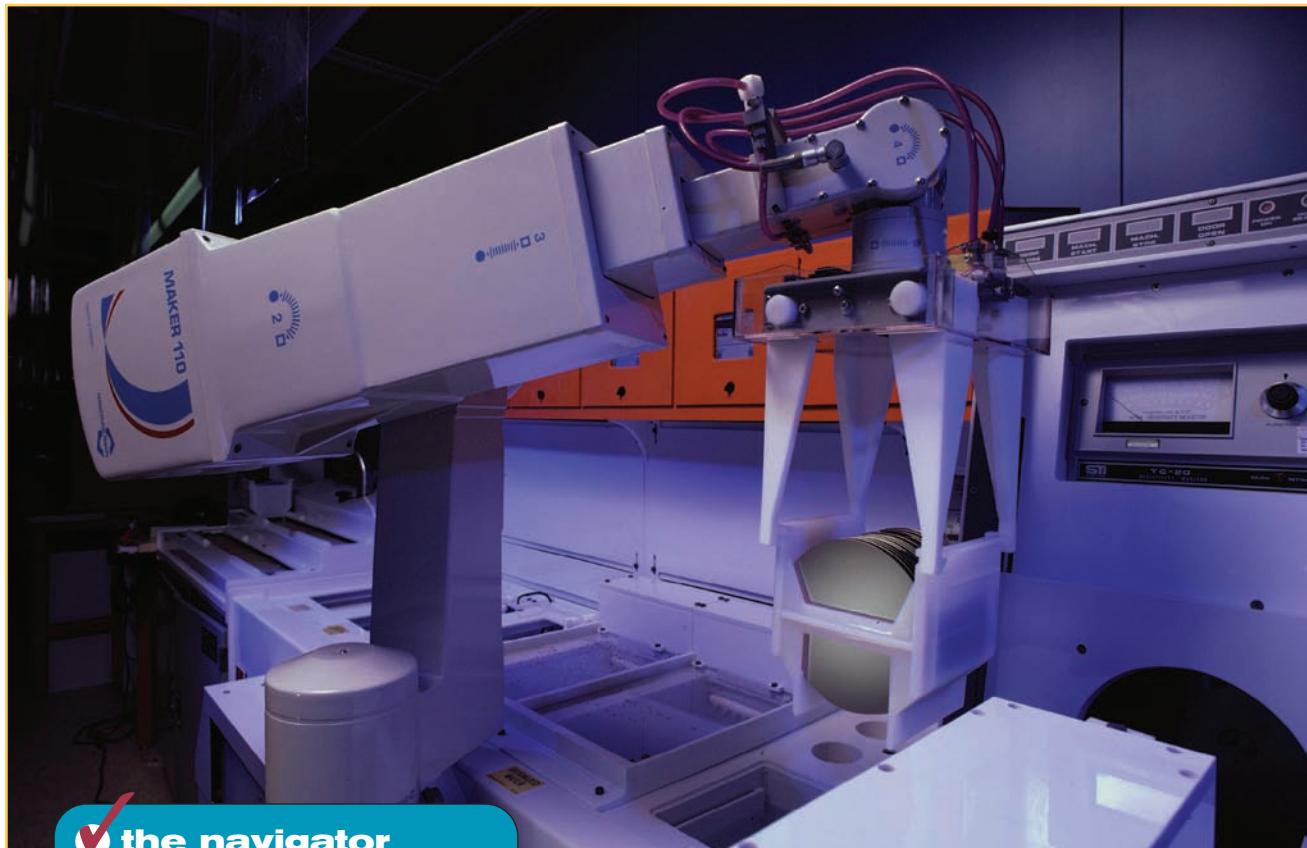


Cost-Volume-Profit Analysis: Additional Issues



the navigator

- Scan Study Objectives
- Read Feature Story
- Read Preview
- Read Text and answer **Do it!**
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- Work Using the Decision Toolkit
- Review Summary of Study Objectives
- Work Comprehensive **Do it!** p. 273
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- Complete Assignments

study 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



What Goes Up (Fast), Must Come Down (Fast)

During the late 1990s many people marveled at the efficiency of the so-called “New Economy,” which uses digital technologies to improve business processes. Some managers were actually startled by their own success. The New Economy had created a new formula for profit. For example, David Peterschmidt, chief executive at software developer **Inktomi**, noted that the company had incurred considerable fixed costs in developing new software, but its variable costs were minor. As a consequence, once sales had covered the fixed costs, every additional sale was basically pure profit. When sales were booming, he happily stated, “Next to the federal government, this is the only business that’s allowed to print money.” But that was then. When the economy lagged, the new profit formula went sour. The company’s sales disappeared, but its fixed costs did not. In no time, Inktomi

went from record profits to staggering losses.

Many other companies have had similar experiences. As their manufacturing plants have become more automated, their fixed costs have become increasingly high. For example, during a five-year period, the average cost of a typical **Intel** semiconductor plant rose from \$500 million to \$2 billion as its manufacturing processes became increasingly sophisticated. These high fixed costs have made Intel very dependent on producing a high volume of computer chips. It needs high volume so that it can spread its fixed costs across a lot of units, thereby reducing the fixed cost per unit. As one Intel employee put it, “You have high fixed costs, so you want to minimize those fixed costs and keep factories running 24 hours a day.”

However, when management focuses too heavily on keeping volume

high to reduce fixed costs per unit, it sometimes produces more inventory than the market wants. When this happens, companies have to cut prices sharply. High-tech firms, like Intel, whose products rapidly become obsolete, have occasionally been stuck with inventory that nobody wanted. Thus, while the huge outlays for new equipment have made these companies exceptionally efficient, such outlays have also increased their exposure to economic swings. In fact, because so many companies now have cost structures that rely heavily on fixed costs, many economists worry that swings in the entire economy will be more volatile than in the past.

Source: Greg Ip, “As Profits Swoon, Companies Blame a Marked Change in Cost Structure,” *Wall Street Journal*, May 16, 2001.



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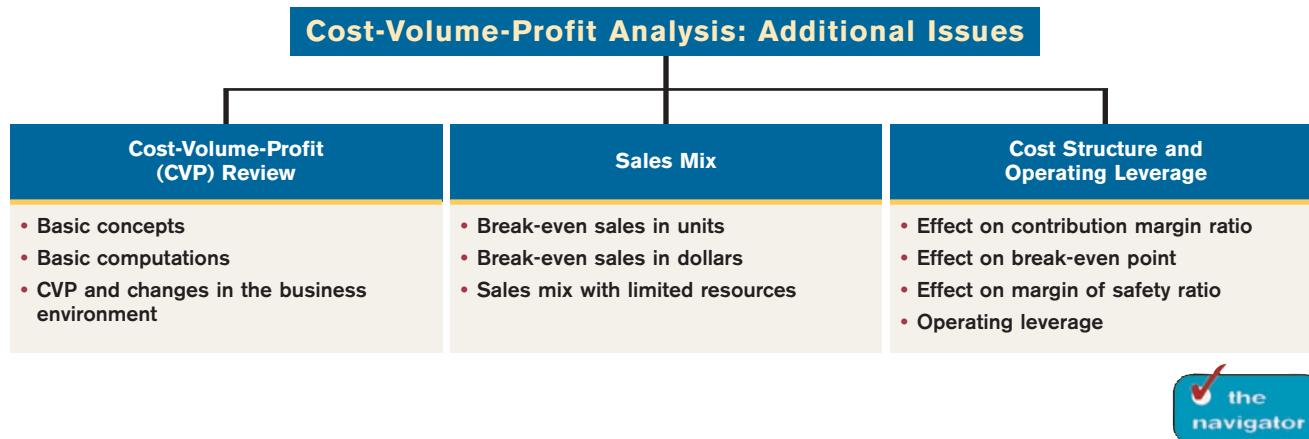
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preview of chapter 6

As the Feature Story about **Inktomi** and **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 (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 such management decisions as determining product mix, maximizing use of production facilities, and setting selling prices.

BASIC CONCEPTS

study 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 5-11, on page 213). 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, 2011		
	Total	Per Unit
Sales (1,600 camcorders)	\$ 800,000	\$ 500
Variable costs	480,000	300
Contribution margin	320,000	\$200
Fixed costs	200,000	
Net income	\$120,000	

Companies often prepare detailed CVP income statements. To illustrate, we use the same base information in Illustration 6-2 as that presented in Illustration 6-1.

