	Total fixed costs	(100,000)	
	Profit before taxes	-0-	

If fixed costs are $100,000, unit sales price is $12, and unit variable cost is $4, the BEP is 12,500 units.

Using CVP Analysis

- Setting a target profit
  - Enter before-tax profit in numerator

$$\frac{\$100{,}000 + \$30{,}000}{\frac{12 - 4}{12}} = \$195{,}000$$

If fixed costs are $100,000, unit sales price is $12, unit variable cost is $4, and the desired before-tax profit is $30,000, the required sales are $195,000.

Using CVP Analysis

- Setting a target profit
  - Convert after-tax profit to before-tax profit

$$\text{Before-tax profit} = \frac{\text{After-tax profit}}{1 - \text{tax rate}}$$

$$\$60{,}000 = \frac{\$48{,}000}{1 - 20\%}$$

At a 20% tax rate, an after-tax profit of $48,000 equals a before-tax profit of $60,000.

Using CVP Analysis

Setting a target profit

- Convert after-tax profit to before-tax profit
- Enter before-tax profit in numerator

$$\frac{\$100{,}000 + \$60{,}000}{\$12 - \$4} = \$240{,}000$$

$$\$12$$

If fixed costs are $100,000, unit sales price is $12, unit variable cost is $4, and the desired after-tax profit is $48,000, the required sales are $240,000.

Income Statement Proof

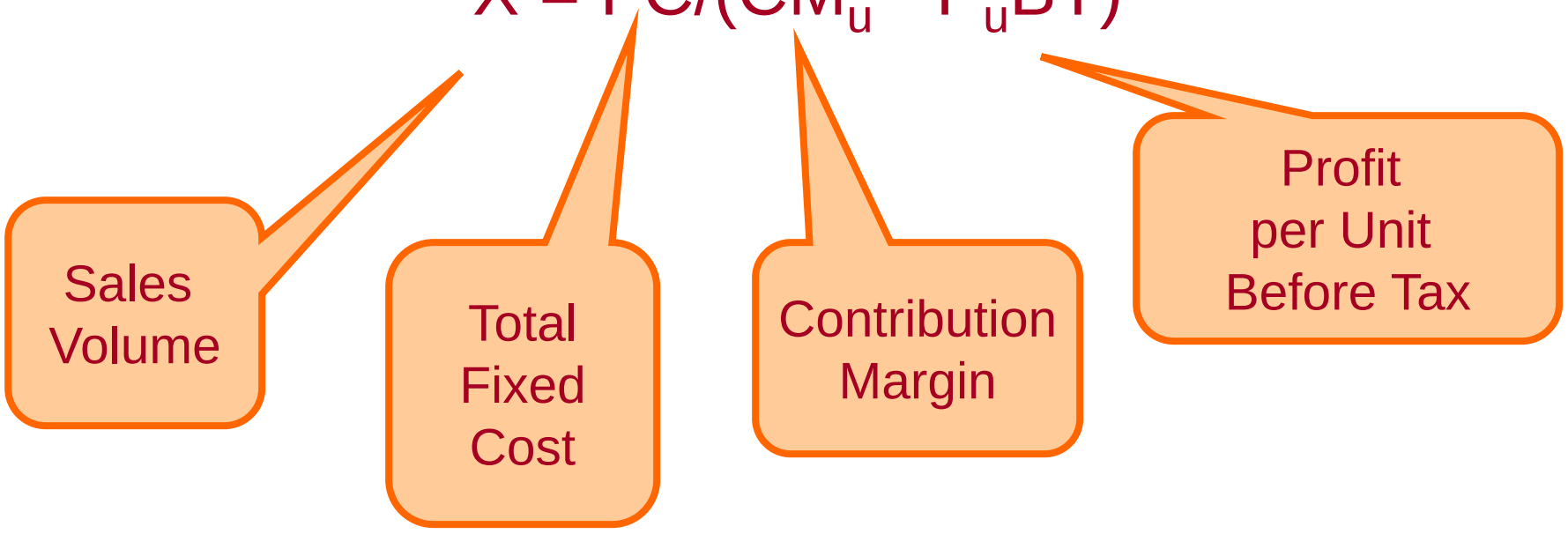
	Sales	$	240,000	(20,000 * 12)
Less	Total variable costs		(80,000)	(20,000 * 4)
	Contribution Margin	$	160,000	
Less	Total fixed costs		(100,000)	
	Profit before taxes	$	60,000	
	Income taxes		(12,000)	(60,000 * 20%)
	Profit after taxes	$	48,000	

If fixed costs are $100,000, unit sales price is $12, unit variable cost is $4, and the desired after-tax profit is $48,000, the required sales are $240,000.

