Cost-Volume-Profit

Feature Story

Don’t Worry—Just Get Big

It wasn’t that Jeff Bezos didn’t have a good job. He was a vice president at a Wall Street firm. But, he quit his job, moved to Seattle, and started an online retailer, which he named Amazon.com. Like any good entrepreneur, Jeff strove to keep his initial investment small. Operations were run out of his garage. And, to avoid the need for a warehouse, he took orders for books and had them shipped from other distributors’ warehouses. One board member recalls how excited the board was whenever an order came in from a customer in a state that Amazon had never serviced before.

By its fourth month, Amazon was selling 100 books a day. In its first full year, it had $15.7 million in sales. The next year, sales increased eightfold. Two years later, sales were $1.6 billion. Although its sales growth was impressive, Amazon’s ability to lose money was equally amazing. One analyst nicknamed it Amazon.bomb, while another, predicting its demise, called it Amazon.toast. Why was it losing money? The company used every available dollar to reinvest in itself. It built massive warehouses and bought increasingly sophisticated (and expensive) computer systems to improve its distribution system. This desire to grow as fast as possible was...
captured in a T-shirt slogan at its company picnic, which read “Eat another hot dog, get big fast.” This buying binge was increasing the company’s fixed costs at a rate that exceeded its sales growth. Skeptics were predicting that Amazon would soon run out of cash. It didn’t.

In the fourth quarter of 2010 (only 15 years after its world headquarters were located in a garage), Amazon reported quarterly revenues of $12.95 billion and quarterly income of $416 million. But, even as it announced record profits, its share price fell by 9%. Why? Because although the company was predicting that its sales revenue in the next quarter would increase by at least 28%, it predicted that its operating profit would fall by at least 2% and perhaps by as much as 34%.

The company made no apologies. It explained that it was in the process of expanding from 39 distribution centers to 52. As Amazon’s finance chief noted, “You’re not as productive on those assets for some time. I’m very pleased with the investments we’re making and we’ve shown over our history that we’ve been able to make great returns on the capital we invest in.” In other words, eat another hot dog.

Watch the Southwest Airlines video in WileyPLUS to learn more about cost-volume-profit analysis in the real world.


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**Preview of Chapter 5**

As the Feature Story indicates, to manage any size business you must understand how costs respond to changes in sales volume and the effect of costs and revenues on profits. A prerequisite to understanding cost-volume-profit (CVP) relationships is knowledge of how costs behave. In this chapter, we first explain the considerations involved in cost behavior analysis. Then, we discuss and illustrate CVP analysis.

The content and organization of Chapter 5 are as follows.
Cost behavior analysis is the study of how specific costs respond to changes in the level of business activity. As you might expect, some costs change, and others remain the same. For example, for an airline company such as Southwest or United, the longer the flight, the higher the fuel costs. On the other hand, Massachusetts General Hospital’s costs to staff the emergency room on any given night are relatively constant regardless of the number of patients treated. A knowledge of cost behavior helps management plan operations and decide between alternative courses of action. Cost behavior analysis applies to all types of entities.

The starting point in cost behavior analysis is measuring the key business activities. Activity levels may be expressed in terms of sales dollars (in a retail company), miles driven (in a trucking company), room occupancy (in a hotel), or dance classes taught (by a dance studio). Many companies use more than one measurement base. A manufacturer, for example, may use direct labor hours or units of output for manufacturing costs, and sales revenue or units sold for selling expenses.

For an activity level to be useful in cost behavior analysis, changes in the level or volume of activity should be correlated with changes in costs. The activity level selected is referred to as the activity (or volume) index. The activity index identifies the activity that causes changes in the behavior of costs. With an appropriate activity index, companies can classify the behavior of costs in response to changes in activity levels into three categories: variable, fixed, or mixed.

### Variable Costs

Variable costs are costs that vary in total directly and proportionately with changes in the activity level. If the level increases 10%, total variable costs will increase 10%. If the level of activity decreases by 25%, variable costs will decrease 25%. Examples of variable costs include direct materials and direct labor for a manufacturer; cost of goods sold, sales commissions, and freight-out for a merchandiser; and gasoline in airline and trucking companies. A variable cost may also be defined as a cost that remains the same per unit at every level of activity.

To illustrate the behavior of a variable cost, assume that Damon Company manufactures tablet computers that contain a $10 camera. The activity index is the number of tablet computers produced. As Damon manufactures each tablet, the total cost of cameras used increases by $10. As part (a) of Illustration 5-1

### Illustration 5-1

Behavior of total and unit variable costs

<table>
<thead>
<tr>
<th>Tablet Computers Produced (in 000)</th>
<th>Total Variable Costs (Cameras)</th>
<th>Variable Costs per Unit (Cameras)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>$10</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>$10</td>
</tr>
<tr>
<td>6</td>
<td>60</td>
<td>$10</td>
</tr>
<tr>
<td>8</td>
<td>80</td>
<td>$10</td>
</tr>
<tr>
<td>10</td>
<td>100</td>
<td>$10</td>
</tr>
</tbody>
</table>

**Helpful Hint**

True or false: Variable costs per unit change directly and proportionately with changes in activity. Answer: False. Per unit costs remain constant at all levels of activity.
shows, total cost of the cameras will be $20,000 if Damon produces 2,000 tablets, and $100,000 when it produces 10,000 tablets. We also can see that a variable cost remains the same per unit as the level of activity changes. As part (b) of Illustration 5-1 shows, the unit cost of $10 for the cameras is the same whether Damon produces 2,000 or 10,000 tablets.

Companies that rely heavily on labor to manufacture a product, such as Nike or Reebok, or to provide a service, such as Hilton or Marriott, are likely to have many variable costs. In contrast, companies that use a high proportion of machinery and equipment in producing revenue, such as AT&T or Duke Energy Co., may have few variable costs.

## Fixed Costs

**Fixed costs** are costs that remain the same in total regardless of changes in the activity level. Examples include property taxes, insurance, rent, supervisory salaries, and depreciation on buildings and equipment. Because total fixed costs remain constant as activity changes, it follows that **fixed costs per unit vary inversely with activity: As volume increases, unit cost declines, and vice versa.**

To illustrate the behavior of fixed costs, assume that Damon Company leases its productive facilities at a cost of $10,000 per month. Total fixed costs of the facilities will remain constant at every level of activity, as part (a) of Illustration 5-2 shows. But, **on a per unit basis, the cost of rent will decline as activity increases**, as part (b) of Illustration 5-2 shows. At 2,000 units, the unit cost per tablet computer is $5 ($10,000 ÷ 2,000). When Damon produces 10,000 tablets, the unit cost of the rent is only $1 per tablet ($10,000 ÷ 10,000).

![Illustration 5-2](image)

The trend for many manufacturers is to have more fixed costs and fewer variable costs. This trend is the result of increased use of automation and less use of employee labor. As a result, depreciation and lease charges (fixed costs) increase, whereas direct labor costs (variable costs) decrease.
What are some of the variable and fixed costs that are impacted by hydroponic farming?

(See page 234.)

Gardens in the Sky

Because of population increases, the United Nations’ Food and Agriculture Organization estimates that food production will need to increase by 70% by 2050. Also, by 2050, roughly 70% of people will live in cities, which means more food needs to be hauled further to get it to the consumer. To address the lack of farmable land and reduce the cost of transporting produce, some have suggested building “vertical farming” skyscrapers in cities. This sounds great, but do the numbers work? Some variable costs would be reduced. For example, the use of pesticides, herbicides, fuel costs for shipping, and water would all drop. Soil erosion would be a non-issue since plants would be grown hydroponically (in a solution of water and minerals), and land requirements would be reduced because of vertical structures. But, other costs would be higher. First, there is the cost of the building. Also, any multistory building would require artificial lighting for plants on lower floors.

Until these cost challenges can be overcome, it appears that these skyscrapers will not break even. On the other hand, rooftop greenhouses on existing city structures already appear financially viable. For example, a 15,000 square-foot rooftop greenhouse in Brooklyn already produces roughly 30 tons of vegetables per year for local residents.

