

# Cost-Volume-Profit Analysis: Additional Issues

## Chapter 6



### Feature Story

#### Rapid Replay

Intel doesn't do things half-way. If you own a PC, then there is a roughly 85% chance that the microprocessor chip that runs your machine was made by Intel. In fact, for as long as most people can remember, Intel has had at least an 85% share of the market for PC computer chips. That doesn't mean, however, that life is easy for Intel. Its earnings swings, like everything else about the company, are major league. Consider these two *Wall Street Journal* headlines: "Intel's Net Plunges as Demand Dries Up" and then, only slightly more than a year later, "Intel Earnings Set High Bar."

If Intel is so dominant in the computer chip market, why does it experience such huge swings in its earnings? First, to produce computer chips, Intel must continually make huge investments in sophisticated equipment. Now, consider what you learned in the previous chapter. The higher a company's fixed costs, the more units it must sell to break even. In this chapter, you will learn that if a company has high fixed costs as a percentage of total costs, then its earnings will be very susceptible to economic swings.

Another way of saying this is that when the economy gets the sniffles,



#### The Navigator

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### Learning Objectives

*After studying this chapter, you should be able to:*

- 1** Describe the essential features of a cost-volume-profit income statement.
- 2** Apply basic CVP concepts.
- 3** Explain the term sales mix and its effects on break-even sales.
- 4** Determine sales mix when a company has limited resources.
- 5** Understand how operating leverage affects profitability.



#### The Navigator

Intel gets the flu. A drop in Intel's sales results in a disproportionately large drop in its profits. For example, during a recent quarter when Intel's sales fell 23%, its profits fell 90%. On the other hand, the minute the economy turns upward, Intel's profits do a sharp about-face. After the recent downturn, Intel's sales jumped 44%. While this was a nice bump in sales, consider what happened to its net income. Its net income increased by almost 10 times as much—nearly 400%.



reliance on fixed costs. But to do this, it would have to rely more heavily on outside suppliers rather than producing its

own chips. Intel is probably reluctant to make this change because it would lose some of its control over product quality.

Watch the *Whole Foods* video in WileyPLUS to learn more about the use of cost-volume-profit analysis in a changing business environment.

Is there anything that Intel can do to tame this roller coaster ride? It can try to change its cost structure by reducing its

Source: Don Clark and Ben Worthen, "Intel's Net Plunges as Demand Dries Up," *Wall Street Journal Online* (January 16, 2009); and Don Clark, "Intel Earnings Set High Bar," *Wall Street Journal Online* (April 13, 2010).



## Preview of Chapter 6

As the Feature Story about **Intel** suggests, the relationship between a company's fixed and variable costs can have a huge impact on its profitability. In particular, the trend toward cost structures dominated by fixed costs has significantly increased the volatility of many companies' net income. The purpose of this chapter is to demonstrate additional uses of cost-volume-profit analysis in making sound business decisions.

The content and organization of this chapter are as follows.

### COST-VOLUME-PROFIT ANALYSIS: ADDITIONAL ISSUES

Cost-Volume-Profit (CVP) Review	Sales Mix	Cost Structure and Operating Leverage
<ul style="list-style-type: none"> <li>• Basic concepts</li> <li>• Basic computations</li> <li>• CVP and changes in the business environment</li> </ul>	<ul style="list-style-type: none"> <li>• Break-even sales in units</li> <li>• Break-even sales in dollars</li> <li>• Sales mix with limited resources</li> </ul>	<ul style="list-style-type: none"> <li>• Effect on contribution margin ratio</li> <li>• Effect on break-even point</li> <li>• Effect on margin of safety ratio</li> <li>• Operating leverage</li> </ul>



## Cost-Volume-Profit (CVP) Review

As indicated in Chapter 5, cost-volume-profit (CVP) analysis is the study of the effects of changes in costs and volume on a company's profit. CVP analysis is important to profit planning. It is also a critical factor in determining product mix, maximizing use of production facilities, and setting selling prices.

### Basic Concepts

#### LEARNING OBJECTIVE 1

Describe the essential features of a cost-volume-profit income statement.

Because CVP is so important for decision-making, management often wants this information reported in a CVP income statement format for internal use. The CVP income statement classifies costs as *variable* or *fixed* and computes a contribution margin. **Contribution margin** is the amount of revenue remaining after deducting variable costs. It is often stated both as a total amount and on a per unit basis.

Illustration 6-1 presents the CVP income statement for Vargo Video (which was shown in Illustration 5-12, on page 207). Note that Vargo's sales included 1,600 camcorders at \$500 per unit.

**Illustration 6-1**  
Basic CVP income statement

Vargo Video Company CVP Income Statement For the Month Ended June 30, 2014		
	<u>Total</u>	<u>Per Unit</u>
Sales (1,600 camcorders)	\$ 800,000	\$ 500
Variable costs	480,000	300
<b>Contribution margin</b>	<b>320,000</b>	<b>\$200</b>
Fixed costs	200,000	
<b>Net income</b>	<b>\$120,000</b>	

Companies often prepare detailed CVP income statements. The CVP income statement in Illustration 6-2 uses the same base information as that presented in Illustration 6-1 but provides more detailed information (using assumed data) about the composition of expenses.

**Illustration 6-2**  
Detailed CVP income statement

Vargo Video Company CVP Income Statement For the Month Ended June 30, 2014		
	<u>Total</u>	<u>Per Unit</u>
Sales	\$ 800,000	\$ 500
Variable expenses		
Cost of goods sold	\$400,000	
Selling expenses	60,000	
Administrative expenses	20,000	
Total variable expenses	480,000	300
<b>Contribution margin</b>	<b>320,000</b>	<b>\$200</b>
Fixed expenses		
Cost of goods sold	120,000	
Selling expenses	40,000	
Administrative expenses	40,000	
Total fixed expenses	200,000	
<b>Net income</b>	<b>\$120,000</b>	

#### Helpful Hint

The appendix to this chapter provides additional discussion of income statements used for decision-making.

In the applications of CVP analysis that follow, we assume that the term “cost” includes all costs and expenses related to production and sale of the product. That is, **cost includes manufacturing costs plus selling and administrative expenses.**

## > DO IT!

### CVP Income Statement

Garner Inc. sold 20,000 units and recorded sales of \$800,000 for the first quarter of 2014. In making the sales, the company incurred the following costs and expenses.

	<u>Variable</u>	<u>Fixed</u>
Cost of goods sold	\$250,000	\$110,000
Selling expenses	100,000	25,000
Administrative expenses	82,000	73,000

- Prepare a CVP income statement for the quarter ended March 31, 2014.
- Compute the contribution margin per unit.
- Compute the contribution margin ratio.

### Solution

#### Action Plan

- ✓ Use the CVP income statement format.
- ✓ Use the formula for contribution margin per unit.
- ✓ Use the formula for the contribution margin ratio.

(a)		
<b>Garner Inc.</b>		
<b>Income Statement</b>		
<b>For the Quarter Ended March 31, 2014</b>		
Sales (20,000 units)		\$800,000
Variable expenses		
Cost of goods sold	\$250,000	
Selling expenses	100,000	
Administrative expenses	<u>82,000</u>	
Total variable expenses		<u>432,000</u>
Contribution margin		368,000
Fixed expenses		
Cost of goods sold	110,000	
Selling expenses	25,000	
Administrative expenses	<u>73,000</u>	
Total fixed expenses		<u>208,000</u>
Net income		<u><u>\$160,000</u></u>

- Contribution margin per unit:  
 $\$368,000 \div 20,000 \text{ units} = \$18.40 \text{ per unit.}$
- Contribution margin ratio:  
 $\$368,000 \div \$800,000 = 46\%$  (or  $\$18.40 \div \$40 = 46\%$ ).

Related exercise material: **BE6-1, BE6-2, and DO IT! 6-1.**



## Basic Computations

Before we introduce additional issues of CVP analysis, let's review some of the basic concepts that you learned in Chapter 5, specifically break-even analysis, target net income, and margin of safety.

### BREAK-EVEN ANALYSIS

Vargo Video's CVP income statement (Illustration 6-2) shows that total contribution margin (sales minus variable expenses) is \$320,000, and the company's

LEARNING OBJECTIVE 2

Apply basic CVP concepts.

contribution margin per unit is \$200. Recall that contribution margin can also be expressed in the form of the **contribution margin ratio** (contribution margin divided by sales), which in the case of Vargo is 40% ( $\$200 \div \$500$ ).

Illustration 6-3 demonstrates how to compute Vargo's break-even point in units (using contribution margin per unit).

**Illustration 6-3**

Break-even point in units

<b>Fixed Costs</b>	÷	<b>Contribution Margin per Unit</b>	=	<b>Break-Even Point in Units</b>
\$200,000	÷	\$200	=	1,000 units

Illustration 6-4 shows the computation for the break-even point in dollars (using contribution margin ratio).

**Illustration 6-4**

Break-even point in dollars

<b>Fixed Costs</b>	÷	<b>Contribution Margin Ratio</b>	=	<b>Break-Even Point in Dollars</b>
\$200,000	÷	.40	=	\$500,000

When a company is in its early stages of operation, its primary goal is to break even. Failure to break even will lead eventually to financial failure.

**TARGET NET INCOME**

Once a company achieves break-even, it then sets a sales goal that will generate a target net income. For example, assume that Vargo's management has a target net income of \$250,000. Illustration 6-5 shows the required sales in units to achieve its target net income.

**Illustration 6-5**

Target net income in units

<b>(Fixed Costs + Target Net Income)</b>	÷	<b>Contribution Margin per Unit</b>	=	<b>Required Sales in Units</b>
(\$200,000 + \$250,000)	÷	\$200	=	2,250 units

Illustration 6-6 uses the contribution margin ratio to compute the required sales in dollars.

**Illustration 6-6**

Target net income in dollars

<b>(Fixed Costs + Target Net Income)</b>	÷	<b>Contribution Margin Ratio</b>	=	<b>Required Sales in Dollars</b>
(\$200,000 + \$250,000)	÷	.40	=	\$1,125,000

In order to achieve net income of \$250,000, Vargo has to sell 2,250 camcorders, for a total price of \$1,125,000.

**MARGIN OF SAFETY**

Another measure managers use to assess profitability is the margin of safety. The **margin of safety** tells us **how far sales can drop** before the company will be operating at a loss. Managers like to have a sense of how much cushion they have between their current situation and operating at a loss. This can be expressed in dollars or as a ratio. In Illustration 6-2, for example, Vargo reported sales of \$800,000. At that sales level, its margin of safety in dollars and as a ratio are as follows.

**Illustration 6-7**

Margin of safety in dollars

<b>Actual (Expected) Sales</b>	–	<b>Break-Even Sales</b>	=	<b>Margin of Safety in Dollars</b>
\$800,000	–	\$500,000	=	\$300,000

As shown in Illustration 6-8, Vargo’s sales could drop by \$300,000, or 37.5%, before the company would operate at a loss.

**Illustration 6-8**  
Margin of safety ratio

<b>Margin of Safety in Dollars</b>	÷	<b>Actual (Expected) Sales</b>	=	<b>Margin of Safety Ratio</b>
\$300,000	÷	\$800,000	=	37.5%

### CVP and Changes in the Business Environment

To better understand how CVP analysis works, let’s look at three independent situations that might occur at Vargo Video. Each case uses the original camcorder sales and cost data, which were:

Unit selling price	\$500
Unit variable cost	\$300
Total fixed costs	\$200,000
Break-even sales	\$500,000 or 1,000 units

**Illustration 6-9**  
Original camcorder sales and cost data

#### CASE I

A competitor is offering a 10% discount on the selling price of its camcorders. Management must decide whether to offer a similar discount.

**Question:** What effect will a 10% discount on selling price have on the break-even point for camcorders?

**Answer:** A 10% discount on selling price reduces the selling price per unit to \$450 [ $\$500 - (\$500 \times 10\%)$ ]. Variable costs per unit remain unchanged at \$300. Thus, the contribution margin per unit is \$150. Assuming no change in fixed costs, break-even sales are 1,333 units, computed as follows.

<b>Fixed Costs</b>	÷	<b>Contribution Margin per Unit</b>	=	<b>Break-Even Sales</b>
\$200,000	÷	\$150	=	1,333 units (rounded)

**Illustration 6-10**  
Computation of break-even sales in units

For Vargo Video, this change requires monthly sales to increase by 333 units, or 33½%, in order to break even. In reaching a conclusion about offering a 10% discount to customers, management must determine how likely it is to achieve the increased sales. Also, management should estimate the possible loss of sales if the competitor’s discount price is not matched.

#### CASE II

To meet the threat of foreign competition, management invests in new robotic equipment that will lower the amount of direct labor required to make camcorders. The company estimates that total fixed costs will increase 30% and that variable cost per unit will decrease 30%.

**Question:** What effect will the new equipment have on the sales volume required to break even?

**Answer:** Total fixed costs become \$260,000 [ $\$200,000 + (30\% \times \$200,000)$ ]. The variable cost per unit becomes \$210 [ $\$300 - (30\% \times \$300)$ ]. The new break-even point is approximately 897 units, computed as shown on the next page.

**Illustration 6-11**

Computation of break-even sales in units

$$\begin{array}{rclcl} \text{Fixed Costs} & \div & \text{Contribution} & = & \text{Break-Even Sales} \\ \$260,000 & \div & (\$500 - \$210) & = & 897 \text{ units (rounded)} \end{array}$$

These changes appear to be advantageous for Vargo Video. The break-even point is reduced by approximately 10%, or 100 units.

**CASE III**

Vargo's principal supplier of raw materials has just announced a price increase. The higher cost is expected to increase the variable cost of camcorders by \$25 per unit. Management decides to hold the line on the selling price of the camcorders. It plans a cost-cutting program that will save \$17,500 in fixed costs per month. Vargo is currently realizing monthly net income of \$80,000 on sales of 1,400 camcorders.

**Question:** What increase in units sold will be needed to maintain the same level of net income?

**Answer:** The variable cost per unit increases to \$325 (\$300 + \$25). Fixed costs are reduced to \$182,500 (\$200,000 – \$17,500). Because of the change in variable cost, the contribution margin per unit becomes \$175 (\$500 – \$325). The required number of units sold to achieve the target net income is computed as follows.

**Illustration 6-12**

Computation of required sales

$$\begin{array}{rclcl} \left( \begin{array}{c} \text{Fixed Costs + Target} \\ \text{Net Income} \end{array} \right) & \div & \text{Contribution} & = & \text{Required Sales} \\ (\$182,500 + \$80,000) & \div & \$175 & = & \text{in Units} \\ & & & & 1,500 \end{array}$$

To achieve the required sales, Vargo Video will have to sell 1,500 camcorders, an increase of 100 units. If this does not seem to be a reasonable expectation, management will either have to make further cost reductions or accept less net income if the selling price remains unchanged.

We hope that the concepts reviewed in this section are now familiar to you. We are now ready to examine additional ways that companies use CVP analysis to assess profitability and to help in making effective business decisions.

**MANAGEMENT INSIGHT****Don't Just Look—Buy Something**

When analyzing an Internet business, analysts closely watch the so-called “conversion rate.” This rate is calculated by dividing the number of people who actually take action at an Internet site (buy something) by the total number of people who visit the site. Average conversion rates are from 3% to 5%. A rate below 2% is poor, while a rate above 10% is great.

Conversion rates have an obvious effect on the break-even point. Suppose you spend \$10,000 on your site, and you attract 5,000 visitors. If you get a 2% conversion rate (100 purchases), your site costs \$100 per purchase (\$10,000 ÷ 100). A 4% conversion rate gets you down to a cost of \$50 per transaction, and an 8% conversion rate gets you down to \$25. Studies show that conversion rates increase if the site has an easy-to-use interface, fast-performing screens, a convenient ordering process, and advertising that is both clever and clear.

Source: J. William Gurley, “The One Internet Metric That Really Counts” *Fortune* (March 6, 2000), p. 392.



Besides increasing their conversion rates, what steps can online merchants use to lower their break-even points? (See page 290.)

# DECISION TOOLKIT

DECISION CHECKPOINTS	INFO NEEDED FOR DECISION	TOOL TO USE FOR DECISION	HOW TO EVALUATE RESULTS
How can a company use CVP analysis to improve profitability?	Data on what effect a price change, a fixed-cost change, or a trade-off between fixed and variable costs would have on volume and costs	Measurement of income at new volume levels	If profitability increases under proposed change, adopt change.

## > DO IT!

### CVP Analysis

Krisanne Company reports the following operating results for the month of June.

**Krisanne Company  
CVP Income Statement  
For the Month Ended June 30, 2014**

	Total	Per Unit
Sales (5,000 units)	\$300,000	\$60
Variable costs	180,000	36
Contribution margin	120,000	\$24
Fixed expenses	100,000	
Net income	\$ 20,000	

To increase net income, management is considering reducing the selling price by 10%, with no changes to unit variable costs or fixed costs. Management is confident that this change will increase unit sales by 25%.

Using the contribution margin technique, compute the break-even point in units and dollars and margin of safety in dollars (a) assuming no changes to sales price or costs, and (b) assuming changes to sales price and volume as described above. (c) Comment on your findings.

#### Solution

#### Action Plan

- ✓ Apply the formula for the break-even point in units.
- ✓ Apply the formula for the break-even point in dollars.
- ✓ Apply the formula for the margin of safety in dollars.

- (a) Assuming no changes to sales price or costs:  
 Break-even point in units = 4,167 units (rounded) ( $\$100,000 \div \$24$ ).  
 Break-even point in sales dollars = \$250,000 ( $\$100,000 \div .40^a$ ).  
 Margin of safety in dollars = \$50,000 ( $\$300,000 - \$250,000$ ).  
<sup>a</sup> $\$24 \div \$60$ .
- (b) Assuming changes to sales price and volume:  
 Break-even point in units = 5,556 units (rounded) ( $\$100,000 \div \$18^b$ ).  
 Break-even point in sales dollars = \$300,000 ( $\$100,000 \div (\$18 \div \$54)$ ).  
 Margin of safety in dollars = \$37,500 ( $\$337,500^c - \$300,000$ ).  
<sup>b</sup> $\$60 - (.10 \times \$60) - 36 = \$18$ .  
<sup>c</sup> $5,000 + (.25 \times 5,000) = 6,250$  units,  $6,250 \text{ units} \times \$54 = \$337,500$ .
- (c) The increase in the break-even point and the decrease in the margin of safety indicate that management should not implement the proposed change. The increase in sales volume will result in contribution margin of \$112,500 ( $6,250 \times \$18$ ), which is \$7,500 less than the current amount.

Related exercise material: **BE6-3, BE6-4, BE6-5, BE6-6, E6-1, E6-2, E6-3, E6-4, E6-5, and DO IT! 6-2.**

## Sales Mix

### LEARNING OBJECTIVE 3

Explain the term sales mix and its effects on break-even sales.

To this point, our discussion of CVP analysis has assumed that a company sells only one product. However, most companies sell multiple products. When a company sells many products, it is important that management understand its sales mix.