Using CVP Analysis

Set profit per unit

$$X = FC/(CM_u - P_uBT)$$

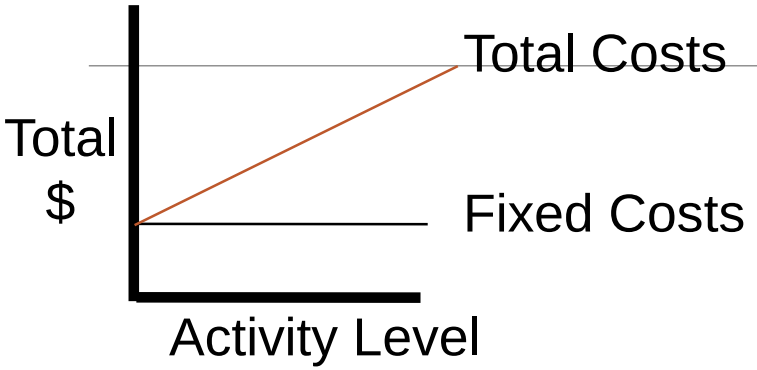


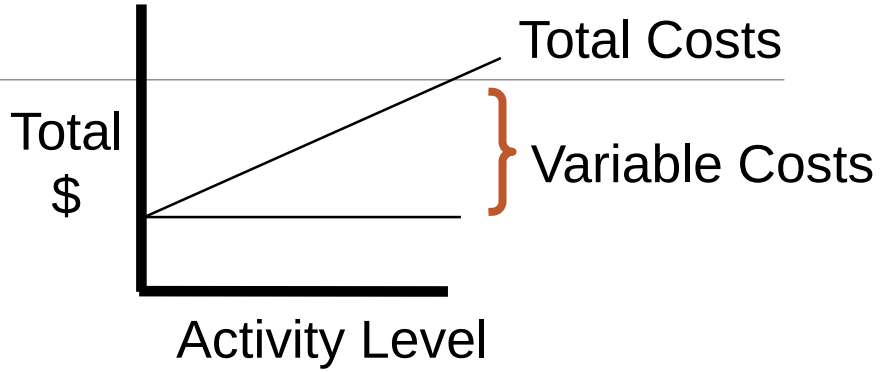
Graph Approach to Breakeven

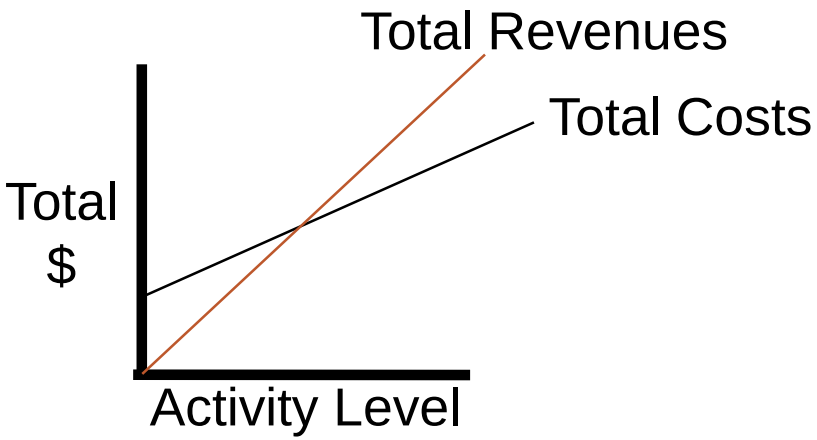
Break-even chart illustrates relationships among