Source: “Vertical Farming: Does It Really Stack Up?” The Economist (December 9, 2010).

Relevant Range

In Illustration 5-1 part (a) (page 198), a straight line is drawn throughout the entire range of the activity index for total variable costs. In essence, the assumption is that the costs are linear. If a relationship is linear (that is, straight-line), then changes in the activity index will result in a direct, proportional change in the variable cost. For example, if the activity level doubles, the cost doubles.

It is now necessary to ask: Is the straight-line relationship realistic? Does the linear assumption produce useful data for CVP analysis?

In most business situations, a straight-line relationship does not exist for variable costs throughout the entire range of possible activity. At abnormally low levels of activity, it may be impossible to be cost-efficient. Small-scale operations may not allow the company to obtain quantity discounts for raw materials or to use specialized labor. In contrast, at abnormally high levels of activity, labor costs may increase sharply because of overtime pay. Also, at high activity levels, materials costs may jump significantly because of excess spoilage caused by worker fatigue.

As a result, in the real world, the relationship between the behavior of a variable cost and changes in the activity level is often curvilinear, as shown in part (a) of Illustration 5-3. In the curved sections of the line, a change in the activity index will not result in a direct, proportional change in the variable cost. That is, a doubling of the activity index will not result in an exact doubling of the variable cost. The variable cost may more than double, or it may be less than double.

Total fixed costs also do not have a straight-line relationship over the entire range of activity. Some fixed costs will not change. But it is possible for management to change other fixed costs. For example, in some instances, salaried employees (fixed) are replaced with freelance workers (variable). Illustration 5-3, part (b), shows an example of the behavior of total fixed costs through all potential levels of activity.

Helpful Hint

Fixed costs that may be changeable include research, such as new product development, and management training programs.
For most companies, operating at almost zero or at 100% capacity is the exception rather than the rule. Instead, companies often operate over a somewhat narrower range, such as 40–80% of capacity. The range over which a company expects to operate during a year is called the relevant range of the activity index. Within the relevant range, as both diagrams in Illustration 5-4 show, a straight-line relationship generally exists for both variable and fixed costs.

As you can see, although the linear (straight-line) relationship may not be completely realistic, the linear assumption produces useful data for CVP analysis as long as the level of activity remains within the relevant range.

Mixed Costs

Mixed costs are costs that contain both a variable element and a fixed element. Mixed costs, therefore, change in total but not proportionately with changes in the activity level.

The rental of a U-Haul truck is a good example of a mixed cost. Assume that local rental terms for a 17-foot truck, including insurance, are $50 per day plus 50 cents per mile. When determining the cost of a one-day rental, the per day charge is a fixed cost (with respect to miles driven), whereas the mileage charge is a variable cost. The graphic presentation of the rental cost for a one-day rental is as follows.
In this case, the fixed-cost element is the cost of having the service available. The variable-cost element is the cost of actually using the service. Another example of a mixed cost is utility costs (electric, telephone, and so on), where there is a flat service fee plus a usage charge.

For purposes of CVP analysis, **mixed costs must be classified into their fixed and variable elements**. How does management make the classification? One possibility is to determine the variable and fixed components each time a mixed cost is incurred. But because of time and cost constraints, this approach is rarely followed. Instead, the usual approach is to collect data on the behavior of the mixed costs at various levels of activity. Analysts then identify the fixed- and variable-cost components. Companies use various types of analysis. One type of analysis, called the **high-low method**, is discussed next. Other methods, such as the scatter diagram method and least squares regression analysis, are more appropriately explained in cost accounting courses.

### Types of Costs

**Action Plan**

- ✔ Recall that a variable cost varies in total directly and proportionately with each change in activity level.
- ✔ Recall that a fixed cost remains the same in total with each change in activity level.
- ✔ Recall that a mixed cost changes in total but not proportionately with each change in activity level.

Helena Company reports the following total costs at two levels of production.

<table>
<thead>
<tr>
<th></th>
<th>10,000 Units</th>
<th>20,000 Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials</td>
<td>$20,000</td>
<td>$40,000</td>
</tr>
<tr>
<td>Maintenance</td>
<td>8,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Direct labor</td>
<td>17,000</td>
<td>34,000</td>
</tr>
<tr>
<td>Indirect materials</td>
<td>1,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Depreciation</td>
<td>4,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Utilities</td>
<td>3,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Rent</td>
<td>6,000</td>
<td>6,000</td>
</tr>
</tbody>
</table>

Classify each cost as variable, fixed, or mixed.

### Solution

- Direct materials, direct labor, and indirect materials are variable costs.
- Depreciation and rent are fixed costs.
- Maintenance and utilities are mixed costs.

Related exercise material: **BE5-1, BE5-2, E5-1, E5-2, E5-4, and DO IT 5-1.**
HIGH-LOW METHOD

The high-low method uses the total costs incurred at the high and low levels of activity to classify mixed costs into fixed and variable components. The difference in costs between the high and low levels represents variable costs, since only the variable-cost element can change as activity levels change.

The steps in computing fixed and variable costs under this method are as follows.

1. **Determine variable cost per unit from the following formula.**

   \[
   \text{Variable Cost per Unit} = \frac{\text{Change in Total Costs}}{\text{High minus Low Activity Level}}
   \]

   To illustrate, assume that Metro Transit Company has the following maintenance costs and mileage data for its fleet of buses over a 6-month period.

<table>
<thead>
<tr>
<th>Month</th>
<th>Miles Driven</th>
<th>Total Cost</th>
<th>Month</th>
<th>Miles Driven</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>20,000</td>
<td>$30,000</td>
<td>April</td>
<td>50,000</td>
<td>$63,000</td>
</tr>
<tr>
<td>February</td>
<td>40,000</td>
<td>48,000</td>
<td>May</td>
<td>30,000</td>
<td>42,000</td>
</tr>
<tr>
<td>March</td>
<td>35,000</td>
<td>49,000</td>
<td>June</td>
<td>43,000</td>
<td>61,000</td>
</tr>
</tbody>
</table>

   The high and low levels of activity are 50,000 miles in April and 20,000 miles in January. The maintenance costs at these two levels are $63,000 and $30,000, respectively. The difference in maintenance costs is $33,000 ($63,000 − $30,000), and the difference in miles is 30,000 (50,000 − 20,000). Therefore, for Metro Transit, variable cost per unit is $1.10, computed as follows.

   \[
   \frac{33,000}{30,000} = 1.10
   \]

2. **Determine the fixed costs by subtracting the total variable costs at either the high or the low activity level from the total cost at that activity level.**

   For Metro Transit, the computations are shown in Illustration 5-8.

<table>
<thead>
<tr>
<th>Activity Level</th>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cost</td>
<td>$63,000</td>
<td>$30,000</td>
</tr>
<tr>
<td>Less: Variable costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50,000 × $1.10</td>
<td>55,000</td>
<td></td>
</tr>
<tr>
<td>20,000 × $1.10</td>
<td>22,000</td>
<td></td>
</tr>
<tr>
<td>Total fixed costs</td>
<td><strong>$ 8,000</strong></td>
<td><strong>$ 8,000</strong></td>
</tr>
</tbody>
</table>
Maintenance costs are therefore $8,000 per month of fixed costs plus $1.10 per mile of variable costs. This is represented by the following formula:

\[ \text{Maintenance costs} = 8,000 + (1.10 \times \text{Miles driven}) \]

For example, at 45,000 miles, estimated maintenance costs would be $8,000 fixed and $49,500 variable ($1.10 \times 45,000) for a total of $57,500.

The graph in Illustration 5-9 plots the 6-month data for Metro Transit Company. The red line drawn in the graph connects the high and low data points, and therefore represents the equation that we just solved using the high-low method. The red, “high-low” line intersects the y-axis at $8,000 (the fixed-cost level), and it rises by $1.10 per unit (the variable cost per unit). Note that a completely different line would result if we chose any two of the other data points. That is, by choosing any two other data points, we would end up with a different estimate of fixed costs and a different variable cost per unit. Thus, from this scatter plot, we can see that while the high-low method is simple, the result is rather arbitrary. A better approach, which uses information from all the data points to estimate fixed and variable costs, is called regression analysis. A discussion of regression analysis is provided in a supplement on the book’s companion website.