**Sales mix** is the relative percentage in which a company sells its multiple products. For example, if 80% of **Hewlett Packard's** unit sales are printers and the other 20% are PCs, its sales mix is 80% printers to 20% PCs.

Sales mix is important to managers because different products often have substantially different contribution margins. For example, **Ford's** SUVs and F150 pickup trucks have higher contribution margins compared to its economy cars. Similarly, first-class tickets sold by **United Airlines** provide substantially higher contribution margins than coach-class tickets. **Intel's** sales of computer chips for netbook computers have increased, but the contribution margin on these chips is lower than for notebook and desktop PCs.

### Break-Even Sales in Units

Companies can compute break-even sales for a mix of two or more products by determining the **weighted-average unit contribution margin of all the products**. To illustrate, assume that Vargo Video sells not only camcorders but high-definition TVs as well. Vargo sells its two products in the following amounts: 1,500 camcorders and 500 TVs. The sales mix, expressed as a percentage of the 2,000 total units sold, is as follows.

#### Illustration 6-13

Sales mix as a function of units sold

Camcorders	TVs
1,500 units ÷ 2,000 units = 75%	500 units ÷ 2,000 units = 25%

That is, 75% of the 2,000 units sold are camcorders, and 25% of the 2,000 units sold are TVs.

Illustration 6-14 shows additional information related to Vargo Video. The unit contribution margin for camcorders is \$200, and for TVs it is \$500. Vargo's fixed costs total \$275,000.

#### Illustration 6-14

Per unit data—sales mix

Unit Data	Camcorders	TVs
Selling price	\$500	\$1,000
Variable costs	300	500
Contribution margin	\$200	\$500
Sales mix—units	75%	25%
Fixed costs = \$275,000		

To compute break-even for Vargo, we must determine the weighted-average unit contribution margin for the two products. We use the **weighted-average** contribution margin because Vargo sells three times as many camcorders as TVs. As a result, in determining an average unit contribution margin, three times as much weight should be placed on the contribution margin of the camcorders as on the TVs. Therefore, the camcorders must be counted three times for every TV sold. The weighted-average contribution margin for a sales mix of 75% camcorders and 25% TVs is \$275, which is computed as follows.

Camcorders			TVs			<b>Weighted-Average Unit Contribution Margin</b>		
(Unit Contribution Margin)	×	Sales Mix Percentage)	+	(Unit Contribution Margin)	×		Sales Mix Percentage)	=
(\$200	×	.75)	+	(\$500	×	.25)	=	<b>\$275</b>

Similar to our calculation in the single-product setting, we can compute the break-even point in units by dividing the fixed costs by the weighted-average unit contribution margin. Then, we use the weighted-average unit contribution margin of \$275 to compute the break-even point in unit sales. The computation of break-even sales in units for Vargo Video, assuming \$275,000 of fixed costs, is as follows.

**Illustration 6-15**  
Weighted-average unit contribution margin

<b>Fixed Costs</b>	÷	<b>Weighted-Average Unit Contribution Margin</b>	=	<b>Break-Even Point in Units</b>
\$275,000	÷	\$275	=	<b>1,000 units</b>

**Illustration 6-16**  
Break-even point in units

Illustration 6-16 shows the break-even point for Vargo Video is 1,000 units—camcorders and TVs combined. Management needs to know how many of these 1,000 units are camcorders and how many are TVs. Applying the sales mix percentages that we computed previously of 75% for camcorders and 25% for TVs, these 1,000 units would be comprised of 750 camcorders (.75 × 1,000 units) and 250 TVs (.25 × 1,000). This can be verified by the computations in Illustration 6-17, which shows that the total contribution margin is \$275,000 when 1,000 units are sold, which equals the fixed costs of \$275,000.

Product	Unit Sales	×	Unit Contribution Margin	=	Total Contribution Margin
Camcorders	750	×	\$200	=	\$ 150,000
TVs	250	×	500	=	125,000
	<b><u>1,000</u></b>				<b><u>\$275,000</u></b>

**Illustration 6-17**  
Break-even proof—sales units

Management should continually review the company's sales mix. At any level of units sold, **net income will be greater if higher contribution margin units are sold, rather than lower contribution margin units.** For Vargo Video, the TVs produce the higher contribution margin. Consequently, if Vargo sells 300 TVs and 700 camcorders, net income would be higher than in the current sales mix even though total units sold are the same.

An analysis of these relationships shows that a shift from low-margin sales to high-margin sales may increase net income even though there is a decline in total units sold. Likewise, a shift from high- to low-margin sales may result in a decrease in net income even though there is an increase in total units sold.

## DECISION TOOLKIT

DECISION CHECKPOINTS	INFO NEEDED FOR DECISION	TOOL TO USE FOR DECISION	HOW TO EVALUATE RESULTS
How many units of product A and product B do we need to sell to break even?	Fixed costs, weighted-average unit contribution margin, sales mix	Break-even point in units = $\frac{\text{Fixed costs}}{\text{Weighted-average unit contribution margin}}$	To determine number of units of product A and B, allocate total units based on sales mix.

### Break-Even Sales in Dollars

The calculation of the break-even point presented for Vargo Video in the previous section works well if a company has only a *small number* of products. In contrast, consider 3M, the maker of Post-it Notes, which has more than 30,000 products. In order to calculate the break-even point for 3M using a weighted-average unit contribution margin, we would need to calculate 30,000 different unit contribution margins. That is not realistic.

Therefore, for a company with many products, we calculate the break-even point in terms of sales dollars (rather than units sold), using sales information for divisions or product lines (rather than individual products). This requires that we compute sales mix as a percentage of total dollars sales (rather than units sold) and we compute the contribution margin ratio (rather than contribution margin per unit).

To illustrate, suppose that Kale Garden Supply Company has two divisions—Indoor Plants and Outdoor Plants. Each division has hundreds of different types of plants and plant-care products. Illustration 6-18 provides information necessary for determining the sales mix percentages for the two divisions of Kale Garden Supply.

#### Illustration 6-18

Cost-volume-profit data for Kale Garden Supply

	<b>Indoor Plant Division</b>	<b>Outdoor Plant Division</b>	<b>Total</b>
Sales	\$ 200,000	\$ 800,000	\$1,000,000
Variable costs	120,000	560,000	680,000
Contribution margin	<u>\$ 80,000</u>	<u>\$ 240,000</u>	<u>\$ 320,000</u>
Sales mix percentage (Division sales ÷ Total sales)	$\frac{\$ 200,000}{\$1,000,000} = .20$	$\frac{\$ 800,000}{\$1,000,000} = .80$	

As shown in Illustration 6-19, the contribution margin ratio for the combined company is 32%, which is computed by dividing the total contribution margin by total sales.

#### Illustration 6-19

Contribution margin ratio for each division

	<b>Indoor Plant Division</b>	<b>Outdoor Plant Division</b>	<b>Total</b>
Contribution margin ratio (Contribution margin ÷ Sales)	$\frac{\$ 80,000}{\$200,000} = .40$	$\frac{\$240,000}{\$800,000} = .30$	$\frac{\$ 320,000}{\$1,000,000} = .32$

It is useful to note that the contribution margin ratio of 32% is a weighted average of the individual contribution margin ratios of the two divisions (40% and 30%). To illustrate, in Illustration 6-20 we multiply each division's contribution margin ratio by its sales mix percentage, based on dollar sales, and then sum these amounts. As shown later, the calculation in Illustration 6-20 is useful because it enables us to determine how the break-even point changes when the sales mix changes.

#### Illustration 6-20

Calculation of weighted-average contribution margin

<u>Indoor Plant Division</u>		<u>Outdoor Plant Division</u>				<b>Weighted-Average Contribution Margin Ratio</b>			
(	Contribution Margin Ratio	×	Sales Mix Percentage	+ (	Contribution Margin Ratio	×	Sales Mix Percentage)	=	
	(.40	×	.20)	+ (	.30	×	.80)	=	.32

Kale Garden Supply's break-even point in dollars is then computed by dividing its fixed costs of \$300,000 by the weighted-average contribution margin ratio of 32%, as shown in Illustration 6-21.

Fixed Costs	÷	Weighted-Average Contribution Margin Ratio	=	Break-Even Point in Dollars
\$300,000	÷	.32	=	\$937,500

**Illustration 6-21**  
Calculation of break-even point in dollars

The break-even point is based on the sales mix of 20% to 80%. We can determine the amount of sales contributed by each division by multiplying the sales mix percentage of each division by the total sales figure. Of the company's total break-even sales of \$937,500, a total of \$187,500 ( $.20 \times \$937,500$ ) will come from the Indoor Plant Division, and \$750,000 ( $.80 \times \$937,500$ ) will come from the Outdoor Plant Division.

What would be the impact on the break-even point if a higher percentage of Kale Garden Supply's sales were to come from the Indoor Plant Division? Because the Indoor Plant Division enjoys a higher contribution margin ratio, this change in the sales mix would result in a higher weighted-average contribution margin ratio, and consequently a lower break-even point in dollars. For example, if the sales mix changes to 50% for the Indoor Plant Division and 50% for the Outdoor Plant Division, the weighted-average contribution margin ratio would be 35% [ $(.40 \times .50) + (.30 \times .50)$ ]. The new, lower, break-even point is \$857,143 ( $\$300,000 \div .35$ ). The opposite would occur if a higher percentage of sales were expected from the Outdoor Plant Division. As you can see, the information provided using CVP analysis can help managers better understand the impact of sales mix on profitability.

## SERVICE COMPANY INSIGHT

### Healthy for You, and Great for the Bottom Line



**Zoom Kitchen**, a chain of four restaurants in the Chicago area, is known for serving sizable portions of meat and potatoes. But the company's management is quite pleased with the fact that during the past four years, salad sales have increased from 18% of its sales mix to 40%. Why are they pleased? Because the contribution margin on salads is much higher than on meat. The restaurant made a conscious effort to encourage people to buy more salads by offering an interesting assortment of salad ingredients including jicama, beets, marinated mushrooms, grilled tuna, and carved turkey. Management has to be very sensitive to contribution margin—it costs about \$600,000 to open up a new Zoom Kitchen restaurant.

Source: Amy Zuber, "Salad Sales 'Zoom' at Meat-and-Potatoes Specialist," *Nation's Restaurant News* (November 12, 2001), p. 26.



Why do you suppose restaurants are so eager to sell beverages and desserts? (See page 290.)

## DECISION TOOLKIT



DECISION CHECKPOINTS	INFO NEEDED FOR DECISION	TOOL TO USE FOR DECISION	HOW TO EVALUATE RESULTS
How many dollars of sales are required from each division in order to break even?	Fixed costs, weighted-average contribution margin ratio, sales mix	Break-even point in dollars = $\frac{\text{Fixed costs}}{\text{Weighted-average contribution margin ratio}}$	To determine the sales dollars required from each division, allocate the total break-even sales using the sales mix.

## > DO IT!

### Sales Mix Break-Even

Manzeck Bicycles International produces and sells three different types of mountain bikes. Information regarding the three models is shown below.

	<u>Pro</u>	<u>Intermediate</u>	<u>Standard</u>	<u>Total</u>
Units sold	5,000	10,000	25,000	40,000
Selling price	\$800	\$500	\$350	
Variable costs	\$500	\$300	\$250	

The company's total fixed costs to produce the bicycles are \$7,500,000.

- Determine the sales mix as a function of units sold for the three products.
- Determine the weighted-average unit contribution margin.
- Determine the total number of units that the company must produce to break even.
- Determine the number of units of each model that the company must produce to break even.

#### Action Plan

- ✓ The sales mix is the relative percentage of each product sold in units.
- ✓ The weighted-average unit contribution margin is the sum of the per unit contribution margins multiplied by the respective sales mix percentage.
- ✓ Determine the break-even point in units by dividing the fixed costs by the weighted-average unit contribution margin.
- ✓ Determine the number of units of each model to produce by multiplying the total break-even units by the respective sales mix percentage for each product.

#### Solution

- (a) The sales mix percentages as a function of units sold are:

<u>Pro</u>	<u>Intermediate</u>	<u>Standard</u>
$5,000/40,000 = 12.5\%$	$10,000/40,000 = 25\%$	$25,000/40,000 = 62.5\%$

- (b) The weighted-average unit contribution margin is:

$$[.125 \times (\$800 - \$500)] + [.25 \times (\$500 - \$300)] + [.625 \times (\$350 - \$250)] = \$150$$

- (c) The break-even point in units is:

$$\$7,500,000 \div \$150 = 50,000 \text{ units}$$

- (d) The break-even units to produce for each product are:

Pro:	$50,000 \text{ units} \times 12.5\% =$	6,250 units
Intermediate:	$50,000 \text{ units} \times 25\% =$	12,500 units
Standard:	$50,000 \text{ units} \times 62.5\% =$	31,250 units
		<u>50,000 units</u>

Related exercise material: **BE6-7, BE6-8, BE6-9, BE6-10, E6-6, E6-7, E6-8, E6-9, E6-10, and DO IT! 6-3.**



## Determining Sales Mix with Limited Resources

#### LEARNING OBJECTIVE 4

Determine sales mix when a company has limited resources.

In the previous discussion, we assumed a certain sales mix and then determined the break-even point given that sales mix. We now discuss how limited resources influence the sales-mix decision.

Everyone's resources are limited. The limited resource may be floor space in a retail department store, or raw materials, direct labor hours, or machine capacity in a manufacturing company. When a company has limited resources, management must decide which products to make and sell in order to maximize net income.

To illustrate, recall that Vargo manufactures camcorders and TVs. The limiting resource is machine capacity, which is 3,600 hours per month. Relevant data consist of the following.

#### Illustration 6-22

Contribution margin and machine hours

	<u>Camcorders</u>	<u>TVs</u>
Contribution margin per unit	\$200	\$500
Machine hours required per unit	.2	.625

The TVs may appear to be more profitable since they have a higher contribution margin per unit (\$500) than the camcorders (\$200). However, the camcorders take fewer machine hours to produce than the TVs. Therefore, it is necessary to find the **contribution margin per unit of limited resource**—in this case, contribution margin per machine hour. This is obtained by dividing the contribution margin per unit of each product by the number of units of the limited resource required for each product, as shown in Illustration 6-23.

	<u>Camcorders</u>	<u>TVs</u>
Contribution margin per unit (a)	\$200	\$500
Machine hours required (b)	0.2	0.625
<b>Contribution margin per unit of limited resource [(a) ÷ (b)]</b>	<b>\$1,000</b>	<b>\$800</b>

**Helpful Hint**

CM alone is not enough to make this decision. The key factor is CM per unit of limited resource.

**Illustration 6-23**

Contribution margin per unit of limited resource

The computation shows that the camcorders have a higher contribution margin per unit of limited resource. This would suggest that, given sufficient demand for camcorders, Vargo should shift the sales mix to produce more camcorders or increase machine capacity.

As indicated in Illustration 6-23, the constraint for the production of the TVs is the larger number of machine hours needed to produce them. In addressing this problem, we have taken the limited number of machine hours as a given and have attempted to maximize the contribution margin given the constraint. One question that Vargo should ask, however, is whether this constraint can be reduced or eliminated. If Vargo is able to increase machine capacity from 3,600 hours to 4,200 hours, the additional 600 hours could be used to produce either the camcorders or TVs. The total contribution margin under each alternative is found by multiplying the machine hours by the contribution margin per unit of limited resource, as shown below.

	<u>Camcorders</u>	<u>TVs</u>
Machine hours (a)	600	600
Contribution margin per unit of limited resource (b)	\$ 1,000	\$ 800
<b>Contribution margin [(a) × (b)]</b>	<b><u>\$600,000</u></b>	<b><u>\$480,000</u></b>

**Illustration 6-24**

Incremental analysis—computation of total contribution margin

From this analysis, we can see that to maximize net income, all of the increased capacity should be used to make and sell the camcorders.

Vargo's manufacturing constraint might be due to a bottleneck in production or to poorly trained machine operators. In addition to finding ways to solve those problems, the company should consider other possible solutions, such as outsourcing part of the production, acquiring additional new equipment (discussed in Chapter 12), or striving to eliminate any non-value-added activities (see Chapter 4). As discussed in Chapter 1, this approach to evaluating constraints is referred to as the theory of constraints. The **theory of constraints** is a specific approach used to identify and manage constraints in order to achieve the company's goals. According to this theory, a company must continually identify its constraints and find ways to reduce or eliminate them, where appropriate.



## MANAGEMENT INSIGHT



### Something Smells

When fragrance sales went flat, retailers turned up the heat on fragrance manufacturers. They reduced the amount of floor space devoted to fragrances, leaving fragrance manufacturers fighting each other for the smaller space. The retailer doesn't just choose the fragrance with the highest contribution margin. Instead, it chooses the fragrance with the highest contribution margin per square foot for a given period of time. In this game, a product with a lower contribution margin, but a higher turnover, could well be the winner.



What is the limited resource for a retailer, and what implications does this have for sales mix? (See page 290.)

## DECISION TOOLKIT



DECISION CHECKPOINTS	INFO NEEDED FOR DECISION	TOOL TO USE FOR DECISION	HOW TO EVALUATE RESULTS
How many units of product A and B should we produce in light of a limited resource?	Contribution margin per unit, limited resource required per unit	$\text{Contribution margin per unit of limited resource} = \frac{\text{Contribution margin per unit}}{\text{Limited resource per unit}}$	Any additional capacity of limited resource should be applied toward the product with higher contribution margin per unit of limited resource.

## > DO IT!

### Sales Mix with Limited Resources

Carolina Corporation manufactures and sells three different types of high-quality sealed ball bearings. The bearings vary in terms of their quality specifications—primarily with respect to their smoothness and roundness. They are referred to as Fine, Extra-Fine, and Super-Fine bearings. Machine time is limited. More machine time is required to manufacture the Extra-Fine and Super-Fine bearings. Additional information is provided below.

	Product		
	Fine	Extra-Fine	Super-Fine
Selling price	\$6.00	\$10.00	\$16.00
Variable costs and expenses	4.00	6.50	11.00
Contribution margin	<u>\$2.00</u>	<u>\$ 3.50</u>	<u>\$ 5.00</u>
Machine hours required	0.02	0.04	0.08

- Ignoring the machine time constraint, what strategy would appear optimal?
- What is the contribution margin per unit of limited resource for each type of bearing?
- If additional machine time could be obtained, how should the additional capacity be used?

### Solution

#### Action Plan

- ✓ Calculate the contribution margin per unit of limited resource for each product.

- The Super-Fine bearings have the highest contribution margin per unit. Thus, ignoring any manufacturing constraints, it would appear that the company should shift toward production of more Super-Fine units.

**Action Plan (cont'd.)**

- ✓ Apply the formula for the contribution margin per unit of limited resource.
- ✓ To maximize net income, shift sales mix to the product with the highest contribution margin per unit of limited resource.

