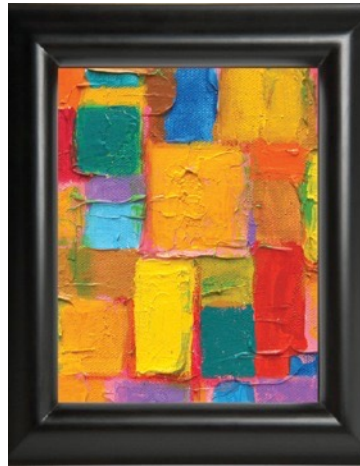


# Cost-Volume-Profit Analysis

## Chapter 7



# Objective 1

Calculate the unit contribution margin  
and the contribution margin ratio



# Cost-Volume-Profit (CVP) Analysis

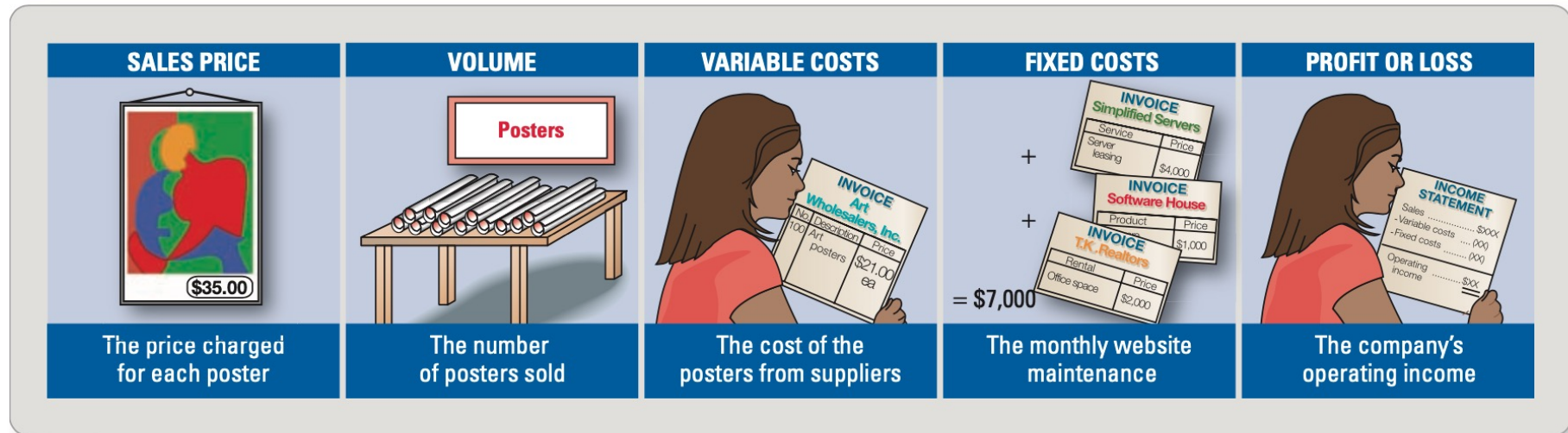
- Is a powerful tool that helps managers make important business decisions
- Is a relationship among costs, volume, and profit or loss
- Determines how much the company must sell each month just to cover costs or to break even
- Helps managers determine the sales volume needed to earn a target profit

# Components of CVP Analysis

- CVP analysis relies on the interdependency of five components, or pieces of information
  - Sales price per unit
  - Volume sold
  - Variable costs per unit
  - Fixed costs
  - Profit or loss

# Components of CVP Analysis

**EXHIBIT 7-1** Components of CVP Analysis



# CVP Assumptions

1. A change in volume is the only factor that affects costs
2. Managers can classify each cost (or the components of mixed costs) as either variable or fixed. Costs are linear throughout relevant range of volume.
3. Revenues are linear in relevant range of volume.

# CVP Assumptions

4. Inventory levels will not change. Keep no inventory or no inventory greatly fluctuate from one period to the next.

5. The sales mix of products will not change.  
Sales mix is the combination of products that make up total sales.

# Reviews from last chapter

- Contribution margin income statement:
  - 1) Separate costs on the income statement by cost behavior rather than function.
  - 2) Information for CVP analysis in a “ready-to-use” format.
  - 3) Contribution margin= Sales- Variable Costs



# Contribution margin per unit

- Another name: unit contribution margin
- Contribution margin per unit = sales per unit - variable cost per unit
- Each unit contribution margin first cover firm's fixed costs.
- Thus, each additional unit sold improves the company's operating income by the amount of the unit contribution margin.

# Contribution margin per unit

- Manager could forecast operating income
- Operating Income

= total contribution margin - fixed costs

- Total contribution margin

= unit contribution margin \* number of units  
sale (Later)

# Contribution margin per unit

- Contribution margin ratio  
= contribution margin per unit / sales price per unit  
= contribution margin / sales revenue
- The contribution margin ratio is the percentage of **each sales dollar** that is available for covering fixed expenses and generating a profit

# Total contribution margin

- Total contribution margin  
= unit contribution margin \* number of units  
sale  
= contribution margin ratio \* sales revenues  
(**NOT sales units**)

# Notes

- Managers must keep in mind the relevant range.
- What if a large company offers hundreds or thousands of products?

As long as sales mix remain constant (one of our CVP assumptions), the contribution margin ratio will remain constant.

# CVP Example Facts–Kay's Posters

Kay has an e-tail poster business. She currently sells each poster for \$35, while each poster has a variable cost of \$21. Kay has fixed costs of \$7,000. Kay is currently selling 550 posters.

# Contribution Margin Income Statement

## Kay's e-tail poster example from prior slide

Sales revenue (550 posters).....	\$ 19,250
Less: Variable expenses .....	<u>11,550</u>
Contribution margin .....	7,700
Less: Fixed expenses.....	<u>7,000</u>
Operating income.....	<u>\$ 700</u>

# Unit Contribution Margin

Kay's e-tail poster example from previous slides

Sales price per unit	\$35
Less: Variable costs per unit	<u>21</u>
Contribution margin per unit	<u>\$14</u>

---

Now assume sales are 650 units:

Contribution margin (650 sales x \$14)	\$9,100
Less: Fixed expenses	<u>7,000</u>
Operating income	<u>\$2,100</u>



# Contribution Margin Ratio

Contribution margin ratio = *percentage of each sales dollar that is available for covering fixed expenses and generating a profit.*

$$\text{Contribution margin ratio} = \frac{\text{Contribution margin per unit}}{\text{Sales price per unit}} = \frac{\$14}{\$35} = 40\%$$

$$\text{Contribution margin ratio} = \frac{\text{Contribution margin}}{\text{Sales revenue}} = \frac{\$7,700}{\$19,250} = 40\%$$

*Numbers above are from the Kay's e-tail poster example on previous slides.*

# Now Turn to S7-1

## Crystal Cruiseline Data Set used for S7-1 through S7-12:

---

Crystal Cruiseline offers nightly dinner cruises off the coast of Miami, San Francisco, and Seattle. Dinner cruise tickets sell for \$50 per passenger. Crystal Cruiseline's variable cost of providing the dinner is \$20 per passenger, and the fixed cost of operating the vessels (depreciation, salaries, docking fees, and other expenses) is \$210,000 per month. The company's relevant range extends to 14,000 monthly passengers.