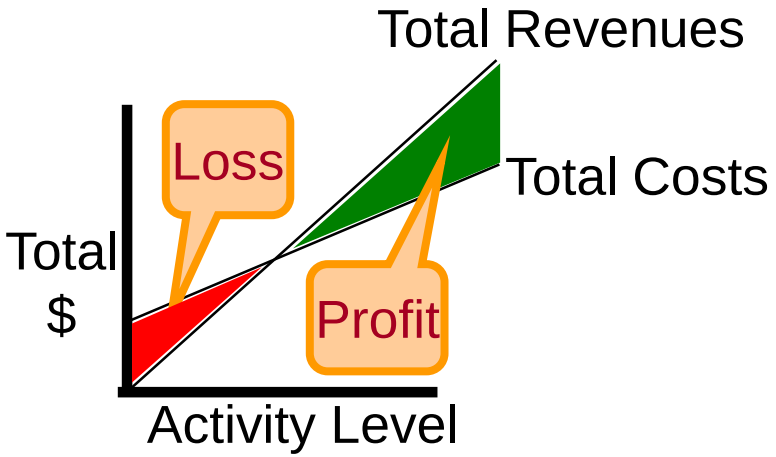
- Revenue
- Volume
- Costs

Traditional CVP Graph

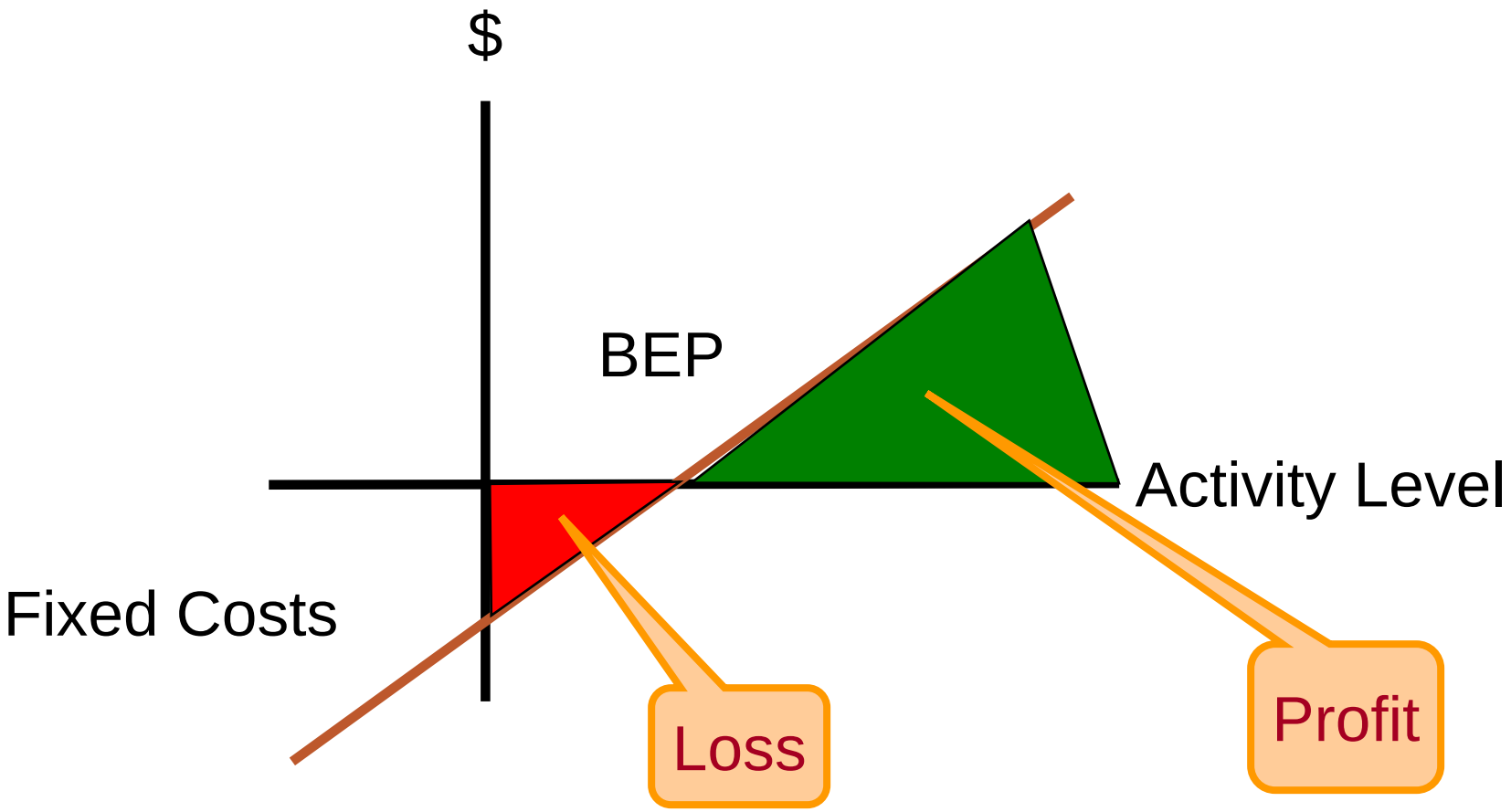








Profit-Volume Graph



Income Statement Approach

		B/E	Target Profit
	Sales	$ 150,000	$ 240,000
Less	Total variable costs	(50,000)	(80,000)
	Contribution Margin	$ 100,000	$ 160,000
Less	Total fixed costs	(100,000)	(100,000)
	Profit before taxes	-0-	60,000
	Income taxes		(24,000)
	Profit after taxes		36,000