(b) The contribution margin per unit of limited resource (machine hours) is calculated as:

	<u>Fine</u>	<u>Extra-Fine</u>	<u>Super-Fine</u>
Contribution margin per unit	$\frac{\$2}{.02} = \$100$	$\frac{\$3.5}{.04} = \$87.50$	$\frac{\$5}{.08} = \$62.50$
Limited resource consumed per unit	.02	.04	.08

(c) The Fine bearings have the highest contribution margin per unit of limited resource even though they have the lowest contribution margin per unit. Given the resource constraint, any additional capacity should be used to make Fine bearings.

Related exercise material: **BE6-11, E6-11, E6-12, E6-13, and DO IT! 6-4.**



## Cost Structure and Operating Leverage

**Cost structure** refers to the relative proportion of fixed versus variable costs that a company incurs. Cost structure can have a significant effect on profitability. For example, computer equipment manufacturer **Cisco Systems** has substantially reduced its fixed costs by choosing to outsource much of its production. By minimizing its fixed costs, Cisco is now less susceptible to economic swings. However, as the following discussion shows, its reduced reliance on fixed costs has also reduced its ability to experience the incredible profitability that it used to have during economic booms.

The choice of cost structure should be carefully considered. There are many ways that companies can influence their cost structure. For example, by acquiring sophisticated robotic equipment, many companies have reduced their use of manual labor. Similarly, some brokerage firms, such as **E\*Trade**, have reduced their reliance on human brokers and have instead invested heavily in computers and online technology. In so doing, they have increased their reliance on fixed costs (through depreciation on the robotic equipment or computer equipment) and reduced their reliance on variable costs (the variable employee labor cost). Alternatively, some companies have reduced their fixed costs and increased their variable costs by outsourcing their production. **Nike**, for example, does very little manufacturing but instead outsources the manufacture of nearly all of its shoes. It has consequently converted many of its fixed costs into variable costs and therefore changed its cost structure.

Consider the following example of Vargo Video and one of its competitors, New Wave Company. Both make camcorders. Vargo Video uses a traditional, labor-intensive manufacturing process. New Wave Company has invested in a completely automated system. The factory employees are involved only in setting up, adjusting, and maintaining the machinery. Illustration 6-25 shows CVP income statements for each company.

	<b>Vargo Video</b>	<b>New Wave Company</b>
Sales	\$800,000	\$800,000
Variable costs	<u>480,000</u>	<u>160,000</u>
Contribution margin	320,000	640,000
Fixed costs	<u>200,000</u>	<u>520,000</u>
Net income	<u>\$120,000</u>	<u>\$120,000</u>

**LEARNING OBJECTIVE** 5

Understand how operating leverage affects profitability.

**Illustration 6-25**  
CVP income statements for two companies

Both companies have the same sales and the same net income. However, because of the differences in their cost structures, they differ greatly in the risks and rewards related to increasing or decreasing sales. Let's evaluate the impact of cost structure on the profitability of the two companies.

### Effect on Contribution Margin Ratio

First let's look at the contribution margin ratio. Illustration 6-26 shows the computation of the contribution margin ratio for each company.

**Illustration 6-26**  
Contribution margin ratio  
for two companies

	Contribution Margin	÷	Sales	=	Contribution Margin Ratio
Vargo Video	\$320,000	÷	\$800,000	=	.40
New Wave	\$640,000	÷	\$800,000	=	.80

Because of its lower variable costs, New Wave has a contribution margin ratio of 80% versus only 40% for Vargo. That means that with every dollar of sales, New Wave generates 80 cents of contribution margin (and thus an 80-cent increase in net income), versus only 40 cents for Vargo. However, it also means that for every dollar that sales decline, New Wave loses 80 cents in net income, whereas Vargo will lose only 40 cents. New Wave's cost structure, which relies more heavily on fixed costs, makes it more sensitive to changes in sales revenue.

### Effect on Break-Even Point

The difference in cost structure also affects the break-even point. The break-even point for each company is calculated in Illustration 6-27.

**Illustration 6-27**  
Computation of break-even  
point for two companies

	Fixed Costs	÷	Contribution Margin Ratio	=	Break-Even Point in Dollars
Vargo Video	\$200,000	÷	.40	=	\$500,000
New Wave	\$520,000	÷	.80	=	\$650,000

New Wave needs to generate \$150,000 (\$650,000 – \$500,000) more in sales than Vargo before it breaks even. This makes New Wave riskier than Vargo because a company cannot survive for very long unless it at least breaks even.

### Effect on Margin of Safety Ratio

We can also evaluate the relative impact that changes in sales would have on the two companies by computing the margin of safety ratio. Illustration 6-28 shows the computation of the **margin of safety ratio** for the two companies.

**Illustration 6-28**  
Computation of margin  
of safety ratio for two  
companies

	( Actual Sales	–	Break-Even Sales	) ÷	Actual Sales	=	Margin of Safety Ratio
Vargo Video	(\$800,000	–	\$500,000)	÷	\$800,000	=	.38
New Wave	(\$800,000	–	\$650,000)	÷	\$800,000	=	.19

The difference in the margin of safety ratio also reflects the difference in risk between the two companies. Vargo could sustain a 38% decline in sales before it would be operating at a loss. New Wave could sustain only a 19% decline in sales before it would be “in the red.”

### Operating Leverage

**Operating leverage** refers to the extent to which a company's net income reacts to a given change in sales. Companies that have higher fixed costs relative to variable costs have higher operating leverage. When a company's sales revenue is

increasing, high operating leverage is a good thing because it means that profits will increase rapidly. But when sales are declining, too much operating leverage can have devastating consequences.

**DEGREE OF OPERATING LEVERAGE**

How can we compare operating leverage between two companies? The **degree of operating leverage** provides a measure of a company’s earnings volatility and can be used to compare companies. Degree of operating leverage is computed by dividing contribution margin by net income. This formula is presented in Illustration 6-29 and applied to our two manufacturers of camcorders.

	Contribution Margin	÷	Net Income	=	Degree of Operating Leverage
Vargo Video	\$320,000	÷	\$120,000	=	2.67
New Wave	\$640,000	÷	\$120,000	=	5.33

**Illustration 6-29**  
Computation of degree of operating leverage

New Wave’s earnings would go up (or down) by about two times ( $5.33 \div 2.67 = 1.99$ ) as much as Vargo’s with an equal increase (or decrease) in sales. For example, suppose both companies experience a 10% decrease in sales. Vargo’s net income will decrease by 26.7% ( $2.67 \times 10\%$ ), while New Wave’s will decrease by 53.3% ( $5.33 \times 10\%$ ). Thus, New Wave’s higher operating leverage exposes it to greater earnings volatility risk.

You should be careful not to conclude from this analysis that a cost structure that relies on higher fixed costs, and consequently has higher operating leverage, is necessarily bad. Some have suggested that Internet radio company **Pandora** has limited potential for growth in its profitability because it has very little operating leverage. When its revenues grow, its variable costs (fees it pays for the right to use music) grow proportionally. When used carefully, operating leverage can add considerably to a company’s profitability. For example, computer equipment manufacturer **Komag** enjoyed a 66% increase in net income when its sales increased by only 8%. As one commentator noted, “Komag’s fourth quarter illustrates the company’s significant operating leverage; a small increase in sales leads to a big profit rise.” However, as our illustration demonstrates, increased reliance on fixed costs increases a company’s risk.

**SERVICE COMPANY INSIGHT**



**There Is Something About a Train**

Warren Buffett, arguably the most successful investor in history, recently bought a new train set—for \$44 billion. The sage from Omaha bought **Burlington Northern Railroad** for a price that exceeded its market value by 31%. At a time when the rest of the investing public was obsessed with technology companies like **Facebook** and **Twitter**, what could Buffett possibly see in a railroad? What he sees is a business whose costs are between 50–60% fixed. With such high fixed costs, railways have huge operating leverage. And because he bought the railroad at the bottom of a recession, when the economy turns around, Burlington could take off as well. Add to that the fact that railroad transport is very energy-efficient, and it has high barriers to entry. So, as energy prices increase, more people will turn to the rails, but there are a limited number of railways. Makes sense to me.

Source: Liam Denning, “Buffett’s Unusual Train of Thought,” *Wall Street Journal* (November 4, 2009).



Why did Warren Buffett think that this was a good time to invest in railroad stocks? (See page 290.)

## DECISION TOOLKIT

DECISION CHECKPOINTS	INFO NEEDED FOR DECISION	TOOL TO USE FOR DECISION	HOW TO EVALUATE RESULTS
How sensitive is the company's net income to changes in sales?	Contribution margin and net income	Degree of operating leverage = $\frac{\text{Contribution margin}}{\text{Net income}}$	Reports the change in net income that will occur with a given change in sales. A high degree of operating leverage means that the company's net income is very sensitive to changes in sales.

## USING THE DECISION TOOLKIT

Rexfield Corp. is contemplating a huge investment in automated mass-spectrometers for its medical laboratory testing services. Its current process relies heavily on the expertise of a high number of lab technicians. The new equipment would employ a computer expert system that integrates much of the decision process and knowledge base that is used by a skilled lab technician.

Rex Field, the company's CEO, has requested that an analysis of projected results using the old technology versus the new technology be done for the coming year. The accounting department has prepared the following CVP income statements for use in your analysis.

	<u>Old</u>	<u>New</u>
Sales	\$2,000,000	\$2,000,000
Variable costs	<u>1,400,000</u>	<u>600,000</u>
Contribution margin	600,000	1,400,000
Fixed costs	<u>400,000</u>	<u>1,200,000</u>
Net income	<u>\$ 200,000</u>	<u>\$ 200,000</u>

### Instructions

Use the information provided above to do the following.

- Compute the degree of operating leverage for the company under each scenario, and discuss your results.
- Compute the break-even point in dollars and margin of safety ratio for the company under each scenario, and discuss your results.

### Solution

(a)	Contribution Margin	÷	Net Income	=	Degree of Operating Leverage
	Old		\$600,000	÷	\$200,000 = 3
	New		\$1,400,000	÷	\$200,000 = 7

The degree of operating leverage measures the company's sensitivity to changes in sales. By switching to a cost structure dominated by fixed costs, the company would significantly increase its operating leverage. As a result, with a percentage change in sales, its percentage change in net income would be 2.33 times as much ( $7 \div 3$ ) under the new structure as it would under the old.

- To compute the break-even point in sales dollars, we need first to compute the contribution margin ratio under each scenario. Under the old structure, the contribution margin ratio would be .30 ( $\$600,000 \div \$2,000,000$ ), and under the new it would be .70 ( $\$1,400,000 \div \$2,000,000$ ).

	Fixed Costs	÷	Contribution Margin Ratio	=	Break-Even Point in Dollars
Old	\$400,000	÷	.30	=	\$1,333,333
New	\$1,200,000	÷	.70	=	\$1,714,286

Because the company's fixed costs would be substantially higher under the new cost structure, its break-even point would increase significantly, from \$1,333,333 to \$1,714,286. A higher break-even point is riskier because it means that the company must generate higher sales to be profitable.

The margin of safety ratio tells how far sales can fall before the company is operating at a loss.

	$\left( \begin{array}{c} \text{Actual} \\ \text{Sales} \end{array} \right)$	–	$\left( \begin{array}{c} \text{Break-Even} \\ \text{Sales} \end{array} \right)$	÷	Actual Sales	=	Margin of Safety Ratio
Old	(\$2,000,000	–	\$1,333,333)	÷	\$2,000,000	=	.33
New	(\$2,000,000	–	\$1,714,286)	÷	\$2,000,000	=	.14

Under the old structure, sales could fall by 33% before the company would be operating at a loss. Under the new structure, sales could fall by only 14%.



## SUMMARY OF LEARNING OBJECTIVES



- 1 Describe the essential features of a cost-volume-profit income statement.** The CVP income statement classifies costs and expenses as variable or fixed and reports contribution margin in the body of the statement.
- 2 Apply basic CVP concepts.** Contribution margin is the amount of revenue remaining after deducting variable costs. It can be expressed as a per unit amount or as a ratio. The break-even point in units is fixed costs divided by contribution margin per unit. The break-even point in dollars is fixed costs divided by the contribution margin ratio. These formulas can also be used to determine units or sales dollars needed to achieve target net income, simply by adding target net income to fixed costs before dividing by the contribution margin. Margin of safety indicates how much sales can decline before the company is operating at a loss. It can be expressed in dollar terms or as a percentage.
- 3 Explain the term sales mix and its effects on break-even sales.** Sales mix is the relative proportion in which each product is sold when a company sells more than one product. For a company with a small number of products, break-even sales in units is determined by using the weighted-average unit contribution margin of

all the products. If the company sells many different products, then calculating the break-even point using unit information is not practical. Instead, in a company with many products, break-even sales in dollars is calculated using the weighted-average contribution margin ratio.

- 4 Determine sales mix when a company has limited resources.** When a company has limited resources, it is necessary to find the contribution margin per unit of limited resource. This amount is then multiplied by the units of limited resource to determine which product maximizes net income.
- 5 Understand how operating leverage affects profitability.** Operating leverage refers to the degree to which a company's net income reacts to a change in sales. Operating leverage is determined by a company's relative use of fixed versus variable costs. Companies with high fixed costs relative to variable costs have high operating leverage. A company with high operating leverage will experience a sharp increase (decrease) in net income with a given increase (decrease) in sales. The degree of operating leverage can be measured by dividing contribution margin by net income.

## DECISION TOOLKIT A SUMMARY



DECISION CHECKPOINTS	INFO NEEDED FOR DECISION	TOOL TO USE FOR DECISION	HOW TO EVALUATE RESULTS
How can a company use CVP analysis to improve profitability?	Data on what effect a price change, a fixed-cost change, or a trade-off between fixed and variable costs would have on volume and costs	Measurement of income at new volume levels	If profitability increases under proposed change, adopt change.
How many units of product A and product B do we need to sell to break even?	Fixed costs, weighted-average unit contribution margin, sales mix	Break-even point in units = $\frac{\text{Fixed costs}}{\text{Weighted-average unit contribution margin}}$	To determine number of units of product A and B, allocate total units based on sales mix.
How many dollars of sales are required from each division in order to break even?	Fixed costs, weighted-average contribution margin ratio, sales mix	Break-even point in dollars = $\frac{\text{Fixed costs}}{\text{Weighted-average contribution margin ratio}}$	To determine the sales dollars required from each division, allocate the total break-even sales using the sales mix.

DECISION CHECKPOINTS	INFO NEEDED FOR DECISION	TOOL TO USE FOR DECISION	HOW TO EVALUATE RESULTS
How many units of product A and B should we produce in light of a limited resource?	Contribution margin per unit, limited resource required per unit	$\frac{\text{Contribution margin per unit of limited resource}}{\text{Contribution margin per unit}} = \text{Limited resource per unit}$	Any additional capacity of limited resource should be applied toward the product with higher contribution margin per unit of limited resource.
How sensitive is the company's net income to changes in sales?	Contribution margin and net income	$\text{Degree of operating leverage} = \frac{\text{Contribution margin}}{\text{Net income}}$	Reports the change in net income that will occur with a given change in sales. A high degree of operating leverage means that the company's net income is very sensitive to changes in sales.

## APPENDIX 6A ABSORPTION COSTING VERSUS VARIABLE COSTING

**LEARNING OBJECTIVE 6**

**Explain the difference between absorption costing and variable costing.**

In the earlier chapters, we classified both variable and fixed manufacturing costs as product costs. In job order costing, for example, a job is assigned the costs of direct materials, direct labor, and **both** variable and fixed manufacturing overhead. This costing approach is referred to as **full** or **absorption costing**. It is so named because all manufacturing costs are charged to, or absorbed by, the product. Absorption costing is the approach used for external reporting under generally accepted accounting principles.

An alternative approach is to use **variable costing**. Under variable costing, only direct materials, direct labor, and variable manufacturing overhead costs are considered product costs. Companies recognize fixed manufacturing overhead costs as period costs (expenses) when incurred. The difference between absorption costing and variable costing is shown graphically as follows.

**Illustration 6A-1**  
Difference between absorption costing and variable costing



Under both absorption and variable costing, selling and administrative expenses are period costs.

Companies may not use variable costing for external financial reports because generally accepted accounting principles require that fixed manufacturing overhead be accounted for as a product cost.

### Example Comparing Absorption Costing with Variable Costing

To illustrate absorption and variable costing, assume that Premium Products Corporation manufactures a polyurethane sealant, called Fix-It, for car windshields. Relevant data for Fix-It in January 2014, the first month of production, are as shown on the next page.

Selling price	\$20 per unit.
Units	Produced 30,000; sold 20,000; beginning inventory zero.
Variable unit costs	Manufacturing \$9 (direct materials \$5, direct labor \$3, and variable overhead \$1). Selling and administrative expenses \$2.
Fixed costs	Manufacturing overhead \$120,000. Selling and administrative expenses \$15,000.

**Illustration 6A-2**

Sealant sales and cost data for Premium Products Corporation

The per unit manufacturing cost under each costing approach is computed in Illustration 6A-3.

Type of Cost	Absorption Costing	Variable Costing
Direct materials	\$ 5	\$5
Direct labor	3	3
Variable manufacturing overhead	1	1
<b>Fixed manufacturing overhead</b> <b>(\$120,000 ÷ 30,000 units produced)</b>	<b>4</b>	<b>0</b>
<b>Manufacturing cost per unit</b>	<b>\$13</b>	<b>\$9</b>

**Illustration 6A-3**

Computation of per unit manufacturing cost

The manufacturing cost per unit is \$4 higher (\$13 – \$9) for absorption costing. This occurs because fixed manufacturing overhead costs are a product cost under absorption costing. Under variable costing, they are, instead, a period cost, and so they are expensed. Based on these data, each unit sold and each unit remaining in inventory is costed under absorption costing at \$13 and under variable costing at \$9.

**ABSORPTION COSTING EXAMPLE**

Illustration 6A-4 shows the income statement for Premium Products using absorption costing. It shows that cost of goods manufactured is \$390,000, computed by multiplying the 30,000 units produced times the manufacturing cost per unit of \$13 (see Illustration 6A-3). Cost of goods sold is \$260,000, after subtracting ending inventory of \$130,000. Under absorption costing, \$40,000 of the fixed overhead (10,000 units × \$4) is deferred to a future period as part of the cost of ending inventory.

Premium Products Corporation		
Income Statement		
For the Month Ended January 31, 2014		
Absorption Costing		
Sales (20,000 units × \$20)		\$400,000
Cost of goods sold		
Inventory, January 1	\$ –0–	
Cost of goods manufactured (30,000 units × \$13)	390,000	
Cost of goods available for sale	390,000	
<b>Inventory, January 31 (10,000 units × \$13)</b>	<b>130,000</b>	
Cost of goods sold (20,000 units × \$13)		260,000
Gross profit		140,000
Variable selling and administrative expenses (20,000 × \$2)	40,000	
Fixed selling and administrative expenses	15,000	55,000
<b>Net income</b>		<b>\$ 85,000</b>

**Illustration 6A-4**

Absorption costing income statement

**Helpful Hint**

The income statement format in Illustration 6A-4 is the same as that used under generally accepted accounting principles.