---

### **S7-1 Compute unit contribution margin and contribution margin ratio**

*(Learning Objective 1)*

Use the information from the Crystal Cruiseline Data Set to compute the following:

- What is the contribution margin per passenger?
- What is the contribution margin ratio?
- Use the unit contribution margin to project operating income if monthly sales total 11,000 passengers.
- Use the contribution margin ratio to project operating income if monthly sales revenue totals \$490,000.

# S7-1

- a. What is the contribution margin per passenger?

Sales revenue (1 passenger).....	\$50
Less: Variable expenses .....	\$20
Contribution margin .....	\$30

## S7-1 (cont.)

b. What is the contribution margin ratio?

$$\text{Contribution margin ratio} = \frac{\text{Unit contribution margin}}{\text{Sales price per unit}} = \frac{\$30}{\$50} = 60\%$$

c. Use the unit contribution margin to project operating income if monthly sales total 11,000 passengers.

$$11,000 \times \$30 = \$330,000 - \text{Fixed costs of } \$210,000 = \$120,000$$

d. Use the contribution margin ratio to project operating income if monthly sales revenue totals \$490,000.

<b>Contribution margin ( \$490,000 sales x 60%)</b>	<b>\$294,000</b>
<b>Less: Fixed cost</b>	<b><u>210,000</u></b>
<b>Operating income</b>	<b><u>\$ 84,000</u></b>

# Now Turn to S7-2

## Crystal Cruiseline Data Set used for S7-1 through S7-12:

---

Crystal Cruiseline offers nightly dinner cruises off the coast of Miami, San Francisco, and Seattle. Dinner cruise tickets sell for \$50 per passenger. Crystal Cruiseline's variable cost of providing the dinner is \$20 per passenger, and the fixed cost of operating the vessels (depreciation, salaries, docking fees, and other expenses) is \$210,000 per month. The company's relevant range extends to 14,000 monthly passengers.

---

### **S7-2** Project change in income (*Learning Objective 1*)

Use the information from the Crystal Cruiseline Data Set. If Crystal Cruiseline sells an additional 600 tickets, by what amount will its operating income increase (or operating loss decrease)?

## S7-2

- If Crystal Cruiseline sells an additional 600 tickets, by what amount will its operating income increase (or operating loss decrease)?

Contribution margin per unit × additional tickets

$$600 \text{ tickets} \times \$30 = \$18,000$$

# Objective 2

Use CVP analysis to find breakeven points and target profit volumes



# Breakeven Point

Breakeven point:

- Sales level at which operating income is zero
  - If sales above breakeven, then profit
  - If sales below breakeven, then loss
- Fixed expenses = Total contribution margin
- Total sales = Total expenses



# Breakeven Point

- Three ways to calculate the breakeven point
  - 1) The income statement approach
  - 2) The shortcut approach using the unit contribution margin
  - 3) The shortcut approach using the contribution margin ratio

Note: 1) & 2) find breakeven in terms of sale units; 3) finds breakeven in terms of sales revenue (sales dollars)

# Breakeven Point Rules of Thumb

*When finding the breakeven point, always use “zero” as the operating income in the formulas.*

*Once a company achieves breakeven, each additional unit sold contributes its unique unit contribution margin directly to profit.*

*Dividing fixed costs by the **unit** contribution margin provides breakeven in sales **units**. Dividing fixed costs by the contribution margin **ratio** provides breakeven in sales **dollars** (sales revenue).*

# Income Statement Approach

SALES REVENUE – VARIABLE EXPENSES – FIXED EXPENSES = OPERATING INCOME

$$\left( \begin{matrix} \text{Sales price} \\ \text{per unit} \end{matrix} \times \text{Units sold} \right) - \left( \begin{matrix} \text{Variable cost} \\ \text{per unit} \end{matrix} \times \text{Units sold} \right) - \text{Fixed expenses} = \text{Operating income}$$

SALES REVENUE – VARIABLE EXPENSES – FIXED EXPENSES = OPERATING INCOME

$$\left( \begin{matrix} \text{Sales price} \\ \text{per unit} \end{matrix} \times \text{Units sold} \right) - \left( \begin{matrix} \text{Variable cost} \\ \text{per unit} \end{matrix} \times \text{Units sold} \right) - \text{Fixed expenses} = \text{Operating income}$$

$$(\$35 \times \text{Units sold}) - (\$21 \times \text{Units sold}) - \$7,000 = \$0$$

$$(\$35 - \$21) \times \text{Units sold} - \$7,000 = \$0$$

$$\$14 \times \text{Units sold} = \$7,000$$

$$\text{Units sold} = \$7,000 / \$14$$

$$\text{Sales in units} = 500 \text{ posters}$$

# Approach: Unit Contribution Margin

$$\text{SALES REVENUE} - \text{VARIABLE EXPENSES} - \text{FIXED EXPENSES} = \text{OPERATING INCOME}$$

$$\underbrace{\text{Contribution margin}} - \text{Fixed expenses} = \text{Operating income}$$

$$\text{Contribution margin} = \text{Fixed expenses} + \text{Operating income}$$

$$(\text{Contribution margin per unit} \times \text{Units sold}) = \text{Fixed expenses} + \text{Operating income}$$

$$\text{Sales in units} = \frac{\text{Fixed expenses} + \text{Operating income}}{\text{Contribution margin per unit}}$$

# Using Unit Contribution Margin to Calculate Breakeven Point in Units

$$\text{Units sold} = \frac{\text{Fixed expenses} + \text{Operating income}}{\text{Contribution margin per unit}}$$

$$\text{Units sold} = \frac{\$7,000 + \$0}{\$14}$$

$$= 500 \text{ posters}$$

*Numbers above are from the Kay's e-tail poster example on previous slides.*

# Approach: Contribution Margin Ratio

- Why: It doesn't make sense for large companies to determine the number of each various product they need to sell to breakeven.
- Multiproduct companies usually compute breakeven in terms of sales revenue (dollars).

# Approach: Contribution Margin Ratio

$$\text{Sales in dollars} = \frac{\text{Fixed expenses} + \text{Operating income}}{\text{Contribution margin ratio}}$$

# Using Contribution Margin Ratio to Calculate Breakeven Point in Sales Dollars

$$\text{Sales in \$} = \frac{\text{Fixed expenses} + \text{Operating income}}{\text{Contribution margin ratio}}$$

$$\text{Sales in \$} = \frac{\$7,000 + \$0}{0.40}$$

$$= \$17,500$$

*Numbers above are from the Kay's e-tail poster example on previous slides.*



# Finding Volume Needed for Target Profit Using Unit CM

Assume that Kay wants to earn an operating income of \$4,900.

$$\text{Units to be sold} = \frac{\text{Fixed expenses} + \text{Operating income}}{\text{Contribution margin per unit}}$$

$$\text{Units to be sold} = \frac{\$7,000 + \$4,900}{\$14} = \frac{\$11,900}{\$14}$$

$$= 850 \text{ posters}$$

$$= 850 \text{ posters} \times \$35 = \$29,750 \text{ (Sales dollars needed to achieve target profit)}$$

# Finding the Volume Needed for a Target Profit Using CM Ratio

- CVP analysis helps managers determine what they need to sell to earn a target amount of profit

$$\text{Sales \$ needed} = \frac{\text{Fixed expenses} + \text{Target operating income}}{\text{Contribution margin ratio}}$$

$$\begin{aligned}\text{Sales \$ needed} &= \frac{\$7,000 + \$4,900}{0.40} = \frac{\$11,900}{0.40} \\ &= \$29,750\end{aligned}$$

*Numbers above are from the Kay's e-tail poster example on previous slides.*

# Now Turn to S7-3

Crystal Cruiseline Data Set used for S7-1 through S7-12:

---

Crystal Cruiseline offers nightly dinner cruises off the coast of Miami, San Francisco, and Seattle. Dinner cruise tickets sell for \$50 per passenger. Crystal Cruiseline's variable cost of providing the dinner is \$20 per passenger, and the fixed cost of operating the vessels (depreciation, salaries, docking fees, and other expenses) is \$210,000 per month. The company's relevant range extends to 14,000 monthly passengers.