VARGO VIDEO COMPANY		
CVP Income Statement		
For the Month Ended June 30, 2011		
	Total	Per Unit
Sales	\$ 800,000	\$ 500
Variable expenses		
Cost of goods sold	\$400,000	
Selling expenses	60,000	
Administrative expenses	<u>20,000</u>	
Total variable expenses	480,000	300
Contribution margin	320,000	\$200
Fixed expenses		
Cost of goods sold	120,000	
Selling expenses	40,000	
Administrative expenses	<u>40,000</u>	
Total fixed expenses	200,000	
Net income	<u>\$120,000</u>	

Illustration 6-2
Detailed CVP income statement

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!

Garner Manufacturing Inc. sold 20,000 units and recorded sales of \$800,000 for the first quarter of 2011. In making the sales, the company incurred the following costs and expenses.

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

- (a) Prepare a CVP income statement for the quarter ended March 31, 2011.
- (b) Compute the contribution margin per unit.
- (c) Compute the contribution margin ratio.

Solution

GARNER MANUFACTURING INC.		
Income Statement		
For the Quarter Ended March 31, 2011		
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	432,000	
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	208,000	
Net income	<u><u>\$160,000</u></u>	

before you go on...

CVP Income Statement

Action Plan

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

- (b) Contribution margin per unit:
 $\$40 (\$800,000 \div 20,000 \text{ units}) - \$21.60 (\$432,000 \div 20,000 \text{ units}) = \18.40 per unit.
- (c) Contribution margin ratio:
 $\$368,000 \div \$800,000 = 46\% \text{ (or } \$18.40 \div \$40 = 46\%).$

Related exercise material: BE6-1, BE6-2, and **Do it! 6-1.**



BASIC COMPUTATIONS

study objective **2**

Apply basic CVP concepts.

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 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) or in dollars (using contribution margin ratio).

Illustration 6-3
Break-even point

Fixed Costs	\div	Contribution Margin per Unit	$=$	Break-even Point in Units
\$200,000	\div	\$200	$=$	1,000 units
Fixed Costs			\div	Contribution Margin Ratio
\$200,000			\div	.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 6-4 shows the required sales in units and dollars to achieve its target net income.

Illustration 6-4
Target net income

(Fixed Costs + Target Net Income)	\div	Contribution Margin per Unit	$=$	Required Sales in Units
(\$200,000 + \$250,000)	\div	\$200	$=$	2,250 units
(Fixed Costs + Target Net Income)			\div	Contribution Margin Ratio
(\$200,000 + \$250,000)			\div	.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 6-5
Margin of safety

Actual (Expected) Sales	–	Break-even Sales	= Margin of Safety in Dollars
\$800,000	–	\$500,000	= \$300,000
Margin of Safety in Dollars ÷ Actual (Expected) Sales	= Margin of Safety Ratio		
\$300,000	÷	\$800,000	= 37.5%

Thus, Vargo's sales could drop by \$300,000, or 37.5%, before the company would operate at a loss.

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 6-6
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 × 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.

$$\text{Fixed Costs} \div \text{Contribution Margin per Unit} = \text{Break-even Sales}$$

$$\$200,000 \div \$150 = 1,333 \text{ units (rounded)}$$

Illustration 6-7
Computation of break-even sales in units

For Vargo Video, this change requires monthly sales to increase by 333 units, or 33%, 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% × \$200,000)]. The variable cost per unit becomes \$210 [\$300 – (30% × \$300)]. The new break-even point is approximately 897 units, computed as shown on the next page.

Illustration 6-8

Computation of break-even sales in units

$$\text{Fixed Costs} \div \frac{\text{Contribution Margin per Unit}}{} = \text{Break-even Sales}$$

$$\$260,000 \div (\$500 - \$210) = 897 \text{ units (rounded)}$$

These changes appear to be advantageous for Vargo Video. The break-even point is reduced by 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 6-9

Computation of required sales

$$\frac{\text{Fixed Costs} + \text{Target Net Income}}{\text{Contribution Margin per Unit}} = \frac{\text{Required Sales in Units}}{}$$

$$(\$182,500 + \$80,000) \div \$175 = 1,500$$

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 ($\$10,000 \div 100$). 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?



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.

before you go on...

Do it!

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

CVP Analysis

KRISANNE COMPANY
CVP Income Statement
For the Month Ended June 30, 2011

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

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

(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 ($\$300,000 - \$250,000$).

^a $\$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 ($\$337,500^c - \$300,000$).

^b $\$60 - (.10 \times \$60) - 36 = \$18$.

^c $5,000 + (.25 \times 5,000) = 6,250$ 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.

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.

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

study 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% to 20%.

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.

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 TV sets as well. Vargo sells its two products in the following amounts: 1,500 camcorders and 500 TVs. The sales mix, expressed as a function of total units sold, is as follows.

Illustration 6-10

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 units sold are camcorders, and 25% of the units sold are TVs.

Illustration 6-11 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 6-11

Per unit data—sales mix

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

To compute break-even for Vargo, we then 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 TV sets, and therefore the camcorders must be counted three times for every TV set sold. The weighted-average contribution margin for a sales mix of 75% camcorders and 25% TVs is \$275, which is computed as follows.

Illustration 6-12

Weighted-average unit contribution margin

Camcorders	TVs	Weighted-Average Unit Contribution Margin
$\left(\begin{array}{c} \text{Unit} \\ \text{Contribution} \\ \text{Margin} \end{array} \times \begin{array}{c} \text{Sales Mix} \\ \text{Percentage} \end{array} \right) + \left(\begin{array}{c} \text{Unit} \\ \text{Contribution} \\ \text{Margin} \end{array} \times \begin{array}{c} \text{Sales Mix} \\ \text{Percentage} \end{array} \right) = \begin{array}{c} \text{Weighted-Average} \\ \text{Unit Contribution} \\ \text{Margin} \end{array}$	$(\$200 \times .75) + (\$500 \times .25) = \$275$	\$275

We then 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.

Fixed Costs	÷	Weighted-Average Unit Contribution Margin	=	Break-even Point in Units
\$275,000	÷	\$275	=	1,000 units

Illustration 6-13
Break-even point in units

Illustration 6-13 shows the break-even point for Vargo Video is 1,000 units (camcorders and TVs combined). These 1,000 units would be comprised of 750 camcorders ($.75 \times 1,000$ units) and 250 TVs ($.25 \times 1,000$). This can be verified by the computations in Illustration 6-14, 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
	<u>1,000</u>				<u>\$275,000</u>

Illustration 6-14
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 television sets 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 = $\frac{\text{Fixed costs}}{\text{Weighted-average unit contribution margin}}$	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 like 3M, 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 approach requires that we compute sales mix as a percentage of total dollars sales (rather than units sold) and that 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 6-15 provides information necessary for performing cost-volume-profit analysis for the two divisions of Kale Garden Supply.

Illustration 6-15

Cost-volume-profit data for
Kale Garden Supply

	Indoor Plant Division	Outdoor Plant Division	Total
Sales	\$ 200,000	\$ 800,000	\$1,000,000
Variable costs	120,000	560,000	680,000
Contribution margin	\$ 80,000	\$ 240,000	\$ 320,000
Sales-mix percentage (Division sales ÷ Total sales)	\$ 200,000 \$1,000,000 = .20	\$ 800,000 \$1,000,000 = .80	
Contribution margin ratio (Contribution margin ÷ Sales)	\$ 80,000 \$ 200,000 = .40	\$ 240,000 \$ 800,000 = .30	\$ 320,000 \$1,000,000 = .32
Total fixed costs = \$300,000			

As shown in Illustration 6-15, the contribution margin ratio for the combined company is 32%, which is computed by dividing the total contribution margin by total sales. 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 6-16 we multiply each division's contribution margin ratio by its sale-mix percentage, based on dollar sales, and then sum these amounts. As shown later, the calculation in Illustration 6-16 is useful because it enables us to determine how the break-even point changes when the sales mix changes.

Illustration 6-16

Calculation of weighted-average contribution margin

Indoor Plant Division	Outdoor Plant Division	Weighted-Average Contribution Margin Ratio
$(\text{Contribution Margin Ratio} \times \text{Sales Mix Percentage}) + (\text{Contribution Margin Ratio} \times \text{Sales Mix Percentage})$		
(.40 × .20) + (.30 × .80) = .32		

Kale Garden Supply's break-even point in dollars is then computed by dividing fixed costs by the weighted-average contribution margin ratio of 32%, as shown in Illustration 6-17.

Illustration 6-17

Calculation of break-even point in dollars

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

The break-even point is based on the sales mix of 20% to 80%. 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?