**VARIABLE COSTING EXAMPLE**

As Illustration 6A-5 shows, companies use the cost-volume-profit format in preparing a variable costing income statement. The variable manufacturing cost of \$270,000 is computed by multiplying the 30,000 units produced times variable manufacturing cost of \$9 per unit (see Illustration 6A-3). As in absorption costing, both variable and fixed selling and administrative expenses are treated as period costs.

**Illustration 6A-5**

Variable costing income statement

**Helpful Hint**

Note the difference in the computation of the ending inventory: \$9 per unit here, \$13 per unit in Illustration 6A-4.

Premium Products Corporation		
Income Statement		
For the Month Ended January 31, 2014		
Variable Costing		
Sales (20,000 units × \$20)		\$400,000
Variable cost of goods sold		
Inventory, January 1	\$ -0-	
Variable cost of goods manufactured (30,000 units × \$9)	270,000	
Variable cost of goods available for sale	270,000	
<b>Inventory, January 31 (10,000 units × \$9)</b>	<b>90,000</b>	
Variable cost of goods sold	180,000	
Variable selling and administrative expenses (20,000 units × \$2)	40,000	220,000
Contribution margin		180,000
Fixed manufacturing overhead	120,000	
Fixed selling and administrative expenses	15,000	135,000
<b>Net income</b>		<b>\$ 45,000</b>

**There is one primary difference between variable and absorption costing: Under variable costing, companies charge the fixed manufacturing overhead as an expense in the current period.** Fixed manufacturing overhead costs of the current period, therefore, are not deferred to future periods through the ending inventory. As a result, absorption costing will show a **higher net income number** than variable costing **whenever units produced exceed units sold**. This difference can be seen in the income statements in Illustrations 6A-4 and 6A-5. There is a \$40,000 difference in the ending inventories (\$130,000 under absorption costing versus \$90,000 under variable costing). Under absorption costing, \$40,000 of the fixed overhead costs (10,000 units × \$4) has been deferred to a future period as part of inventory. In contrast, under variable costing, all fixed manufacturing costs are expensed in the current period.

As shown, when units produced exceed units sold, income under absorption costing is *higher*. When units produced are less than units sold, income under absorption costing is *lower*. When units produced and sold are the same, net income will be *equal* under the two costing approaches. In this case, there is no increase in ending inventory. So fixed overhead costs of the current period are not deferred to future periods through the ending inventory.

## LEARNING OBJECTIVE

7

Discuss net income effects under absorption costing versus variable costing.

**An Extended Example**

To further illustrate the concepts underlying absorption and variable costing, we will look at an extended example using Overbay Inc., a manufacturer of small airplane drones. We assume that production volume stays the same each year over the 3-year period, but the number of units sold varies each year.

**2013 RESULTS**

As indicated in Illustration 6A-6 below, the variable manufacturing cost per drone is \$240,000, and the fixed manufacturing overhead cost per drone is \$60,000 (assuming 10 drones). Total manufacturing cost per drone under absorption costing is therefore \$300,000 (\$240,000 + \$60,000). Overbay also has variable selling and administrative expenses of \$5,000 per drone. The fixed selling and administrative expenses are \$80,000.

	<u>2013</u>	<u>2014</u>	<u>2015</u>
<b><u>Volume information</u></b>			
Drones in beginning inventory	0	0	2
Drones produced	10	10	10
Drones sold	10	8	12
Drones in ending inventory	0	2	0
<b><u>Financial information</u></b>			
Selling price per drone	\$400,000		
Variable manufacturing cost per drone	\$240,000		
Fixed manufacturing overhead for the year	\$600,000		
Fixed manufacturing overhead per drone	\$ 60,000 (\$600,000 ÷ 10)		
Variable selling and administrative expenses per drone	\$ 5,000		
Fixed selling and administrative expenses	\$ 80,000		

**Illustration 6A-6**

Information for Overbay Inc.

An absorption costing income statement for 2013 for Overbay Inc. is shown in Illustration 6A-7.

<b>Overbay Inc.</b>	
Income Statement	
For the Year Ended December 31, 2013	
Absorption Costing	
Sales (10 drones × \$400,000)	\$4,000,000
Cost of goods sold (10 drones × \$300,000)	<u>3,000,000</u>
Gross profit	1,000,000
Variable selling and administrative expenses (10 drones × \$5,000)	\$50,000
Fixed selling and administrative expenses	<u>80,000</u>
	<u>130,000</u>
Net income	<u>\$ 870,000</u>

**Illustration 6A-7**

Absorption costing income statement—2013

Overbay reports net income of \$870,000 under absorption costing.

Under a variable costing system, the income statement follows a cost-volume-profit (CVP) format. In this case, the manufacturing cost is comprised solely of the variable manufacturing costs of \$240,000 per drone. The fixed manufacturing overhead costs of \$600,000 for the year are expensed in 2013. As in absorption costing, the fixed and variable selling and administrative expenses are period costs expensed in 2013. A variable costing income statement for Overbay Inc. for 2013 is shown in Illustration 6A-8 (page 260).

As shown in Illustration 6A-8, the variable costing net income of \$870,000 is the same as the absorption costing net income computed in Illustration 6A-7. **When the numbers of units produced and sold are the same, net income is equal under the two costing approaches.** Because no increase in ending inventory occurs, no fixed manufacturing overhead costs incurred in 2013 are deferred to future periods using absorption costing.

**Illustration 6A-8**

Variable costing income statement—2013

<b>Overbay Inc.</b> Income Statement For the Year Ended December 31, 2013 Variable Costing		
Sales (10 drones × \$400,000)		\$4,000,000
Variable cost of goods sold (10 drones × \$240,000)	\$2,400,000	
Variable selling and administrative expenses (10 drones × \$5,000)	<u>50,000</u>	<u>2,450,000</u>
Contribution margin		1,550,000
Fixed manufacturing overhead	600,000	
Fixed selling and administrative expenses	<u>80,000</u>	<u>680,000</u>
Net income		<u>\$ 870,000</u>

**2014 RESULTS**

In 2014, Overbay produced 10 drones but sold only eight drones. As a result, there are two drones in ending inventory. The absorption costing income statement for 2014 is shown in Illustration 6A-9.

**Illustration 6A-9**

Absorption costing income statement—2014

<b>Overbay Inc.</b> Income Statement For the Year Ended December 31, 2014 Absorption Costing		
Sales (8 drones × \$400,000)		\$3,200,000
Cost of goods sold (8 drones × \$300,000)		<u>2,400,000</u>
Gross profit		800,000
Variable selling and administrative expenses (8 drones × \$5,000)	\$40,000	
Fixed selling and administrative expenses	<u>80,000</u>	<u>120,000</u>
Net income		<u>\$ 680,000</u>

Under absorption costing, the ending inventory of two drones is \$600,000 (\$300,000 × 2). Each unit of ending inventory includes \$60,000 of fixed manufacturing overhead. Therefore, fixed manufacturing overhead costs of \$120,000 (\$60,000 × 2 drones) are deferred until a future period.

The variable costing income statement for 2014 is shown in Illustration 6A-10.

**Illustration 6A-10**

Variable costing income statement—2014

<b>Overbay Inc.</b> Income Statement For the Year Ended December 31, 2014 Variable Costing		
Sales (8 drones × \$400,000)		\$3,200,000
Variable cost of goods sold (8 drones × \$240,000)	\$1,920,000	
Variable selling and administrative expenses (8 drones × \$5,000)	<u>40,000</u>	<u>1,960,000</u>
Contribution margin		1,240,000
Fixed manufacturing overhead	600,000	
Fixed selling and administrative expenses	<u>80,000</u>	<u>680,000</u>
Net income		<u>\$ 560,000</u>

**As shown, when units produced (10) exceeds units sold (8), net income under absorption costing (\$680,000) is higher than net income under variable costing (\$560,000).** The reason: The cost of the ending inventory is higher under absorption costing than under variable costing. In 2014, under absorption costing, fixed manufacturing overhead of \$120,000 is deferred and carried to future periods as part of inventory. Under variable costing, the \$120,000 is expensed in the current period and, therefore the difference in the two net income numbers is \$120,000 (\$680,000 – \$560,000).

## 2015 RESULTS

In 2015, Overbay produced 10 drones and sold 12 (10 drones from the current year's production and 2 drones from the beginning inventory). As a result, there are no drones in ending inventory. The absorption costing income statement for 2015 is shown in Illustration 6A-11.

<b>Overbay Inc.</b>		
Income Statement		
For the Year Ended December 31, 2015		
Absorption Costing		
Sales (12 drones × \$400,000)		\$4,800,000
Cost of goods sold (12 drones × \$300,000)		<u>3,600,000</u>
Gross profit		1,200,000
Variable selling and administrative expenses (12 drones × \$5,000)	\$60,000	
Fixed selling and administrative expenses	<u>80,000</u>	<u>140,000</u>
Net income		<u><u>\$1,060,000</u></u>

**Illustration 6A-11**  
Absorption costing income statement—2015

Fixed manufacturing costs of \$720,000 ( $\$60,000 \times 12$  drones) are expensed as part of cost of goods sold in 2015. This \$720,000 includes \$120,000 of fixed manufacturing costs incurred during 2014 and included in beginning inventory, plus \$600,000 of fixed manufacturing costs incurred during 2015. Given this result for the absorption costing statement, what would you now expect the result to be under variable costing? Let's take a look.

The variable costing income statement for 2015 is shown in Illustration 6A-12.

<b>Overbay Inc.</b>		
Income Statement		
For the Year Ended December 31, 2015		
Variable Costing		
Sales (12 drones × \$400,000)		\$4,800,000
Variable cost of goods sold (12 drones × \$240,000)	\$2,880,000	
Variable selling and administrative expenses (12 drones × \$5,000)	<u>60,000</u>	<u>2,940,000</u>
Contribution margin		1,860,000
Fixed manufacturing overhead	600,000	
Fixed selling and administrative expenses	<u>80,000</u>	<u>680,000</u>
Net income		<u><u>\$1,180,000</u></u>

**Illustration 6A-12**  
Variable costing income statement—2015

When Drones produced (10) are less than Drones sold (12), net income under absorption costing (\$1,060,000) is less than net income under variable costing

(\$1,180,000). This difference of \$120,000 (\$1,180,000 – \$1,060,000) results because \$120,000 of fixed manufacturing overhead costs in beginning inventory are charged to 2015 under absorption costing. Under variable costing, there is no fixed manufacturing overhead cost in beginning inventory.

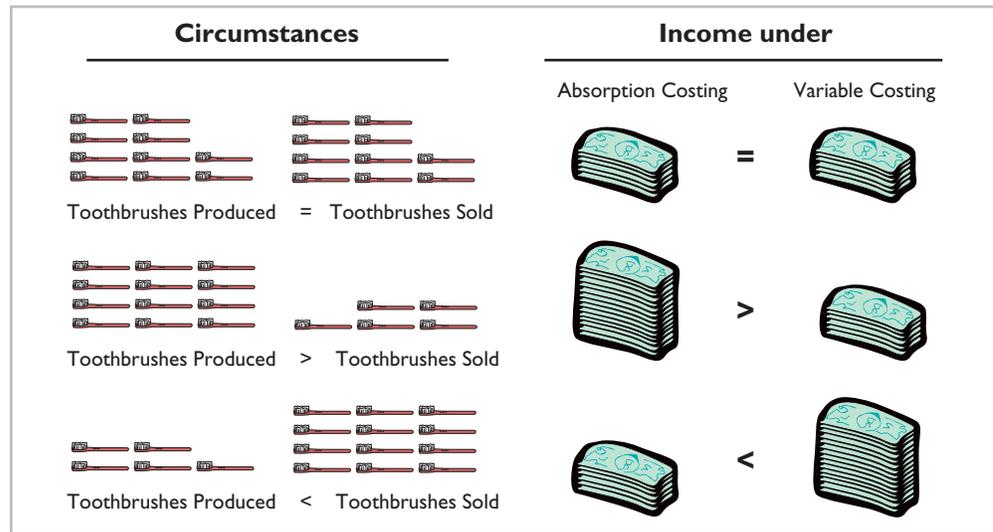
Illustration 6A-13 summarizes the results of the three years.

**Illustration 6A-13**  
Comparison of net income under two costing approaches

	Net Income under Two Costing Approaches		
	2013	2014	2015
	Production = Sales	Production > Sales	Production < Sales
Absorption costing	\$870,000	\$ 680,000	\$1,060,000
Variable costing	870,000	560,000	1,180,000
Difference	<u>\$ -0-</u>	<u>\$120,000</u>	<u>\$ (120,000)</u>

This relationship between production and sales and its effect on net income under the two costing approaches is shown graphically in Illustration 6A-14.

**Illustration 6A-14**  
Summary of income effects under absorption costing and variable costing



### Decision-Making Concerns

**LEARNING OBJECTIVE 8**  
Discuss the merits of absorption versus variable costing for management decision-making.

Generally accepted accounting principles require that absorption costing be used for the costing of inventory for external reporting purposes. Net income measured under GAAP (absorption costing) is often used internally to evaluate performance, justify cost reductions, or evaluate new projects. Some companies, however, have recognized that net income calculated using GAAP does not highlight differences between variable and fixed costs and may lead to poor business decisions. Consequently, these companies use variable costing for internal reporting purposes. The following discussion and example highlight a significant problem related to the use of absorption costing for decision-making purposes.

When production exceeds sales, absorption costing reports a higher net income than variable costing. The reason is that some fixed manufacturing costs are not expensed in the current period but are deferred to future periods as part of inventory. As a result, management may be tempted to overproduce in a given period in order to increase net income. Although net income will increase, this decision to overproduce may not be in the company’s best interest.

Suppose, for example, a division manager's compensation is based upon the division's net income. In such a case, the manager may decide to meet the net income targets by increasing production. While this overproduction may increase the manager's compensation, the buildup of inventories in the long run will lead to additional costs to the company. Variable costing avoids this situation because net income under variable costing is unaffected by changes in production levels, as the following illustration shows.

Warren Lund, a division manager of Walker Enterprises, is under pressure to boost the performance of the Lighting Division in 2014. Unfortunately, recent profits have not met expectations. The expected sales for this year are 20,000 units. As he plans for the year, Warren has to decide whether to produce 20,000 or 30,000 units. The following facts are available for the division.

Beginning inventory	0
Expected sales in units	20,000
Selling price per unit	\$15
Variable manufacturing cost per unit	\$6
Fixed manufacturing overhead cost (total)	\$60,000
Fixed manufacturing overhead costs per unit	
Based on 20,000 units	\$3 per unit (\$60,000 ÷ 20,000 units)
Based on 30,000 units	\$2 per unit (\$60,000 ÷ 30,000 units)
Total manufacturing cost per unit	
Based on 20,000 units	\$9 per unit (\$6 variable + \$3 fixed)
Based on 30,000 units	\$8 per unit (\$6 variable + \$2 fixed)
Variable selling and administrative expenses per unit	\$1
Fixed selling and administrative expenses	\$15,000

**Illustration 6A-15**  
Facts for Lighting  
Division—2014

Illustration 6A-16 presents the division's results based upon the two possible levels of output under absorption costing.

<b>Lighting Division</b>		
Income Statement		
For the Year Ended December 31, 2014		
Absorption Costing		
	<b>20,000 Produced</b>	<b>30,000 Produced</b>
Sales (20,000 units × \$15)	\$300,000	\$ 300,000
Cost of goods sold	<u>180,000*</u>	<u>160,000**</u>
Gross profit	120,000	140,000
Variable selling and administrative expenses (20,000 units × \$1)	20,000	20,000
Fixed selling and administrative expenses	<u>15,000</u>	<u>15,000</u>
Net income	<b><u>\$ 85,000</u></b>	<b><u>\$105,000</u></b>
*20,000 units × \$9		
**20,000 units × \$8		

**Illustration 6A-16**  
Absorption costing income  
statement—2014

If the Lighting Division produces 20,000 units, its net income under absorption costing is \$85,000. If it produces 30,000 units, its net income is \$105,000. By producing 30,000 units, the division has inventory of 10,000 units. This excess inventory causes net income to increase \$20,000 because \$20,000 of fixed costs

(10,000 units  $\times$  \$2) are not charged to the current year, but are deferred to future periods.

What do you think Warren Lund might do in this situation? Given his concern about the profit numbers of the Lighting Division, he may be tempted to increase production. Although this increased production will increase 2014 net income, it may be costly to the company in the long run.

Now let's evaluate the same situation under variable costing. A variable costing income statement is shown for production at both 20,000 and 30,000 units, using the information from Illustration 6A-15.

**Illustration 6A-17**  
Variable costing income  
statement—2014

Lighting Division Income Statement For the Year Ended December 31, 2014 Variable Costing		
	<b>20,000 Produced</b>	<b>30,000 Produced</b>
Sales (20,000 units $\times$ \$15)	\$300,000	\$300,000
Variable cost of goods sold (20,000 units $\times$ \$6)	120,000	120,000
Variable selling and administrative expenses (20,000 units $\times$ \$1)	<u>20,000</u>	<u>20,000</u>
Contribution margin	160,000	160,000
Fixed manufacturing overhead	60,000	60,000
Fixed selling and administrative expenses	<u>15,000</u>	<u>15,000</u>
Net income	<b><u>\$ 85,000</u></b>	<b><u>\$ 85,000</u></b>

From this example, we see that under variable costing, net income is not affected by the number of units produced. Net income is \$85,000 whether the division produces 20,000 or 30,000 units. Why? Because fixed manufacturing overhead is treated as a period expense. Unlike absorption costing, no fixed manufacturing overhead is deferred through inventory buildup. Therefore, under variable costing, production does not increase income; sales do. As a result, if the company uses variable costing, managers like Warren Lund cannot affect profitability by increasing production.

### Potential Advantages of Variable Costing

Variable costing has a number of potential advantages relative to absorption costing:

1. Net income computed under variable costing is unaffected by changes in production levels. As a result, it is much easier to understand the impact of fixed and variable costs on the computation of net income when variable costing is used.
2. The use of variable costing is consistent with the cost-volume-profit material presented in Chapters 5 and 6.
3. Net income computed under variable costing is closely tied to changes in sales levels (not production levels), and therefore provides a more realistic assessment of the company's success or failure during a period.

4. The presentation of fixed and variable cost components on the face of the variable costing income statement makes it easier to identify these costs and understand their effect on the business. Under absorption costing, the allocation of fixed costs to inventory makes it difficult to evaluate the impact of fixed costs on the company's results.

Companies that use just-in-time processing techniques to minimize their inventories will not have significant differences between absorption and variable costing net income.