Illustration 5-9
Scatter plot for Metro Transit Company

MANAGEMENT INSIGHT

Skilled Labor Is Truly Essential

The recession that started in 2008 had devastating implications for employment. But one surprise was that for some manufacturers, the number of jobs lost was actually lower than in previous recessions. One of the main explanations for this was that between 2000 and 2008, many factories adopted lean manufacturing practices. This meant that production relied less on large numbers of low-skilled workers, and more on machines and a few highly skilled workers. As a result of this approach, a single employee was supporting far more dollars in sales. Thus, it would require a larger decline in sales before an employee would need to be laid-off in order to continue to break even. Also, because the employees are highly skilled, employers are reluctant to lose them. Instead of lay-offs, many manufacturers have resorted to cutting employees hours.


Would you characterize labor costs as being a fixed cost, a variable cost, or something else in this situation? (See page 234.)
Importance of Identifying Variable and Fixed Costs

Why is it important to segregate costs into variable and fixed elements? The answer may become apparent if we look at the following four business decisions.

1. If American Airlines is to make a profit when it reduces all domestic fares by 30%, what reduction in costs or increase in passengers will be required?
   **Answer:** To make a profit when it cuts domestic fares by 30%, American Airlines will have to increase the number of passengers or cut its variable costs for those flights. Its fixed costs will not change.

2. If Ford Motor Company meets workers’ demands for higher wages, what increase in sales revenue will be needed to maintain current profit levels?
   **Answer:** Higher wages at Ford Motor Company will increase the variable costs of manufacturing automobiles. To maintain present profit levels, Ford will have to cut other variable costs or increase the price of its automobiles.

3. If United States Steel Corp.’s program to modernize plant facilities through significant equipment purchases reduces the work force by 50%, what will be the effect on the cost of producing one ton of steel?
   **Answer:** The modernizing of plant facilities at United States Steel Corp. changes the proportion of fixed and variable costs of producing one ton of steel. Fixed costs increase because of higher depreciation charges, whereas variable costs decrease due to the reduction in the number of steelworkers.

4. What happens if Kellogg’s increases its advertising expenses but cannot increase prices because of competitive pressure?
   **Answer:** Sales volume must be increased to cover the increase in fixed advertising costs.

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**DO IT!**

**High-Low Method**

Byrnes Company accumulates the following data concerning a mixed cost, using units produced as the activity level.

<table>
<thead>
<tr>
<th>Units Produced</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>9,800</td>
</tr>
<tr>
<td>April</td>
<td>8,500</td>
</tr>
<tr>
<td>May</td>
<td>7,000</td>
</tr>
<tr>
<td>June</td>
<td>7,600</td>
</tr>
<tr>
<td>July</td>
<td>8,100</td>
</tr>
</tbody>
</table>

**Action Plan**

- ✔ Determine the highest and lowest levels of activity.
- ✔ Compute variable cost per unit as: Change in total costs ÷ (High – low activity level) = Variable cost per unit.
- ✔ Compute fixed cost as: Total cost – (Variable cost per unit × Units produced) = Fixed cost.

(a) Compute the variable- and fixed-cost elements using the high-low method.
(b) Estimate the total cost if the company produces 6,000 units.

**Solution**

(a) Variable cost: ($14,740 − $11,100) ÷ (9,800 − 7,000) = $1.30 per unit
   Fixed cost: $14,740 − $12,740 ($1.30 × 9,800 units) = $2,000
   or $11,100 − $9,100 ($1.30 × 7,000) = $2,000

(b) Total cost to produce 6,000 units: $2,000 + $7,800 ($1.30 × 6,000) = $9,800

Related exercise material: BE5-3, BE5-4, BE5-5, E5-3, E5-5, E5-6, and DO IT! 5-2.
Cost-volume-profit (CVP) analysis is the study of the effects of changes in costs and volume on a company’s profits. CVP analysis is important in profit planning. It also is a critical factor in such management decisions as setting selling prices, determining product mix, and maximizing use of production facilities.

### Basic Components

CVP analysis considers the interrelationships among the components shown in Illustration 5-10.

<table>
<thead>
<tr>
<th>Volume or level of activity</th>
<th>Unit selling prices</th>
<th>Variable costs per unit</th>
<th>Total fixed costs</th>
<th>Sales mix</th>
</tr>
</thead>
</table>

The following assumptions underlie each CVP analysis.

1. The behavior of both costs and revenues is linear throughout the relevant range of the activity index.
2. Costs can be classified accurately as either variable or fixed.
3. Changes in activity are the only factors that affect costs.
4. All units produced are sold.
5. When more than one type of product is sold, the sales mix will remain constant. That is, the percentage that each product represents of total sales will stay the same. Sales mix complicates CVP analysis because different products will have different cost relationships. In this chapter, we assume a single product. (In Chapter 6, we relax this assumption.)

When these assumptions are not valid, the CVP analysis may be inaccurate.

### CVP Income Statement

Because CVP is so important for decision-making, management often wants this information reported in a cost-volume-profit (CVP) income statement format for internal use. The CVP income statement classifies costs as variable or fixed and computes a contribution margin. Contribution margin (CM) 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.

We will use Vargo Video Company to illustrate a CVP income statement. Vargo Video produces a high-definition digital camcorder with 15× optical zoom and a wide-screen, high-resolution LCD monitor. Relevant data for the camcorders sold by this company in June 2014 are as follows.

<table>
<thead>
<tr>
<th>Assumed selling and cost data for Vargo Video</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit selling price of camcorder $500</td>
</tr>
<tr>
<td>Unit variable costs $300</td>
</tr>
<tr>
<td>Total monthly fixed costs $200,000</td>
</tr>
<tr>
<td>Units sold 1,600</td>
</tr>
</tbody>
</table>

The CVP income statement for Vargo Video therefore would be reported as follows.
A traditional income statement and a CVP income statement both report the same net income of $120,000. However, a traditional income statement does not classify costs as variable or fixed, and therefore it does not report a contribution margin. In addition, sometimes per unit amounts and percentage of sales amounts are shown on a CVP income statement to facilitate CVP analysis. Homework assignments specify which columns to present.

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.

**CONTRIBUTION MARGIN PER UNIT**

Illustration 5-14 shows Vargo Video’s CVP income statement at the point where net income equals zero. It shows a contribution margin of $200,000, and a contribution margin per unit of $200 ($500 – $300). The formula for contribution margin per unit and the computation for Vargo Video are:

\[
\text{Contribution Margin per Unit} = \frac{\text{Unit Selling Price} - \text{Unit Variable Costs}}{\text{Total Units Sold}}
\]

\[
= \frac{500 - 300}{1,000} = \$200
\]

Contribution margin per unit indicates that for every camcorder sold, the selling price exceeds the variable costs by $200. Vargo generates $200 per unit sold to cover fixed costs and contribute to net income. Because Vargo Video has fixed costs of $200,000, it must sell 1,000 camcorders ($200,000 ÷ $200) to cover its fixed costs. At the point where total contribution margin exactly equals fixed costs, Vargo will report net income of zero. At this point, referred to as the **break-even point**, total costs (variable plus fixed) exactly equal total revenue.
It follows that for every camcorder sold above the break-even point of 1,000 units, **net income increases by the amount of the contribution margin per unit, $200**. For example, assume that Vargo sold one more camcorder; for a total of 1,001 camcorders sold. In this case, Vargo reports net income of $200, as shown in Illustration 5-15.

### Illustration 5-15
CVP income statement, with net income and per unit data

<table>
<thead>
<tr>
<th>Vargo Video Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVP Income Statement</td>
</tr>
<tr>
<td>For the Month Ended June 30, 2014</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Sales (1,001 camcorders)</td>
</tr>
<tr>
<td>Variable costs</td>
</tr>
<tr>
<td><strong>Contribution margin</strong></td>
</tr>
<tr>
<td>Fixed costs</td>
</tr>
<tr>
<td><strong>Net income</strong></td>
</tr>
</tbody>
</table>

**CONTRIBUTION MARGIN RATIO**
Some managers prefer to use a contribution margin ratio in CVP analysis. The contribution margin ratio is the contribution margin expressed as a percentage of sales, as shown in Illustration 5-16.

