

Cost-Volume-Profit Relationships

LEARNING OBJECTIVES

After studying this chapter, we should be able to:

- 1. Explain how changes in activity affect contribution margin.
- 2. Compute the contribution margin ratio (CM) ratio and use it to compute changes in contribution margin and net income.
- 3. Show the effects on contribution margin of changes in variable costs, fixed costs, selling price and volume.
- 4. Compute the break-even point by both the equation method and the contribution margin method.

LEARNING OBJECTIVES

After studying this chapter, we should be able to:

- Prepare a cost-volume-profit (CVP) graph and explain the significance of each of its components.
- 6. Use the CVP formulas to determine the activity level needed to achieve a desired target profit.
- 7. Compute the margin of safety and explain its significance.

LEARNING OBJECTIVES

After studying this chapter, we should be able to:

- 8. Compute the degree of operating leverage at a particular level of sales and explain how the degree of operating leverage can be used to predict changes to net income.
- 9. Compute the break-even point for a multiple product company and explain the effects of shifts in the sales mix on contribution margin and the break-even point.
- 10.(Appendix 6A) Understand cost-volume-profit with uncertainty.

Cost-Volume-Profit (CVP)

- □CVP is a powerful tool that helps managers understand relationships among cost, volume, and profit.
- □CVP analysis focuses on how profit are affected by the following five factors:
- ➤ Selling Prices
- ➤ Sales Volume
- ➤ Unit Variable Costs
- ➤ Total Fixed Costs
- ➤ Mix of Product Sold
- As CVP analysis helps managers understand how profit is affected by the above five factors, this is a vital tool in many business decisions, i.e., what products and services to offer, what prices to charge, what marketing strategy to use, what cost structure to maintain, etc.

Contribution Margin (CM)

- □CM is the amount remaining from sales revenue after variable expenses have been deducted.
- ☐ This is the amount available to cover fixed expenses and then to provide profits for the product. That means, CM is used first to cover fixed expenses, and then whatever remains goes toward profits.
- □ If the CM margin is not enough to cover fixed expenses, then a loss occurs for the period.

Contribution Margin (CM) = Sales Revenue – Variable Costs

Per Unit CM= Selling Price – Per Unit Variable Costs

The Basics of Cost-Volume-Profit (CVP) Analysis

WIND BICYCLE CO.

Contribution Income StatementFor the Month of June

Sales (500 bikes)\$250,000\$500Less: variable expenses150,000300Contribution margin100,000\$200Less: fixed expenses80,000

CM is used to cover fixed expenses.



For each additional unit Wind Bicycle sells, \$200 more in contribution margin will help to cover fixed expenses and profit.

	Total	<u>Per Uni</u>	
Sales (500 bikes)	\$250,000	\$	500
Less: variable expenses	<u> 150.000</u>		300
Contribution margin	\$100,000	\$	200
Less: fixed expenses	80.000		
Net income	\$ 20,000		



Each month Wind must generate at least \$80,000 in total CM to break even.

Total

Sales (500 bikes)

Less: variable expenses

Contribution margin

Less: fixed expenses

Net income

\$250,000

150,000

\$100,000

80,000

\$20,000



If Wind sells 400 units in a month, it will be operating at the break-even point.

WIND BICY Contribution Inco For the Mon	ome Stateme	ent
Sales (400 bikes) Less: variable expenses	Total \$200,000 120,000	Per Unit \$ 500 300
Contribution margin Less: fixed expenses Net income	80,000 80.000 \$ 0	\$ 200



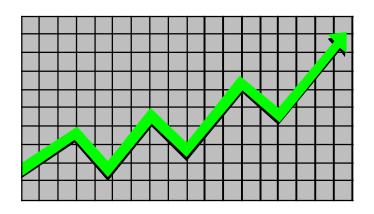
If Wind sells one additional unit (401 bikes), net income will increase by \$200.