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.

before you go on...

Do it!

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

	Pro	Intermediate	Standard	Total
Units sold	5,000	10,000	25,000	40,000
Selling price	\$800	\$500	\$350	
Variable cost	\$500	\$300	\$250	

Sales Mix Break-even

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 is:

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

- (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:	$50,000 \text{ units} \times 12.5\% = 6,250 \text{ units}$
Intermediate:	$50,000 \text{ units} \times 25\% = 12,500 \text{ units}$
Standard:	$50,000 \text{ units} \times 62.5\% = \frac{31,250 \text{ units}}{50,000 \text{ units}}$

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

study 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. For a company, 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 6-18

Contribution margin and machine hours

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

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

The TV sets 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 TV sets. 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 6-19.

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

Illustration 6-19
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 6-19, 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.

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

Illustration 6-20
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?





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	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.

before you go on...

Sales Mix with Limited Resources

Do it!

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?

Action Plan

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

Solution

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

$$\frac{\text{Contribution margin per unit}}{\text{Limited resource consumed per unit}} = \frac{\$2}{.02} = \$100 \quad \frac{\$3.5}{.04} = \$87.50 \quad \frac{\$5}{.08} = \$62.50$$

- 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

study objective 5

Understand how operating leverage affects profitability.

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. While this makes Cisco less susceptible to economic swings, it has also reduced its ability to experience the incredible profitability that it used to have during economic booms.

The choice of cost structure must 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 6-21 shows CVP income statements for each company.

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

Illustration 6-21
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 6-22 shows the computation of the contribution margin ratio for each company.

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

Illustration 6-22
Contribution margin ratio
for two companies

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 6-23 (page 258).

Illustration 6-23

Computation of break-even point for two companies

	Fixed Costs	\div	Contribution Margin Ratio	$=$	Break-even Point in Dollars
Vargo Video	\$200,000	\div	.40	$=$	\$500,000
New Wave	\$520,000	\div	.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 6-24 shows the computation of the **margin of safety ratio** for the two companies.

Illustration 6-24

Computation of margin of safety ratio for two companies

	(Actual Sales – Break-even Sales)	\div	Actual Sales	$=$	Margin of Safety Ratio
Vargo Video	$(\$800,000 - \$500,000)$	\div	\$800,000	$=$.38
New Wave	$(\$800,000 - \$650,000)$	\div	\$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 6-25 and applied to our two manufacturers of camcorders.

Illustration 6-25

Computation of degree of operating leverage

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

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. 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

The Cost of Experience

Cost structures vary considerably across industries, but they also vary considerably across companies within industries. For example, the airline industry is characterized by two types of companies—low-cost, low-fare airlines such as **Southwest Airlines** and **JetBlue Airways**, and the high-cost, high-fare airline giants such as **United Airlines** and **American Airlines**. One reason that airline giants have higher costs is that they are somewhat trapped in a flight system that they invented—the hub-and-spoke approach. Under this approach, passengers are flown from their city of origination to centralized hub cities and then flown to their ultimate destination. This results in high fixed costs and high operating leverage. When air traffic was at peak volumes during the late 1990s, the large carriers enjoyed record profits. But when travel volume declined, this same cost structure resulted in massive losses and a series of bankruptcy declarations.



As a result of being in business for a long time, the established airline giants also must pay very large retirement payments, a cost the newer airlines do not face. What impact do these payments have on the break-even equation?



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.

Be sure to read
all about YOU
Big Decisions for Your Energy Future
on page 260 for information on how topics in this chapter apply to you.

Big Decisions for Your Energy Future

It seems that a day does not pass without some reminder that our use of energy, as we know it, is going to have to change, and change in a big way. Many politicians, scientists, economists, and business people 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. Alternative sources of energy have been available for many years, but due to their high cost relative to coal, their use has been limited. However, faced with rapidly growing energy needs and concerns over global warming, communities will soon have to make huge investments in alternative energy sources. The big question is, "What will be the best investments for the future?"

To answer this question, decision makers will employ the tools that you learned about in this and other chapters. The stakes are high, which is why it is important to make an informed decision.

Some Facts

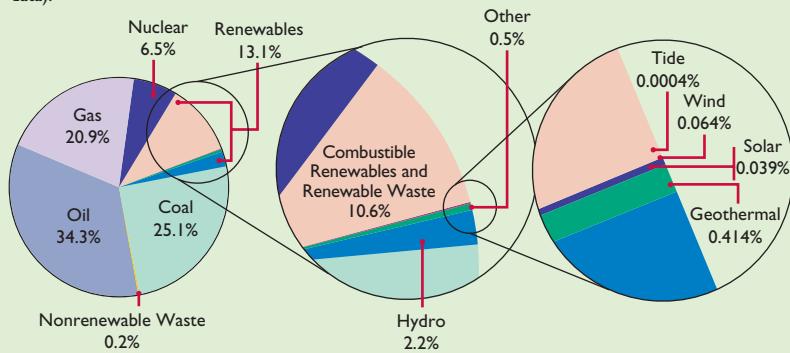
- * In 1980, wind-power electricity cost 80 cents per kilowatt hour. Using today's highly efficient turbines with rotor diameters of up to 125 meters, the cost can be as low as 3 to 4 cents (about the same as coal), or as much as 20 cents in places with less wind.
- * It costs about \$77,500 to install a residential solar-power system with a 10 kilowatt-capacity. Without subsidies, the system would take about 50 years to pay itself off; with subsidies, it would pay off in about 10 years.
- * Industrial plants using solar panels have a cost per kilowatt hour of about 30 cents; with a new approach, called *concentrating solar power*, the cost is between 9 and 12 cents per kilowatt hour.
- * Homes that use only products with the Environmental Protection Agency's Energy Star designation will use 30% less energy and save about \$400 per year. In a recent year, consumers saved \$12 billion on utility bills using Energy Star products.
- * Employing new materials and technologies, homes can now be built 70% more energy-efficient than homes of the past.
- * The United States, China, and India are the largest emitters of greenhouse gases.

About the Numbers

This following drawing illustrates that only 13% of the world's energy is provided by renewable sources. Of that, almost 10% is provided by biomass, the conversion of plant matter to create energy, usually through burning. This often involves the burning of methane gas, a byproduct of decaying plant matter. Since methane is a powerful greenhouse gas, burning it has the additional desirable effect of reducing a greenhouse gas.

Going Green

Renewable energy sources—such as biomass, hydro, solar, wind, tide, and geothermal—make up 13.1% of the world's primary energy supplies, according to the International Energy Agency (2004 data).



Note: Totals may not add up due to rounding.

Source: IEA Energy Statistics (accessed September 2006).

What Do You Think?

Although renewable energy sources, such as solar and wind power, have been available for a long time, they have not been widely adopted because of their high cost relative to coal. 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?

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 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.

Sources: Rebecca Smith, "The New Math of Alternative Energy," *Wall Street Journal Online*, February 12, 2007; Christine Burma, "How to Cut Energy Costs," *Wall Street Journal Online*, February 12, 2007; "The Heat Is On," *The Economist*, September 9, 2006, survey section, pp. 1–24.



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.

	Old	New
Sales revenue	\$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><u>\$ 200,000</u></u>	<u><u>\$ 200,000</u></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.



	(Actual Sales - Break-even Sales)	÷	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 Study 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	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.
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.

appendix

Absorption Costing versus 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.

study objective 6

Explain the difference between absorption costing and variable costing.



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 2011, the first month of production, are as shown on the next page.

Illustration 6A-2

Sealant sales and cost data for Premium Products Corporation

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.

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

Illustration 6A-3

Computation of per unit manufacturing cost

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

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

Illustration 6A-4

Absorption costing income statement

PREMIUM PRODUCTS CORPORATION Income Statement For the Month Ended January 31, 2011 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	
Inventory, January 31 (10,000 units × \$13)	130,000	
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
Net income		\$ 85,000

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

subtracting ending inventory of \$130,000. Under absorption costing, \$40,000 of the fixed overhead (10,000 units \times \$4) is deferred to a future period as part of the cost of ending inventory.

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.

PREMIUM PRODUCTS CORPORATION Income Statement For the Month Ended January 31, 2011 Variable Costing		
Sales (20,000 units \times \$20)		\$400,000
Variable cost of goods sold		
Inventory, January 1	\$ -0-	
Variable cost of goods manufactured (30,000 units \times \$9)	270,000	
Variable cost of goods available for sale	270,000	
Inventory, January 31 (10,000 units \times \$9)	90,000	
Variable cost of goods sold	180,000	
Variable selling and administrative expenses (20,000 units \times \$2)	40,000	220,000
Contribution margin		180,000
Fixed manufacturing overhead	120,000	
Fixed selling and administrative expenses	15,000	135,000
Net income		\$ 45,000

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.