Proof of CVP and/or graph solutions

Incremental Analysis

Focuses only on factors that change from one option to another

Changes in revenues, costs, and/or volume

BEP increases when

- Fixed costs increase
- Sales price decreases
- Variable costs increase

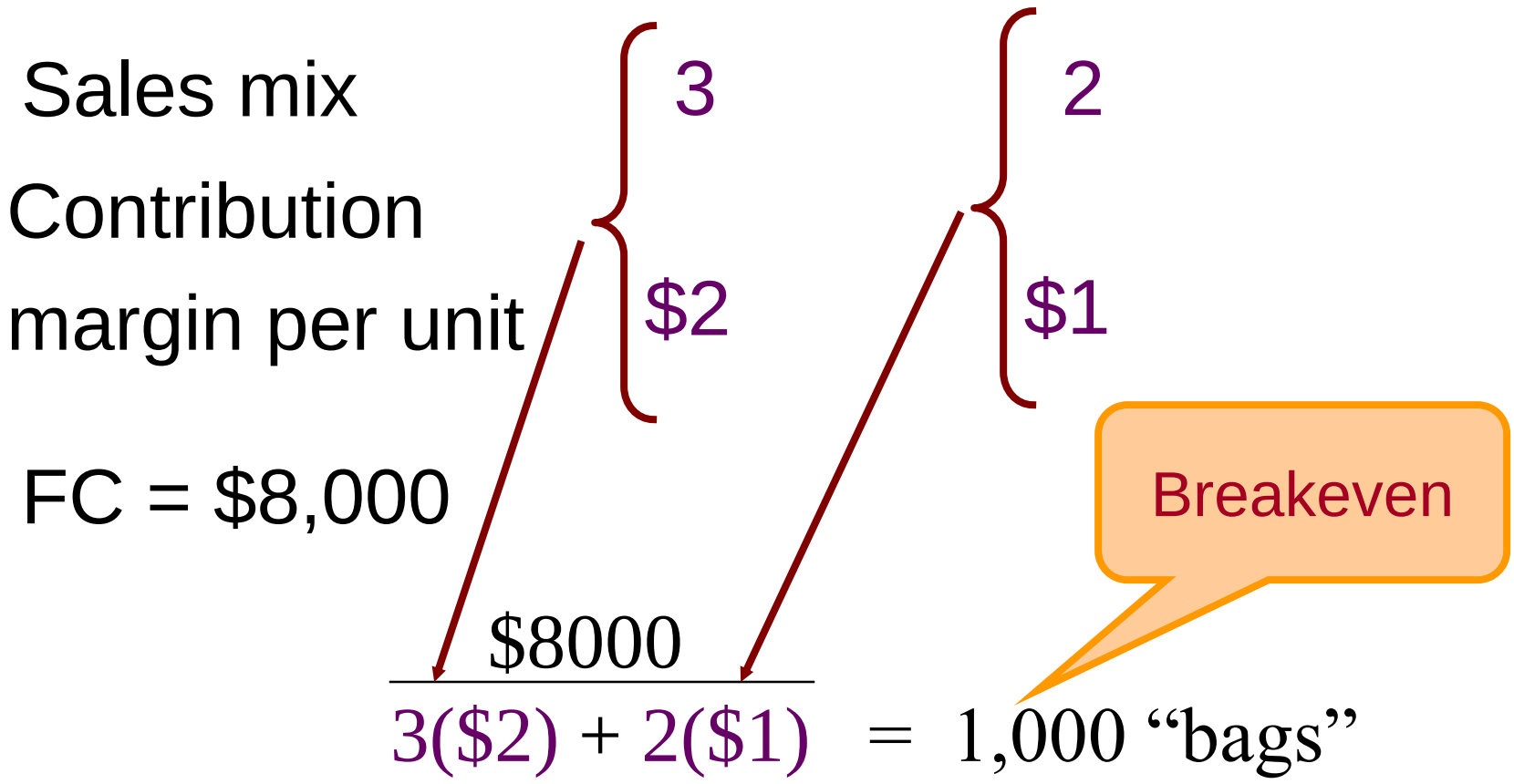
Multiproduct CVP Analysis

Assumes a constant product sales mix

Contribution margin is weighted on the quantities of each product included in the “bag” of products

Contribution margin of the product making up the largest proportion of the bag has the greatest impact on the average contribution margin of the product mix

Multiproduct CVP Analysis



"Bag"—three units of first product for every two units second product.