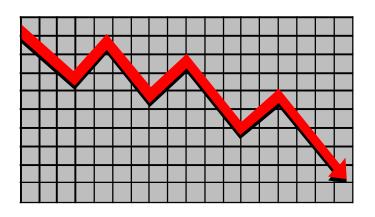
WIND BICY		nt.	
Contribution Income Statement For the Month of June			
	Total	Per Upit	
Sales (401 bikes)	\$200,500	\$ 500	
Less: variable expenses	120.300	300	
Contribution margin	80,200	\$ 200	
Less: fixed expenses	80.000		
Net income	<u>\$ 20</u> 0		



The Break-Even Point

- ☐ The break-even point can be defined either as:
- The point where total sales revenue equals total expenses (variable and fixed).
- The point where total contribution margin equals total fixed expenses.
- □Once the break-even point has been reached, the net operating income will increase by the amount of Unit CM for each additional unit sold.





☐ The contribution margin as percentage (%) of sales is referred to as the contribution margin ration (CM ratio).
□CM ratio can also be determined as the ration between unit contribution margin and per unit selling price.
□CM ratio can be used in CVP calculations.
☐The CM ratio shows how the contribution margin will be affected by a change in total sales.
□CM ratio of 40% OR 0.40 means that for each dollar increase in sales, total CM will increase by 40 cents and net operating income will also increase by 40 cents, assuming that fixed costs are not affected by the increase in sales.
☐Generally, the effect of a change in sales on the contribution margin is expressed in equation as follows:

Change in CM = CM ratio * Change in Sales

Profit and CM Ratio

☐The relation between profit and the CM ratio can be expressed using the following equation:
Profit = (CM Ratio * Sales) - Total Fixed Expenses
☐This approach will often be quicker and easier than constructing contribution format income statement.
☐The CM ratio is particularly valuable in situations where the dollar sales of one product must be traded off against the dollar sales of another product.
☐ In this situation, products that yield the greatest amount of contribution margin per dollar of sales (CM ratio) should be emphasized.

The contribution margin ratio is:

For Wind Bicycle Co. the ratio is:

At Wind, each \$1.00 increase in sales revenue results in a total contribution margin increase of 40¢.

If sales increase by \$50,000, what will be the increase in total contribution margin?

500 Bikes 400 Bikes \$200,000 \$250,000 Sales 120,000 150,000 Less: variable expenses **Contribution margin** 80,000 100,000 Less: fixed expenses 80,000 80,000 **Net income** 20,000

A \$50,000 increase in sales revenue

Sales
Less: variable expenses
Contribution margin
Less: fixed expenses
Net income

\$200,000 120,000 80,000 \$ - \$250,000 150,000 100,000 80,000 \$ 20,000

A \$50,000 increase in sales revenue results in a \$20,000 increase in CM or (\$50,000 × 40% = \$20,000)

Variable Expense Ratio

- ☐ The variable expense ratio is the ratio of variable expenses to sales.
- ☐ It can be computed by diving the total variable expenses by the total sales, or in a single product analysis, it can be computed by dividing the per unit variable expenses by the unit selling price.

Variable expense ratio = Variable expense/Sales

CM ratio = Contribution margin/Sales

CM ratio = (Sales – Variable expenses)/Sales

CM ratio = 1 – Variable expense ratio

❖In the Wind Bicycle Co. problem, variable expense ratio is 0.60 (\$300/\$500).

Changes in Fixed Costs and Sales Volume

Wind is currently selling 500 bikes per month. The company's sales manager believes that an increase of \$10,000 in the monthly advertising budget would increase bike sales to 540 units.

Should we authorize the requested increase in the advertising budget?

Changes in Fixed Costs and Sales Volume

\$80,000 + \$10,000 advertising = \$90,000

	rent Sales 00 bikes)	cted Sales 0 bikes)
Sales	\$ 250,000	\$ 270,000
Less: variable expenses	150.000	162.000
Contribution margin	100,000	108,000
Less: fixed expenses	80.000	90.000
Net income	\$ <u>20,00</u> 0	\$ <u>18,00</u> 0

Sales increased by \$20,000, but net income decreased by \$2,000.

Changes in Fixed Costs and Sales Volume

The Shortcut Solution

Increase in CM (40 units X \$200)
Increase in advertising expenses
Decrease in net income

\$ 8,000 10.000 \$ (2.000)

APPLICATIONS OF CVP

Consider the following basic data:

	Per unit	Percent
Sales Price	\$250	100
Less: Variable cost	150	60
Contribution margin	100	40
Fixed costs total \$35	5,000	

 Current sales are \$100,000. Sales manager feels \$10,000 increase in sales budget will provide \$30,000 increase in sales. Should the budget be changed?