### Illustration 5-16
CVP income statement, with net income and percent of sales data

<table>
<thead>
<tr>
<th>Vargo Video Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVP Income Statement</td>
</tr>
<tr>
<td>For the Month Ended June 30, 2014</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Sales (1,001 camcorders)</td>
</tr>
<tr>
<td>Variable costs</td>
</tr>
<tr>
<td><strong>Contribution margin</strong></td>
</tr>
<tr>
<td>Fixed costs</td>
</tr>
<tr>
<td><strong>Net income</strong></td>
</tr>
</tbody>
</table>

Alternatively, the **contribution margin ratio** is the contribution margin per unit divided by the unit selling price. For Vargo Video, the ratio is as follows.

### Illustration 5-17
Formula for contribution margin ratio

<table>
<thead>
<tr>
<th>Contribution Margin per Unit</th>
<th>÷</th>
<th>Unit Selling Price</th>
<th>=</th>
<th>Contribution Margin Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>$200</td>
<td>÷</td>
<td>$500</td>
<td></td>
<td>40%</td>
</tr>
</tbody>
</table>

The contribution margin ratio of 40% means that Vargo generates 40 cents of contribution margin with each dollar of sales. That is, $0.40 of each sales dollar (40% × $1) is available to apply to fixed costs and to contribute to net income.

This expression of contribution margin is very helpful in determining the effect of changes in sales on net income. For example, if Vargo’s sales increase $100,000, net income will increase $40,000 (40% × $100,000). Thus, by using the contribution margin ratio, managers can quickly determine increases in net income from any change in sales.
We can also see this effect through a CVP income statement. Assume that Vargo Video’s current sales are $500,000 and it wants to know the effect of a $100,000 (200-unit) increase in sales. Vargo prepares a comparative CVP income statement analysis as follows.

<table>
<thead>
<tr>
<th>Vargo Video Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVP Income Statements</td>
</tr>
<tr>
<td>For the Month Ended June 30, 2014</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>No Change</th>
<th>With Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Per Unit</td>
</tr>
<tr>
<td>Sales</td>
<td>$500,000</td>
<td>$500</td>
</tr>
<tr>
<td>Variable costs</td>
<td>300,000</td>
<td>300</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>200,000</td>
<td>$200</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>200,000</td>
<td></td>
</tr>
<tr>
<td>Net income</td>
<td>$ –0–</td>
<td></td>
</tr>
</tbody>
</table>

The $40,000 increase in net income can be calculated on either a contribution margin per unit basis (200 units × $200 per unit) or using the contribution margin ratio times the increase in sales dollars (40% × $100,000). Note that the contribution margin per unit and contribution margin as a percentage of sales remain unchanged by the increase in sales.

Study these CVP income statements carefully. The concepts presented in these statements are used extensively in this and later chapters.

**DECISION TOOLKIT**

<table>
<thead>
<tr>
<th>DECISION CHECKPOINTS</th>
<th>INFO NEEDED FOR DECISION</th>
<th>TOOL TO USE FOR DECISION</th>
<th>HOW TO EVALUATE RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>What was the contribution toward fixed costs and income from each unit sold?</td>
<td>Selling price per unit and variable cost per unit</td>
<td>Contribution margin = Unit selling price − variable cost</td>
<td>Every unit sold will increase income by the contribution margin.</td>
</tr>
<tr>
<td>What was the increase in income as a result of an increase in sales?</td>
<td>Contribution margin per unit and unit selling price</td>
<td>Contribution margin = Unit margin + selling price</td>
<td>Every dollar of sales will increase income by the contribution margin ratio.</td>
</tr>
</tbody>
</table>

**Break-Even Analysis**

A key relationship in CVP analysis is the level of activity at which total revenues equal total costs (both fixed and variable)—the *break-even point*. At this volume of sales, the company will realize no income but will suffer no loss. The process of finding the break-even point is called *break-even analysis*. Knowledge of the break-even point is useful to management when it decides whether to introduce new product lines, change sales prices on established products, or enter new market areas.

The break-even point can be:

1. Computed from a mathematical equation.
2. Computed by using contribution margin.
3. Derived from a cost-volume-profit (CVP) graph.

The break-even point can be expressed either in *sales units* or *sales dollars*. 
MATHEMATICAL EQUATION

The first line of Illustration 5-19 shows a common equation used for CVP analysis. When net income is set to zero, this equation can be used to calculate the break-even point.

### Illustration 5-19

**Basic CVP equation**

<table>
<thead>
<tr>
<th>Required Sales</th>
<th>Variable Costs</th>
<th>Fixed Costs</th>
<th>Net Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>$500Q</td>
<td>$300Q</td>
<td>$200,000</td>
<td>$0</td>
</tr>
</tbody>
</table>

As shown in Illustration 5-14 (page 207), net income equals zero when the contribution margin (sales minus variable costs) is equal to fixed costs.

To reflect this, Illustration 5-20 rewrites the equation with contribution margin (sales minus variable costs) on the left side, and fixed costs and net income on the right. We can compute the break-even point in units by using unit selling prices and unit variable costs. The computation for Vargo Video is:

### Illustration 5-20

**Computation of break-even point in units**

<table>
<thead>
<tr>
<th>Required Sales</th>
<th>Variable Costs</th>
<th>Fixed Costs</th>
<th>Net Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>$500Q</td>
<td>$300Q</td>
<td>$200,000</td>
<td>$0</td>
</tr>
<tr>
<td>$500Q</td>
<td>$300Q</td>
<td>$200,000</td>
<td>+ $0</td>
</tr>
<tr>
<td>$200Q</td>
<td>$200,000</td>
<td>$200</td>
<td></td>
</tr>
</tbody>
</table>

\[
Q = \frac{\text{Fixed Costs}}{\text{Contribution Margin per Unit}}
\]

where

- \(Q\) = sales volume in units
- $500 = selling price
- $300 = variable costs per unit
- $200,000 = total fixed costs

Thus, Vargo Video must sell 1,000 units to break even.

To find the amount of sales dollars required to break even, we multiply the units sold at the break-even point times the selling price per unit, as shown below.

\[
1,000 \times $500 = $500,000 \text{ (break-even sales dollars)}
\]

### CONTRIBUTION MARGIN TECHNIQUE

Many managers employ the contribution margin to compute the break-even point.

### CONTRIBUTION MARGIN IN UNITS

The final step in Illustration 5-20 divides fixed costs by the contribution margin per unit (highlighted in red). Thus, rather than walk through all of the steps of the equation approach, we can simply employ this formula shown in Illustration 5-21.

### Illustration 5-21

**Formula for break-even point in units using contribution margin per unit**

\[
\frac{\text{Fixed Costs}}{\text{Contribution Margin per Unit}} = \text{Break-Even Point in Units}
\]

\[
\frac{$200,000}{\$200} = 1,000 \text{ units}
\]

Why does this formula work? The contribution margin per unit is the net amount by which each sale exceeds the variable costs per unit. Every sale generates this
much money to pay off fixed costs. Consequently, if we divide fixed costs by the contribution margin per unit, we know how many units we need to sell to break even.

**CONTRIBUTION MARGIN RATIO** As we will see in the next chapter, when a company has numerous products, it is not practical to determine the contribution margin per unit for each product. In this case, using the contribution margin ratio is very useful for determining the break-even point in total dollars (rather than units). Recall that the contribution margin ratio is the amount of contribution margin that is generated from each dollar of sales. Therefore, to determine the sales dollars needed to cover fixed costs, we divide fixed costs by the contribution margin ratio, as shown in Illustration 5-22.