---

## **S7-3 Find breakeven** (*Learning Objective 2*)

Use the information from the Crystal Cruiseline Data Set to compute the number of dinner cruise tickets it must sell to break even and the sales dollars needed to break even.

# S7-3

Breakeven number of passengers:

$$\text{Units to be sold} = \frac{\text{Fixed expenses} + \text{Operating income}}{\text{Contribution margin per unit}}$$

$$\text{Units to be sold} = \frac{\$210,000 + \$0}{\$30}$$

$$\text{Units to be sold} = \frac{\$210,000}{\$30}$$

$$= 7,000 \text{ passengers}$$

## S7-3 (cont.)

Sales revenue needed to break even:

$$7,000 \text{ units to breakeven} \times \$50 \text{ sales price} = \$350,000$$

Alternatively:

$$\text{Sales in \$} = \frac{\text{Fixed expenses} + \text{Operating income}}{\text{Contribution margin ratio}^*}$$

$$\begin{aligned} \text{Sales in \$} &= \frac{\$210,000 + 0}{0.60} \\ &= \$350,000 \end{aligned}$$

$$^*\text{CM ratio} = \$30/\$50 = .60$$

# Graphing the CVP Relationships

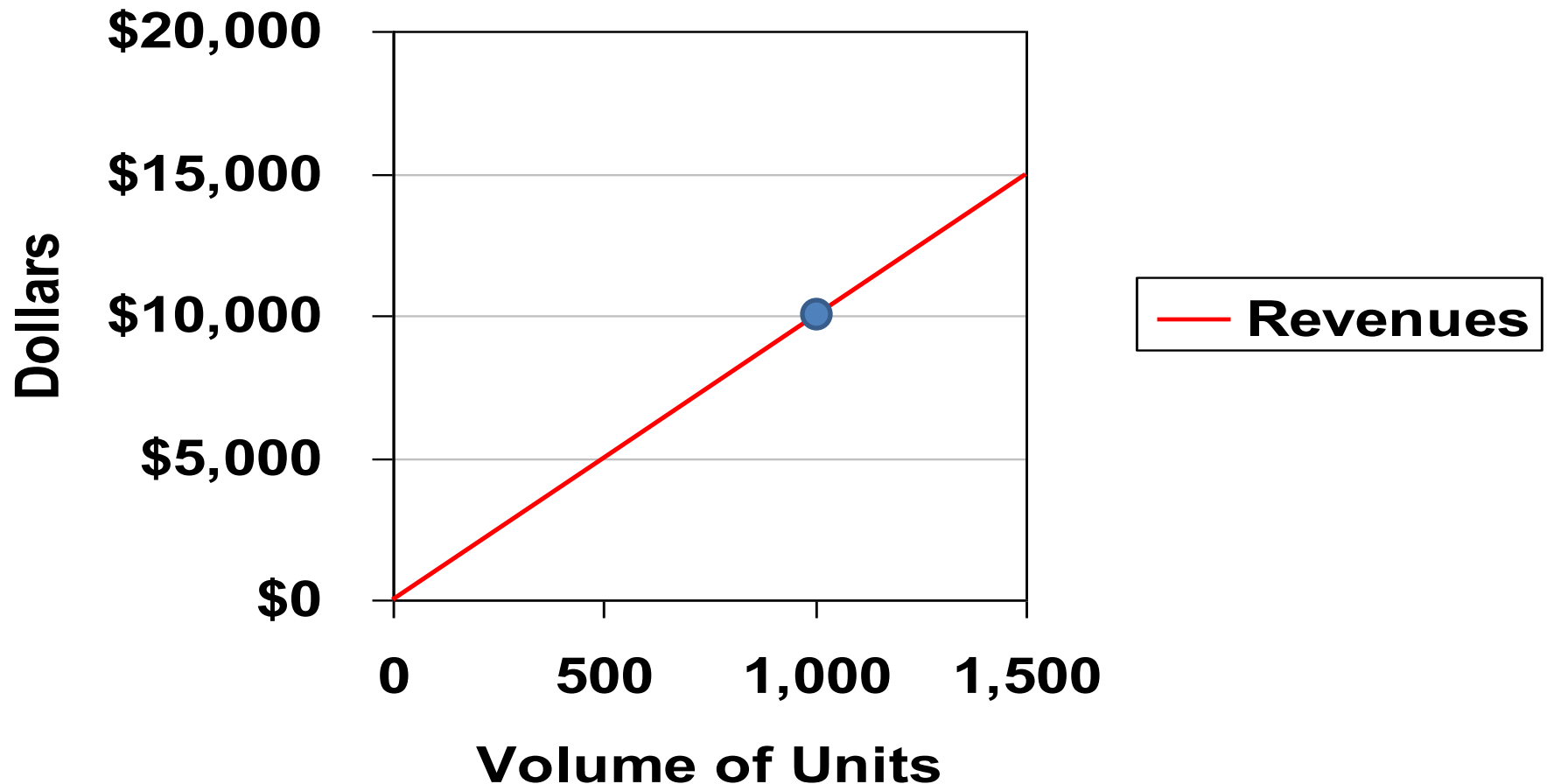
## Step 1:

- Choose a sales volume (Units x \$Price)
- Plot point for total sales revenue
- Draw sales revenue line from origin (0) through the plotted point

# Preparing a CVP Chart

Step 1:

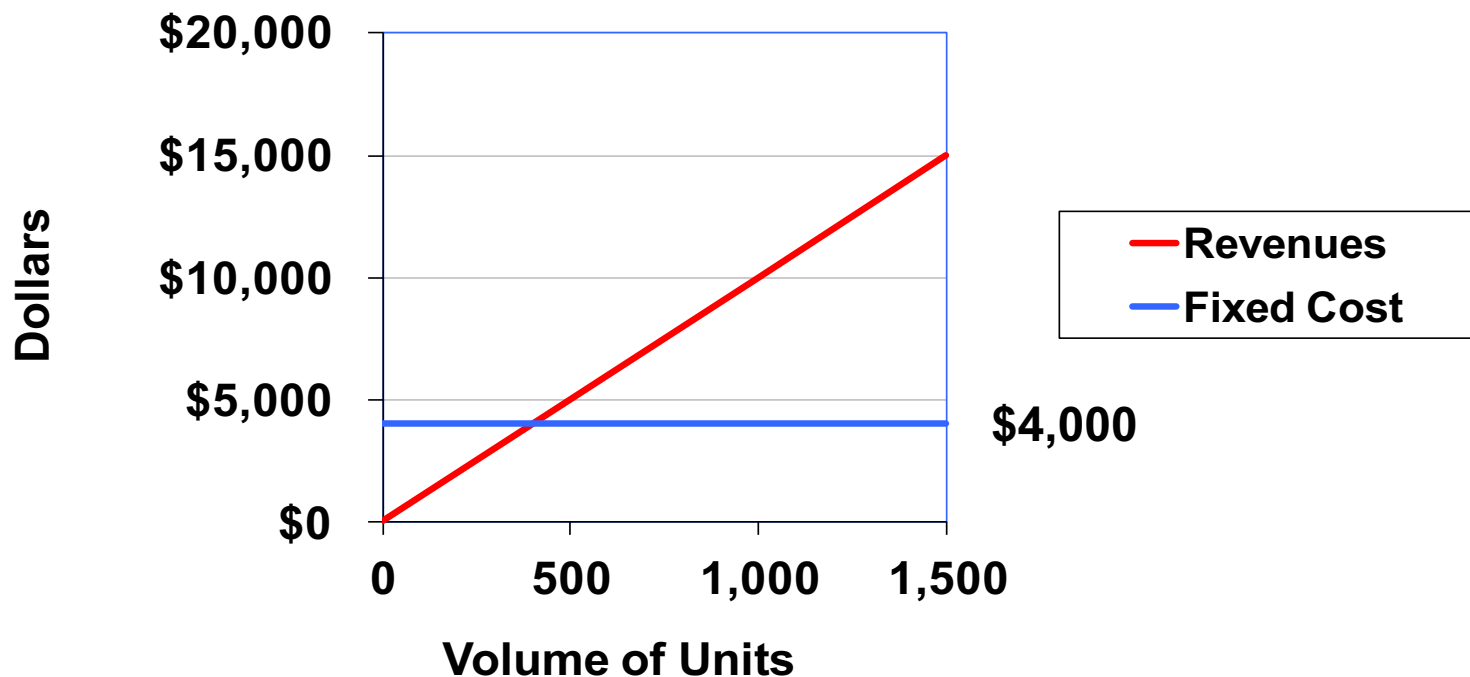
— Choose the sales volume



# Preparing a CVP Chart

## Step 2:

—Draw the fixed cost line

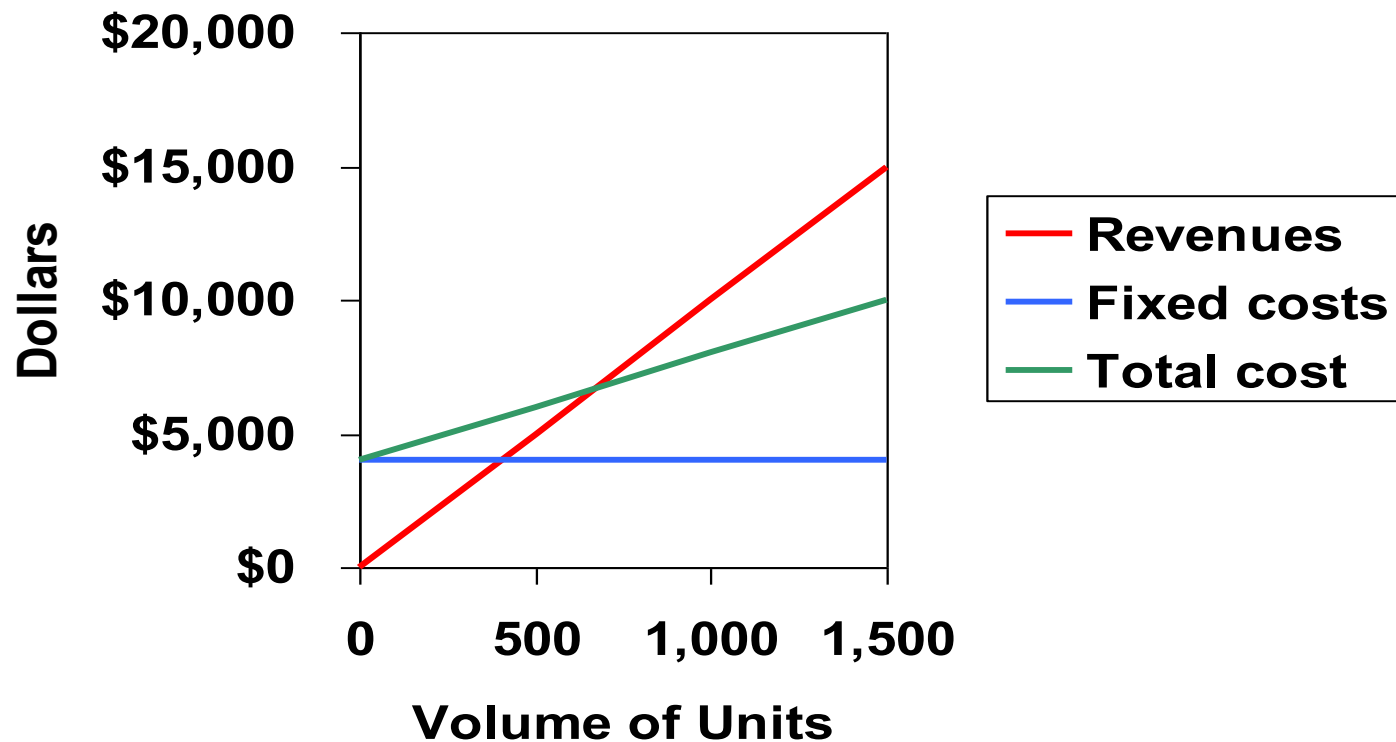




# Preparing a CVP Chart

## Step 3:

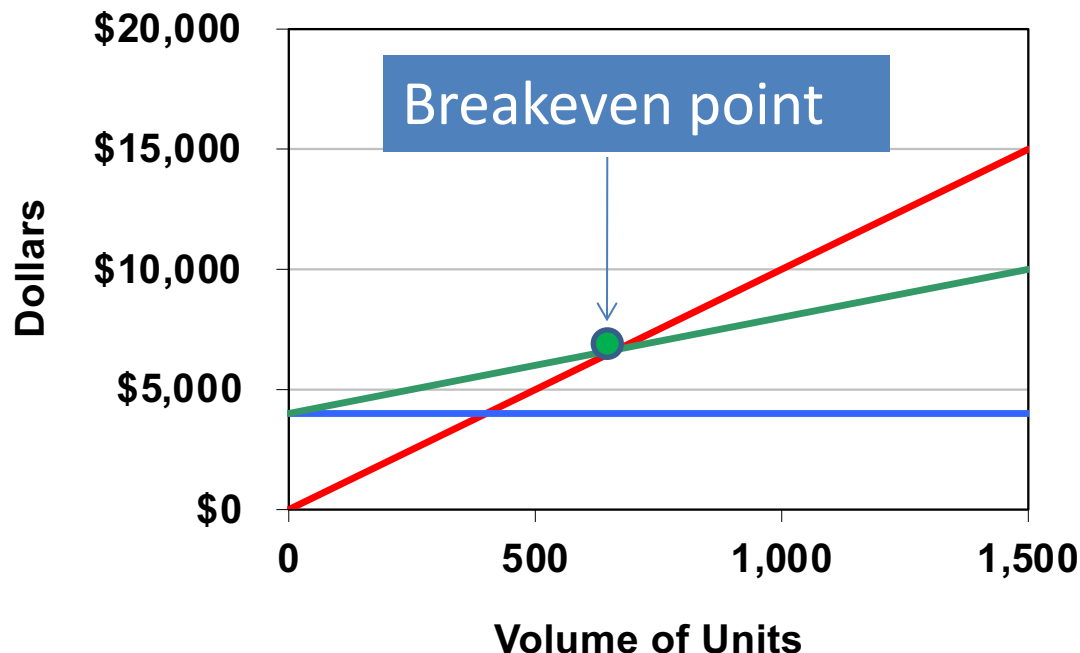
- Draw the total cost line (fixed plus variable)