YES

Incremental CM approach:
\$30,000 x 40% CM ratio

Additional advertising expense

10,000

Increase in net income

2.000

 Management is considering increasing quality of speakers at an additional cost of \$10 per speaker. Plan to sell 80 more units. Should management increase quality?

Expected total CM

= (480 speakers x\$90)

\$43,200

Present total CM

= (400 speakers x\$100)

40,000

Increase in total contribution margin (and net income)

3,200

 Management advises that if selling price dropped \$20 per speaker and advertising increased by \$15,000/month, sales would increase 50%. Good idea?

Expected	total	CM
-----------------	-------	----

= (400x150%x\$80)

Present total CM (400x\$100)

Incremental CM

Additional advertising cost Reduction in net income

NO

\$48,000

<u>40.000</u>

8,000

15.000

(7.000)

 A plan to switch sales people from flat salary (\$6,000 per month) to a sales commission of \$15 per speaker could increase sales by 15%. Good idea?

Expected total CM (400x115%x\$85) \$39,100 Current total CM (400x\$100) 40,000

Decrease in total CM (900)

Salaries avoided if commission paid 6,000 Increase in net income \$5,100

 A wholesaler is willing to buy 150 speakers if we will give him a discount off our price. The sale will not disturb regular sales and will not change fixed costs. We want to make \$3,000 on this sale. What price should we quote?

Variable cost per speaker \$150

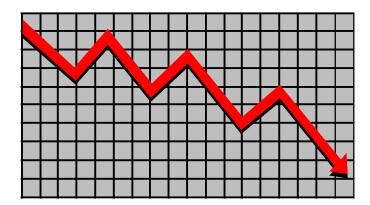
Desired profit on order (3,000/150) 20

Quoted price per speaker \$170

Break-Even Analysis

Break-even analysis can be approached in two ways:

- Equation method
- Contribution margin method.



Profits = Sales – (Variable expenses + Fixed expenses)

OR

Sales = Variable expenses + Fixed expenses + Profits

At the break-even point profits equal zero.

Here is the information from Wind Bicycle Co.:

	Total	Per Unit	<u>Percent</u>
Sales (500 bikes)	\$250,000	\$ 500	100%
Less: variable expenses	150,000_	300	60%
Contribution margin	\$100,000	\$ 200	40%
Less: fixed expenses	80,000		
Net income	\$ 20,000		

We calculate the break-even point as follows:

Sales = Variable expenses + Fixed expenses + Profits

```
$500Q = $300Q + $80,000 + $0
```

Where:

Q = Number of bikes sold

\$500 = Unit sales price

\$300 = Unit variable expenses

\$80,000 = Total fixed expenses

We calculate the break-even point as follows:

Sales = Variable expenses + Fixed expenses + Profits

$$$500Q = $300Q + $80,000 + $0$$

$$$200Q = $80,000$$

$$Q = 400 \text{ bikes}$$

We can also use the following equation to compute the break-even point in sales dollars.

Sales = Variable expenses + Fixed expenses + Profits

```
X = 0.60X + $80,000 + $0
```

Where:

X = Total sales dollars

0.60 = Variable expenses as a

percentage of sales

\$80,000 = Total fixed expenses



We can also use the following equation to compute the break-even point in sales dollars.

Sales = Variable expenses + Fixed expenses + Profits

$$X = 0.60X + $80,000 + $0$$

$$0.40X = $80,000$$

$$X = $200,000$$

Contribution Margin Method

The contribution margin method is a variation of the equation method.