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 \times \$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.

study 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 three-year period, but the number of units sold varies each year.

2011 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.

Illustration 6A-6

Information for Overbay Inc.

	<u>2011</u>	<u>2012</u>	<u>2013</u>
Volume information			
Drones in beginning inventory	0	0	2
Drones produced	10	10	10
Drones sold	10	8	12
Drones in ending inventory	0	2	0
Financial information			
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		

An absorption costing income statement for 2011 for Overbay Inc. is shown in Illustration 6A-7.

Illustration 6A-7

Absorption costing income statement—2011

OVERBAY INC.		
Income Statement		
For the Year Ended December 31, 2011		
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><u>\$ 870,000</u></u>

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 2011. As in absorption costing, the fixed and variable selling and administrative expenses are period costs expensed in 2011. A variable costing income statement for Overbay Inc. for 2011 is shown in Illustration 6A-8.

OVERBAY INC. Income Statement For the Year Ended December 31, 2011 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)	50,000	2,450,000
Contribution margin		1,550,000
Fixed manufacturing overhead	600,000	
Fixed selling and administrative expenses	80,000	680,000
Net income		\$ 870,000

Illustration 6A-8
Variable costing income statement—2011

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 2011 are deferred to future periods using absorption costing.

2012 Results

In 2012, Overbay produced ten drones but sold only eight drones. As a result, there are two drones in ending inventory. The absorption costing income statement for 2012 is shown in Illustration 6A-9.

OVERBAY INC. Income Statement For the Year Ended December 31, 2012 Absorption Costing		
Sales (8 drones × \$400,000)		\$3,200,000
Cost of goods sold (8 drones × \$300,000)		2,400,000
Gross profit		800,000
Variable selling and administrative expenses (8 drones × \$5,000)	\$40,000	
Fixed selling and administrative expenses	80,000	120,000
Net income		\$ 680,000

Illustration 6A-9
Absorption costing income statement—2012

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

The variable costing income statement for 2012 is shown in Illustration 6A-10.

Illustration 6A-10

Variable costing income statement—2012

OVERBAY INC. Income Statement For the Year Ended December 31, 2012 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><u>\$ 560,000</u></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 2012, 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).

2013 Results

In 2013, Overbay produced ten drones and sold twelve (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 2013 is shown in Illustration 6A-11.

Illustration 6A-11

Absorption costing income statement—2013

OVERBAY INC. Income Statement For the Year Ended December 31, 2013 Absorption Costing		
Sales (12 drones × \$400,000)		\$4,800,000
Cost of goods sold (12 drones × \$300,000)	3,600,000	
Gross profit		1,200,000
Variable selling and administrative expenses (12 drones × \$5,000)	<u>60,000</u>	
Fixed selling and administrative expenses	<u>80,000</u>	<u>140,000</u>
Net income		<u><u>\$ 1,060,000</u></u>

Fixed manufacturing costs of \$720,000 are expensed as part of cost of goods sold in 2013. This \$720,000 includes \$120,000 of fixed manufacturing costs incurred during 2012 and included in beginning inventory, plus \$600,000 of fixed manufacturing costs incurred during 2013. 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 2013 is shown in Illustration 6A-12.

OVERBAY INC. Income Statement For the Year Ended December 31, 2013 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)	60,000	2,940,000
Contribution margin		1,860,000
Fixed manufacturing overhead	600,000	
Fixed selling and administrative expenses	80,000	680,000
Net income		\$1,180,000

Illustration 6A-12
Variable costing income statement—2013

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 2013 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.

	Net Income under Two Costing Approaches		
	2011	2012	2013
	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	\$ -0-	\$120,000	\$(120,000)

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

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

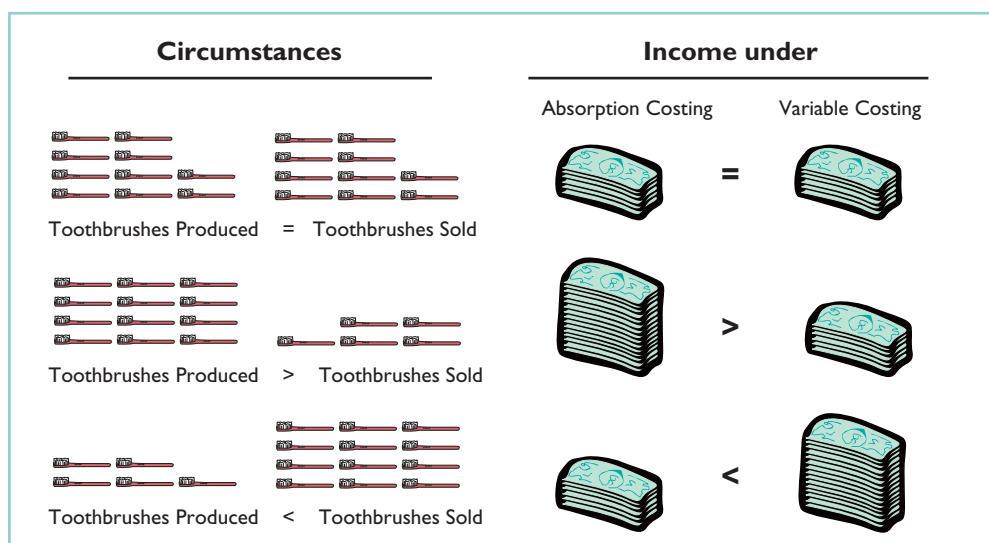


Illustration 6A-14
Summary of income effects under absorption costing and variable costing

DECISION-MAKING CONCERNS

study 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 2011. 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.

Illustration 6A-15

Facts for Lighting Division—2011

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 ($\$60,000 \div 20,000$ units)
Based on 30,000 units	\$2 per unit ($\$60,000 \div 30,000$ 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-16 presents the division's results based upon the two possible levels of output under absorption costing.

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 × \$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 2011 net income, it may be costly to the company in the long run.

LIGHTING DIVISION Income Statement For the Year Ended December 31, 2011 Absorption Costing		
	20,000 Produced	30,000 Produced
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	\$ 85,000	\$105,000

*20,000 units × \$9
**20,000 units × \$8

Illustration 6A-16
Absorption costing income statement—2011

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.

LIGHTING DIVISION Income Statement For the Year Ended December 31, 2011 Variable Costing		
	20,000 Produced	30,000 Produced
Sales (20,000 units × \$15)	\$300,000	\$300,000
Variable cost of goods sold (20,000 units × \$6)	120,000	120,000
Variable selling and administrative expenses (20,000 units × \$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	\$ 85,000	\$ 85,000

Illustration 6A-17
Variable costing income statement—2011

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.

before you go on...

Variable Costing

Do it!

Justin and Andrea Doll Company produces and sells tennis balls. The following costs are available for the year ended December 31, 2011. The company has no beginning inventory. In 2011, 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 2011 income statement for Justin and Andrea Doll Company using variable costing.

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.

Solution

- (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.

JUSTIN AND ANDREA DOLL COMPANY
Income Statement
For the Year Ended December 31, 2011
Variable Costing

Sales ($7,500,000 \times \$0.50$)		\$3,750,000
Variable cost of goods sold ($7,500,000 \times \$0.23$)	\$1,725,000	
Variable selling and administrative expenses $(7,500,000 \times .02)$	<u>150,000</u>	<u>1,875,000</u>
Contribution margin		1,875,000
Fixed manufacturing overhead	500,000	
Fixed selling and administrative expenses	<u>100,000</u>	<u>600,000</u>
Net income		\$1,275,000

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





Summary of Study Objectives for Appendix

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 (p. 263) A costing approach in which all manufacturing costs are charged to the product.

Cost structure (p. 256) The relative proportion of fixed versus variable costs that a company incurs.

Degree of operating leverage (p. 258) 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.

Operating leverage (p. 258) 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.

Sales mix (p. 250) The relative percentage in which a company sells its multiple products.

Theory of constraints (p. 255) A specific approach used to identify and manage constraints in order to achieve the company's goals.

Variable costing (p. 263) A costing approach in which only variable manufacturing costs are product costs, and fixed manufacturing costs are period costs (expenses).



Comprehensive Do it!