# Preparing a CVP Chart

## Step 4:

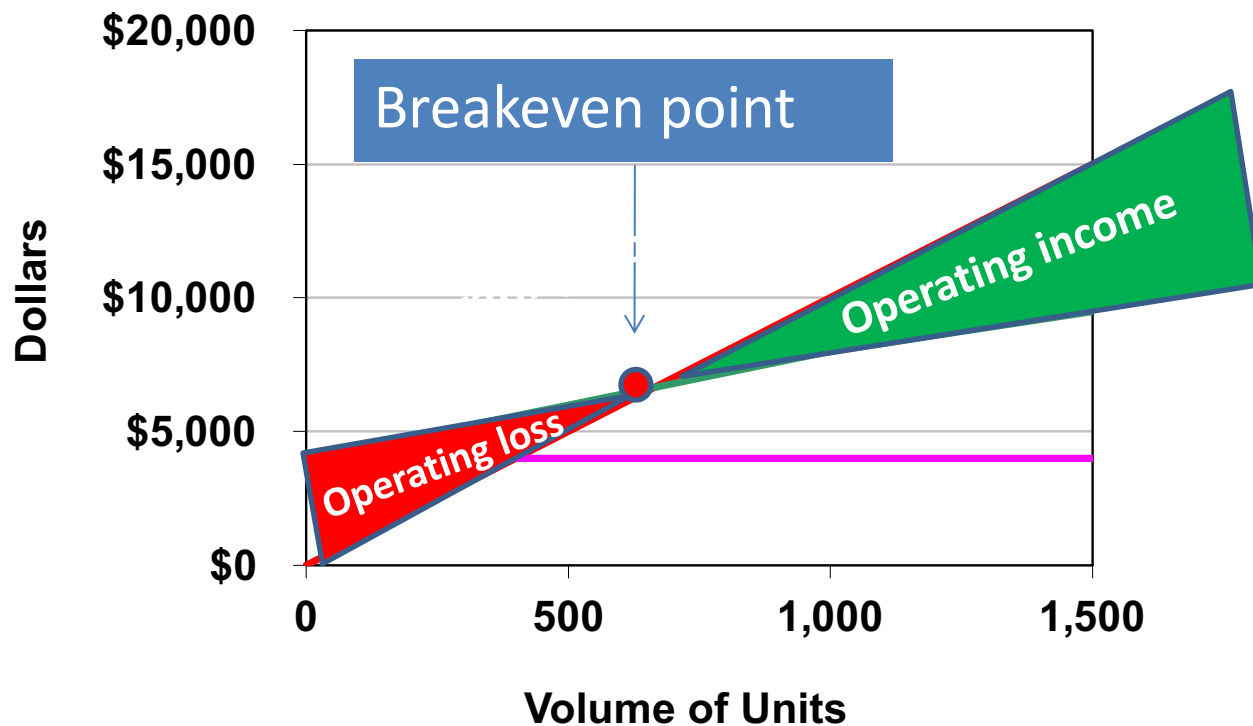
- Identify the breakeven point (sales revenues line intersects the total expense line)



# Preparing a CVP Chart

## Step 5:

- Mark operating income and operating loss areas on graph



# Objective 3

Perform sensitivity analysis in response to changing business conditions



# Sensitivity Analysis

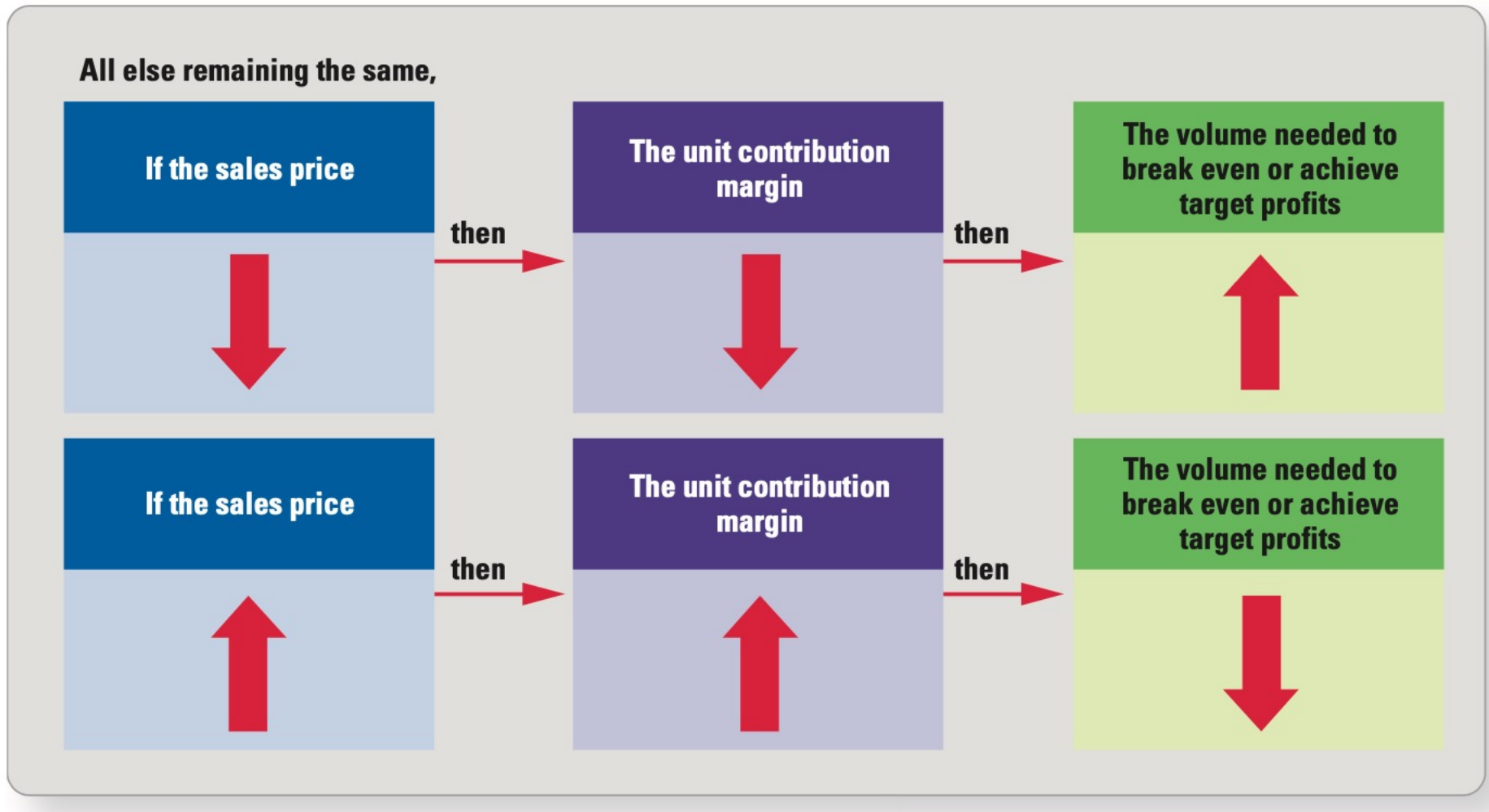
- Managers need to be prepared for increasing costs, pricing pressure from competitors, and other changing business conditions.
- Managers use CVP analysis to conduct sensitivity analysis.
- Conducts “What if” analysis, what results will be
  - If the sales price changes?
  - If costs change?
  - If the sales mix changes?