Break-even point in units sold = Fixed expenses
Unit contribution margin

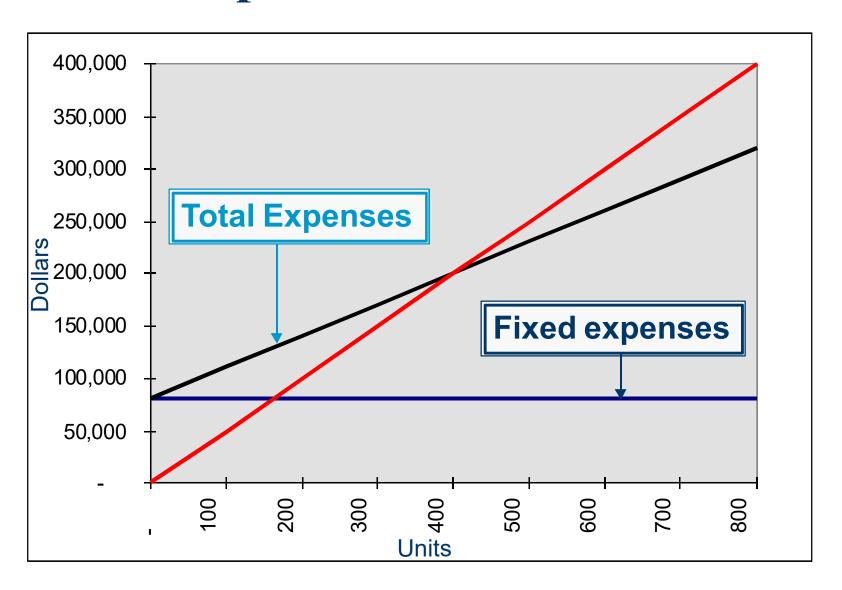
Break-even point in total sales dollars = Fixed expenses CM ratio

CVP Relationships in Graphic Form

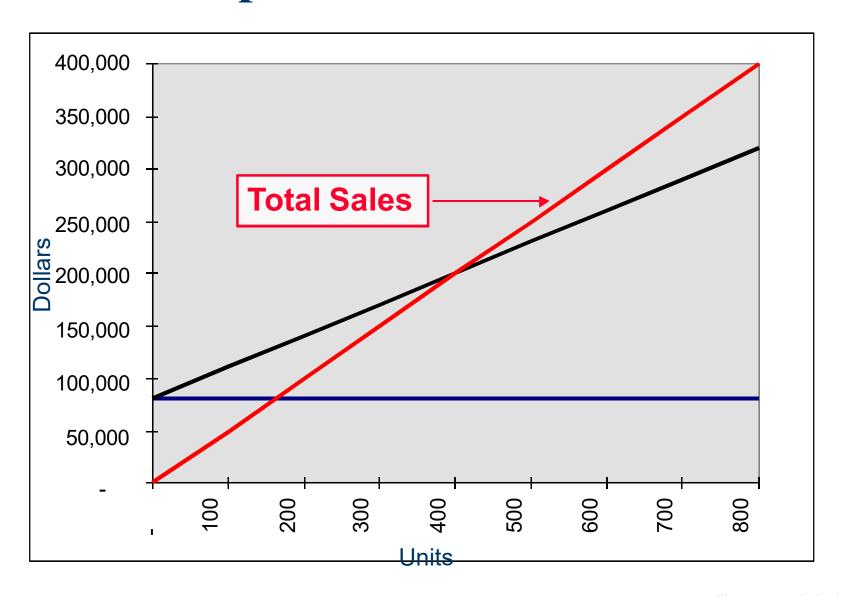
Viewing CVP relationships in a graph gives managers a perspective that can be obtained in no other way. Consider the following information for Wind Co.:

	Income 00 units	•	Income 00 units	Income 500 units
Sales	\$ 150,000	\$	200,000	\$250,000
Less: variable expenses	90,000		120,000	150,000
Contribution margin	\$ 60,000	\$	80,000	\$100,000
Less: fixed expenses	80,000		80,000	80,000
Net income (loss)	\$ (20,000)	\$	-	\$ 20,000