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	\$2.00	\$ 3.50	\$ 5.00
Machine hours required	0.02	0.04	0.08

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 bearing?
- 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!

- 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.
- The contribution margin per unit of limited resource is calculated as:

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

- 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.



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

Self-Study Questions

Answers are at the end of the chapter.

- (SO 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.
- (SO 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 cost 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.
- (SO 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.
- (SO 1) 4. The following information is available for Chap 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?
- 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?
- \$200,000.
 - \$450,000.
 - \$480,000.
 - \$600,000.
7. Sales mix is:
- (SO 3)
- important to sales managers but not to accountants.
 - easier to analyze on absorption costing income statements.
 - a measure of the relative percentage of a company's variable costs to its fixed costs.
 - a measure of the relative percentage in which a company's products are sold.
8. Net income will be:
- (SO 3)
- 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.
- (SO 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.
 (b) \$5.
 (c) \$4.
 (d) No correct answer is given.
- (SO 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.
- (SO 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:
 (a) that has the highest contribution margin.
 (b) that has the highest selling price.
 (c) that has the highest gross profit.
 (d) that has the highest contribution margin per unit of that limited resource.
- (SO 5) 12. The degree of operating leverage:
 (a) can be computed by dividing total contribution margin by net income.
 (b) provides a measure of the company's earnings volatility.
- (SO 5) 13. A high degree of operating leverage: (SO 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 \$500,000 and net income of \$200,000. If Stevens' sales fall by 10%, Stevens can be expected to experience a: (SO 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: (SO 6)
 (a) period costs under absorption costing.
 (b) product costs under absorption costing.
 (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: (SO 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,
 for Additional Self-Study Questions.



Questions

- What is meant by CVP analysis?
- Provide three examples of management decisions that benefit from CVP analysis.
- Distinguish between a traditional income statement and a CVP income statement.
- 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.
- The traditional income statement for Rice Company shows sales \$900,000, cost of goods sold \$500,000, and operating expenses \$200,000. Assuming all costs and expenses are 70% variable and 30% fixed, prepare a CVP income statement through contribution margin.
- If management chooses to reduce its selling price to match that of a competitor, how will the break-even point be affected?
- What is meant by the term sales mix? How does sales mix affect the calculation of the break-even point?
- Radial Company sells two types of radial tires. The lower-priced model is guaranteed for only 40,000 miles; the higher-priced model is guaranteed for 100,000 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.** Acorn Company has a degree of operating leverage of 8. Oak 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.** Flygt Corporation sells one product, its waterproof hiking boot. It began operations in the current year and had an ending inventory of 10,500 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



Determine missing amounts
for contribution margin.
(SO 1, 2)

Prepare CVP income
statement.
(SO 1, 2)

Compute the break-even point.
(SO 1, 2)

Compute the break-even point.
(SO 1, 2)

Compute sales for target net
income.
(SO 1, 2)

Compute the margin of safety
and the margin of safety ratio.
(SO 1, 2)

Compute weighted-average
unit contribution margin
based on sales mix.
(SO 3)

BE6-1 Determine the missing amounts.

	Unit Selling Price	Unit Variable Costs	Contribution Margin per Unit	Contribution Margin Ratio
1.	\$250	\$170	(a)	(b)
2.	\$500	(c)	\$200	(d)
3.	(e)	(f)	\$300	30%

BE6-2 Pesavento Manufacturing Inc. has sales of \$1,800,000 for the first quarter of 2011. In making the sales, the company incurred the following costs and expenses.

	Variable	Fixed
Cost of goods sold	\$760,000	\$540,000
Selling expenses	95,000	60,000
Administrative expenses	79,000	66,000

Prepare a CVP income statement for the quarter ended March 31, 2011.

BE6-3 Loder Corp. had total variable costs of \$170,000, total fixed costs of \$120,000, and total revenues of \$250,000. Compute the required sales in dollars to break even.

BE6-4 Hunt Company has a unit selling price of \$400, variable costs per unit of \$260, and fixed costs of \$210,000. Compute the break-even point in units using (a) the mathematical equation and (b) contribution margin per unit.

BE6-5 For Deines Company, variable costs are 70% 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.)

BE6-6 For Westerville Company actual sales are \$1,200,000 and break-even sales are \$900,000. Compute (a) the margin of safety in dollars and (b) the margin of safety ratio.

BE6-7 Bruno 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, 25%; and C124, 15%. What is the weighted-average unit contribution margin?

BE6-8 Information for Bruno Corporation is given in BE6-7. If the company has fixed costs of \$199,500, how many units of each model must the company sell in order to break even?

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

(SO 3)

BE6-9 Presto Candle Supply makes candles. The sales mix (as a percent 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.

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

(SO 3)

Candle Type	Contribution Margin Ratio
Birthday	10%
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?

Determine weighted-average contribution margin.

(SO 3)

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

	Bedroom Division	Dining Room Division	Total
Sales	\$500,000	\$750,000	\$1,250,000
Variable costs	250,000	450,000	700,000
Contribution margin	<u>\$250,000</u>	<u>\$300,000</u>	<u>\$ 550,000</u>

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

Show allocation of limited resources.

(SO 4)

BE6-11 In Larissa Company, data concerning two products are: Contribution margin per unit—Product A \$10, Product B \$12; machine hours required for one unit—Product A 2, Product B 3. Compute the contribution margin per unit of limited resource for each product.

Compute degree of operating leverage.

(SO 5)

BE6-12 John'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 \$160,000 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.

Compute degree of operating leverage.

(SO 5)

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

	Turgro Co.	Meriden Co.
Sales	\$150,000	\$150,000
Variable costs	60,000	15,000
Contribution margin	90,000	135,000
Fixed costs	50,000	95,000
Net income	<u>\$ 40,000</u>	<u>\$ 40,000</u>

Compute break-even point with change in operating leverage.

(SO 5)

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

BE6-14 The degree of operating leverage for Dousmann Corp. and PCB Co. are 1.4 and 5.6, respectively. Both have net incomes of \$50,000. Determine their respective contribution margins.

Determine contribution margin from degree of operating leverage.

(SO 5)

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

	Contribution Margin per Unit	Machine Hours Required for Production
Product 1	\$42	.14 hours
Product 2	\$36	.10 hours

Show allocation of limited resources.

(SO 4)

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

Compute product costs under variable costing.
(SO 6)

Compute product costs under absorption costing.
(SO 6)

Determine manufacturing cost per unit under absorption and variable costing.
(SO 6)

Compute net income under absorption and variable costing.
(SO 7)

Prepare CVP income statement and compute contribution margin.
(SO 1)

Compute the break-even point and margin of safety under different alternatives.
(SO 2)

***BE6-16** Large Orange Company produces basketballs. It incurred the following costs during the year.

Direct materials	\$14,490
Direct labor	\$25,530
Fixed manufacturing overhead	\$10,000
Variable manufacturing overhead	\$32,420
Selling costs	\$21,000

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

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

***BE6-18** Kozy Manufacturing incurred the following costs during the year: direct materials \$20 per unit; direct labor \$12 per unit; variable manufacturing overhead \$15 per unit; variable selling and administrative costs \$8 per unit; fixed manufacturing overhead \$120,000; and fixed selling and administrative costs \$10,000. Kozy produced 12,000 units and sold 10,000 units. Determine the manufacturing cost per unit under (a) absorption costing and (b) variable costing.

***BE6-19** Dugan Company's fixed overhead costs are \$3 per unit, and its variable overhead costs are \$8 per unit. In the first month of operations, 50,000 units are produced, and 47,000 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.

Do it! Review



Do it! 6-1 Naylor Manufacturing Inc. sold 8,000 units and recorded sales of \$400,000 for the first month of 2011. In making the sales, the company incurred the following costs and expenses.

	Variable	Fixed
Cost of goods sold	\$184,000	\$70,000
Selling expenses	40,000	30,000
Administrative expenses	16,000	40,000

- (a) Prepare a CVP income statement for the month ended January 31, 2011.
- (b) Compute the contribution margin per unit.
- (c) Compute the contribution margin ratio.

Do it! 6-2 Cottonwood Company reports the following operating results for the month of April.

COTTONWOOD COMPANY CVP Income Statement For the Month Ended April 30, 2011

	Total	Per Unit
Sales (9,000 units)	\$450,000	\$50.00
Variable costs	<u>247,500</u>	<u>27.50</u>
Contribution margin	202,500	\$22.50
Fixed expenses	<u>150,000</u>	
Net income	<u><u>\$ 52,500</u></u>	

Management is considering the following course of action to increase net income: Reduce 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 30%.