<table>
<thead>
<tr>
<th>Fixed Costs</th>
<th>Contribution Margin Ratio</th>
<th>Break-Even Point in Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>$200,000</td>
<td>40%</td>
<td>$500,000</td>
</tr>
</tbody>
</table>

To apply this formula to Vargo, consider that its 40% contribution margin ratio means that for every dollar sold, it generates 40 cents of contribution margin. The question is, how many dollars of sales does Vargo need in order to generate total contribution margin of $200,000 to pay off fixed costs? We divide the fixed costs of $200,000 by the 40 cents of contribution margin generated by each dollar of sales to arrive at $500,000 ($200,000 ÷ 40%). To prove this result, if we generate 40 cents of contribution margin for each dollar of sales, then the total contribution margin generated by $500,000 in sales is $200,000 ($500,000 × 40%).

**SERVICE COMPANY INSIGHT**

**Charter Flights Offer a Good Deal**

The Internet is wringing inefficiencies out of nearly every industry. While commercial aircraft spend roughly 4,000 hours a year in the air, chartered aircraft are flown only 500 hours annually. That means that they are sitting on the ground—not making any money—about 90% of the time. One company, FlightServe, saw a business opportunity in that fact. For about the same cost as a first-class ticket, FlightServe decided to match up executives with charter flights in small “private jets.” The executive would get a more comfortable ride and could avoid the hassle of big airports. FlightServe noted that the average charter jet has eight seats. When all eight seats were full, the company would have an 80% profit margin. It would break even at an average of 3.3 full seats per flight.

**Source:** “Jet Set Go,” *The Economist* (March 18, 2000), p. 68.

**GRAPHIC PRESENTATION**

An effective way to find the break-even point is to prepare a break-even graph. Because this graph also shows costs, volume, and profits, it is referred to as a cost-volume-profit (CVP) graph.

As the CVP graph in Illustration 5-23 (page 212) shows, sales volume is recorded along the horizontal axis. This axis should extend to the maximum level of expected sales. Both total revenues (sales) and total costs (fixed plus variable) are recorded on the vertical axis.
Cost-Volume-Profit

The construction of the graph, using the data for Vargo Video, is as follows.

1. Plot the sales line, starting at the zero activity level. For every camcorder sold, total revenue increases by $500. For example, at 200 units, sales are $100,000. At the upper level of activity (1,800 units), sales are $900,000. The revenue line is assumed to be linear through the full range of activity.

2. Plot the total fixed costs using a horizontal line. For the camcorders, this line is plotted at $200,000. The fixed costs are the same at every level of activity.

3. Plot the total-cost line. This starts at the fixed-cost line at zero activity. It increases by the variable costs at each level of activity. For each camcorder, variable costs are $300. Thus, at 200 units, total variable costs are $60,000, and the total cost is $260,000. At 1,800 units, total variable costs are $540,000, and total cost is $740,000. On the graph, the amount of the variable costs can be derived from the difference between the total-cost and fixed-cost lines at each level of activity.

4. Determine the break-even point from the intersection of the total-cost line and the sales line. The break-even point in dollars is found by drawing a horizontal line from the break-even point to the vertical axis. The break-even point in units is found by drawing a vertical line from the break-even point to the horizontal axis. For the camcorders, the break-even point is $500,000 of sales, or 1,000 units. At this sales level, Vargo Video will cover costs but make no profit.

The CVP graph also shows both the net income and net loss areas. Thus, the amount of income or loss at each level of sales can be derived from the sales and total-cost lines.

A CVP graph is useful because the effects of a change in any element in the CVP analysis can be quickly seen. For example, a 10% increase in selling price will change the location of the sales line. Likewise, the effects on total costs of wage increases can be quickly observed.
### DECISION TOOLKIT

<table>
<thead>
<tr>
<th>DECISION CHECKPOINTS</th>
<th>INFO NEEDED FOR DECISION</th>
<th>TOOL TO USE FOR DECISION</th>
<th>HOW TO EVALUATE RESULTS</th>
</tr>
</thead>
</table>
| At what amount of sales does a company cover its costs? | Unit selling price, unit variable cost, and total fixed costs | Break-even point analysis  
**In units:**  
Break-even point = Fixed costs / Unit contribution margin  
**In dollars:**  
Break-even point = Fixed costs / Contribution margin ratio | Below the break-even point, the company is unprofitable. |

### DO IT!

#### Break-Even Analysis

**Action Plan**

✔ Apply the formula:
Sales = Variable costs + Fixed costs + Net income.

✔ Apply the formula:
Fixed costs / Contribution margin per unit = Break-even point in units.

**Lombardi Company** has a unit selling price of $400, variable costs per unit of $240, and fixed costs of $180,000. Compute the break-even point in units using (a) a mathematical equation and (b) contribution margin per unit.

**Solution**

(a) The equation is $400Q - 240Q - 180,000 = 0; (400Q - 240Q) = 180,000.

The break-even point in units is 1,125.

(b) The contribution margin per unit is $160 ($400 - $240). The formula therefore is $180,000 / 160, and the break-even point in units is 1,125.

Related exercise material: BE5-6, BE5-7, BE5-8, BE5-9, E5-8, E5-9, E5-10, E5-11, E5-12, E5-13, and E5-3.

#### Target Net Income

Rather than simply “breaking even,” management usually sets an income objective often called **target net income**. It indicates the sales necessary to achieve a specified level of income. Companies determine the sales necessary to achieve target net income by using one of the three approaches discussed earlier.

**MATHEMATICAL EQUATION**

We know that at the break-even point no profit or loss results for the company. By adding an amount for target net income to the same basic equation, we obtain the following formula for determining required sales.

\[
\text{Required Sales} - \text{Variable Costs} - \text{Fixed Costs} = \text{Target Net Income}
\]

Recall that once the break-even point has been reached so that fixed costs are covered, each additional unit sold increases net income by the amount of the contribution margin per unit. We can rewrite the equation with contribution margin (sales minus variable costs) on the left-hand side, and fixed costs and net income on the right. Assuming that target net income is $120,000 for Vargo Video, the computation of required sales in units is as follows.
Vargo must sell 1,600 units to achieve target net income of $120,000. The sales dollars required to achieve the target net income is found by multiplying the units sold by the unit selling price \([1,600 \times \$500] = \$800,000\].

**CONTRIBUTION MARGIN TECHNIQUE**

As in the case of break-even sales, we can compute in either units or dollars the sales required to meet target net income. The formula to compute required sales in units for Vargo Video using the contribution margin per unit can be seen in the final step of the equation approach in Illustration 5-25 (shown in red). We simply divide the sum of fixed costs and target net income by the contribution margin per unit. Illustration 5-26 shows this for Vargo.

\[
Q = \frac{\text{Fixed Costs} + \text{Net Target Income}}{\text{Contribution Margin per Unit}}
\]

where
- \(Q\) = sales volume
- \$500 = selling price
- \$300 = variable costs per unit
- \$200,000 = total fixed costs
- \$120,000 = target net income

To achieve its desired target net income of \$120,000, Vargo must sell 1,600 camcorders.

The formula to compute the required sales in dollars for Vargo Video using the contribution margin ratio is shown below.

\[
\frac{\text{Fixed Costs} + \text{Target Net Income}}{\text{Target Net Income}} \div \text{Contribution Margin Ratio} = \text{Required Sales in Dollars}
\]

\[
\frac{$200,000 + $120,000}{40\%} = $800,000
\]

To achieve its desired target net income of \$120,000, Vargo must generate sales of \$800,000.

**GRAPHIC PRESENTATION**

We also can use the CVP graph in Illustration 5-23 (on page 212) to find the sales required to meet target net income. In the profit area of the graph, the distance between the sales line and the total-cost line at any point equals net income. We can find required sales by analyzing the differences between the two lines until the desired net income is found.
For example, suppose Vargo Video sells 1,400 camcorders. Illustration 5-23 shows that a vertical line drawn at 1,400 units intersects the sales line at $700,000 and the total cost line at $620,000. The difference between the two amounts represents the net income (profit) of $80,000.

**Margin of Safety**

Margin of safety is the difference between actual or expected sales and sales at the break-even point. It measures the “cushion” that a particular level of sales provides. It tells us how far sales could fall before the company begins operating at a loss. The margin of safety is expressed in dollars or as a ratio.