## > DO IT!

### Variable Costing

Franklin Company produces and sells tennis balls. The following costs are available for the year ended December 31, 2014. The company has no beginning inventory. In 2014, 8,000,000 units were produced, but only 7,500,000 units were sold. The unit selling price was \$0.50 per ball. Costs and expenses were:

Variable costs per unit	
Direct materials	\$0.10
Direct labor	0.05
Variable manufacturing overhead	0.08
Variable selling and administrative expenses	0.02
Annual fixed costs and expenses	
Manufacturing overhead	\$500,000
Selling and administrative expenses	100,000

- (a) Compute the manufacturing cost of one unit of product using variable costing.  
 (b) Prepare a 2014 income statement for Franklin Company using variable costing.

### Solution

#### Action Plan

- ✓ Recall that under variable costing, only variable manufacturing costs are treated as manufacturing (product) costs.
- ✓ Subtract all fixed costs, both manufacturing overhead and selling and administrative expenses, as period costs.

- (a) The cost of one unit of product under variable costing would be:

Direct materials	\$0.10
Direct labor	0.05
Variable manufacturing overhead	0.08
	<u>\$0.23</u>

- (b) The variable costing income statement would be as follows.

<b>Franklin Company</b>		
<b>Income Statement</b>		
<b>For the Year Ended December 31, 2014</b>		
<b>Variable Costing</b>		
Sales (7,500,000 × \$0.50)		\$3,750,000
Variable cost of goods sold (7,500,000 × \$0.23)	\$1,725,000	
Variable selling and administrative expenses (7,500,000 × .02)	150,000	<u>1,875,000</u>
Contribution margin		1,875,000
Fixed manufacturing overhead	500,000	
Fixed selling and administrative expenses	100,000	<u>600,000</u>
Net income		<u>\$1,275,000</u>

Related exercise material: **BE6-16, BE6-17, BE6-18, BE6-19, E6-17, E6-18, and E6-19.**

## SUMMARY OF LEARNING OBJECTIVES FOR APPENDIX 6A



**6 Explain the difference between absorption costing and variable costing.** Under absorption costing, fixed manufacturing costs are product costs. Under variable costing, fixed manufacturing costs are period costs.

**7 Discuss net income effects under absorption costing versus variable costing.** If production volume exceeds sales volume, net income under absorption costing will exceed net income under variable costing by the amount of fixed manufacturing costs included in ending inventory that results from units produced but not sold during the period. If production volume is less than sales volume, net income under absorption costing will be

less than under variable costing by the amount of fixed manufacturing costs included in the units sold during the period that were not produced during the period.

**8 Discuss the merits of absorption versus variable costing for management decision-making.** The use of variable costing is consistent with cost-volume-profit analysis. Net income under variable costing is unaffected by changes in production levels. Instead, it is closely tied to changes in sales. The presentation of fixed costs in the variable costing approach makes it easier to identify fixed costs and to evaluate their impact on the company's profitability.

## GLOSSARY

**Absorption costing** A costing approach in which all manufacturing costs are charged to the product. (p. 256).

**Cost structure** The relative proportion of fixed versus variable costs that a company incurs. (p. 251).

**Degree of operating leverage** A measure of the extent to which a company's net income reacts to a change in sales. It is calculated by dividing contribution margin by net income. (p. 253).

**Operating leverage** The extent to which a company's net income reacts to a change in sales. Operating leverage

is determined by a company's relative use of fixed versus variable costs. (p. 252).

**Sales mix** The relative percentage in which a company sells its multiple products. (p. 244).

**Theory of constraints** A specific approach used to identify and manage constraints in order to achieve the company's goals. (p. 249).

**Variable costing** A costing approach in which only variable manufacturing costs are product costs, and fixed manufacturing costs are period costs (expenses). (p. 256).

## > Comprehensive DO IT!

Francis Corporation manufactures and sells three different types of water-sport wakeboards. The boards vary in terms of their quality specifications—primarily with respect to their smoothness and finish. They are referred to as Smooth, Extra-Smooth, and Super-Smooth boards. Machine time is limited. More machine time is required to manufacture the Extra-Smooth and Super-Smooth boards. Additional information is provided below.

	Product		
	Smooth	Extra-Smooth	Super-Smooth
Selling price	\$60	\$100	\$160
Variable costs and expenses	<u>50</u>	<u>75</u>	<u>130</u>
Contribution margin	<u>\$10</u>	<u>\$ 25</u>	<u>\$ 30</u>
Machine hours required	0.25	0.40	0.60
Total fixed costs: \$234,000			

### Instructions

Answer each of the following questions.

- Ignoring the machine time constraint, what strategy would appear optimal?
- What is the contribution margin per unit of limited resource for each type of board?
- If additional machine time could be obtained, how should the additional capacity be used?

**Action Plan**

- ✓ To determine how best to use a limited resource, calculate the contribution margin per unit of limited resource for each product type.

**Solution to Comprehensive DO IT!**

- (a) The Super-Smooth boards have the highest contribution margin per unit. Thus, ignoring any manufacturing constraints, it would appear that the company should shift toward production of more Super-Smooth units.
- (b) The contribution margin per unit of limited resource is calculated as:

	<u>Smooth</u>	<u>Extra-Smooth</u>	<u>Super-Smooth</u>
Contribution margin per unit	$\frac{\$10}{.25} = \$40$	$\frac{\$25}{.40} = \$62.50$	$\frac{\$30}{.60} = \$50$
Limited resource consumed per unit	.25	.40	.60

- (c) The Extra-Smooth boards have the highest contribution margin per unit of limited resource. Given the resource constraint, any additional capacity should be used to make Extra-Smooth boards.



Self-Test, Brief Exercises, Exercises, Problem Set A, and many more resources are available for practice in WileyPLUS.

Note: All asterisked Questions, Exercises, and Problems relate to material contained in the appendix to the chapter.

**SELF-TEST QUESTIONS**

Answers are at the end of the chapter.

- (LO 1) 1. Which one of the following is the format of a CVP income statement?
- Sales – Variable costs = Fixed costs + Net income.
  - Sales – Fixed costs – Variable costs – Operating expenses = Net income.
  - Sales – Cost of goods sold – Operating expenses = Net income.
  - Sales – Variable costs – Fixed costs = Net income.
- (LO 1, 2) 2. Croc Catchers calculates its contribution margin to be less than zero. Which statement is *true*?
- Its fixed costs are less than the variable costs per unit.
  - Its profits are greater than its total costs.
  - The company should sell more units.
  - Its selling price is less than its variable costs.
- (LO 2) 3. Which one of the following describes the break-even point?
- It is the point where total sales equals total variable plus total fixed costs.
  - It is the point where the contribution margin equals zero.
  - It is the point where total variable costs equal total fixed costs.
  - It is the point where total sales equals total fixed costs.

4. The following information is available for Chap (LO 1) Company.

Sales	\$350,000
Cost of goods sold	\$120,000
Total fixed expenses	\$60,000
Total variable expenses	\$100,000

Which amount would you find on Chap's CVP income statement?

- Contribution margin of \$250,000.
  - Contribution margin of \$190,000.
  - Gross profit of \$230,000.
  - Gross profit of \$190,000.
5. Gabriel Corporation has fixed costs of \$180,000 and variable costs of \$8.50 per unit. It has a target income of \$268,000. How many units must it sell at \$12 per unit to achieve its target net income? (LO 2)
- 51,429 units.
  - 128,000 units.
  - 76,571 units.
  - 21,176 units.
6. Mackey Corporation has fixed costs of \$150,000 and variable costs of \$9 per unit. If sales price per unit is \$12, what is break-even sales in dollars? (LO 2)
- \$200,000.
  - \$450,000.
  - \$480,000.
  - \$600,000.
7. Sales mix is: (LO 3)
- important to sales managers but not to accountants.

- (b) easier to analyze on absorption costing income statements.
- (c) a measure of the relative percentage of a company's variable costs to its fixed costs.
- (d) a measure of the relative percentage in which a company's products are sold.
- (LO 3) 8.** Net income will be:
- (a) greater if more higher-contribution margin units are sold than lower-contribution margin units.
- (b) greater if more lower-contribution margin units are sold than higher-contribution margin units.
- (c) equal as long as total sales remain equal, regardless of which products are sold.
- (d) unaffected by changes in the mix of products sold.
- (LO 4) 9.** If the contribution margin per unit is \$15 and it takes 3.0 machine hours to produce the unit, the contribution margin per unit of limited resource is:
- (a) \$25. (c) \$4.
- (b) \$5. (d) None of the above.
- (LO 4) 10.** MEM manufactures two products. Product X has a contribution margin of \$26 and requires 4 hours of machine time. Product Y has a contribution margin of \$14 and requires 2 hours of machine time. Assuming that machine time is limited to 3,000 hours, how should it allocate the machine time to maximize its income?
- (a) Use 1,500 hours to produce X and 1,500 hours to produce Y.
- (b) Use 2,250 hours to produce X and 750 hours to produce Y.
- (c) Use 3,000 hours to produce only X.
- (d) Use 3,000 hours to produce only Y.
- (LO 4) 11.** When a company has a limited resource, it should apply additional capacity of that resource to providing more units of the product or service that has:
- (a) the highest contribution margin.
- (b) the highest selling price.
- (c) the highest gross profit.
- (d) the highest contribution margin per unit of that limited resource.
- 12.** The degree of operating leverage: **(LO 5)**
- (a) can be computed by dividing total contribution margin by net income.
- (b) provides a measure of the company's earnings volatility.
- (c) affects a company's break-even point.
- (d) All of the above.
- 13.** A high degree of operating leverage: **(LO 5)**
- (a) indicates that a company has a larger percentage of variable costs relative to its fixed costs.
- (b) is computed by dividing fixed costs by contribution margin.
- (c) exposes a company to greater earnings volatility risk.
- (d) exposes a company to less earnings volatility risk.
- 14.** Stevens Company has a degree of operating leverage of 3.5 at a sales level of \$1,200,000 and net income of \$200,000. If Stevens' sales fall by 10%, Stevens can be expected to experience a: **(LO 5)**
- (a) decrease in net income of \$70,000.
- (b) decrease in contribution margin of \$7,000.
- (c) decrease in operating leverage of 35%.
- (d) decrease in net income of \$175,000.
- \*15.** Fixed manufacturing overhead costs are recognized as: **(LO 6)**
- (a) period costs under absorption costing.
- (b) product costs under absorption costs.
- (c) product costs under variable costing.
- (d) part of ending inventory costs under both absorption and variable costing.
- \*16.** Net income computed under absorption costing will be: **(LO 6)**
- (a) higher than net income under variable costing in all cases.
- (b) equal to net income under variable costing in all cases.
- (c) higher than net income under variable costing when units produced are greater than units sold.
- (d) higher than net income under variable costing when units produced are less than units sold.

Go to the book's companion website, [www.wiley.com/college/weygandt](http://www.wiley.com/college/weygandt), for additional Self-Test Questions.



## QUESTIONS

1. What is meant by CVP analysis?
2. Provide three examples of management decisions that benefit from CVP analysis.
3. Distinguish between a traditional income statement and a CVP income statement.
4. Describe the features of a CVP income statement that make it more useful for management decision-making than the traditional income statement that is prepared for external users.
5. The traditional income statement for Wheat Company shows sales \$900,000, cost of goods sold \$500,000, and operating expenses \$200,000. Assuming all costs and expenses are 75% variable and 25% fixed, prepare a CVP income statement through contribution margin.
6. If management chooses to reduce its selling price to match that of a competitor, how will the break-even point be affected?
7. What is meant by the term sales mix? How does sales mix affect the calculation of the break-even point?
8. Performance Company sells two types of performance tires. The lower-priced model is guaranteed for only 50,000 miles; the higher-priced model is guaranteed for 150,000 miles. The unit contribution margin on the higher-priced tire is twice as high as that of the

- lower-priced tire. If the sales mix shifts so that the company begins to sell more units of the lower-priced tire, explain how the company's break-even point in units will change.
9. What approach should be used to calculate the break-even point of a company that has many products?
  10. How is the contribution margin per unit of limited resource computed?
  11. What is the theory of constraints? Provide some examples of possible constraints for a manufacturer.
  12. What is meant by "cost structure?" Explain how a company's cost structure affects its break-even point.
  13. What is operating leverage? How does a company increase its operating leverage?
  14. How does the replacement of manual labor with automated equipment affect a company's cost structure? What implications does this have for its operating leverage and break-even point?
  15. What is a measure of operating leverage, and how is it calculated?
  16. Pine Company has a degree of operating leverage of 8. Fir Company has a degree of operating leverage of 4. Interpret these measures.
  - \*17. Distinguish between absorption costing and variable costing.
  - \*18. (a) What is the major rationale for the use of variable costing?  
(b) Discuss why variable costing may not be used for financial reporting purposes.
  - \*19. Doc Rowan Corporation sells one product, its waterproof hiking boot. It began operations in the current year and had an ending inventory of 8,500 units. The company sold 20,000 units throughout the year. Fixed manufacturing overhead is \$5 per unit, and total manufacturing cost per unit is \$20 (including fixed manufacturing overhead costs). What is the difference in net income between absorption and variable costing?
  - \*20. If production equals sales, what, if any, is the difference between net income under absorption costing versus under variable costing?
  - \*21. If production is greater than sales, how does absorption costing net income differ from variable costing net income?
  - \*22. In the long run, will net income be higher or lower under variable costing compared to absorption costing?

## BRIEF EXERCISES

**BE6-1** Determine the missing amounts.

	<u>Unit Selling Price</u>	<u>Unit Variable Costs</u>	<u>Contribution Margin per Unit</u>	<u>Contribution Margin Ratio</u>
1.	\$250	\$180	(a)	(b)
2.	\$500	(c)	\$300	(d)
3.	(e)	(f)	\$330	30%

*Determine missing amounts for contribution margin.*

(LO 1, 2), AN

**BE6-2** Hamby Inc. has sales of \$2,000,000 for the first quarter of 2014. In making the sales, the company incurred the following costs and expenses.

	<u>Variable</u>	<u>Fixed</u>
Cost of goods sold	\$760,000	\$600,000
Selling expenses	95,000	60,000
Administrative expenses	79,000	66,000

*Prepare CVP income statement.*

(LO 1, 2), AP

Prepare a CVP income statement for the quarter ended March 31, 2014.

**BE6-3** Wesland Corp. had total variable costs of \$175,000, total fixed costs of \$120,000, and total revenues of \$250,000. Compute the required sales in dollars to break even.

*Compute the break-even point.*

(LO 1, 2), AP

**BE6-4** Dilts Company has a unit selling price of \$400, variable costs per unit of \$250, and fixed costs of \$210,000. Compute the break-even point in units using (a) the mathematical equation and (b) contribution margin per unit.

*Compute the break-even point.*

(LO 1, 2), AP

**BE6-5** For Ortega Company, variable costs are 60% of sales, and fixed costs are \$210,000. Management's net income goal is \$60,000. Compute the required sales needed to achieve management's target net income of \$60,000. (Use the mathematical equation approach.)

*Compute sales for target net income.*

(LO 1, 2), AP

**BE6-6** For Kosko Company actual sales are \$1,200,000 and break-even sales are \$960,000. Compute (a) the margin of safety in dollars and (b) the margin of safety ratio.

*Compute the margin of safety and the margin of safety ratio.*

(LO 1, 2), AP

**BE6-7** Markowis Corporation sells three different models of mosquito "zapper." Model A12 sells for \$50 and has variable costs of \$40. Model B22 sells for \$100 and has variable costs of \$70. Model C124 sells for \$400 and has variable costs of \$300. The sales mix of the three models is: A12, 60%; B22, 15%; and C124, 25%. What is the weighted-average unit contribution margin?

*Compute weighted-average unit contribution margin based on sales mix.*

(LO 3), AP

Compute break-even point in units for company with multiple products.

(LO 3), AP

Compute break-even point in dollars for company with multiple product lines.

(LO 3), AP

Determine weighted-average contribution margin.

(LO 3), AP

Show allocation of limited resources.

(LO 4), AP

Compute degree of operating leverage.

(LO 5), AP

Compute break-even point with change in operating leverage.

(LO 5), AP

Determine contribution margin from degree of operating leverage.

(LO 5), AP

Show allocation of limited resources.

(LO 4), AP

**BE6-8** Information for Markowis Corporation is given in BE6-7. If the company has fixed costs of \$213,000, how many units of each model must the company sell in order to break even?

**BE6-9** Peine Candle Supply makes candles. The sales mix (as a percentage of total dollar sales) of its three product lines is birthday candles 30%, standard tapered candles 50%, and large scented candles 20%. The contribution margin ratio of each candle type is shown below.

<u>Candle Type</u>	<u>Contribution Margin Ratio</u>
Birthday	20%
Standard tapered	20%
Large scented	45%

- (a) What is the weighted-average contribution margin ratio?  
 (b) If the company's fixed costs are \$440,000 per year, what is the dollar amount of each type of candle that must be sold to break even?

**BE6-10** Faune Furniture Co. consists of two divisions, Bedroom Division and Dining Room Division. The results of operations for the most recent quarter are:

	<u>Bedroom Division</u>	<u>Dining Room Division</u>	<u>Total</u>
Sales	\$500,000	\$750,000	\$1,250,000
Variable costs	225,000	450,000	675,000
Contribution margin	<u>\$275,000</u>	<u>\$300,000</u>	<u>\$ 575,000</u>

- (a) Determine the company's sales mix.  
 (b) Determine the company's weighted-average contribution margin ratio.

**BE6-11** In Briggs Company, data concerning two products are contribution margin per unit—Product A \$12, Product B \$15; machine hours required for one unit—Product A 2, Product B 3. Compute the contribution margin per unit of limited resource for each product.

**BE6-12** Sam's Shingle Corporation is considering the purchase of a new automated shingle-cutting machine. The new machine will reduce variable labor costs but will increase depreciation expense. Contribution margin is expected to increase from \$200,000 to \$240,000. Net income is expected to be the same at \$40,000. Compute the degree of operating leverage before and after the purchase of the new equipment. Interpret your results.

**BE6-13** Presented below are variable costing income statements for Logan Company and Morgan Company. They are in the same industry, with the same net incomes, but different cost structures.

	<u>Logan Co.</u>	<u>Morgan Co.</u>
Sales	\$200,000	\$200,000
Variable costs	80,000	50,000
Contribution margin	120,000	150,000
Fixed costs	60,000	90,000
Net income	<u>\$ 60,000</u>	<u>\$ 60,000</u>

Compute the break-even point in dollars for each company and comment on your findings.

**BE6-14** The degree of operating leverage for Montana Corp. and APK Co. are 1.6 and 5.4, respectively. Both have net incomes of \$50,000. Determine their respective contribution margins.

**BE6-15** Ger Corporation manufactures two products with the following characteristics.

	<u>Contribution Margin per Unit</u>	<u>Machine Hours Required for Production</u>
Product 1	\$42	.15 hours
Product 2	\$35	.10 hours

If Ger's machine hours are limited to 2,000 per month, determine which product it should produce.

**\*BE6-16** The Rock Company produces basketballs. It incurred the following costs during the year:

Direct materials	\$14,400
Direct labor	\$25,600
Fixed manufacturing overhead	\$12,000
Variable manufacturing overhead	\$32,400
Selling costs	\$21,000

What are the total product costs for the company under variable costing?