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.

Do it! 6-3 Glacial Springs produces and sells water filtration systems for homeowners. Information regarding its three models is shown below.

	Basic	Basic Plus	Premium	Total
Units sold	840	350	210	1,400
Selling price	\$250	\$400	\$800	
Variable cost	\$195	\$288	\$416	

The company's total fixed costs to produce the filtration systems are \$140,000.

- 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.

Do it! 6-4 Capital 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.

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

(SO 3)

Determine sales mix with limited resources.

(SO 4)

	Product		
	Good	Better	Best
Selling price	\$80.00	\$300.00	\$900.00
Variable costs and expenses	50.00	180.00	450.00
Contribution margin	\$30.00	\$120.00	\$450.00
Grinding and polishing time required	0.5 hrs	1.5 hrs	6 hrs

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

Exercises



E6-1 The San Marcos Inn is trying to determine its break-even point. The inn has 75 rooms that are rented at \$50 a night. Operating costs are as follows.

Compute break-even point and margin of safety.

(SO 2)



Salaries	\$8,500 per month
Utilities	2,000 per month
Depreciation	1,000 per month
Maintenance	500 per month
Maid service	5 per room
Other costs	33 per room

Instructions

- Determine the inn's break-even point in (1) number of rented rooms per month and (2) dollars.
- 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, Paula's Beauty Salon gave 3,500 haircuts, shampoos, and permanents at an average price of \$30. During the month, fixed costs were \$16,800 and variable costs were 80% of sales.

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

(SO 2)



Compute net income under different alternatives.

(SO 2)



Instructions

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

E6-3 Giesen Company reports the following operating results for the month of August: Sales \$300,000 (units 5,000); variable costs \$210,000; and fixed costs \$70,000.

Management is considering the following independent courses of action to increase net income.

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?

Compute break-even point and prepare CVP income statement.

(SO 2)



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

(SO 2)

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

(SO 3)

E6-4 Regional 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 Regional'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.

Fare revenues (300 fares)	\$45,000
Variable costs	
Fuel	\$14,000
Snacks and drinks	800
Landing fees	2,000
Supplies and forms	1,200
	<u>18,000</u>
Contribution margin	27,000
Fixed costs	
Depreciation	3,000
Salaries	15,000
Advertising	500
Airport hanger fees	1,750
	<u>20,250</u>
Net income	<u><u>\$ 6,750</u></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 35%. Should the fare decrease be adopted?

E6-5 Mozena Company had sales in 2011 of \$1,500,000 on 60,000 units. Variable costs totaled \$720,000, and fixed costs totaled \$400,000.

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 CVP income statement for 2011, (a) assuming the changes have not been made, and (b) assuming that changes are made as described.

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

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

Grass King has fixed costs of \$4,600,000.

Instructions

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

E6-7 Rapid Auto 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 65% of its sales and provide a contribution margin ratio of 20%. Brake repair represents 35% 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).

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

(SO 3)



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?

E6-8 Blazer 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 10% contribution margin). The other 20% of its revenue came from delivering non-standardized boxes (which provides a 60% contribution margin). With the rapid growth of Internet retail sales, Blazer believes that there are great opportunities for growth in the delivery of non-standardized boxes. The company has fixed costs of \$12,000,000.

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

(SO 3)



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?

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

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

(SO 3)

	Pairs of Shoes	Pairs of Gloves	Range-Finder
Unit sales price	\$100	\$30	\$250
Unit variable costs	60	10	200
Unit contribution margin	\$ 40	\$20	\$ 50
Sales mix	40%	50%	10%

Fixed costs are \$620,000.

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 Mega Electronix sells television sets and DVD players. The business is divided into two divisions along product lines. CVP income statements for a recent quarter's activity are presented below.

Determine break-even point in dollars for two divisions.

(SO 3)

	TV Division	DVD Division	Total
Sales	\$600,000	\$400,000	\$1,000,000
Variable costs	450,000	240,000	690,000
Contribution margin	\$150,000	\$160,000	310,000
Fixed costs			124,000
Net income			\$ 186,000

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.

Compute contribution margin and determine the product to be manufactured.
(SO 4)

Compute contribution margin and determine the products to be manufactured.
(SO 4)

Compute degree of operating leverage and evaluate impact of alternative cost structures on net income.
(SO 5)

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

	Product		
	A	B	C
Selling price	\$9	\$12	\$14
Variable costs and expenses	\$3	\$9.50	\$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 Hadicke Inc. produces and sells three products. Unit data concerning each product is shown below.

	Product		
	D	E	F
Selling price	\$200	\$300	\$250
Direct labor costs	25	75	30
Other variable costs	105	90	148

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 Lynn Company manufactures and sells two products. Relevant per unit data concerning each product follow.

	Product	
	Basic	Deluxe
Selling price	\$40	\$52
Variable costs	\$18	\$24
Machine hours	.5	.7

Instructions

- Compute the contribution margin per machine hour for each product.
- If 1,000 additional machine hours are available, which product should Dalton 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).

E6-14 The CVP income statements shown below are available for Grissom Company and Moran Company.

	Grissom Co.	Moran Co.
Sales revenue	\$600,000	\$600,000
Variable costs	280,000	80,000
Contribution margin	320,000	520,000
Fixed costs	170,000	370,000
Net income	<u><u>\$150,000</u></u>	<u><u>\$150,000</u></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.

E6-15 Imagen Arquitectonica of Tijuana, Mexico, is contemplating a major change in its cost structure. Currently, all of its drafting work is performed by skilled draftsmen. Alfredo Ayala, Imagen's owner, is considering replacing the draftsmen with a computerized drafting system. However, before making the change Alfredo 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.

	Manual System	Computerized System
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>60,000</u>	<u>660,000</u>
Net income	<u><u>\$ 240,000</u></u>	<u><u>\$ 240,000</u></u>

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

(SO 5)

**Instructions**

- Determine the degree of operating leverage for each alternative.
- Which alternative would produce the higher net income if sales increased by \$100,000?
- Using the margin of safety ratio, determine which alternative could sustain the greater decline in sales before operating at a loss.

E6-16 An investment banker is analyzing two companies that specialize in the production and sale of candied apples. Old-Fashion Apples uses a labor-intensive approach, and Mech-Apple uses a mechanized system. CVP income statements for the two companies are shown below.

	Old-Fashion Apples	Mech-Apple
Sales	\$400,000	\$400,000
Variable costs	<u>320,000</u>	<u>160,000</u>
Contribution margin	80,000	240,000
Fixed costs	<u>20,000</u>	<u>180,000</u>
Net income	<u><u>\$ 60,000</u></u>	<u><u>\$ 60,000</u></u>

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

(SO 5)

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 10% and if sales increase by 5%. Do not prepare income statements.
- Which company should the investment banker acquire? Discuss.

***E6-17** Matt's Company builds custom fishing lures for sporting goods stores. In its first year of operations, 2011, the company incurred the following costs.

Variable Cost per Unit

Direct materials	\$7.50
Direct labor	\$2.45
Variable manufacturing overhead	\$5.75
Variable selling and administrative expenses	\$3.90

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

(SO 6)

**Fixed Costs per Year**

Fixed manufacturing overhead	\$234,650
Fixed selling and administrative expenses	\$240,100

Matt's Company sells the fishing lures for \$25. During 2011, the company sold 80,000 lures and produced 95,000 lures.

Instructions

- Assuming the company uses variable costing, calculate Matt's manufacturing cost per unit for 2011.
- Prepare a variable costing income statement for 2011.
- Assuming the company uses absorption costing, calculate Matt's manufacturing cost per unit for 2011.
- Prepare an absorption costing income statement for 2011.

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

(SO 6, 7)

- ***E6-18** Ogilvie Company produced 10,000 units during the past year, but only 9,000 of the units were sold. The following additional information is also available.

Direct materials used	\$90,000
Direct labor incurred	\$30,000
Variable manufacturing overhead	\$24,000
Fixed manufacturing overhead	\$50,000
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 Ogilvie have any beginning finished goods inventory.

Instructions

- What would be Ogilvie 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?

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

(SO 6)

- ***E6-19** Hardwood Inc. produces wooden crates used for shipping products by ocean liner. In 2011, Hardwood incurred the following costs.