Multiproduct CVP Analysis

Sales mix	3	2
Breakeven "bag"	x 1,000	x 1,000
Breakeven units	3,000	2,000

To break even, sell 3,000 of first product and 2,000 of second product.

Income Statement Proof

		Product 1	Product 2	Total
	Sales (units)	3,000	2,000	
	CM per unit	X 2	X 1	
	Total CM	$6,000	$2,000	$8,000
Less	Total fixed costs			(8,000)
	Profit before taxes			-0-

Margin of Safety

How far the company is operating from its BEP

Budgeted (or actual) sales after the BEP

The amount that sales can drop before reaching the BEP

Measure of the amount of “cushion” against losses

Indication of risk

The lower the margin of safety, the more carefully management must watch sales and control costs.

Margin of Safety

Units

Actual units – break-even units

Dollars

Actual sales dollars – break-even sales dollars

Percentage

$$\frac{\text{Margin of Safety in units or dollars}}{\text{Actual unit sales or dollar sales}}$$

Operating Leverage

Relationship of variable and fixed costs

Effect on profits when volume changes

Cost structure strongly influences the impact that a change in volume has on profits

Operating Leverage

High Operating Leverage	Low Operating Leverage
Low variable costs	High variable costs
High fixed costs	Low fixed costs
High contribution margin	Low contribution margin
High BEP	Low BEP
Sales after break-even have greater impact on profits	Sales after break-even have lesser impact on profits

Degree of Operating Leverage

Measures how a percentage change in sales will affect profits

Degree of Operating Leverage

$$\frac{\text{Contribution Margin}}{\text{Profit Before Taxes}}$$

Degree of Operating Leverage and Margin of Safety

- When margin of safety is small, the degree of operating leverage is large

Margin of Safety % = 1/Degree of Operating Leverage

Degree of Operating Leverage = 1/Margin of Safety %

Degree of Operating Leverage and Margin of Safety

Actual sales	200,000 units
Break-even sales	90,000 units
Contribution margin	$408,000
Profit before tax	$224,400

$$\text{Margin of Safety \%} = \frac{\text{Actual sales} - \text{Break-even sales}}{\text{Actual sales}}$$

$$55\% = \frac{200{,}000 - 90{,}000}{200{,}000}$$

Degree of Operating Leverage and Margin of Safety

Actual sales	200,000 units
Break-even sales	90,000 units
Contribution margin	$408,000
Profit before tax	$224,400

$$\text{Degree of Operating Leverage} = \frac{\text{Contribution margin}}{\text{Profit before taxes}}$$

$$1.818 = \frac{\$408,000}{\$224,400}$$

Degree of Operating Leverage and Margin of Safety

$$\text{Margin of Safety \%} = \frac{1}{\text{Degree of Operating Leverage}}$$

$$55\% = \frac{1}{1.818}$$

$$\text{Degree of Operating Leverage} = \frac{1}{\text{Margin of Safety\%}}$$

$$1.818 = \frac{1}{.55}$$

Additional CVP Assumptions

Total contribution margin increases proportionally with increases in unit sales

No change in inventory (production equals sales)

No change in capacity

Sales mix remains constant

Anticipated price level changes included in formulas

Labor productivity, production technology, and market conditions remain constant

Are fixed costs fixed or long-term variable costs?

Questions

What is the difference between absorption and variable costing?

How do companies use CVP analysis?

What are the underlying assumptions of CVP analysis?

Potential Ethical Issues

Ignoring relevant range in setting assumptions about cost behavior

Using absorption (fixed manufacturing) costs as part of variable costs for CVP analysis

Using improper assumptions about cost and volume relationships to manipulate results

Assuming constant sales mix while ignoring demand for individual products

Using CVP analysis to improperly support long-term cost management strategies

Visually distorting break-even graphs

Using irrelevant information in incremental analysis

Reference and source

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