# What if the Sales Price Changes?

- Contribution margin will change
- Breakeven point will change

# What if the Sales Price Changes?

**EXHIBIT 7-5** The Effect of Changes in Sales Price on Breakeven and Target Profit Volumes



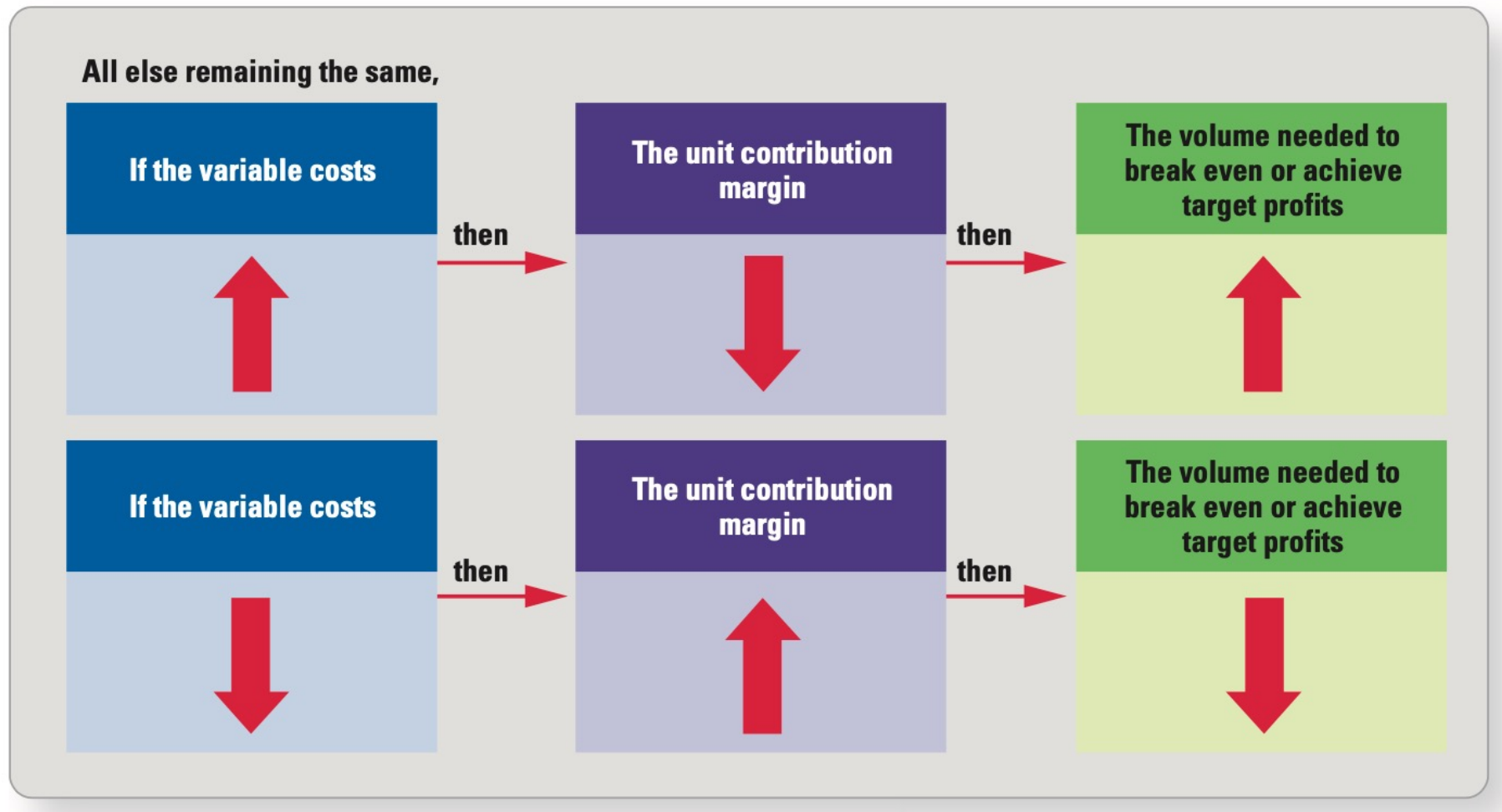
# What if Variable Costs Change?

