

Cost-Volume-Profit

LO 1: Apply Concepts

Review Terms

Cost-Volume-Profit Analysis

Cost-Volume-Profit Income Statement

Contribution Margin

Unit Contribution Margin

Breakeven Point

Contribution Margin Ratio

CVP income statement

- Basic CVP income statement shows contribution margin, usually both in total and for a per unit basis

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

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

- Detailed CVP income statement shows types of variable and fixed costs

Breakeven

- To Determine Breakeven in units:
 $\text{Fixed Costs} \div \text{Unit Contribution Margin} = \text{Breakeven in units}$
- To Determine Breakeven in Sales Dollars:
 $\text{Fixed Costs} \div \text{Contribution Margin Ratio} = \text{Breakeven in dollars}$

Target Net Income

- To Determine Breakeven in units:
 $(\text{Fixed Costs} + \text{Target Net Income}) \div \text{Unit Contribution Margin} = \text{Breakeven in units}$
- To Determine Breakeven in Sales Dollars:
 $(\text{Fixed Costs} + \text{Target Net Income}) \div \text{Contribution Margin Ratio} = \text{Breakeven in dollars}$

Margin of Safety

1. In Dollars:
 $\text{Actual (expected) Sales} - \text{Break-even Sales} = \text{Margin of Safety in Dollars}$
2. As a Ratio:
 $\text{Margin of Safety in Dollars} / \text{Actual (expected) Sales} = \text{Margin of Safety Ratio}$

CVP Analysis

Uses the above equations to study the effects of changes in cost and volume on a company's profit

Practice #1

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. The sales manager is proposing a 10% reduction in selling price, which he believes will produce a 25% increase in the number of pillows, sold each month.

Required:

- A) What is the current and proposed break-even points in units? Will the proposed break-even point be supported by the 25% increase in pillows?
- B) What is the current and proposed margin of safety?
- C) Based on A and B, should the company make the proposed changes?
- D) If the company makes the proposed change, but also increase advertising expenses by \$10,000, how many units must they sell to have a net income of \$315,800? What is the dollar sales?

LO 2: Sales Mix

The sales mix is the relative percentage in which a company sells its multiple products and is used to determine breakeven for the company as a whole.

Follow the following steps to determine breakeven in sales dollars or units. To determine sales dollars, use contribution margin ratios and sales mix for sales. To determine units, use contribution margin per unit and sales mix for units.

Step 1: Find sales mix percentage for each product.

Unit

Product 1 unit sales / total unit sales = Product 1 sales mix percentage for units

Product 2 unit sales / total unit sales = Product 2 sales mix percentage for units

Sales

Product 1 total sales dollars / total dollar sales = Product 1 sales mix percentage for sales

Product 2 total sales dollars / total dollar sales = Product 2 sales mix percentage for sales

Note: total unit sales = Product 1 unit sales + Product 2 unit sales

Step 2: Find Weighted Average Unit Contribution Margin

$$\frac{(\text{Contribution Margin Product 1} * \text{Sales Mix Percentage}) + (\text{Contribution Margin Product 2} * \text{Sales Mix Percentage})}{\text{Weighted Average contribution margin}}$$

Step 3: Determine Breakeven

$$\text{Fixed Costs} / \text{weighted average contribution margin} = \text{Breakeven point}$$

Step 4: Determine individual product amounts

$$\text{Breakeven point} * \text{Sales mix Product 1} = \text{Dollar or units of Product 1 to breakeven}$$

$$\text{Breakeven point} * \text{Sales mix Product 2} = \text{Dollar or units of Product 2 to breakeven}$$

Practice #2

Z Company sells two models of doghouses, the Puppy Palace and the Canine Castle. Fixed costs are \$742,875.

	Puppy Palace	Canine Castle
Sales price per unit	\$50	\$75
Variable cost per unit	30	30
Unit Sales	37,500	12,500

Determine the company's breakeven point in sales units and dollars.

LO 3: Limited Resources**Terms**

Theory of constraints

Limited resource decisions: Management must determine which products will maximize net income in multiple produce utilize the same resource. They can do this by determining the contribution margin per unit of the limited resource.

Unit contribution margin	/	Limited resource requirement per unit	=	Contribution margin per unit of limited resource
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1. Calculate contribution margin per unit
2. Apply above formula to get contribution margin per unit of limited resource

3. Produce product with highest contribution margin per unit of limited resource to meet demand, then produce other products in order of contribution margin per unit of limited resource from highest to lowest.