The formula for stating the *margin of safety in dollars* is actual (or expected) sales minus break-even sales. Assuming that actual (expected) sales for Vargo Video are $750,000, the computation is:

\[
\text{Margin of Safety in Dollars} = \text{Actual (Expected) Sales} - \text{Break-Even Sales}
\]

Vargo’s margin of safety is $250,000. Its sales could fall $250,000 before it operates at a loss.

The *margin of safety ratio* is the margin of safety in dollars divided by actual (or expected) sales. The formula and computation for determining the margin of safety ratio are:

\[
\text{Margin of Safety Ratio} = \frac{\text{Margin of Safety in Dollars}}{\text{Actual (Expected) Sales}}
\]

This means that the company’s sales could fall by 33% before it would be operating at a loss.

The higher the dollars or the percentage, the greater the margin of safety. Management continuously evaluates the adequacy of the margin of safety in terms of such factors as the vulnerability of the product to competitive pressures and to downturns in the economy.

**SERVICE COMPANY INSIGHT**

**How a Rolling Stones’ Tour Makes Money**

Computation of break-even and margin of safety is important for service companies. Consider how the promoter for the Rolling Stones’ tour used the break-even point and margin of safety. For example, one outdoor show should bring 70,000 individuals for a gross of $2.45 million. The promoter guarantees $1.2 million to the Rolling Stones. In addition, 20% of gross goes to the stadium in which the performance is staged. Add another $400,000 for other expenses such as ticket takers, parking attendants, advertising, and so on. The promoter also shares in sales of T-shirts and memorabilia for which the promoter will net over $7 million during the tour. From a successful Rolling Stones’ tour, the promoter could make $35 million!

What amount of sales dollars are required for the promoter to break even? (See page 234.)
Break-Even, Margin of Safety, Target Net Income

Action Plan
✔ Apply the formula for the break-even point in dollars.
✔ Apply the formulas for the margin of safety in dollars and the margin of safety ratio.
✔ Apply the formula for the required sales in dollars.

Zootsuit Inc. makes travel bags that sell for $56 each. For the coming year, management expects fixed costs to total $320,000 and variable costs to be $42 per unit. Compute the following: (a) break-even point in dollars using the contribution margin (CM) ratio; (b) the margin of safety and margin of safety ratio assuming actual sales are $1,382,400; and (c) the sales dollars required to earn net income of $410,000.

Solution

(a) Contribution margin ratio = \( \frac{($56 - $42)}{56} \) = 25%
Break-even sales in dollars = \( \frac{320,000}{25\%} \) = $1,280,000

(b) Margin of safety = $1,382,400 - $1,280,000 = $102,400
Margin of safety ratio = \( \frac{102,400}{1,382,400} \) = 7.4%

(c) Required sales in dollars = \( \frac{(320,000 + 410,000)}{25\%} \) = $2,920,000

Related exercise material: BE5-10, BE5-11, BE5-12, E5-14, E5-15, E5-16, and DOIT 5-4.

USING THE DECISION TOOLKIT

B.T. Hernandez Company, maker of high-quality flashlights, has experienced steady growth over the last 6 years. However, increased competition has led Mr. Hernandez, the president, to believe that an aggressive campaign is needed next year to maintain the company's present growth. The company's accountant has presented Mr. Hernandez with the following data for the current year, 2013, for use in preparing next year's advertising campaign.

Cost Schedules

<table>
<thead>
<tr>
<th>Variable costs</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct labor per flashlight</td>
<td>8.00</td>
</tr>
<tr>
<td>Direct materials</td>
<td>4.00</td>
</tr>
<tr>
<td>Variable overhead</td>
<td>3.00</td>
</tr>
<tr>
<td>Variable cost per flashlight</td>
<td>$15.00</td>
</tr>
<tr>
<td>Fixed costs</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>$25,000</td>
</tr>
<tr>
<td>Selling</td>
<td>40,000</td>
</tr>
<tr>
<td>Administrative</td>
<td>70,000</td>
</tr>
<tr>
<td>Total fixed costs</td>
<td>$135,000</td>
</tr>
</tbody>
</table>

Selling price per flashlight $25.00
Sales, 2013 (20,000 flashlights) $500,000

Mr. Hernandez has set the sales target for the year 2014 at a level of $550,000 (22,000 flashlights).

Instructions
(Ignore any income tax considerations.)
(a) What is the operating income for 2013?
(b) What is the contribution margin per unit for 2013?
(c) What is the break-even point in units for 2013?
1. **Distinguish between variable and fixed costs.** Variable costs are costs that vary in total directly and proportionately with changes in the activity index. Fixed costs are costs that remain the same in total regardless of changes in the activity index.

2. **Explain the significance of the relevant range.** The relevant range is the range of activity in which a company expects to operate during a year. It is important in CVP analysis because the behavior of costs is assumed to be linear throughout the relevant range.

3. **Explain the concept of mixed costs.** Mixed costs increase in total but not proportionately with changes in the activity level. For purposes of CVP analysis, mixed costs must be classified into their fixed and variable elements. One method that management may use to classify these costs is the high-low method.

4. **List the five components of cost-volume-profit analysis.** The five components of CVP analysis are (a) volume or level of activity, (b) unit selling prices, (c) variable costs per unit, (d) total fixed costs, and (e) sales mix.

5. **Indicate what contribution margin is and how it can be expressed.** Contribution margin is the amount of revenue remaining after deducting variable costs. It is identified in a CVP income statement, which classifies costs as variable or fixed. It can be expressed as a total amount, as a per unit amount, or as a ratio.

6. **Identify the three ways to determine the break-even point.** The break-even point can be (a) computed from a mathematical equation, (b) computed by using a contribution margin technique, and (c) derived from a CVP graph.

7. **Give the formulas for determining sales required to earn target net income.** The general formula for required sales is: Required sales = [Fixed costs + Target net income] / Contribution margin per unit. Two other formulas are Required sales in units = (Fixed costs + Target net income) / Contribution margin per unit, and Required sales in dollars = (Fixed costs + Target net income) / Contribution margin ratio.

8. **Define margin of safety, and give the formulas for computing it.** Margin of safety is the difference between actual or expected sales and sales at the break-even point. The formulas for margin of safety are Actual (expected) sales − Break-even sales = Margin of safety in dollars; Margin of safety in dollars / Actual (expected) sales = Margin of safety ratio.

---

**Solution**

(a) **Sales**

Less:

- **Variable costs** (20,000 flashlights × $15) = 300,000
- **Fixed costs** = 135,000
- **Operating income** = $  65,000

(b) **Selling price per flashlight** = $25
- **Variable cost per flashlight** = 15
- **Contribution margin per unit** = $10

(c) **Fixed costs ÷ Contribution margin per unit = Break-even point in units** $135,000 ÷ $10 = 13,500 units

(d) **Fixed costs ÷ Contribution margin ratio = Break-even point in dollars** $145,000 * ÷ 40% ** = $362,500

*Fixed costs (from 2013) = $135,000
- **Additional advertising expense** = 10,000
- **Fixed costs (2014) = $145,000**

**Contribution margin ratio = Contribution margin per unit ÷ Unit selling price 40% = $10 ÷ $25**

(e) **Required sales = (Fixed costs + Target net income) / Contribution margin ratio**

$525,000 = ($145,000 + $65,000) ÷ 40%
## DECISION TOOLKIT A SUMMARY

<table>
<thead>
<tr>
<th>DECISION CHECKPOINTS</th>
<th>INFO NEEDED FOR DECISION</th>
<th>TOOL TO USE FOR DECISION</th>
<th>HOW TO EVALUATE RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>What was the contribution toward fixed costs and income from each unit sold?</td>
<td>Selling price per unit and variable cost per unit</td>
<td>Contribution margin per unit = Unit selling price − Variable cost</td>
<td>Every unit sold will increase income by the contribution margin.</td>
</tr>
<tr>
<td>What was the increase in income as a result of an increase in sales?</td>
<td>Contribution margin per unit and unit selling price</td>
<td>Contribution margin ratio = Contribution margin per unit / Unit selling price</td>
<td>Every dollar of sales will increase income by the contribution margin ratio</td>
</tr>
<tr>
<td>At what amount of sales does a company cover its costs?</td>
<td>Unit selling price, unit variable cost, and total fixed costs</td>
<td>Break-even point analysis In units: Break-even point = Fixed costs / Unit contribution margin In dollars: Break-even point = Fixed costs / Contribution margin ratio</td>
<td>Below the break-even point, the company is unprofitable.</td>
</tr>
</tbody>
</table>

## GLOSSARY

**Activity index** The activity that causes changes in the behavior of costs. (p. 198).

**Break-even point** The level of activity at which total revenues equal total costs. (p. 207).

**Contribution margin (CM)** The amount of revenue remaining after deducting variable costs. (p. 206).

**Contribution margin per unit** The amount of revenue remaining per unit after deducting variable costs; calculated as unit selling price minus unit variable cost. (p. 207).