- Contribution margin changes
- Breakeven point changes



# What if Variable Costs Change?

**EXHIBIT 7-6** The Effect of Changes in Variable Costs on Breakeven and Target Profit Volumes

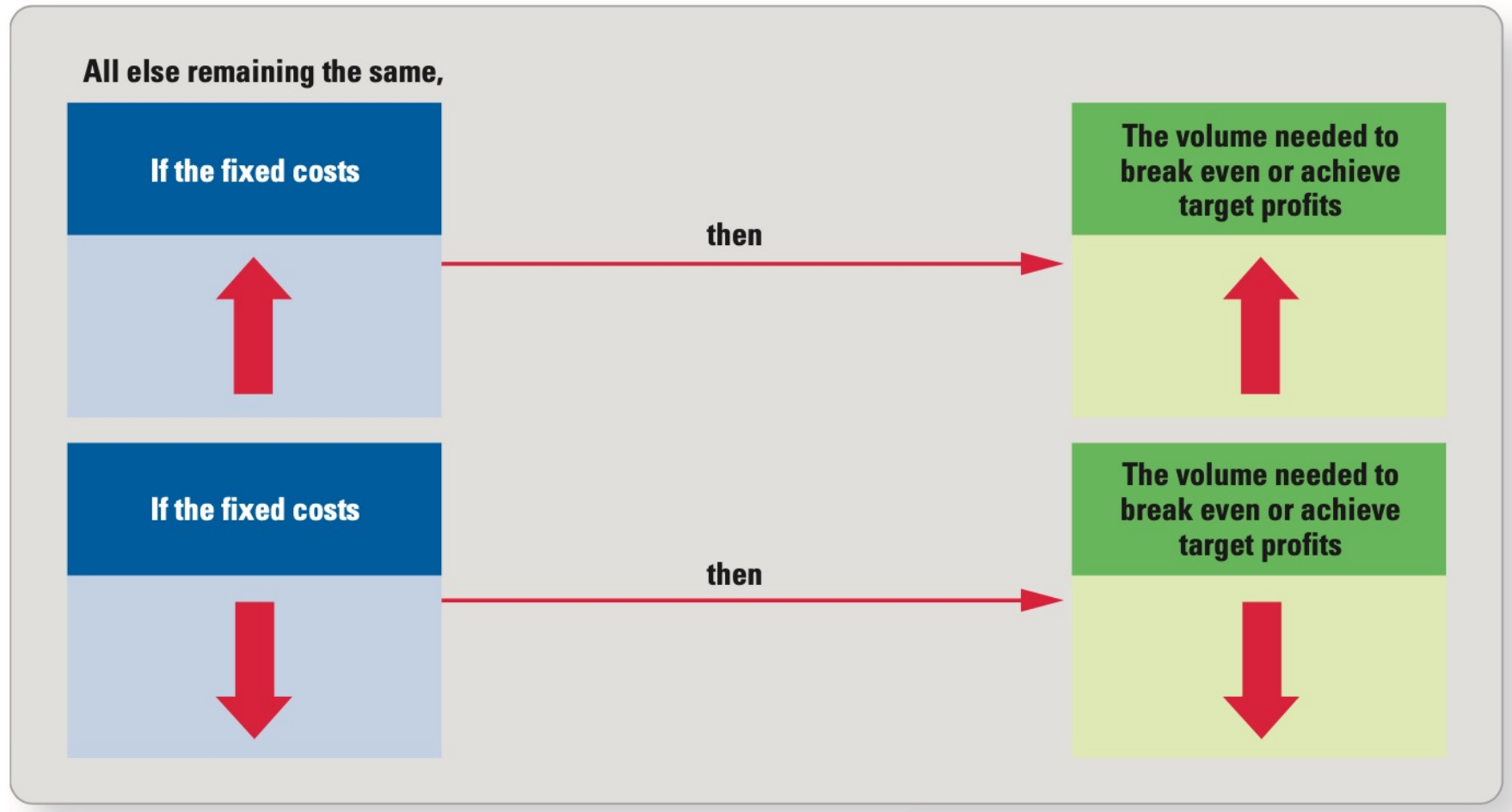


# What if Fixed Costs Change?

- Will not affect contribution margin
- Will change breakeven point

# What if Fixed Costs Change?

**EXHIBIT 7-7** The Effect of Changes in Fixed Costs on Breakeven and Target Profit Volumes

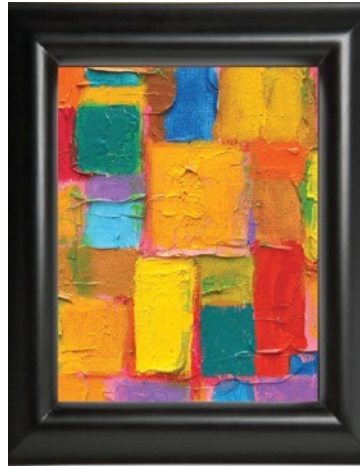


# Sustainability and CVP

- Reducing costs and helping the environment
- For example, decreasing use of plastic in bottles reduces variable costs
- Decreasing variable costs makes it easier to reach a target profit

# Objective 4

Find breakeven and target profit volumes for multiproduct companies



# Breakeven in Sales Revenue— Multiproduct Firm Example, Exhibit 7-8

	A	B	C	D
		Regular Posters	Large Posters	Total in "basket"
1	<b>Calculating Weighted Average Contribution Margin per Unit</b>			
2	Sales price per unit	\$ 35	\$ 70	
3	Less: Variable cost per unit	21	40	
4	Contribution margin per unit	\$ 14	\$ 30	
5	Multiply by: Sales mix (number of units in "basket")	5	3	8
6	Contribution margin	\$ 70	\$ 90	160
7				
8	Weighted average contribution margin per unit (\$160/8 units)			\$ 20
9				

# Breakeven in Sales Revenue— Multiproduct Firm Example (cont.)

$$\text{Units sold} = \frac{\text{Fixed expenses} + \text{Operating income}}{\text{Weighted-average contribution margin per unit}}$$

$$\text{Units sold} = \frac{\$7,000 + 0}{\$20} = \frac{\$7,000}{\$20}$$

$$= 350 \text{ posters}$$

# Breakeven in Sales Revenue— Multiproduct Firm Example (cont.)

Breakeven sales of regular posters ( $350 \times 5/8$ )	218.75 regular posters
Breakeven sales of large posters ( $350 \times 3/8$ )	131.25 large posters

*Because partial posters cannot be sold, the number of each to be sold is rounded up (to avoid a loss)*



# Now Turn to S7-9

## **S7-9** Compute weighted-average contribution margin (*Learning Objective 4*)

Use the information from the Crystal Cruiseline Data Set. Suppose Crystal Cruiseline decides to offer two types of dinner cruises: regular cruises and executive cruises. The executive cruise includes complimentary cocktails and a five-course dinner on the upper deck. Assume that fixed expenses remain at \$210,000 per month and that the following ticket prices and variable expenses apply:

	Regular Cruise	Executive Cruise
Sales price per ticket.....	\$50	\$130
Variable expense per passenger .....	\$20	\$ 40

Assuming that Crystal Cruiseline expects to sell four regular cruises for every executive cruise, compute the weighted-average contribution margin per unit. Is it higher or lower than a *simple* average contribution margin? Why? Is it higher or lower than the regular cruise contribution margin calculated in S7-1? Why? Will this new sales mix cause Crystal Cruiseline's breakeven point to increase or decrease from what it was when it sold only regular cruises?

# S7-9

Assuming that Crystal Cruiseline expects to sell four regular cruises for every executive cruise, compute the weighted-average contribution margin per unit.

<b>Sales Mix Calculation</b>	<b>Regular</b>	<b>Executive</b>	<b>Total</b>
Sales price per unit .....	\$ 50	\$130	
Less: Variable cost per unit .....	20	40	
Contribution margin per unit .....	\$ 30	\$ 90	
Sales mix .....	<u>x 4</u>	<u>x 1</u>	5
Contribution margin .....	\$120	\$ 90	\$210
Weighted-average contribution margin per unit (\$210/5) .....			<u>\$ 42</u>

# Now Turn to S7-10

## **S7-10** Continuation of S7-9: Breakeven (*Learning Objective 4*)

Refer to your answer to S7-9.

- a. Compute the total number of dinner cruises that Crystal Cruiseline must sell to break even.
- b. Compute the number of regular cruises and executive cruises the company must sell to break even.

# S7-10

$$\text{Sales in units} = \frac{\text{Fixed expenses} + \text{Operating income}}{\text{Weighted-average contribution margin per unit}}$$

$$\begin{aligned} \text{Sales in units} &= \frac{\$210,000 + 0}{\$42.00^*} && \text{*from S7-9 on prior slide} \\ &= 5,000 \text{ tickets} \end{aligned}$$

Breakeven sales of regular cruises (5,000 × 4/5).....	4,000
Breakeven sales of executive cruises (5,000 × 1/5).....	<u>1,000</u>
Total cruise passengers.....	<u>5,000</u>

# Now Turn to E7-28A

## E7-28A Extension of E7-27A: Multiproduct firm (*Learning Objective 4*)

Danny Carter admired his wife's success at selling scarves at local craft shows (E7-27A), so he decided to make two types of plant stands to sell at the shows. Danny makes twig stands out of downed wood from his backyard and the yards of his neighbors, so his variable cost is minimal (wood screws, glue, and so forth). However, Danny has to purchase wood to make his oak plant stands. His unit prices and costs are as follows:

	Twig Stands	Oak Stands
Sales price .....	\$15.00	\$35.00
Variable cost .....	\$ 2.50	\$10.00

The twig stands are more popular, so Danny sells four twig stands for every one oak stand. Susie charges her husband \$300 to share her booth at the craft shows (after all, she has paid the entrance fees). How many of each plant stand does Danny need to sell to break even? Will this affect the number of scarves Susie needs to sell to break even? Explain.