Wood used in crate production	\$54,000
Nails (considered insignificant and a variable expense)	\$ 340
Direct labor	\$37,000
Utilities for the plant:	
\$2,000 each month,	
plus \$0.45 for each kilowatt-hour used each month	
Rent expense for the plant for the year	\$21,400

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

Instructions

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

Exercises: Set B

Visit the book's companion website at www.wiley.com/college/weygandt, and choose the Student Companion site, to access Exercise Set B.

Problems: Set A

Compute break-even point under alternative courses of action.

(SO 1, 2)

- P6-1A** Giere Manufacturing had a bad year in 2011. 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 \$1,600,000; total costs and expenses \$1,740,000; and net loss \$140,000. Costs and expenses consisted of the following.

	Total	Variable	Fixed
Cost of goods sold	\$1,200,000	\$780,000	\$420,000
Selling expenses	420,000	75,000	345,000
Administrative expenses	120,000	45,000	75,000
	<u><u>\$1,740,000</u></u>	<u><u>\$900,000</u></u>	<u><u>\$840,000</u></u>



Management is considering the following independent alternatives for 2012.

1. Increase unit selling price 25% with no change in costs and expenses.
2. 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.
3. Purchase new high-tech factory machinery that will change the proportion between variable and fixed cost of goods sold to 50:50.

Instructions

- (a) Compute the break-even point in dollars for 2011.
- (b) 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) \$1,754,839

P6-2A Mills Corporation has collected the following information after its first year of sales. Net sales were \$1,600,000 on 100,000 units; selling expenses \$240,000 (40% variable and 60% fixed); direct materials \$511,000; direct labor \$285,000; administrative expenses \$280,000 (20% variable and 80% fixed); manufacturing overhead \$360,000 (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.

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

(SO 1, 2)

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 first year.
- (c) The company has a target net income of \$310,000. 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 \$104,000 and would change its manufacturing overhead costs to 30% variable and 70% fixed (assume total manufacturing overhead cost is \$360,000, 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 \$240,000, 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) 119,000 units

(e) (3) \$1,515,152

P6-3A Stiever 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. Stiever is currently operating at full capacity with limited machine time.

Determine sales mix with limited resources.

(SO 4)

Sales and production information relevant to each model follows.

	Product		
	Economy	Standard	Deluxe
Selling price	\$30	\$50	\$100
Variable costs and expenses	\$12	\$18	\$42
Machine hours required	.5	.8	1.6

Instructions

- (a) Ignoring the machine time constraint, which single product should Stiever 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 \$36

P6-4A The Creekside Inn is a restaurant in Tucson, Arizona. It specializes in southwestern style meals in a moderate price range. Will Feld, the manager of Creekside, 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.

(SO 2, 3)

	Percent of Total Sales	Contribution Margin Ratio
Appetizers	10%	60%
Main entrees	60%	30%
Desserts	10%	50%
Beverages	20%	80%



Will 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 \$150,000. The company has fixed costs of \$1,200,000 per year.

Instructions

- (a) Total sales \$3,000,000
 (b) Total sales \$3,750,000

- (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) Will 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 50%. At the same time, he is proposing to change the sales mix to the following.

	Percent of Total Sales	Contribution Margin Ratio
Appetizers	20%	60%
Main entrees	30%	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 Will 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.

(SO 5)

P6-5A The following CVP income statements are available for Old Company and New Company.

	Old Company	New Company
Sales	\$400,000	\$400,000
Variable costs	180,000	80,000
Contribution margin	220,000	320,000
Fixed costs	170,000	270,000
Net income	\$ 50,000	\$ 50,000

Instructions

- (a) BE, Old \$309,091
 BE, New \$337,500
 (b) DOL, Old 4.4
 DOL, New 6.4

- (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.

(SO 2, 5)

P6-6A Olin 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, 2011, is as follows.

OLIN BEAUTY CORPORATION		
Income Statement		
For the Year Ended December 31, 2011		
Sales		\$78,000,000
Cost of goods sold		
Variable	\$35,100,000	
Fixed	8,610,000	43,710,000
Gross margin		\$34,290,000
Selling and marketing expenses		
Commissions	\$14,040,000	
Fixed costs	10,260,000	24,300,000
Operating income		\$ 9,990,000

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 \$7.8 million.

Instructions

- (a) Under the current policy of using a network of sales agents, calculate the Olin Beauty Corporation's break-even point in sales dollars for the year 2011. **(a) \$51,000**
- (b) Calculate the company's break-even point in sales dollars for the year 2011 if it hires its own sales force to replace the network of agents.
- (c) Calculate the degree of operating leverage at sales of \$78 million if (1) Olin Beauty uses sales agents, and (2) Olin Beauty employs its own sales staff. Describe the advantages and disadvantages of each alternative. **(c) (2) 3.67**
- (d) Calculate the estimated sales volume in sales dollars that would generate an identical net income for the year ending December 31, 2011, regardless of whether Olin 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)

***P6-7A** Marotta Company produces plastic that is used for injection-molding applications such as gears for small motors. In 2010, the first year of operations, Marotta produced 4,000 tons of plastic and sold 3,000 tons. In 2011, 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 \$2,400,000, and fixed administrative expenses were \$600,000.

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

(SO 6, 7)

Instructions

- (a) Prepare income statements for each year using variable costing. (Use the format from Illustration 6A-5.) **(a) 2011 \$3,000,000**
- (b) Prepare income statements for each year using absorption costing. (Use the format from Illustration 6A-4.) **(b) 2011 \$2,400,000**
- (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** Basic Electric Motors is a division of Basic Electric Products Corporation. The division manufactures and sells an electric motor used in a wide variety of applications. During the coming year it expects to sell 50,000 units for \$30 per unit. Kerry Tharp is the division manager. She is considering producing either 50,000 or 80,000 units during the period. Other information is presented in the schedule.

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.

(SO 6, 7, 8)

Division Information for 2011

Beginning inventory	0
Expected sales in units	50,000
Selling price per unit	\$30
Variable manufacturing costs per unit	\$12
Fixed manufacturing overhead costs (total)	\$400,000
Fixed manufacturing overhead costs per unit:	
Based on 50,000 units	\$8 per unit (\$400,000 ÷ 50,000)
Based on 80,000 units	\$5 per unit (\$400,000 ÷ 80,000)
Manufacturing cost per unit:	
Based on 50,000 units	\$20 per unit (\$12 variable + \$8 fixed)
Based on 80,000 units	\$17 per unit (\$12 variable + \$5 fixed)
Variable selling and administrative expenses	\$2
Fixed selling and administrative expenses (total)	\$40,000

Instructions

- (a) Prepare an absorption costing income statement, with one column showing the results if 50,000 units are produced and one column showing the results if 80,000 units are produced. **(a) 80,000 units: NI \$510,000**
- (b) Prepare a variable costing income statement, with one column showing the results if 50,000 units are produced and one column showing the results if 80,000 units are produced. **(b) 80,000 units: NI \$360,000**
- (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 B

Compute break-even point under alternative courses of action.
(SO 1, 2)

P6-1B Guillen Manufacturing had a bad year in 2011, 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 \$2,000,000; total costs and expenses \$2,120,000; and net loss \$120,000. Costs and expenses consisted of the following.

	Total	Variable	Fixed
Cost of goods sold	\$1,295,000	\$ 975,000	\$320,000
Selling expenses	575,000	325,000	250,000
Administrative expenses	250,000	100,000	150,000
	<u>\$2,120,000</u>	<u>\$1,400,000</u>	<u>\$720,000</u>

Management is considering the following independent alternatives for 2012.

1. Increase unit selling price 30% 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

(b) (2) \$2,500,000

- (a) Compute the break-even point in dollars for 2011.
- (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.

Compute break-even point and margin of safety ratio, and prepare a CVP income statement before and after changes in business environment.
(SO 1, 2)

P6-2B Donkey Corporation has collected the following information after its first year of sales. Net sales were \$1,000,000 on 50,000 units; selling expenses \$200,000 (30% variable and 70% fixed); direct materials \$300,000; direct labor \$170,000; 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

(b) 73,055 units

(e) (3) \$1,263,930

- (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 \$187,000. 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 \$70,000 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.

Determine sales mix with limited resources.
(SO 4)

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

Sales and production information relevant to each model is shown on the next page.

	Product		
	Economy	Standard	Deluxe
Selling price	\$270	\$450	\$650
Variable costs and expenses	\$150	\$261	\$425
Machine hours required	.6	.9	1.2

Instructions

- (a) Ignoring the machine time constraint, which single product should Riser 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?