**Contribution margin ratio** The percentage of each dollar of sales that is available to apply to fixed costs and contribute to net income; calculated as contribution margin per unit divided by unit selling price. (p. 207).

**Cost behavior analysis** The study of how specific costs respond to changes in the level of business activity. (p. 198).

**Cost-volume-profit (CVP) analysis** The study of the effects of changes in costs and volume on a company’s profits. (p. 206).

**Cost-volume-profit (CVP) graph** A graph showing the relationship between costs, volume, and profits. (p. 211).

**Cost-volume-profit (CVP) income statement** A statement for internal use that classifies costs as fixed or variable and reports contribution margin in the body of the statement. (p. 206).

**Fixed costs** Costs that remain the same in total regardless of changes in the activity level. (p. 199).

**High-low method** A mathematical method that uses the total costs incurred at the high and low levels of activity to classify mixed costs into fixed and variable components. (p. 203).

**Margin of safety** The difference between actual or expected sales and sales at the break-even point. (p. 215).

**Mixed costs** Costs that contain both a variable- and a fixed-cost element and change in total but not proportionately with changes in the activity level. (p. 201).

**Relevant range** The range of the activity index over which the company expects to operate during the year. (p. 201).

**Target net income** The income objective set by management. (p. 213).

**Variable costs** Costs that vary in total directly and proportionately with changes in the activity level. (p. 198).

### Comprehensive DO IT!

Mabo Company makes calculators that sell for $20 each. For the coming year, management expects fixed costs to total $220,000 and variable costs to be $9 per unit.

**Instructions**

(a) Compute break-even point in units using the mathematical equation.

(b) Compute break-even point in dollars using the contribution margin (CM) ratio.
(c) Compute the margin of safety percentage assuming actual sales are $500,000.
(d) Compute the sales required in dollars to earn net income of $165,000.

**Solution to Comprehensive**

<table>
<thead>
<tr>
<th>Question</th>
<th>Formula</th>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(a) Sales − Variable costs − Fixed costs = Net income</strong></td>
<td>$20Q − $9Q − $220,000 = $0</td>
<td>$11Q = $220,000</td>
<td>$Q = 20,000 units</td>
</tr>
<tr>
<td><strong>(b) Contribution margin per unit</strong></td>
<td>Unit selling price − Unit variable costs</td>
<td>$11 = $20 − $9</td>
<td><strong>Break-even point in dollars</strong></td>
</tr>
<tr>
<td></td>
<td>Contribution margin ratio = Contribution margin per unit ÷ Unit selling price</td>
<td>$55% = $11 ÷ $20</td>
<td>$220,000 ÷ 55%</td>
</tr>
<tr>
<td></td>
<td>Break-even point in dollars = Fixed costs + Contribution margin ratio</td>
<td>$220,000</td>
<td><strong>Margin of safety</strong></td>
</tr>
<tr>
<td></td>
<td>$500,000 − $400,000 = $200,000</td>
<td><strong>Required sales</strong></td>
<td>$11Q = $385,000</td>
</tr>
<tr>
<td></td>
<td>Q = 35,000 units</td>
<td><strong>35,000 units × $20 = $700,000 required sales</strong></td>
<td></td>
</tr>
</tbody>
</table>
corresponded with 10,000 units of production during the high month and 2,000 units during the low month. What are the fixed and variable components of its utility costs using the high-low method?
(a) $0.075 variable and $450 fixed.
(b) $0.120 variable and $50 fixed.
(c) $0.300 variable and $50 fixed.
(d) $0.060 variable and $600 fixed.

(LO 4) 6. Which of the following is not involved in CVP analysis?
(a) Sales mix.
(b) Unit selling prices.
(c) Fixed costs per unit.
(d) Volume or level of activity.

(LO 5) 7. When comparing a traditional income statement to a CVP income statement:
(a) net income will always be greater on the traditional statement.
(b) net income will always be less on the traditional statement.
(c) net income will always be identical on both.
(d) net income will be greater or less depending on the sales volume.

(LO 5) 8. Contribution margin:
(a) is revenue remaining after deducting variable costs.
(b) may be expressed as contribution margin per unit.
(c) is selling price less cost of goods sold.
(d) Both (a) and (b) above.

(LO 5) 9. Cournot Company sells 100,000 wrenches for $12 a unit. Fixed costs are $300,000, and net income is $200,000. What should be reported as variable expenses in the CVP income statement?

(LO 5) 10. Gossen Company is planning to sell 200,000 pliers for $4 per unit. The contribution margin ratio is 25%. If Gossen will break even at this level of sales, what are the fixed costs?
(a) $100,000.
(b) $160,000.
(c) $200,000.
(d) $300,000.

(LO 6) 11. Brownstone Company’s contribution margin ratio is 30%. If Brownstone’s sales revenue is $100 greater than its break-even sales in dollars, its net income:
(a) will be $100.
(b) will be $70.
(c) will be $30.
(d) cannot be determined without knowing fixed costs.

(LO 7) 12. The mathematical equation for computing required sales to obtain target net income is: Required sales =
(a) Variable costs + Target net income.
(b) Variable costs + Fixed costs + Target net income.
(c) Fixed costs + Target net income.
(d) No correct answer is given.

(LO 8) 13. Margin of safety is computed as:
(a) Actual sales – Break-even sales.
(b) Contribution margin – Fixed costs.
(c) Break-even sales – Variable costs.
(d) Actual sales – Contribution margin.

(LO 8) 14. Marshall Company had actual sales of $600,000 when break-even sales were $420,000. What is the margin of safety ratio?
(a) 25%.  (c) 33 1/3%.
(b) 30%.  (d) 45%.

Go to the book’s companion website, www.wiley.com/college/wegandt, for additional Self-Test Questions.
13. Total fixed costs are $26,000 for Daz Inc. It has a contribution margin per unit of $15, and a contribution margin ratio of 25%. Compute the break-even sales in dollars.

14. Peggy Turnbull asks your help in constructing a CVP graph. Explain to Peggy (a) how the break-even point is plotted, and (b) how the level of activity and dollar sales at the break-even point are determined.

15. Define the term “margin of safety.” If Revere Company expects to sell 1,250 units of its product at $12 per unit, and break-even sales for the product are $13,200, what is the margin of safety ratio?

16. Huang Company’s break-even sales are $500,000. Assuming fixed costs are $180,000, what sales volume is needed to achieve a target net income of $90,000?

17. The traditional income statement for Pace Company shows sales $900,000, cost of goods sold $600,000, and operating expenses $200,000. Assuming all costs and expenses are 70% variable and 30% fixed, prepare a CVP income statement through contribution margin.

---

**BRIEF EXERCISES**

**BE5-1** Monthly production costs in Pesavento Company for two levels of production are as follows.

<table>
<thead>
<tr>
<th>Cost</th>
<th>2,000 Units</th>
<th>4,000 Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indirect labor</td>
<td>$10,000</td>
<td>$20,000</td>
</tr>
<tr>
<td>Supervisory salaries</td>
<td>5,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Maintenance</td>
<td>4,000</td>
<td>7,000</td>
</tr>
</tbody>
</table>

Indicate which costs are variable, fixed, and mixed, and give the reason for each answer.

**BE5-2** For Lodes Company, the relevant range of production is 40–80% of capacity. At 40% of capacity, a variable cost is $4,000 and a fixed cost is $6,000. Diagram the behavior of each cost within the relevant range assuming the behavior is linear.