**\*BE6-17** Information concerning The Rock Company is provided in BE6-16. What are the total product costs for the company under absorption costing?

**\*BE6-18** Burns Company incurred the following costs during the year: direct materials \$20 per unit; direct labor \$14 per unit; variable manufacturing overhead \$15 per unit; variable selling and administrative costs \$8 per unit; fixed manufacturing overhead \$128,000; and fixed selling and administrative costs \$10,000. Burns produced 8,000 units and sold 6,000 units. Determine the manufacturing cost per unit under (a) absorption costing and (b) variable costing.

**\*BE6-19**  Howser Company's fixed overhead costs are \$4 per unit, and its variable overhead costs are \$8 per unit. In the first month of operations, 50,000 units are produced, and 48,000 units are sold. Write a short memo to the chief financial officer explaining which costing approach will produce the higher income and what the difference will be.

Compute product costs under variable costing.

(LO 6), AP

Compute product costs under absorption costing.

(LO 6), AP

Determine manufacturing cost per unit under absorption and variable costing.

(LO 6), AP

Compute net income under absorption and variable costing.

(LO 7), AP

## > DO IT! REVIEW

**DO IT! 6-1** Amanda Inc. sold 10,000 units and recorded sales of \$400,000 for the first month of 2014. In making the sales, the company incurred the following costs and expenses.

	<u>Variable</u>	<u>Fixed</u>
Cost of goods sold	\$184,000	\$70,000
Selling expenses	40,000	30,000
Administrative expenses	16,000	50,000

- Prepare a CVP income statement for the month ended January 31, 2014.
- Compute the contribution margin per unit.
- Compute the contribution margin ratio.

Prepare CVP income statement and compute contribution margin.

(LO 1), AP

**DO IT! 6-2** Queensland Company reports the following operating results for the month of April.

**Queensland Company**  
**CVP Income Statement**  
**For the Month Ended April 30, 2014**

	<u>Total</u>	<u>Per Unit</u>
Sales (9,000 units)	\$450,000	\$50
Variable costs	<u>270,000</u>	<u>30</u>
Contribution margin	180,000	<u>\$20</u>
Fixed expenses	<u>150,000</u>	
Net income	<u>\$ 30,000</u>	

Compute the break-even point and margin of safety under different alternatives.

(LO 2), AP

Management is considering the following course of action to increase net income: Reduce the selling price by 4%, with no changes to unit variable costs or fixed costs. Management is confident that this change will increase unit sales by 20%.

Using the contribution margin technique, compute the break-even point in units and dollars and margin of safety in dollars:

- (a) Assuming no changes to selling price or costs, and
- (b) Assuming changes to sales price and volume as described above.

Comment on your findings.

Compute sales mix, weighted-average contribution margin, and break-even point.

(LO 3), AP

**DO IT!** 6-3 Snow Cap Springs produces and sells water filtration systems for homeowners. Information regarding its three models is shown below.

	<u>Basic</u>	<u>Basic Plus</u>	<u>Premium</u>	<u>Total</u>
Units sold	750	450	300	1,500
Selling price	\$250	\$400	\$800	
Variable costs	\$195	\$288	\$416	

The company's total fixed costs to produce the filtration systems are \$165,480.

- (a) Determine the sales mix as a function of units sold for the three products.
- (b) Determine the weighted-average unit contribution margin.
- (c) Determine the total number of units that the company must produce to break even.
- (d) Determine the number of units of each model that the company must produce to break even.

Determine sales mix with limited resources.

(LO 4), AP

**DO IT!** 6-4 Eye Spy Corporation manufactures and sells three different types of binoculars. They are referred to as Good, Better, and Best binoculars. Grinding and polishing time is limited. More time is required to grind and polish the lenses used in the Better and Best binoculars. Additional information is provided below.

	<u>Product</u>		
	<u>Good</u>	<u>Better</u>	<u>Best</u>
Selling price	\$90.00	\$330.00	\$900.00
Variable costs and expenses	50.00	180.00	480.00
Contribution margin	\$40.00	\$150.00	\$420.00
Grinding and polishing time required	0.5 hrs	1.5 hrs	6 hrs

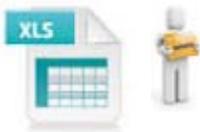
- (a) Ignoring the time constraint, what strategy would appear to be optimal?
- (b) What is the contribution margin per unit of limited resource for each type of binocular?
- (c) If additional grinding and polishing time could be obtained, how should the additional capacity be used?



## EXERCISES

Compute break-even point and margin of safety.

(LO 2), AP



**E6-1** The Bonita Inn is trying to determine its break-even point. The inn has 75 rooms that are rented at \$60 a night. Operating costs are as follows.

Salaries	\$8,800 per month
Utilities	2,400 per month
Depreciation	1,500 per month
Maintenance	800 per month
Maid service	8 per room
Other costs	37 per room

**Instructions**

- (a) Determine the inn's break-even point in (1) number of rented rooms per month and (2) dollars.
- (b) If the inn plans on renting an average of 50 rooms per day (assuming a 30-day month), what is (1) the monthly margin of safety in dollars and (2) the margin of safety ratio?

**E6-2** In the month of June, Jose Hebert's Beauty Salon gave 4,000 haircuts, shampoos, and permanents at an average price of \$30. During the month, fixed costs were \$16,800 and variable costs were 75% of sales.

Compute contribution margin, break-even point, and margin of safety.

(LO 2), AP



**Instructions**

- (a) Determine the contribution margin in dollars, per unit and as a ratio.
- (b) Using the contribution margin technique, compute the break-even point in dollars and in units.
- (c) Compute the margin of safety in dollars and as a ratio.

**E6-3** Norton Company reports the following operating results for the month of August: sales \$310,000 (units 5,000); variable costs \$210,000; and fixed costs \$75,000. Management is considering the following independent courses of action to increase net income.

Compute net income under different alternatives.

(LO 2), AP

- 1. Increase selling price by 10% with no change in total variable costs or sales volume.
- 2. Reduce variable costs to 58% of sales.
- 3. Reduce fixed costs by \$20,000.



**Instructions**

Compute the net income to be earned under each alternative. Which course of action will produce the highest net income?

**E6-4** Comfi Airways, Inc., a small two-plane passenger airline, has asked for your assistance in some basic analysis of its operations. Both planes seat 10 passengers each, and they fly commuters from Comfi's base airport to the major city in the state, Metropolis. Each month, 40 round-trip flights are made. Shown below is a recent month's activity in the form of a cost-volume-profit income statement.

Compute break-even point and prepare CVP income statement.

(LO 2), AP



Fare revenues (400 fares)		\$48,000
Variable costs		
Fuel	\$14,000	
Snacks and drinks	800	
Landing fees	2,000	
Supplies and forms	<u>1,200</u>	<u>18,000</u>
Contribution margin		30,000
Fixed costs		
Depreciation	3,000	
Salaries	15,000	
Advertising	500	
Airport hangar fees	<u>1,750</u>	<u>20,250</u>
Net income		<u>\$ 9,750</u>

**Instructions**

- (a) Calculate the break-even point in (1) dollars and (2) number of fares.
- (b) Without calculations, determine the contribution margin at the break-even point.
- (c) If fares were decreased by 10%, an additional 100 fares could be generated. However, total variable costs would increase by 20%. Should the fare decrease be adopted?

**E6-5** Hall Company had sales in 2014 of \$1,560,000 on 60,000 units. Variable costs totaled \$720,000, and fixed costs totaled \$500,000.

Prepare a CVP income statement before and after changes in business environment.

(LO 2), AP

A new raw material is available that will decrease the variable costs per unit by 25% (or \$3.00). However, to process the new raw material, fixed operating costs will increase by \$150,000. Management feels that one-half of the decline in the variable costs per unit should be passed on to customers in the form of a sales price reduction. The marketing department expects that this sales price reduction will result in a 5% increase in the number of units sold.

**Instructions**

Prepare a projected CVP income statement for 2014 (a) assuming the changes have not been made, and (b) assuming that changes are made as described.

Compute break-even point in units for a company with more than one product.

(LO 3), AP

**E6-6** Yard Tools manufactures lawnmowers, weed-trimmers, and chainsaws. Its sales mix and contribution margin per unit are as follows.

	<u>Sales Mix</u>	<u>Contribution Margin per Unit</u>
Lawnmowers	20%	\$30
Weed-trimmers	50%	\$20
Chainsaws	30%	\$40

Yard Tools has fixed costs of \$4,200,000.

**Instructions**

Compute the number of units of each product that Yard Tools must sell in order to break even under this product mix.

Compute service line break-even point and target net income in dollars for a company with more than one service.

(LO 3), AN



**E6-7** Qwik Repairs has over 200 auto-maintenance service outlets nationwide. It provides primarily two lines of service: oil changes and brake repair. Oil change-related services represent 70% of its sales and provide a contribution margin ratio of 20%. Brake repair represents 30% of its sales and provides a 60% contribution margin ratio. The company's fixed costs are \$16,000,000 (that is, \$80,000 per service outlet).

**Instructions**

- Calculate the dollar amount of each type of service that the company must provide in order to break even.
- The company has a desired net income of \$60,000 per service outlet. What is the dollar amount of each type of service that must be provided by each service outlet to meet its target net income per outlet?

Compute break-even point in dollars for a company with more than one service.

(LO 3), AN



**E6-8** Express Delivery is a rapidly growing delivery service. Last year, 80% of its revenue came from the delivery of mailing "pouches" and small, standardized delivery boxes (which provides a 20% contribution margin). The other 20% of its revenue came from delivering non-standardized boxes (which provides a 70% contribution margin). With the rapid growth of Internet retail sales, Express believes that there are great opportunities for growth in the delivery of non-standardized boxes. The company has fixed costs of \$12,000,000.

**Instructions**

- What is the company's break-even point in total sales dollars? At the break-even point, how much of the company's sales are provided by each type of service?
- The company's management would like to hold its fixed costs constant but shift its sales mix so that 60% of its revenue comes from the delivery of non-standardized boxes and the remainder from pouches and small boxes. If this were to occur, what would be the company's break-even sales, and what amount of sales would be provided by each service type?

Compute break-even point in units for a company with multiple products.

(LO 3), AP

**E6-9** Palmer Golf Accessories sells golf shoes, gloves, and a laser-guided range-finder that measures distance. Shown below are unit cost and sales data.

	<u>Pairs of Shoes</u>	<u>Pairs of Gloves</u>	<u>Range-Finder</u>
Unit sales price	\$100	\$30	\$260
Unit variable costs	60	10	200
Unit contribution margin	\$ 40	\$ 20	\$ 60
Sales mix	<u>30%</u>	<u>60%</u>	<u>10%</u>

Fixed costs are \$630,000.

**Instructions**

- Compute the break-even point in units for the company.
- Determine the number of units to be sold at the break-even point for each product line.
- Verify that the mix of sales units determined in (b) will generate a zero net income.

**E6-10** Personal Electronix sells iPads and iPods. The business is divided into two divisions along product lines. CVP income statements for a recent quarter's activity are presented below.

	<u>iPad Division</u>	<u>iPod Division</u>	<u>Total</u>
Sales	\$600,000	\$400,000	\$1,000,000
Variable costs	<u>420,000</u>	<u>260,000</u>	<u>680,000</u>
Contribution margin	<u>\$180,000</u>	<u>\$140,000</u>	320,000
Fixed costs			120,000
Net income			<u>\$ 200,000</u>

**Instructions**

- Determine sales mix percentage and contribution margin ratio for each division.
- Calculate the company's weighted-average contribution margin ratio.
- Calculate the company's break-even point in dollars.
- Determine the sales level in dollars for each division at the break-even point.

**E6-11** Spencer Company manufactures and sells three products. Relevant per unit data concerning each product are given below.

	<u>Product</u>		
	<u>A</u>	<u>B</u>	<u>C</u>
Selling price	\$8	\$12	\$15
Variable costs and expenses	\$3	\$10	\$12
Machine hours to produce	2	1	2

**Instructions**

- Compute the contribution margin per unit of the limited resource (machine hours) for each product.
- Assuming 1,500 additional machine hours are available, which product should be manufactured?
- Prepare an analysis showing the total contribution margin if the additional hours are (1) divided equally among the products, and (2) allocated entirely to the product identified in (b) above.

**E6-12** Dalton Inc. produces and sells three products. Unit data concerning each product is shown below.

	<u>Product</u>		
	<u>D</u>	<u>E</u>	<u>F</u>
Selling price	\$200	\$300	\$250
Direct labor costs	30	80	35
Other variable costs	95	80	145

The company has 2,000 hours of labor available to build inventory in anticipation of the company's peak season. Management is trying to decide which product should be produced. The direct labor hourly rate is \$10.

**Instructions**

- Determine the number of direct labor hours per unit.
- Determine the contribution margin per direct labor hour.
- Determine which product should be produced and the total contribution margin for that product.

**E6-13** Billings Company manufactures and sells two products. Relevant per unit data concerning each product follow.

	<u>Product</u>	
	<u>Basic</u>	<u>Deluxe</u>
Selling price	\$40	\$52
Variable costs	\$20	\$22
Machine hours	.5	.8

Determine break-even point in dollars for two divisions.

(LO 3), AP

Compute contribution margin and determine the product to be manufactured.

(LO 4), AN

Compute contribution margin and determine the products to be manufactured.

(LO 4), AN

Compute contribution margin and determine the products to be manufactured.

(LO 4), AN

**Instructions**

- Compute the contribution margin per machine hour for each product.
- If 1,000 additional machine hours are available, which product should Billings manufacture?
- Prepare an analysis showing the total contribution margin if the additional hours are:
  - Divided equally between the products.
  - Allocated entirely to the product identified in part (b).

Compute degree of operating leverage and evaluate impact of alternative cost structures on net income.

(LO 5), AN

**E6-14** The CVP income statements shown below are available for Armstrong Company and Contador Company.

	<u>Armstrong Co.</u>	<u>Contador Co.</u>
Sales	\$500,000	\$500,000
Variable costs	<u>240,000</u>	<u>50,000</u>
Contribution margin	260,000	450,000
Fixed costs	<u>160,000</u>	<u>350,000</u>
Net income	<u>\$100,000</u>	<u>\$100,000</u>

**Instructions**

- Compute the degree of operating leverage for each company and interpret your results.
- Assuming that sales revenue increases by 10%, prepare a variable costing income statement for each company.
- Discuss how the cost structure of these two companies affects their operating leverage and profitability.

Compute degree of operating leverage and evaluate impact of alternative cost structures on net income and margin of safety.

(LO 5), AN

**E6-15** Arquitectos Interiores of Juarez, Mexico, is contemplating a major change in its cost structure. Currently, all of its drafting work is performed by skilled draftsmen. Alfonso Jimenez, Arquitectos' owner, is considering replacing the draftsmen with a computerized drafting system. However, before making the change, Alfonso would like to know the consequences of the change, since the volume of business varies significantly from year to year. Shown below are CVP income statements for each alternative.

	<u>Manual System</u>	<u>Computerized System</u>
Sales	\$1,500,000	\$1,500,000
Variable costs	<u>1,200,000</u>	<u>600,000</u>
Contribution margin	300,000	900,000
Fixed costs	<u>50,000</u>	<u>650,000</u>
Net income	<u>\$ 250,000</u>	<u>\$ 250,000</u>

**Instructions**

- Determine the degree of operating leverage for each alternative.
- Which alternative would produce the higher net income if sales increased by \$150,000?
- Using the margin of safety ratio, determine which alternative could sustain the greater decline in sales before operating at a loss.

Compute degree of operating leverage and impact on net income of alternative cost structures.

(LO 5), AN

**E6-16** An investment banker is analyzing two companies that specialize in the production and sale of candied yams. Traditional Yams uses a labor-intensive approach, and Auto-Yams uses a mechanized system. CVP income statements for the two companies are shown below.

	<u>Traditional Yams</u>	<u>Auto-Yams</u>
Sales	\$400,000	\$400,000
Variable costs	<u>320,000</u>	<u>160,000</u>
Contribution margin	80,000	240,000
Fixed costs	<u>30,000</u>	<u>190,000</u>
Net income	<u>\$ 50,000</u>	<u>\$ 50,000</u>

The investment banker is interested in acquiring one of these companies. However, she is concerned about the impact that each company's cost structure might have on its profitability.

**Instructions**

- Calculate each company's degree of operating leverage. Determine which company's cost structure makes it more sensitive to changes in sales volume.
- Determine the effect on each company's net income if sales decrease by 15% and if sales increase by 10%. Do not prepare income statements.
- Which company should the investment banker acquire? Discuss.

**\*E6-17** Felde Company builds custom fishing lures for sporting goods stores. In its first year of operations, 2014, the company incurred the following costs.

**Variable Costs per Unit**

Direct materials	\$7.50
Direct labor	\$2.45
Variable manufacturing overhead	\$5.80
Variable selling and administrative expenses	\$3.90

**Fixed Costs per Year**

Fixed manufacturing overhead	\$225,000
Fixed selling and administrative expenses	\$240,100

Felde Company sells the fishing lures for \$25. During 2014, the company sold 80,000 lures and produced 90,000 lures.

**Instructions**

- Assuming the company uses variable costing, calculate Felde's manufacturing cost per unit for 2014.
- Prepare a variable costing income statement for 2014.
- Assuming the company uses absorption costing, calculate Felde's manufacturing cost per unit for 2014.
- Prepare an absorption costing income statement for 2014.

**\*E6-18** Langdon Company produced 9,000 units during the past year, but only 8,200 of the units were sold. The following additional information is also available.

Direct materials used	\$79,000
Direct labor incurred	\$30,000
Variable manufacturing overhead	\$21,500
Fixed manufacturing overhead	\$45,000
Fixed selling and administrative expenses	\$70,000
Variable selling and administrative expenses	\$10,000

There was no work in process inventory at the beginning of the year, nor did Langdon have any beginning finished goods inventory.

**Instructions**

- What would be Langdon Company's finished goods inventory cost on December 31 under variable costing?
- Which costing method, absorption or variable costing, would show a higher net income for the year? By what amount?

**\*E6-19** Creative Crates Co. produces wooden crates used for shipping products by ocean liner. In 2014, Creative incurred the following costs.

Wood used in crate production	\$54,000
Nails (considered insignificant and a variable expense)	\$ 350
Direct labor	\$38,000
Utilities for the plant:	
\$1,500 each month,	
plus \$0.40 for each kilowatt-hour used each month	
Rent expense for the plant for the year	\$21,400

Assume Creative used an average 500 kilowatt-hours each month over the past year.

**Instructions**

- What is Creative's total manufacturing cost if it uses a variable costing approach?
- What is Creative's total manufacturing cost if it uses an absorption costing approach?
- What accounts for the difference in manufacturing costs between these two costing approaches?