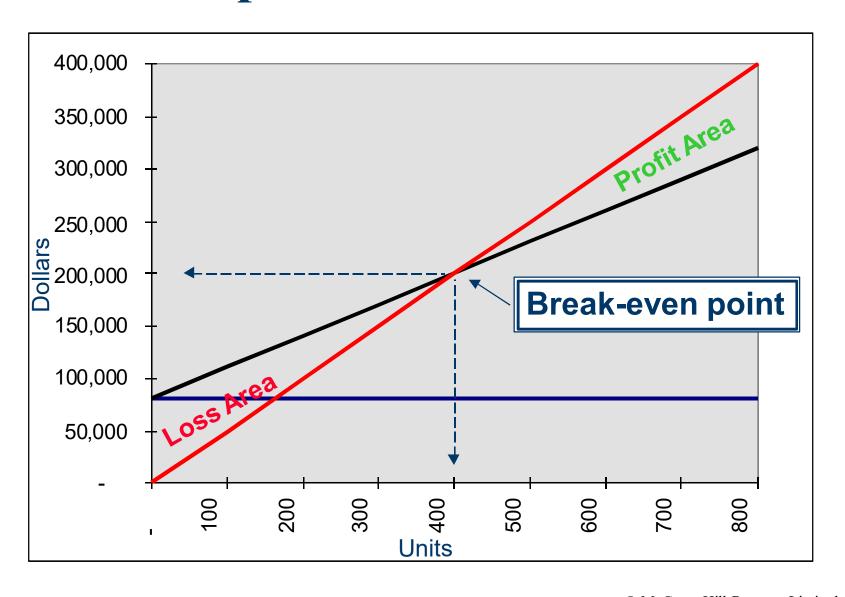
CVP Graph



CVP Graph



CVP Graph



Target Profit Analysis

- ☐ Target profit analysis and break-even analysis are used to answer the questions such as how much would have to be sold to make a certain amount of profit (target profit) or how much would have to be sold to avoid incurring a loss.
- ☐ Target profit analysis is one of the key uses of CVP analysis. In this analysis, sales volume is estimated to achieve a target profit.

Target Profit in Terms of Sales Quantity:

Target Profit = (Unit CM * Required Quantity) – Fixed Expense

Unit Sales to Attain the Target Profit = (Target Profit + Fixed Expenses) / Unit CM

Target Profit in Terms of Sales Dollars:

Target Profit = (CM Ration * Sales Dollars) – Fixed Expense

Sales Dollars to Attain the Target Profit = (Target Profit + Fixed Expenses) / CM Ratio

Target Profit Analysis

Suppose Wind Co. wants to know how many bikes must be sold to earn a profit of \$100,000.

We can use our CVP formula to determine the sales volume needed to achieve a target net profit figure.

The CVP Equation

Sales = Variable expenses + Fixed expenses + Profits

```
$500Q = $300Q + $80,000 + $100,000
```

\$200Q = \$180,000

Q = 900 bikes

The Contribution Margin Approach

We can determine the number of bikes that must be sold to earn a profit of \$100,000 using the contribution margin approach.

```
Units sold to attain _ <u>Fixed expenses + Target profit</u>
the target profit Unit contribution margin
```

The Margin of Safety



Excess of budgeted (or actual) sales over the break-even volume of sales.

The amount by which sales can drop before losses begin to be incurred.

The higher the margin of safety, the lower the risk of not breaking-even and incurring a loss.

Margin of safety = Total sales - Break-even sales

Margin of Safety Percentage = Margin of safety in dollars/Total Budgeted (or Actual) Sales in Dollars

Let's calculate the margin of safety for Wind.

The Margin of Safety

Wind has a break-even point of \$200,000. If actual sales are \$250,000, the margin of safety is \$50,000 or 100 bikes.

	eak-even sales 00 units	Sa	tual ales 500 nits
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 income	\$ -	\$	20,000

The Margin of Safety

The margin of safety can be expressed as **20 percent** of sales.

 $($50,000 \div $250,000)$

Br	eak-even		
	sales	Act	ual
4	00 units		ales 500 hits
\$	200,000	\$	250,000
	120,000		150,000
	80,000		100,000
	80,000		80,000
\$	-	\$	20,000
	\$	400 units \$ 200,000 120,000 80,000 80,000	sales Act 400 units sa \$ 200,000 \$ 120,000 80,000 80,000

CVP Considerations in Choosing a Cost Structure

- □Cost structure refers to the relative proportion of fixed and variable costs in an organization.
- ☐ Managers often have latitude in trading off between these two types of costs.
- ☐For example, fixed investments in automated equipment can reduce variable labor costs, but definitely fixed costs will increase.