# E7-28A

## Step 1: Calculate weighted-average contribution margin

	Twig	Oak
Sale price per unit	\$15.00	\$35.00
Variable costs per unit	<u>2.50</u>	<u>10.00</u>
Contribution margin per unit	\$12.50	\$25.00
Sales mix in units	<u>x4</u>	<u>X1</u>
Contribution margin	<u>\$50</u>	<u>\$25</u>
Weighted average contribution	\$75	
Margin per unit (\$75/5)	<u>\$15</u>	

## E7-28A (cont.)

Step 2: Calculate the breakeven point in units

Fixed costs + Operating income

Weighted-average contribution margin per unit

$$(\$300 + \$0) \div \$15 = 20 \text{ composite units}$$

## E7-28A (cont.)

Step 3: Calculate the breakeven point in units for each product line

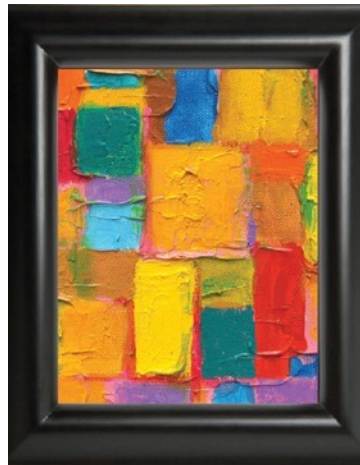
Twig stands:  $20 \text{ units} \times \frac{4}{5} = 16 \text{ units}$

Oak stands:  $20 \text{ units} \times \frac{1}{5} = 4 \text{ units}$



# Objective 5

Determine a firm's margin of safety,  
operating leverage, and most profitable  
cost structure



# Common Indicators of Risk

- Margin of safety
  - The excess of expected sales over breakeven sales
- Operating leverage
  - The relative amount of fixed and variable costs that make up a company's total costs

# Margin of Safety

- Excess of actual or expected sales over breakeven sales
- Drop in sales that the company can absorb before incurring a loss
- Used to evaluate the risk of current operations as well as the risk of new plans

# Margin of Safety—Units and Sales Dollars, Example

Margin of safety in units	=	Expected sales in units	–	Breakeven sales in units
	=	950 units	–	500 units
	=	450 units		

Margin of safety in dollars	=	Expected sales	–	Breakeven sales
	=	\$33,250	–	\$17,500
	=	\$15,750		

*Numbers above are from the Kay's e-tail poster example on previous slides.*

# Margin of Safety—Percentage, Example

$$\begin{aligned}\text{Margin of safety as a percentage} &= \frac{\text{Margin of safety in units}}{\text{Expected sales in units}} \\ &= \frac{450 \text{ Units}}{950 \text{ Units}} \\ &= 47.4\% \text{ (rounded)}\end{aligned}$$

$$\begin{aligned}\text{Margin of safety as a percentage} &= \frac{\text{Margin of safety in dollars}}{\text{Expected sales in dollars}} \\ &= \frac{\$15,750}{\$33,250} \\ &= 47.4\% \text{ (rounded)}\end{aligned}$$

# Now Turn to S7-13

## **S7-13** Compute margin of safety (*Learning Objective 5*)

Sally has an online poster business. Suppose Sally expects to sell 1,500 posters. Her average sales price per poster is \$45 and her average cost per poster is \$25. Her fixed expenses total \$15,000. Compute her margin of safety

- a. in units (posters).
- b. in sales dollars.
- c. as a percentage of expected sales.

# S7-13

a.

Margin of safety in units	=	Expected sales in units	–	Breakeven sales in units
------------------------------	---	----------------------------	---	-----------------------------

	=	1,500 units	–	750 units
--	---	-------------	---	-----------

	=	750 units		
--	---	-----------	--	--

b.

Margin of safety in dollars	=	Expected sales	–	Breakeven sales
--------------------------------	---	----------------	---	-----------------

	=	\$67,500	–	\$33,750
--	---	----------	---	----------

	=	\$33,750		
--	---	----------	--	--

## S7-13 (cont.)

c.

$$\begin{aligned}\text{Margin of safety as a percentage of expected sales} &= \frac{\text{Margin of safety in dollars}}{\text{Expected sales in dollars}} \\ &= \frac{\$33,750}{\$67,500} \\ &= 50\%\end{aligned}$$



# Operating Leverage

- Operating leverage: the relative amount of fixed and variable costs that make up its total costs.
- Formula:

$$\frac{FC}{TC} = \frac{FC}{FC + VC}$$

# High Operating Leverage

- High operating leverage companies have:
  - Higher levels of fixed costs and lower levels of variable costs
  - Higher contribution margin ratios
  - **Higher risk**
  - Higher potential for reward (*reminder*: after breakeven, each unit sold contributes its unit contribution margin directly to profit)

# Low Operating Leverage

- Low operating leverage companies have:
  - Higher levels of variable costs and lower levels of fixed costs
  - Lower contribution margin ratios
- For low operating leverage companies, changes in sales volume do NOT have as significant an effect on operating income, so they face:
  - **Lower risk**
  - Lower potential for reward
- Examples include merchandising companies.

# Risk for High/Low Operating Leverage

- High Operating Leverage (Fixed cost high):  
Sales decreases --- large amount of FC needs to be covered --- High risk
- Low Operating Leverage (Fixed cost low):  
Sales decreases --- small amount of FC needs to be covered --- Lower risk

# Operating Leverage Factor

- How responsive a company's operating income is to changes in volume
- The greater the operating leverage factor, the greater the impact a change in sales volume has on operating income.

# Operating Leverage Factor

Lowest possible value for this factor is 1, if the company has no fixed costs

$$\text{Operating leverage factor} = \frac{\text{Contribution margin}}{\text{Operating income}}$$

$$\text{Operating leverage factor} = \frac{\$13,300}{\$13,300}$$

$$= 1.00$$

*Numbers above are from the Kay's e-tail poster example on previous slides.*

# Operating Leverage Factor— Change in Fixed Costs

$$\text{Operating leverage factor} = \frac{\text{Contribution margin}}{\text{Operating income}}$$

$$\text{Operating leverage factor} = \frac{\$13,300}{\$6,300}$$

$$= 2.11 \text{ (rounded)}$$

*Numbers above are from the Kay's e-tail poster example on previous slides.*

# Now Turn to S7-14

## **S7-14 Compute and use operating leverage factor** (*Learning Objective 5*)

Suppose Sally sells 1,500 posters. Use the original data from S7-13 to compute her operating leverage factor. If sales volume increases 20%, by what percentage will her operating income change? Prove your answer.

## **S7-13 Compute margin of safety** (*Learning Objective 5*)

Sally has an online poster business. Suppose Sally expects to sell 1,500 posters. Her average sales price per poster is \$45 and her average cost per poster is \$25. Her fixed expenses total \$15,000. Compute her margin of safety

- a. in units (posters).
- b. in sales dollars.
- c. as a percentage of expected sales.



# S7-14

Contribution margin (1,500 × \$20 / poster).....	\$30,000
Less: Fixed expenses.....	<u>15,000</u>
Operating income.....	<u><u>\$15,000</u></u>

$$\begin{aligned}\text{Operating leverage factor} &= \frac{\text{Contribution margin}}{\text{Operating income}} \\ &= \frac{\$30,000}{\$15,000} \\ &= 2.0\end{aligned}$$

*If volume increases 20%, operating income will increase 40% (operating leverage factor of 2.0 multiplied by 20).*

## S7-14 (cont.)

### ***Proof:***

Original volume (posters).....	1,500
Add: Increase in volume ( $20\% \times 1,500$ ).....	<u>+ 300</u>
New volume (posters).....	1,800
Multiplied by: Unit contribution margin.....	<u><math>\times \\$20</math></u>
New total contribution margin.....	\$ 36,000
Less: Fixed expenses.....	<u>15,000</u>
New operating income.....	\$21,000
vs.      Operating income before change in volume (from previous slide).....	<u>15,000</u>
Increase in operating income.....	<u><u>\$ 6,000</u></u>
Percentage change ( $6,000/15,000$ ).....	<u><u>40%</u></u>

# End of Chapter 7





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