*Compute product cost and prepare an income statement under variable and absorption costing.*

(LO 6), AP



*Determine ending inventory under variable costing and determine whether absorption or variable costing would result in higher net income.*

(LO 6, 7), AN

*Compute manufacturing cost under absorption and variable costing and explain difference.*

(LO 6), AN

EXERCISES: SET B AND  
CHALLENGE EXERCISES

Visit the book's companion website, at [www.wiley.com/college/weygandt](http://www.wiley.com/college/weygandt), and choose the Student Companion site to access Exercise Set B and Challenge Exercises.

## PROBLEMS: SET A

Compute break-even point under alternative courses of action.

(LO 1, 2), AN

**P6-1A** Fredonia Inc. had a bad year in 2013. For the first time in its history, it operated at a loss. The company's income statement showed the following results from selling 80,000 units of product: net sales \$2,000,000; total costs and expenses \$1,740,000; and net loss \$135,000. Costs and expenses consisted of the following.

	<u>Total</u>	<u>Variable</u>	<u>Fixed</u>
Cost of goods sold	\$1,468,000	\$ 950,000	\$ 518,000
Selling expenses	517,000	92,000	425,000
Administrative expenses	150,000	58,000	92,000
	<u>\$2,135,000</u>	<u>\$1,100,000</u>	<u>\$1,035,000</u>

Management is considering the following independent alternatives for 2014.

- Increase unit selling price 25% with no change in costs and expenses.
- Change the compensation of salespersons from fixed annual salaries totaling \$200,000 to total salaries of \$40,000 plus a 5% commission on net sales.
- Purchase new high-tech factory machinery that will change the proportion between variable and fixed cost of goods sold to 50:50.

**Instructions**

- Compute the break-even point in dollars for 2014.
- Compute the break-even point in dollars under each of the alternative courses of action. (Round to the nearest dollar.) Which course of action do you recommend?

(b) (2) \$2,187,500

Compute break-even point and margin of safety ratio, and prepare a CVP income statement before and after changes in business environment.

(LO 1, 2), AN

**P6-2A** Lorge Corporation has collected the following information after its first year of sales. Sales were \$1,500,000 on 100,000 units; selling expenses \$250,000 (40% variable and 60% fixed); direct materials \$511,000; direct labor \$290,000; administrative expenses \$270,000 (20% variable and 80% fixed); manufacturing overhead \$350,000 (70% variable and 30% fixed). Top management has asked you to do a CVP analysis so that it can make plans for the coming year. It has projected that unit sales will increase by 10% next year.

**Instructions**

- Compute (1) the contribution margin for the current year and the projected year, and (2) the fixed costs for the current year. (Assume that fixed costs will remain the same in the projected year.)
- Compute the break-even point in units and sales dollars for the first year.
- The company has a target net income of \$200,000. What is the required sales in dollars for the company to meet its target?
- If the company meets its target net income number, by what percentage could its sales fall before it is operating at a loss? That is, what is its margin of safety ratio?
- The company is considering a purchase of equipment that would reduce its direct labor costs by \$104,000 and would change its manufacturing overhead costs to 30% variable and 70% fixed (assume total manufacturing overhead cost is \$350,000, as above). It is also considering switching to a pure commission basis for its sales staff. This would change selling expenses to 90% variable and 10% fixed (assume total selling expense is \$250,000, as above). Compute (1) the contribution margin and (2) the contribution margin ratio, and recompute (3) the break-even point in sales dollars. Comment on the effect each of management's proposed changes has on the break-even point.

(b) 157,000 units

(e) (3) \$1,735,714

**P6-3A** Tanek Industries manufactures and sells three different models of wet-dry shop vacuum cleaners. Although the shop vacs vary in terms of quality and features, all are good sellers. Tanek is currently operating at full capacity with limited machine time.

Sales and production information relevant to each model follows.

	<b>Product</b>		
	<u>Economy</u>	<u>Standard</u>	<u>Deluxe</u>
Selling price	\$30	\$50	\$100
Variable costs and expenses	\$14	\$15	\$46
Machine hours required	.5	.8	1.6

Determine sales mix with limited resources.

(LO 4), AN

**Instructions**

- (a) Ignoring the machine time constraint, which single product should Tanek Industries produce?
- (b) What is the contribution margin per unit of limited resource for each product?
- (c) If additional machine time could be obtained, how should the additional time be used?

(b) Economy \$32

**P6-4A** The Hillside Inn is a restaurant in Flagstaff, Arizona. It specializes in southwestern style meals in a moderate price range. Phil Weld, the manager of Hillside, has determined that during the last 2 years the sales mix and contribution margin ratio of its offerings are as follows.

Determine break-even sales under alternative sales strategies and evaluate results.

(LO 3), AN

	<u>Percent of Total Sales</u>	<u>Contribution Margin Ratio</u>
Appetizers	15%	50%
Main entrees	50%	25%
Desserts	10%	50%
Beverages	25%	80%



Phil is considering a variety of options to try to improve the profitability of the restaurant. His goal is to generate a target net income of \$117,000. The company has fixed costs of \$1,053,000 per year.

**Instructions**

- (a) Calculate the total restaurant sales and the sales of each product line that would be necessary to achieve the desired target net income.
- (b) Phil believes the restaurant could greatly improve its profitability by reducing the complexity and selling price of its entrees to increase the number of clients that it serves. It would then more heavily market its appetizers and beverages. He is proposing to reduce the contribution margin ratio on the main entrees to 10% by dropping the average selling price. He envisions an expansion of the restaurant that would increase fixed costs by \$585,000. At the same time, he is proposing to change the sales mix to the following.

(a) Total sales \$2,600,000

(b) Total sales \$3,375,000

	<u>Percent of Total Sales</u>	<u>Contribution Margin Ratio</u>
Appetizers	25%	50%
Main entrees	25%	10%
Desserts	10%	50%
Beverages	40%	80%

Compute the total restaurant sales, and the sales of each product line that would be necessary to achieve the desired target net income.

- (c) Suppose that Phil reduces the selling price on entrees and increases fixed costs as proposed in part (b), but customers are not swayed by the marketing efforts and the sales mix remains what it was in part (a). Compute the total restaurant sales and the sales of each product line that would be necessary to achieve the desired target net income. Comment on the potential risks and benefits of this strategy.

Compute degree of operating leverage and evaluate impact of operating leverage on financial results.

(LO 5), AN

**P6-5A** The following CVP income statements are available for Viejo Company and Nuevo Company.

	<u>Viejo Company</u>	<u>Nuevo Company</u>
Sales	\$500,000	\$500,000
Variable costs	<u>280,000</u>	<u>180,000</u>
Contribution margin	220,000	320,000
Fixed costs	<u>180,000</u>	<u>280,000</u>
Net income	<u>\$ 40,000</u>	<u>\$ 40,000</u>

**Instructions**

- (a) BE, Viejo \$409,091  
BE, Nuevo \$437,500
- (b) DOL, Viejo 5.5  
DOL, Nuevo 8.0
- (a) Compute the break-even point in dollars and the margin of safety ratio for each company.
- (b) Compute the degree of operating leverage for each company and interpret your results.
- (c) Assuming that sales revenue increases by 20%, prepare a CVP income statement for each company.
- (d) Assuming that sales revenue decreases by 20%, prepare a CVP income statement for each company.
- (e)  Discuss how the cost structure of these two companies affects their operating leverage and profitability.

Determine contribution margin, break-even point, target sales, and degree of operating leverage.

(LO 2, 5), AN

**P6-6A** Bonita Beauty Corporation manufactures cosmetic products that are sold through a network of sales agents. The agents are paid a commission of 18% of sales. The income statement for the year ending December 31, 2014, is as follows.

**Bonita Beauty Corporation**  
**Income Statement**  
**For the Year Ended December 31, 2014**

Sales		\$75,000,000
Cost of goods sold		
Variable	\$31,500,000	
Fixed	<u>8,610,000</u>	<u>40,110,000</u>
Gross margin		34,890,000
Selling and marketing expenses		
Commissions	13,500,000	
Fixed costs	<u>10,260,000</u>	<u>23,760,000</u>
Operating income		<u>\$11,130,000</u>

The company is considering hiring its own sales staff to replace the network of agents. It will pay its salespeople a commission of 8% and incur additional fixed costs of \$7.5 million.

**Instructions**

- (a) \$47,175
- (c) (2) 3.37
- (a) Under the current policy of using a network of sales agents, calculate the Bonita Beauty Corporation's break-even point in sales dollars for the year 2014.
- (b) Calculate the company's break-even point in sales dollars for the year 2014 if it hires its own sales force to replace the network of agents.
- (c) Calculate the degree of operating leverage at sales of \$75 million if (1) Bonita Beauty uses sales agents, and (2) Bonita Beauty employs its own sales staff. Describe the advantages and disadvantages of each alternative.
- (d) Calculate the estimated sales volume in sales dollars that would generate an identical net income for the year ending December 31, 2014, regardless of whether Bonita Beauty Corporation employs its own sales staff and pays them an 8% commission or continues to use the independent network of agents.

(CMA-Canada adapted)

Prepare income statements under absorption costing and variable costing for a company with beginning inventory, and reconcile differences.

(LO 6, 7), AN

**\*P6-7A** Gardner Company produces plastic that is used for injection-molding applications such as gears for small motors. In 2013, the first year of operations, Gardner produced 4,000 tons of plastic and sold 2,500 tons. In 2014, the production and sales results were exactly reversed. In each year, the selling price per ton was \$2,000, variable manufacturing costs were 15% of the sales price of units produced, variable selling expenses were 10%

of the selling price of units sold, fixed manufacturing costs were \$2,000,000, and fixed administrative expenses were \$500,000.

### Instructions

- (a) Prepare income statements for each year using variable costing. (Use the format from Illustration 6A-5.) (a) 2014 \$3,500,000
- (b) Prepare income statements for each year using absorption costing. (Use the format from Illustration 6A-4.) (b) 2014 \$2,750,000
- (c) Reconcile the differences each year in net income under the two costing approaches.
- (d)  Comment on the effects of production and sales on net income under the two costing approaches.

**\*P6-8A** Dilithium Batteries is a division of Enterprise Corporation. The division manufactures and sells a long-life battery used in a wide variety of applications. During the coming year, it expects to sell 60,000 units for \$30 per unit. Nyota Uthura is the division manager. She is considering producing either 60,000 or 90,000 units during the period. Other information is presented in the schedule.

### Division Information for 2014

Beginning inventory	0
Expected sales in units	60,000
Selling price per unit	\$30
Variable manufacturing costs per unit	\$12
Fixed manufacturing overhead costs (total)	\$540,000
Fixed manufacturing overhead costs per unit:	
Based on 60,000 units	\$9 per unit (\$540,000 ÷ 60,000)
Based on 90,000 units	\$6 per unit (\$540,000 ÷ 90,000)
Manufacturing costs per unit:	
Based on 60,000 units	\$21 per unit (\$12 variable + \$9 fixed)
Based on 90,000 units	\$18 per unit (\$12 variable + \$6 fixed)
Variable selling and administrative expenses	\$2
Fixed selling and administrative expenses (total)	\$50,000

### Instructions

- (a) Prepare an absorption costing income statement, with one column showing the results if 60,000 units are produced and one column showing the results if 90,000 units are produced. (a) 90,000 units: NI \$550,000
- (b) Prepare a variable costing income statement, with one column showing the results if 60,000 units are produced and one column showing the results if 90,000 units are produced. (b) 90,000 units: NI \$370,000
- (c) Reconcile the difference in net incomes under the two approaches and explain what accounts for this difference.
- (d)  Discuss the relative usefulness of the variable costing income statements versus the absorption costing income statements for decision making and for evaluating the manager's performance.

*Prepare absorption and variable costing income statements and reconcile differences between absorption and variable costing income statements when sales level and production level change. Discuss relative usefulness of absorption costing versus variable costing.*

(LO 6, 7, 8), AN

## PROBLEMS: SET B

**P6-1B** McCure Corporation had a bad year in 2013, operating at a loss for the first time in its history. The company's income statement showed the following results from selling 200,000 units of product: net sales \$2,400,000; total costs and expenses \$2,472,000; and net loss \$72,000. Costs and expenses consisted of the following.

	<u>Total</u>	<u>Variable</u>	<u>Fixed</u>
Cost of goods sold	\$1,486,000	\$1,070,000	\$416,000
Selling expenses	681,000	356,000	325,000
Administrative expenses	305,000	110,000	195,000
	<u>\$2,472,000</u>	<u>\$1,536,000</u>	<u>\$936,000</u>

*Compute break-even point under alternative courses of action.*

(LO 1, 2), AN

Management is considering the following independent alternatives for 2014.

1. Increase unit selling price 25% with no change in costs and expenses.
2. Change the compensation of salespersons from fixed annual salaries totaling \$170,000 to total salaries of \$50,000 plus a 6% commission on net sales.
3. Purchase new high-tech factory machinery that will change the proportion between variable and fixed cost of goods sold to 40:60.

**Instructions**

- (a) Compute the break-even point in dollars for 2014.
- (b) Compute the break-even point in dollars under each of the alternative courses of action. Which course of action do you recommend? Round to the nearest dollar.

(b) (2) \$2,720,000

*Compute break-even point and margin of safety ratio, and prepare a CVP income statement before and after changes in business environment.*

(LO 1, 2), AN

**P6-2B** Huber Corporation has collected the following information after its first year of sales. Sales were \$1,000,000 on 40,000 units; selling expenses \$200,000 (30% variable and 70% fixed); direct materials \$327,000; direct labor \$190,000; administrative expenses \$250,000 (30% variable and 70% fixed); manufacturing overhead \$240,000 (20% variable and 80% fixed). Top management has asked you to do a CVP analysis so that it can make plans for the coming year. It has projected that unit sales will increase by 20% next year.

**Instructions**

- (a) Compute (1) the contribution margin for the current year and the projected year, and (2) the fixed costs for the current year. (Assume that fixed costs will remain the same in the projected year.)
- (b) Compute the break-even point in units and sales dollars for the current year.
- (c) The company has a target net income of \$120,000. What is the required sales in dollars for the company to meet its target?
- (d) If the company meets its target net income number, by what percentage could its sales fall before it is operating at a loss? That is, what is its margin of safety ratio?
- (e) The company is considering a purchase of equipment that would reduce its direct labor costs by \$90,000 and would change its manufacturing overhead costs to 10% variable and 90% fixed (assume total manufacturing overhead cost is \$240,000, as above). It is also considering switching to a pure commission basis for its sales staff. This would change selling expenses to 80% variable and 20% fixed (assume total selling expense is \$200,000, as above). Compute (1) the contribution margin and (2) the contribution margin ratio, and (3) recompute the break-even point in sales dollars. Comment on the effect each of management’s proposed changes has on the break-even point.

(b) 67,600 units

(e) (3) \$1,372,611

*Determine sales mix with limited resources.*

(LO 4), AN

**P6-3B** Keppel Corporation manufactures and sells three different models of exterior doors. Although the doors vary in terms of quality and features, all are good sellers. Keppel is currently operating at full capacity with limited machine time.

Sales and production information relevant to each model is shown below.

	<b>Product</b>		
	<u>Economy</u>	<u>Standard</u>	<u>Deluxe</u>
Selling price	\$270	\$450	\$650
Variable costs and expenses	\$144	\$260	\$430
Machine hours required	.6	.8	1.1

**Instructions**

- (a) Ignoring the machine time constraint, which single product should Keppel produce?
- (b) What is the contribution margin per unit of limited resource for each product?
- (c) If additional machine time could be obtained, how should the additional time be used?

(b) Economy \$210

*Determine break-even sales under alternative sales strategies and evaluate results.*

(LO 3), AN

**P6-4B** The Eatery is a restaurant in DeKalb, Illinois. It specializes in deluxe sandwiches in a moderate price range. Michael Raye, the manager of The Eatery, has determined that during the last 2 years the sales mix and contribution margin ratio of its offerings are as follows.



	<u>Percent of Total Sales</u>	<u>Contribution Margin Ratio</u>
Appetizers	15%	60%
Main entrees	60%	25%
Desserts	10%	40%
Beverages	15%	80%

Michael is considering a variety of options to try to improve the profitability of the restaurant. His goal is to generate a target net income of \$176,000. The company has fixed costs of \$352,000 per year.

### Instructions

- (a) Calculate the total restaurant sales and the sales of each product line that would be necessary to achieve the desired target net income. (a) Total sales, \$1,320,000
- (b) Michael believes the restaurant could greatly improve its profitability by reducing the complexity and selling price of its entrees to increase the number of clients that it serves. It would then more heavily market its appetizers and beverages. He is proposing to reduce the contribution margin ratio on the main entrees to 10% by dropping the average selling price and increasing the contribution margin ratio on desserts to 50% by reducing costs. He envisions an expansion of the restaurant that would increase fixed costs by 50%. At the same time, he is proposing to change the sales mix to the following. (b) Total sales, \$1,600,000

	<u>Percent of Total Sales</u>	<u>Contribution Margin Ratio</u>
Appetizers	25%	60%
Main entrees	40%	10%
Desserts	10%	50%
Beverages	25%	80%

Compute the total restaurant sales, and the sales of each product line that would be necessary to achieve the desired target net income.

- (c) Suppose that Michael reduces the selling price on entrees and increases fixed costs as proposed in part (b), but customers are not swayed by the marketing efforts and the sales mix remains what it was in part (a). Compute the total restaurant sales and the sales of each product line that would be necessary to achieve the desired target net income. Comment on the potential risks and benefits of this strategy. (c) Total sales, \$2,200,000

**P6-5B** The following variable costing income statements are available for Lyte Company and Darke Company.

	<u>Lyte Company</u>	<u>Darke Company</u>
Sales	\$1,000,000	\$1,000,000
Variable costs	600,000	200,000
Contribution margin	400,000	800,000
Fixed costs	200,000	600,000
Net income	<u>\$ 200,000</u>	<u>\$ 200,000</u>

Compute degree of operating leverage and evaluate impact of operating leverage on financial results.

(LO 5), AN

### Instructions

- (a) Compute the break-even point in dollars and the margin of safety ratio for each company. (a) BE Lyte \$500,000  
BE Darke \$750,000
- (b) Compute the degree of operating leverage for each company and interpret your results. (b) DOL, Lyte 2.0  
DOL, Darke 4.0
- (c) Assuming that sales revenue increases by 30%, prepare a variable costing income statement for each company.
- (d) Assuming that sales revenue decreases by 30%, prepare a variable costing income statement for each company.
- (e)  Discuss how the cost structure of these two companies affects their operating leverage and profitability.

Determine contribution margin, break-even point, target sales, and degree of operating leverage.

(LO 2, 5), AN

**P6-6B** Peaches and Cream Corporation manufactures cosmetic products that are sold through a network of sales agents. The agents are paid a commission of 16.25% of sales. The income statement for the year ending December 31, 2014, is shown on the next page.

**Peaches and Cream Corporation**  
**Income Statement**  
**For the Year Ended December 31, 2014**

Sales			\$120,000,000
Cost of goods sold			
Variable	\$58,500,000		
Fixed	<u>11,000,000</u>	<u>69,500,000</u>	
Gross margin			50,500,000
Selling and marketing expenses			
Commissions	19,500,000		
Fixed costs	<u>10,000,000</u>	<u>29,500,000</u>	
Operating income			<u>\$ 21,000,000</u>

The company is considering hiring its own sales staff to replace the network of agents. It will pay its salespeople a commission of 10% and incur additional fixed costs of \$12.0 million.