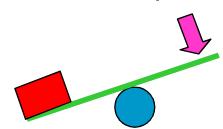
Cost Structure and Profit Stability

- ❖There is no such rule that cost structure with high proportion of variable costs is better than cost structure with high proportion of fixed costs.
- It depends on actual scenario and how costs are being managed in an organization.
- Both have advantages and disadvantages.
- A firm, with higher fixed costs and lower variable costs will experience wider swings in net operating income as sales fluctuates, with greater profits in good years and greater loss in bad years.
- A firm, with lower fixed costs and higher variable costs will enjoy greater profit stability and will be more protected from losses during bad years, but at the cost lower net operating income in good years.

- □ A measure of how sensitive net income is to percentage changes in sales.
- It acts as a multiplier.
- With high leverage, a small percentage increase in sales can produce a much larger percentage increase in net income.

Degree of _ <u>Contribution margin</u>
operating leverage Net income

- □A firm with a high proportion of fixed costs will have high degree of operating leverage.
- □ It is greatest at sales levels near break-even and decreases as sales and profit rise.



```
Actual sales
500 Bikes

Sales
$ 250,000
Less: variable expenses
Contribution margin
Less: fixed expenses
Net income
$ 20,000
```



□The degree of operating leverage can be used to quickly estimate what impact various % sales will have on profits, without necessity of preparing detailed income statement.

□With a measure of operating leverage of 5, if Wind increases its sales by 10%, net income would increase by 50%.

Percent increase in sales

Degree of operating leverage × 5

Percent increase in profits

50%





	Actual sales (500)		icreased les (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 income	\$	20,000	\$ 30,000

10% increase in sales from \$250,000 to \$275,000 . . .

... results in a 50% increase in income from \$20,000 to \$30,000.

Structuring Sales Commissions

- *Companies usually compensate salespeople/retailer by paying them a commission based on sales, a salary, or a combination of two.
- Commission based on sales dollars can lead to lower profits.
- Commission can be based on contribution margin rather than on selling price. If so, sales people/retailer will want to sell the mix of products that maximizes contribution margin.
- Providing that fixed costs are not affected by sales mix, maximizing the contribution margin will also maximize the profit.

		Model
	XR7	Turbo
Selling Price	\$695	\$749
Variable Expense	344	410
Contribution Margin	351	339

The Concept of Sales Mix

- Sales mix is the relative proportions in which a company's products are sold.
- Different products have different selling prices, cost structures, and contribution margins.

Let's assume Wind sells bikes and carts and see how we deal with break-even analysis.



Sales Mix

- The ides is to achieve the combination of, or mix, that will yield the greatest profits.
- For companies that have many products, profits will depend to some extent on the company's sales mix.
- ❖ Profits will be greater if high-margin rather than low-margin items take up a relatively large proportion of total sales.
- Change in the sales mix can cause perplexing variations in a company's profits.
- A shift in the sales mix from high-margin items to low-margin items can cause total profits to decrease even though total sales may increase and vice versa.
- It is one thing to achieve a particular sales volume; it is quite another thing to sell the most profitable mix of products.

Sales Mix and Break-Even Analysis

- ❖If a company sells more than one product, break-even analysis is more complex that discussed before.
- The reason is that different products will have different selling prices, different costs, and different combination margins.
- Consequently, the break-even point depends on the mix in which the various products are sold.
- In preparing a break-even analysis, an assumption must be made concerning the sales mix. The assumption is that sales mix will remain same, it will not change.
- If the sales mix is expected to change, then this must be explicitly considered in any CVP computations.

The Concept of Sales Mix

Wind Bicycle Co. provides us with the following information:

		Bikes			Carts		Total	
Sales	\$	250,000	100%	\$	300,000	100%	\$ 550,000	100%
Var. exp.		150,000	60%		135,000	45%	285.000	52 %
Contrib. margin	\$	100,000	40%	\$	165,000	55 %	265,000	48%
Fixed exp.	\$2	65.000	180/		ounded)		170.000	_
Net income	\$5	50,000	40 /	יו) פ	Juliueuj		\$ 95,000	

Break-even point in sales dollars:

Assumptions of CVP Analysis

□ Selling price is constant. The price of a product or service will not change as volume changes.

□ Costs are linear and can be accurately divided into variable and fixed elements. The variable element is constant per unit, and the fixed element is constant in total over the entire relevant range.