Practice #3

Management has limited machine hours to produce three different products. Below is the information management has gathered. Which order should they produce the products?

	Product A	Product B	Product C
Sales per unit	\$10	\$20	\$25
Variable Cost per unit	5	8	11
Machine Hours Required per unit	.2	.4	.6

LO 4: Operating Leverage

Terms

Cost structure

Operating leverage

Degree of operating leverage

- Operating leverage quantifies, at a given level of sales, the percent change in operating income caused by a percent change in sales.
- Leverage calculations are a two-step process:
 - calculate the Degree of Operating Leverage

$$\text{Degree of Operating Leverage} = \frac{\text{Contribution Margin}}{\text{Net Income}}$$
 - **Step 2:** calculate the percent change in operating income:

$$\text{Percent change in operating income} = \text{Degree of Leverage} \times \text{Operating Income}$$

Practice #4

P 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: Compute the current degree of operating leverage. Management expected sales to increase 10% if variable costs decreased \$10 per unit and increasing fixed costs by \$109,600. Calculate the new degree of operating leverage. Which produces a better degree of operating leverage?

Solution #1

A)

	Current	Proposed
Sales	90	81
Variable Cost	63	63
Contribution Margin	27	18
Fixed Costs	135,000	135,000
Breakeven in units	5,000	7,500

Sales- Variable costs= Contribution margin

Fixed costs/contribution margin= breakeven in units

The proposed breakeven point will require an increase in sales of 50%.

B) Current: $(8,000 \times 90) - (5,000 \times 90) = 270,000$

Proposed: $((8,000 \times 1.25) \times 81) - (7,500 \times 81) =$
 $(10,000 \times 81) - (7,500 \times 81) = 202,500$

C) No, margin of safety is reduced and break-even sales increase by more than 25%

D) $135,000 + 10,000 = 145,000$ in fixed costs

$(145,000 + 315,800) / 18 = 25,600$

$(145,000 + 315,800) / 22\% = \$2,073,600$

Solution #2

Step 1:

Unit

Puppy Palace $37,500 / 50,000 = 75\%$

Canine Castle $12,500 / 50,000 = 25\%$

Sales

Puppy Palace $(37,500 \times 50) / 2,812,500 = 67\%$

Canine Castle $(12,500 \times 75) / 2,812,500 = 33\%$

Step 2:

Puppy Palace $50 - 30 = 20$ per unit or 40%

Canine Castle $75 - 30 = 45$ per unit or 60%

	Puppy Palace		Canine Castle	Company Total
Weighted Average Contribution Margin per Unit	$20 \times 75\%$	+	$45 \times 25\%$	26.25 per unit
Weighted Average Contribution Margin Ratio	$40\% \times 67\%$	+	$60\% \times 33\%$	46.6%

Step 3:

$\$742,875 / 26.25 = 28,300$ units

$\$742,875 / 46.6\% = \$1,594,152$

Step 4:

Puppy Palace $28,300 \times 75\% = 21,225$

Canine Castle $28,300 \times 25\% = 7,075$
 Puppy Palace $\$1,594,152 \times 66.7\% = 1,063,300$
 Canine Castle $\$1,594,152 \times 33.3\% = 530,852$

Note: Some rounding causes breakeven units * selling price to not exactly equal breakeven in sales dollars

Solution #3

	Product A	Product B	Product C
Sales per unit	\$10	\$20	\$25
Variable Cost per unit	5	8	11
Contribution Margin	5	12	14
Machine Hours Required per unit	.2	.4	.6
Contribution margin per limited resource	\$25	\$30	\$23.33

Produce in the following order: B,A,C

Solution #4

	<u>Per Unit</u>	<u>Present</u> <u>%</u>	<u>Total</u>	<u>Proposed</u> <u>Total</u>
Units	1		8,000	8,800
Sales	\$90	100.0	\$720,000	\$792,000
Variable expenses	63	70.0	504,000	466,400
Contribution Margin	27	30.0	216,000	325,600
Fixed expenses			135,000	244,600
Operating income			<u>\$81,000</u>	<u>\$81,000</u>

Degree of leverage	2.67	4.02
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The changes would produce a better degree of operating leverage because switching the cost structure to higher fixed costs, increases the operating leverage and with a percent change in sales would produce a higher percent change in net income.