**Instructions**

- (a) \$60,000
- (b) Calculate the company's break-even point in sales dollars for the year 2014 if it hires its own sales force to replace the network of agents.
- (c) Calculate the degree of operating leverage at sales of \$120 million if (1) Peaches and Cream uses sales agents, and (2) Peaches and Cream employs its own sales staff. Describe the advantages and disadvantages of each alternative.
- (d) Calculate the estimated sales volume in sales dollars that would generate an identical net income for the year ending December 31, 2014, regardless of whether Peaches and Cream Corporation employs its own sales staff and pays them a 10% commission as well as incurring additional fixed costs of \$12.0 million, or continues to use the independent network of agents.

(CMA Canada-adapted)

*Prepare income statements under absorption costing and variable costing for a company with beginning inventory, and reconcile differences.*

(LO 6, 7), AN

(a) 2013 Net income \$100,000

(b) 2013 Net income \$180,000

**\*P6-7B** FAB produces fabrics that are used for clothing and other applications. In 2013, the first year of operations, FAB produced 500,000 yards of fabric and sold 400,000 yards. In 2014, the production and sales results were exactly reversed. In each year, selling price per yard was \$2.50, variable manufacturing costs were 30% of the sales price of units produced, variable selling expenses were 10% of the selling price of units sold, fixed manufacturing costs were \$400,000, and fixed administrative expenses were \$100,000.

**Instructions**

- (a) Prepare income statements for each year using variable costing. (Use the format from Illustration 6A-10.)
- (b) Prepare income statements for each year using absorption costing. (Use the format from Illustration 6A-11.)
- (c) Reconcile the differences each year in income from operations under the two costing approaches.
- (d)  Comment on the effects of production and sales on net income under the two costing approaches.

*Prepare absorption and variable costing income statements and reconcile differences between absorption and variable costing income statements when sales level and production level change. Discuss relative usefulness of absorption costing versus variable costing.*

(LO 6, 7, 8), AN

**P6-8B** Electriccoil is a division of Meier Products Corporation. The division manufactures and sells an electric coil used in a wide variety of applications. During the coming year, it expects to sell 200,000 units for \$9 per unit. Mark Barnes is the division manager. He is considering producing either 200,000 or 250,000 units during the period. Other information is presented in the schedule.

**Division Information for 2014**

Beginning inventory		0
Expected sales in units		200,000
Selling price per unit		\$9
Variable manufacturing costs per unit		\$3
Fixed manufacturing overhead costs (total)		\$500,000

Fixed manufacturing overhead costs per unit:	
Based on 200,000 units	\$2.50 per unit (\$50,000 ÷ 200,000)
Based on 250,000 units	\$2.00 per unit (\$500,000 ÷ 250,000)
Manufacturing costs per unit:	
Based on 200,000 units	\$5.50 per unit (\$3 variable + \$2.50 fixed)
Based on 250,000 units	\$5.00 per unit (\$3 variable + \$2.00 fixed)
Variable selling and administrative expense	\$0.40
Fixed selling and administrative expense (total)	\$15,000

**Instructions**

- (a) Prepare an absorption costing income statement, with one column showing the results if 200,000 units are produced and one column showing the results if 250,000 units are produced. (a) 250,000 produced  
NI, \$705,000
- (b) Prepare a variable costing income statement, with one column showing the results if 200,000 units are produced and one column showing the results if 250,000 units are produced. (b) 250,000 produced  
NI, \$605,000
- (c) Reconcile the difference in net incomes under the two approaches and explain what accounts for this difference.
- (d)  Discuss the relative usefulness of the variable costing income statements versus the absorption costing income statements for decision making and for evaluating the manager's performance.

**PROBLEMS: SET C**

Visit the book's companion website, at [www.wiley.com/college/weygandt](http://www.wiley.com/college/weygandt), and choose the Student Companion site to access Problem Set C.

**WATERWAYS CONTINUING PROBLEM**

(Note: This is a continuation of the Waterways Problem from Chapters 1–5.)

**WCP6** This problem asks you to perform break-even analysis based on Waterways' sales mix and to make sales mix decisions related to Waterways' use of its productive facilities. An optional extension of the problem (related to the chapter appendix) also asks you to prepare a variable costing income statement and an absorption costing income statement.



Go to the book's companion website, [www.wiley.com/college/weygandt](http://www.wiley.com/college/weygandt), to find the remainder of this problem.

**Broadening Your PERSPECTIVE**

**Management Decision-Making**

**Decision-Making at Current Designs**

**BYP6-1** **Current Designs** manufactures two different types of kayaks, rotomolded kayaks and composite kayaks. The following information is available for each product line.



	<u>Rotomolded</u>	<u>Composite</u>
Sales price/unit	\$950	\$2,000
Variable costs/unit	\$570	\$1,340

The company's fixed costs are \$820,000. An analysis of the sales mix identifies that rotomolded kayaks make up 80% of the total units sold.

**Instructions**

- Determine the weighted-average unit contribution margin for Current Designs.
- Determine the break-even point in units for Current Designs and identify how many units of each type of kayak will be sold at the break-even point. (Round to the nearest whole number.)
- Assume that the sales mix changes, and rotomolded kayaks now make up 70% of total units sold. Calculate the total number of units that would need to be sold to earn a net income of \$2,000,000 and identify how many units of each type of kayak will be sold at this level of income. (Round to the nearest whole number.)
- Assume that Current Designs will have sales of \$3,000,000 with two-thirds of the sales dollars in rotomolded kayaks and one-third of the sales dollars in composite kayaks. Assuming \$660,000 of fixed costs are allocated to the rotomolded kayaks and \$160,000 to the composite kayaks, prepare a CVP income statement for each product line.
- Using the information in part (d), calculate the degree of operating leverage for each product line and interpret your findings. (Round to two decimal places.)

**Decision-Making Across The Organization**

**BYP6-2** E-Z Seats manufactures swivel seats for customized vans. It currently manufactures 10,000 seats per year, which it sells for \$500 per seat. It incurs variable costs of \$200 per seat and fixed costs of \$2,000,000. It is considering automating the upholstery process, which is now largely manual. It estimates that if it does so, its fixed costs will be \$3,000,000, and its variable costs will decline to \$100 per seat.

**Instructions**

With the class divided into groups, answer the following questions.

- Prepare a CVP income statement based on current activity.
- Compute contribution margin ratio, break-even point in dollars, margin of safety ratio, and degree of operating leverage based on current activity.
- Prepare a CVP income statement assuming that the company invests in the automated upholstery system.
- Compute contribution margin ratio, break-even point in dollars, margin of safety ratio, and degree of operating leverage assuming the new upholstery system is implemented.
- Discuss the implications of adopting the new system.

**Managerial Analysis**

**BYP6-3** For nearly 20 years, Specialized Coatings has provided painting and galvanizing services for manufacturers in its region. Manufacturers of various metal products have relied on the quality and quick turnaround time provided by Specialized Coatings and its 20 skilled employees. During the last year, as a result of a sharp upturn in the economy, the company's sales have increased by 30% relative to the previous year. The company has not been able to increase its capacity fast enough, so Specialized Coatings has had to turn work away because it cannot keep up with customer requests.

Top management is considering the purchase of a sophisticated robotic painting booth. The booth would represent a considerable move in the direction of automation versus manual labor. If Specialized Coatings purchases the booth, it would most likely lay off 15 of its skilled painters. To analyze the decision, the company compiled production information from the most recent year and then prepared a parallel compilation assuming that the company would purchase the new equipment and lay off the workers. Those data are shown below. As you can see, the company projects that during the last year it would have been far more profitable if it had used the automated approach.

	<u>Current Approach</u>	<u>Automated Approach</u>
Sales	\$2,000,000	\$2,000,000
Variable costs	<u>1,500,000</u>	<u>1,000,000</u>
Contribution margin	500,000	1,000,000
Fixed costs	<u>380,000</u>	<u>800,000</u>
Net income	<u>\$ 120,000</u>	<u>\$ 200,000</u>

**Instructions**

- Compute and interpret the contribution margin ratio under each approach.
- Compute the break-even point in sales dollars under each approach. Discuss the implications of your findings.

- (c) Using the current level of sales, compute the margin of safety ratio under each approach and interpret your findings.
- (d) Determine the degree of operating leverage for each approach at current sales levels. How much would the company's net income decline under each approach with a 10% decline in sales?
- (e) At what level of sales would the company's net income be the same under either approach?
- (f) Discuss the issues that the company must consider in making this decision.

## Real-World Focus

**BYP6-4** In a recent report, the **Del Monte Foods Company** reported three separate operating segments: consumer products (which includes a variety of canned foods including tuna, fruit, and vegetables); pet products (which includes pet food and snacks and veterinary products); and soup and infant-feeding products (which includes soup, broth, and infant feeding and pureed products).

In its annual report, Del Monte uses absorption costing. As a result, information regarding the relative composition of its fixed and variable costs is not available. We have assumed that \$860.3 million of its total operating expenses of \$1,920.3 million are fixed and have allocated the remaining variable costs across the three divisions. Sales data, along with assumed expense data, are provided below.

	(in millions)	
	Sales	Variable Costs
Consumer products	\$1,031.8	\$ 610
Pet products	837.3	350
Soup and infant-feeding products	302.0	100
	\$2,171.1	\$1,060

### Instructions

- (a) Compute each segment's contribution margin ratio and the sales mix.
- (b) Using the information computed in part (a), compute the company's break-even point in dollars, and then determine the amount of sales that would be generated by each division at the break-even point.

**BYP6-5** The external financial statements published by publicly traded companies are based on absorption cost accounting. As a consequence, it is very difficult to gain an understanding of the relative composition of the companies' fixed and variable costs. It is possible, however, to learn about a company's sales mix and the relative profitability of its various divisions. This exercise looks at the financial statements of **FedEx Corporation**.



**Address:** [www.fedex.com/us/investorrelations](http://www.fedex.com/us/investorrelations), or go to [www.wiley.com/college/weygandt](http://www.wiley.com/college/weygandt)

### Steps

1. Go to the site above.
2. Under "Financial Documents," choose "Annual Reports."
3. Choose "2008 Annual Report."

### Instructions

- (a) Read page 25 of the report under the heading "Description of Business." What are the three primary product lines of the company? What does the company identify as the key factors affecting operating results?
- (b) Page 36 of the report lists the operating expenses of FedEx Ground. Assuming that rentals, depreciation, and "other" are all fixed costs, prepare a variable costing income statement for 2008, and compute the division's contribution margin ratio and the break-even point in dollars.
- (c) Page 73, Note 13 ("Business segment information") provides additional information regarding the relative profitability of the three business segments.
  - (i) Calculate the sales mix for 2006 and 2008. (*Note:* Exclude "other" when you calculate total revenue.)

- (ii) The company does not provide the contribution margin for each division, but it does provide “operating margin” (operating income divided by revenues) on pages 34, 36, and 37. List these for each division for 2006 and 2008.
- (iii) Assuming that the “operating margin” (operating income divided by revenues) moves in parallel with each division’s contribution margin, how has the shift in sales mix affected the company’s profitability from 2006 to 2008?

**BYP6-6** The June 8, 2009, edition of the *Wall Street Journal* has an article by JoAnn Lublin entitled “Smart Balance Keeps Tight Focus on Creativity.”

#### Instructions

Read the article and answer the following questions.

- (a) Describe **Smart Balance’s** approach to employment and cost structure.
- (b) What function does it keep “in-house”?
- (c) Based on the discussion in this chapter, what are the advantages to Smart Balance’s approach?
- (d) Based on the discussion in this chapter, what are the disadvantages to Smart Balance’s approach?

## Critical Thinking

### Communication Activity

**BYP6-7** Easton Corporation makes two different boat anchors—a traditional fishing anchor and a high-end yacht anchor—using the same production machinery. The contribution margin of the yacht anchor is three times as high as that of the other product. The company is currently operating at full capacity and has been doing so for nearly two years. Bjorn Borg, the company’s CEO, wants to cut back on production of the fishing anchor so that the company can make more yacht anchors. He says that this is a “no-brainer” because the contribution margin of the yacht anchor is so much higher.

#### Instructions

Write a short memo to Bjorn Borg describing the analysis that the company should do before it makes this decision and any other considerations that would affect the decision.

### Ethics Case



**\*BYP6-8** Brett Stern was hired during January 2014 to manage the home products division of Hi-Tech Products. As part of his employment contract, he was told that he would get \$5,000 of additional bonus for every 1% increase that the division’s profits exceeded those of the previous year.

Soon after coming on board, Brett met with his plant managers and explained that he wanted the plants to be run at full capacity. Previously, the plant had employed just-in-time inventory practices and had consequently produced units only as they were needed. Brett stated that under previous management the company had missed out on too many sales opportunities because it didn’t have enough inventory on hand. Because previous management had employed just-in-time inventory practices, when Brett came on board there was virtually no beginning inventory. The selling price and variable costs per unit remained the same from 2013 to 2014. Additional information is provided below.

	2013	2014
Net income	\$ 300,000	\$ 525,000
Units produced	25,000	30,000
Units sold	25,000	25,000
Fixed manufacturing overhead costs	\$1,350,000	\$1,350,000
Fixed manufacturing overhead costs per unit	\$ 54	\$ 45

**Instructions**

- Calculate Brett's bonus based upon the net income shown above.
- Recompute the 2013 and 2014 results using variable costing.
- Recompute Brett's 2014 bonus under variable costing.
- Were Brett's actions unethical? Do you think any actions need to be taken by the company?

**All About You**

**BYP6-9** Many of you will some day own your own business. One rapidly growing opportunity is no-frills workout centers. Such centers attract customers who want to take advantage of state-of-the-art fitness equipment but do not need the other amenities of full-service health clubs. One way to own your own fitness business is to buy a franchise. **Snap Fitness** is a Minnesota-based business that offers franchise opportunities. For a very low monthly fee (\$26, without an annual contract), customers can access a Snap Fitness center 24 hours a day.



The Snap Fitness website ([www.snapfitness.com](http://www.snapfitness.com)) indicates that start-up costs range from \$60,000 to \$184,000. This initial investment covers the following pre-opening costs: franchise fee, grand opening marketing, leasehold improvements, utility/rent deposits, and training.

**Instructions**

- Suppose that Snap Fitness estimates that each location incurs \$4,000 per month in fixed operating expenses plus \$1,460 to lease equipment. A recent newspaper article describing no-frills fitness centers indicated that a Snap Fitness site might require only 300 members to break even. Using the information provided above and your knowledge of CVP analysis, estimate the amount of variable costs. (When performing your analysis, assume that the only fixed costs are the estimated monthly operating expenses and the equipment lease.)
- Using the information from part (a), what would monthly sales in members and dollars have to be to achieve a target net income of \$3,640 for the month?
- Provide five examples of variable costs for a fitness center.
- Go to a fitness-business website, such as **Curves**, **Snap Fitness**, or **Anytime Fitness**, and find information about purchasing a franchise. Summarize the franchise information needed to decide whether entering into a franchise agreement would be a good idea.

**Considering People, Planet, and Profit**

**BYP6-10** Many politicians, scientists, economists, and businesspeople have become concerned about the potential implications of global warming. The largest source of the emissions thought to contribute to global warming is from coal-fired power plants. The cost of alternative energy has declined, but it is still higher than coal. In 1980, wind-power electricity cost 80 cents per kilowatt hour. Using today's highly efficient turbines with rotor diameters of up to 125 meters, the cost can be as low as 4 cents (about the same as coal), or as much as 20 cents in places with less wind.

Some people have recently suggested that conventional cost comparisons are not adequate because they do not take environmental costs into account. For example, while coal is a very cheap energy source, it is also a significant contributor of greenhouse gases. Should environmental costs be incorporated into decision formulas when planners evaluate new power plants? The basic arguments for and against are as follows.

**YES:** As long as environmental costs are ignored, renewable energy will appear to be too expensive relative to coal.

**NO:** If one country decides to incorporate environmental costs into its decision-making process but other countries do not, the country that does so will be at a competitive disadvantage because its products will cost more to produce.

**Instructions**

Write a response indicating your position regarding this situation. Provide support for your view.

## Answers to Chapter Questions

### Answers to Insight and Accounting Across the Organization Questions

**p. 242 Don't Just Look—Buy Something Q:** Besides increasing their conversion rates, what steps can online merchants use to lower their break-even points? **A:** In theory, one of the principal advantages of online retailers is that they can minimize their investment in “bricks and mortar” and thus minimize their fixed costs. Some online merchants never even handle the merchandise they sell. Instead, they simply provide a centralized location for customers to view merchandise and to place orders. The online retailer then forwards the order to the supplier, and the supplier ships it directly to the customer.

However, some online merchants who originally planned on employing this model have since found it necessary to build their own warehouses and distribution centers to ensure timely and dependable product delivery. This increases their fixed costs and consequently increases their break-even point.

**p. 247 Healthy for You, and Great for the Bottom Line Q:** Why do you suppose restaurants are so eager to sell beverages and desserts? **A:** There is a reason why servers at restaurants keep your beverage glass full, and why they wave the dessert tray in your face at the end of the meal. Both of these items traditionally have very high contribution margins and require very minimal investments in fixed costs. As a consequence, they are a great mechanism by which a company can hit its break-even point.

**p. 250 Something Smells Q:** What is the limited resource for a retailer, and what implications does this have for sales mix? **A:** For retailers, the limited resource is not just shelf space, but shelf space per day. At first, you might think that a product that is small and has a high contribution margin would be the product of choice. But, you also have to factor in the amount of time that a product sits on the shelf.

For example, suppose Product A and B are the same size. Product A has twice the contribution margin as product B, but A sits on the shelf five times as long as product B. In this case, once time spent on the shelf is taken into account, B's superior turnover more than makes up for its lower contribution margin.

**p. 253 There Is Something About a Train Q:** Why did Warren Buffett think that this was a good time to invest in railroad stocks? **A:** Railroads have extremely high fixed costs. Mr. Buffett bought Burlington Northern Railroad at the bottom of a recession. He is counting on the railroad's high operating leverage to provide large profits once the economy rebounds.

### Answers to Self-Test Questions

1. d 2. d 3. a 4. a  $(\$350,000 - \$100,000)$  5. b  $[(\$180,000 + \$268,000) \div (\$12 - \$8.50)]$   
 6. d  $[\$150,000 \div (\$3 \div \$12)]$  7. d 8. a 9. b  $(\$15 \div 3.0)$  10. d  $[(\$26 \div 4) < (\$14 \div 2)]$  11. d  
 12. d 13. c 14. a  $(\$200,000 \times 3.5 \times 10\%)$  \*15. b \*16. c



Remember to go back to The Navigator box on the chapter opening page and check off your completed work.