□ In multiproduct companies, the sales mix is constant.

□ In manufacturing companies, inventories do not change. The number

❖While all these assumptions may not hold true in real scenarios, the results of CVP analysis are often good enough to be quite useful. But, managers need to be careful about making a large change in production volume that is outside the relevant range.

of units produced equals the number of units sold.

Moreover, CVP analysis can be adjusted to take into account anticipated changes in price, costs, and sales mix.



Cost-Volume-Profit with uncertainty

CVP with uncertainty

- Use a decision tree to simplify calculations
- The decision tree is used to calculate profits under various alternatives
- A second decision tree can be used to calculate the probabilities of the various scenarios to further determine a reasonable estimate of profit
- A computer can be used to save time

End of Chapter 5



Problem 1

Voltar Company manufactures and sells a specialized cordless telephone for high electromagnetic radiation environments. The company's contribution format income statement for the most recent year is given below:

	Total	Per Unit	Percent of Sales
Sales (20,000 units)	\$1,200,000 900,000 300,000 240,000 \$ 60,000	\$60 <u>45</u> \$15	100% -?_% -?_%

Management is anxious to increase the company's profit and has asked for an analysis of a number of items.

Required:

- Compute the company's CM ratio and variable expense ratio.
- Compute the company's break-even point in both unit sales and dollar sales. Use the equation method.
- Assume that sales increase by \$400,000 next year. If cost behavior patterns remain unchanged, by how much will the company's net operating income increase? Use the CM ratio to compute your answer.
- 4. Refer to the original data. Assume that next year management wants the company to earn a profit of at least \$90,000. How many units will have to be sold to meet this target profit?
- Refer to the original data. Compute the company's margin of safety in both dollar and percentage form.

- a. Compute the company's degree of operating leverage at the present level of sales.
 - b. Assume that through a more intense effort by the sales staff, the company's sales increase by 8% next year. By what percentage would you expect net operating income to increase? Use the degree of operating leverage to obtain your answer.
 - c. Verify your answer to (b) by preparing a new contribution format income statement showing an 8% increase in sales.
- 7. In an effort to increase sales and profits, management is considering the use of a higher-quality speaker. The higher-quality speaker would increase variable costs by \$3 per unit, but management could eliminate one quality inspector who is paid a salary of \$30,000 per year. The sales manager estimates that the higher-quality speaker would increase annual sales by at least 20%.
 - a. Assuming that changes are made as described above, prepare a projected contribution format income statement for next year. Show data on a total, per unit, and percentage basis.
 - Compute the company's new break-even point in both unit sales and dollar sales. Use the formula method.
 - c. Would you recommend that the changes be made?

Solutions

1.

CM ratio =
$$\frac{\text{Unit contribution margin}}{\text{Unit selling price}} = \frac{\$15}{\$60} = 25\%$$

Variable expense ratio =
$$\frac{\text{Variable expense}}{\text{Selling price}} = \frac{\$45}{\$60} = 75\%$$

2

Profit = Unit CM
$$\times$$
 Q - Fixed expenses

$$$0 = ($60 - $45) \times Q - $240,000$$

$$15Q = 240,000$$

$$Q = $240,000 \div $15$$

Q = 16,000 units; or at \$60 per unit, \$960,000

3.

Increase in sales	\$400,000
Multiply by the CM ratio	× 25%
Expected increase in contribution margin	\$100,000

Because the fixed expenses are not expected to change, net operating income will increase by the entire \$100,000 increase in contribution margin computed above.

Equation method:

Profit = Unit CM
$$\times$$
 Q - Fixed expenses
\$90,000 = (\$60 - \$45) \times Q - \$240,000
\$15 Q = \$90,000 + \$240,000
 Q = \$330,000 ÷ \$15
 Q = 22,000 units

Formula method:

$$\frac{\text{Unit sales to attain}}{\text{the target profit}} = \frac{\text{Target profit} + \text{Fixed expenses}}{\text{Contribution margin per unit}} = \frac{\$90,000 + \$240,000}{\$15 \text{ per unit}} = 22,000 \text{ units}$$

$$= $1,200,000 - $960,000 = $240,000$$

Margin of safety percentage =
$$\frac{\text{Margin of safety in dollars}}{\text{Total sales}} = \frac{\$240,000}{\$1,200,000} = 20\%$$

6. a. Degree of operating leverage = $\frac{\text{Contribution margin}}{\text{Net operating income}} = \frac{\$300,000}{\$60,000} = 5$

b.