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

	Percent of Total Sales	Contribution Margin Ratio
Appetizers	15%	60%
Main entrees	60%	25%
Desserts	10%	60%
Beverages	15%	80%

Josh 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 \$120,000. The company has fixed costs of \$300,000 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) Josh 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 40%. At the same time, he is proposing to change the sales mix to the following.

	Percent of Total Sales	Contribution Margin Ratio
Appetizers	25%	60%
Main entrees	40%	10%
Desserts	10%	60%
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 Josh 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.

P6-5B The following variable costing income statements are available for Yesterday Company and Tomorrow Company.

	Yesterday Company	Tomorrow Company
Sales	\$1,000,000	\$1,000,000
Variable costs	500,000	150,000
Contribution margin	500,000	850,000
Fixed costs	300,000	650,000
Net income	\$ 200,000	\$ 200,000

Instructions

- (a) Compute the break-even point in dollars and the margin of safety ratio for each company.

(b) Economy \$200

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

(SO 4)



(a) Total sales, \$1,000,000

(b) Total sales, \$1,200,000

(c) Total sales, \$1,636,364

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

(SO 4, 5)

(a) BE Yesterday \$600,000
 BE Tomorrow \$764,706

(b) DOL, Yesterday 2.50
DOL, Tomorrow 4.25

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

(SO 2, 5)

- (b) Compute the degree of operating leverage for each company and interpret your results.
- (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.

P6-6B Apple Beauty Corporation manufactures cosmetic products that are sold through a network of sales agents. The agents are paid a commission of 15% of sales. The income statement for the year ending December 31, 2011, is as follows.

APPLE BEAUTY CORPORATION
Income Statement
For the Year Ended December 31, 2011

Sales	\$117,000,000
Cost of goods sold	
Variable	\$52,650,000
Fixed	<u>12,915,000</u>
	65,565,000
Gross margin	51,435,000
Selling and marketing expenses	
Commissions	\$17,550,000
Fixed costs	<u>12,825,000</u>
	30,375,000
Operating income	<u>\$ 21,060,000</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 \$11.7 million.

Instructions

(a) \$64,350

(c) (2) 3.46

- (a) Under the current policy of using a network of sales agents, calculate the Apple Beauty Corporation's break-even point in sales dollars for the year 2011.
- (b) Calculate the company's break-even point in sales dollars for the year 2011 if it hires its own sales force to replace the network of agents.
- (c) Calculate the degree of operating leverage at sales of \$78 million if (1) Apple Beauty uses sales agents, and (2) Apple 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, 2011, regardless of whether Apple Beauty Corporation employs its own sales staff and pays them a 10% commission as well as incurring additional fixed costs of \$11.7 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.

(SO 6, 7, 8)

(a) 2011 Net income

\$120,000

(b) 2011 Net income

\$180,000

***P6-7B** LUX produces fabrics that are used for clothing and other applications. In 2011, the first year of operations, LUX produced 500,000 yards of fabric and sold 400,000 yards. In 2012, the production and sales results were exactly reversed. In each year, selling price per yard was \$2, variable manufacturing costs were 25% of the sales price of units produced, variable selling expenses were 10% of the selling price of units sold, fixed manufacturing costs were \$300,000, 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.

P6-8B Electricswitch is a division of Birmingham Products Corporation. The division manufactures and sells an electric switch used in a wide variety of applications. During the coming year it expects to sell 200,000 units for \$8 per unit. Jeff Lynne 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.

<u>Division Information for 2011</u>	
Beginning inventory	0
Expected sales in units	200,000
Selling price per unit	\$8
Variable manufacturing cost per unit	\$3
Fixed manufacturing overhead cost (total)	\$480,000
Fixed manufacturing overhead costs per unit:	
Based on 200,000 units	\$2.40 per unit (\$480,000 ÷ 200,000)
Based on 250,000 units	\$1.92 per unit (\$480,000 ÷ 250,000)
Manufacturing cost per unit:	
Based on 200,000 units	\$5.40 per unit (\$3 variable + \$2.40 fixed)
Based on 250,000 units	\$4.92 per unit (\$3 variable + \$1.92 fixed)
Variable selling and administrative expense	\$0.50
Fixed selling and administrative expense (total)	\$12,000

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.

(SO 6, 7, 8)

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.
- (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.
- (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.

(a) 250,000 produced
NI, \$504,000

(b) 250,000 produced
NI, \$408,000

Problems: Set C



Visit the book's companion website at 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 through 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,
to find the remainder of this problem.

broadening your perspective



Decision Making Across the Organization

BYP6-1 ComfortCraft manufactures swivel seats for customized vans. It currently manufactures 10,000 seats per year, which it sells for \$480 per seat. It incurs variable costs of \$180 per seat and fixed costs of \$2,200,000. It is considering automating the upholstery process, which is now largely manual. It estimates that if it does so, its fixed costs will be \$3,200,000, and its variable costs will decline to \$80 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

BYP6-2 For nearly 20 years Custom 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 Custom 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 Custom 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 Custom 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.

	Current Approach	Automated Approach
Sales	\$2,000,000	\$2,000,000
Variable costs	<u>1,200,000</u>	<u>400,000</u>
Contribution margin	800,000	1,600,000
Fixed costs	<u>200,000</u>	<u>600,000</u>
Net income	<u><u>\$ 600,000</u></u>	<u><u>\$1,000,000</u></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.
- Using the current level of sales, compute the margin of safety ratio under each approach and interpret your findings.
- 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?
- At what level of sales would the company's net income be the same under either approach?
- Discuss the issues that the company must consider in making this decision.

Real-World Focus

BYP6-3 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 on the next page.

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

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.

Exploring the Web

BYP6-4 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, or go to 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?

Communication Activity

BYP6-5 Westfield 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. Ralph Sampson, 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 Ralph Sampson describing the analysis that the company should do before it makes this decision and any other considerations that would affect the decision.

Ethics Case

***BYP6-6** Scott Bestor was hired during January 2011 to manage the home products division of Advanced Techno. 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, Scott 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. Scott 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 Scott came on board there was virtually no beginning inventory. The selling price and variable cost per unit remained the same from 2010 to 2011. Additional information is provided below.

	2010	2011
Net income	\$ 400,000	\$ 600,000
Units produced	20,000	25,000
Units sold	20,000	20,000
Fixed manufacturing overhead costs	\$1,000,000	\$1,000,000
Fixed manufacturing overhead costs per unit	\$ 50	\$ 40

Instructions

- Calculate Scott's bonus based upon the net income shown above.
- Recompute the 2010 and 2011 results using variable costing.
- Recompute Scott's 2011 bonus under variable costing.
- Were Scott's actions unethical? Do you think any actions need to be taken by the company?

“All About You” Activity



BYP6-7 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) 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 \$2,000 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 \$10,000 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.

Answers to *Insight and Accounting Across the Organization* Questions

Don’t Just Look—Buy Something, p. 248

- 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.

Healthy for You, and Great for the Bottom Line, p. 253

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.

Something Smells, p. 255

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 the following: 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.

The Cost of Experience, p. 259

Q: As a result of being in business for a long time, the established airline giants also must pay very large retirement payments, a cost the newer airlines do not face. What impact do these payments have on the break-even equation?

A: The ongoing costs of retirement and health-care packages for retired employees represent a type of fixed cost. These so-called "legacy" costs can dramatically change the break-even equation. To cover these costs an old-line airline must fly many more passengers than a newer airline.

Authors' Comments on All About You:

Big Decisions for Your Energy Future, p. 260



If reduction of greenhouse gas emissions is a goal, then one step toward attainment of that goal is to assign a cost to greenhouse-gas emissions. One approach that is currently being used is the buying and selling of carbon-emission rights. As companies buy and sell emission rights, the price of polluting becomes a tangible factor in the formulations that will be used to make future energy-source decisions. This approach has been effective in addressing similar issues, such as the reduction of sulfur emissions.

However, as suggested in the "No" response, many believe that, to be effective and fair, an enforceable international agreement on such an approach would be necessary. In the United States, companies currently participate on a voluntary basis; in some other countries, participation is required.

Another factor to consider in these decisions is the timing of conversion to new technology. A gradual conversion to new technologies as existing power plants reach the end of their productive lives would be far less costly than a rapid conversion to new technologies that required scrapping existing plants before they are fully depreciated. Decisions about which plants to replace and when to replace them will require careful cost-benefit analyses.

Answers to Self-Study Questions

1. d 2. d 3. a 4. a 5. b 6. d 7. d 8. a 9. b 10. d 11. d 12. d 13. c 14. a
*15. b *16. c



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