Expected increase in sales	8%
Degree of operating leverage	× 5
Expected increase in net operating income	40%

c. If sales increase by 8%, then 21,600 units (20,000 × 1.08 = 21,600) will be sold next year. The new contribution format income statement would be as follows:

	Total	Per Unit	Percent of Sales
Sales (21,600 units)	\$1,296,000 972,000 324,000 240,000 \$ 84,000	\$60 45 \$15	100%

Thus, the \$84,000 expected net operating income for next year represents a 40% increase over the \$60,000 net operating income earned during the current year:

$$\frac{$84,000 - $60,000}{$60,000} = \frac{$24,000}{$60,000} = 40\%$$
 increase

Note that the increase in sales from 20,000 to 21,600 units has increased *both* total sales and total variable expenses.

7. a. A 20% increase in sales would result in 24,000 units being sold next year: 20,000 units \times 1.20 = 24,000 units.

	Total	Per Unit	Percent of Sales
Sales (24,000 units) Variable expenses	\$1,440,000 1,152,000	\$60 _48*	100% _80%
Contribution margin Fixed expenses	288,000 210,000 [†]	<u>\$12</u>	20%
Net operating income	\$ 78,000		
*\$45 + \$3 = \$48; \$48 ÷ \$60 = 80% †\$240,000 - \$30,000 = \$210,000.			

Note that the change in per unit variable expenses results in a change in both the per unit contribution margin and the CM ratio.

b. Unit sales to break even =
$$\frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

$$= \frac{\$210,000}{\$12 \text{ per unit}} = 17,500 \text{ units}$$

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

$$= \frac{\$210,000}{0.20} = \$1,050,000$$

c. Yes, based on these data, the changes should be made. The changes increase the company's net operating income from the present \$60,000 to \$78,000 per year. Although the changes also result in a higher break-even point (17,500 units as compared to the present 16,000 units), the company's margin of safety actually becomes greater than before:

Margin of safety in dollars = Total sales - Break-even sales
=
$$\$1,440,000 - \$1,050,000 = \$390,000$$

As shown in (5) on the prior page, the company's present margin of safety is only \$240,000. Thus, several benefits will result from the proposed changes.

Problem 2

EXERCISE 5–10 Compute the Break-Even Point for a Multiproduct Company [LO5–9]

Lucido Products markets two computer games: Claimjumper and Makeover. A contribution format income statement for a recent month for the two games appears below:

	Claimjumper	Makeover	Total
Sales	\$30,000 20,000 \$10,000	\$70,000 50,000 \$20,000	\$100,000 70,000 30,000 24,000 \$ 6,000

Required:

- Compute the overall contribution margin (CM) ratio for the company.
- Compute the overall break-even point for the company in dollar sales.
- Verify the overall break-even point for the company by constructing a contribution format income statement showing the appropriate levels of sales for the two products.

Solution

According to given income statement,

Proportion of Claimjumper in sales = \$30,000/\$1,00,000 = 0.30 or 30% Proportion of Makeover in sales = \$70,000/\$1,00,000 = 0.70 or 70%

Variable expense ratio of Claimjumper = \$20,000/\$30,000

=0.6667 or 66.67%

Variable expense ratio of Makeover = \$50,000/\$70,000

= 0.7143 or 71.43%

1. Overall CM ratio = Total Contribution Margin / Total Sales

$$= 0.30 \text{ or } 30\%$$

2. Overall break-even point in dollar sales = Fixed Expenses/CM Ratio

Sales of Claimjumper = \$80,000*0.30 = \$24,000

Sales of Makeover =
$$$80,000*0.70 = $56,000$$

3. Contribution format income statement:

	Claimjumper	Makeover	Total
Sales	24,000	56,000	80,000
Variable Expense	16,000	40,000	56,000
Contribution Margin	8,000	16,000	24,000
Fixed Expense			24,000
Net Operating Income			0