**BE5-3** For Hunt Company, a mixed cost is $15,000 plus $18 per direct labor hour. Diagram the behavior of the cost using increments of 500 hours up to 2,500 hours on the horizontal axis and increments of $15,000 up to $60,000 on the vertical axis.

**BE5-4** Bruno Company accumulates the following data concerning a mixed cost, using miles as the activity level.

<table>
<thead>
<tr>
<th>Miles Driven</th>
<th>Total Cost</th>
<th>Miles Driven</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>8,000</td>
<td>$14,150</td>
<td>March</td>
</tr>
<tr>
<td>February</td>
<td>7,500</td>
<td>13,500</td>
<td>April</td>
</tr>
</tbody>
</table>

Compute the variable- and fixed-cost elements using the high-low method.

**BE5-5** Stiever Corp. has collected the following data concerning its maintenance costs for the past 6 months.

<table>
<thead>
<tr>
<th>Units Produced</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>July</td>
<td>18,000</td>
</tr>
<tr>
<td>August</td>
<td>32,000</td>
</tr>
<tr>
<td>September</td>
<td>36,000</td>
</tr>
<tr>
<td>October</td>
<td>22,000</td>
</tr>
<tr>
<td>November</td>
<td>40,000</td>
</tr>
<tr>
<td>December</td>
<td>38,000</td>
</tr>
</tbody>
</table>

Compute the variable- and fixed-cost elements using the high-low method.

**BE5-6** Determine the missing amounts.

<table>
<thead>
<tr>
<th>Unit Selling Price</th>
<th>Unit Variable Costs</th>
<th>Contribution Margin per Unit</th>
<th>Contribution Margin Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $640</td>
<td>$352</td>
<td>(a)</td>
<td>(b)</td>
</tr>
<tr>
<td>2. $300</td>
<td>(c)</td>
<td>$93</td>
<td>(d)</td>
</tr>
<tr>
<td>3. (e)</td>
<td>(f)</td>
<td>$325</td>
<td>25%</td>
</tr>
</tbody>
</table>

**BE5-7** Radial Inc. had sales of $2,400,000 for the first quarter of 2014. In making the sales, the company incurred the costs and expenses shown on page 222.
Prepare a CVP income statement for the quarter ended March 31, 2014.

**BE5-8** Rice Company has a unit selling price of $520, variable costs per unit of $286, and fixed costs of $163,800. Compute the break-even point in units using (a) the mathematical equation and (b) contribution margin per unit.

**BE5-9** Acorn Corp. had total variable costs of $180,000, total fixed costs of $170,000, and total revenues of $300,000. Compute the required sales in dollars to break even.

**BE5-10** For Flynn Company, variable costs are 70% of sales, and fixed costs are $195,000. Management’s net income goal is $75,000. Compute the required sales in dollars needed to achieve management’s target net income of $75,000. (Use the contribution margin approach.)

**BE5-11** For Stevens Company, actual sales are $1,000,000 and break-even sales are $840,000. Compute (a) the margin of safety in dollars and (b) the margin of safety ratio.

**BE5-12** Deines Corporation has fixed costs of $480,000. It has a unit selling price of $6, unit variable costs of $4.40, and a target net income of $1,500,000. Compute the required sales in units to achieve its target net income.

---

**DO IT! REVIEW**

Classify types of costs.

**DO IT! 5-1** Helena Company reports the following total costs at two levels of production.

<table>
<thead>
<tr>
<th>Units Produced</th>
<th>5,000 Units</th>
<th>10,000 Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indirect labor</td>
<td>$3,000</td>
<td>$6,000</td>
</tr>
<tr>
<td>Property taxes</td>
<td>7,000</td>
<td>7,000</td>
</tr>
<tr>
<td>Direct labor</td>
<td>28,000</td>
<td>56,000</td>
</tr>
<tr>
<td>Direct materials</td>
<td>22,000</td>
<td>44,000</td>
</tr>
<tr>
<td>Depreciation</td>
<td>4,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Utilities</td>
<td>5,000</td>
<td>7,000</td>
</tr>
<tr>
<td>Maintenance</td>
<td>9,000</td>
<td>11,000</td>
</tr>
</tbody>
</table>

Classify each cost as variable, fixed, or mixed.

**DO IT! 5-2** Westerville Company accumulates the following data concerning a mixed cost, using units produced as the activity level.

<table>
<thead>
<tr>
<th>Units Produced</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>10,000</td>
</tr>
<tr>
<td>April</td>
<td>9,000</td>
</tr>
<tr>
<td>May</td>
<td>10,500</td>
</tr>
<tr>
<td>June</td>
<td>8,800</td>
</tr>
<tr>
<td>July</td>
<td>9,500</td>
</tr>
</tbody>
</table>

(a) Compute the variable- and fixed-cost elements using the high-low method.
(b) Estimate the total cost if the company produces 9,200 units.

**DO IT! 5-3** Larissa Company has a unit selling price of $250, variable costs per unit of $170, and fixed costs of $140,000. Compute the break-even point in units using (a) the mathematical equation and (b) contribution margin per unit.

**DO IT! 5-4** Presto Company makes radios that sell for $30 each. For the coming year, management expects fixed costs to total $220,000 and variable costs to be $18 per unit.

(a) Compute the break-even point in dollars using the contribution margin (CM) ratio.
(b) Compute the margin of safety ratio assuming actual sales are $800,000.
(c) Compute the sales dollars required to earn net income of $140,000.
E5-1 Turgro Company manufactures a single product. Annual production costs incurred in the manufacturing process are shown below for two levels of production.

<table>
<thead>
<tr>
<th>Production Costs</th>
<th>5,000</th>
<th>10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Cost</td>
<td>Cost/ Unit</td>
</tr>
<tr>
<td>Direct materials</td>
<td>$8,000</td>
<td>$1.60</td>
</tr>
<tr>
<td>Direct labor</td>
<td>9,500</td>
<td>1.90</td>
</tr>
<tr>
<td>Utilities</td>
<td>2,000</td>
<td>0.40</td>
</tr>
<tr>
<td>Rent</td>
<td>4,000</td>
<td>0.80</td>
</tr>
<tr>
<td>Maintenance</td>
<td>800</td>
<td>0.16</td>
</tr>
<tr>
<td>Supervisory salaries</td>
<td>1,000</td>
<td>0.20</td>
</tr>
</tbody>
</table>

Instructions
(a) Define the terms variable costs, fixed costs, and mixed costs.
(b) Classify each cost above as either variable, fixed, or mixed.

E5-2 Shingle Enterprises is considering manufacturing a new product. It projects the cost of direct materials and rent for a range of output as shown below.

<table>
<thead>
<tr>
<th>Output in Units</th>
<th>Rent Expense</th>
<th>Direct Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000</td>
<td>$5,000</td>
<td>$4,000</td>
</tr>
<tr>
<td>2,000</td>
<td>5,000</td>
<td>7,200</td>
</tr>
<tr>
<td>3,000</td>
<td>8,000</td>
<td>9,000</td>
</tr>
<tr>
<td>4,000</td>
<td>8,000</td>
<td>12,000</td>
</tr>
<tr>
<td>5,000</td>
<td>8,000</td>
<td>15,000</td>
</tr>
<tr>
<td>6,000</td>
<td>8,000</td>
<td>18,000</td>
</tr>
<tr>
<td>7,000</td>
<td>8,000</td>
<td>21,000</td>
</tr>
<tr>
<td>8,000</td>
<td>8,000</td>
<td>24,000</td>
</tr>
<tr>
<td>9,000</td>
<td>10,000</td>
<td>29,300</td>
</tr>
<tr>
<td>10,000</td>
<td>10,000</td>
<td>35,000</td>
</tr>
<tr>
<td>11,000</td>
<td>10,000</td>
<td>44,000</td>
</tr>
</tbody>
</table>

Instructions
(a) Diagram the behavior of each cost for output ranging from 1,000 to 11,000 units.
(b) Determine the relevant range of activity for this product.
(c) Calculate the variable costs per unit within the relevant range.
(d) Indicate the fixed cost within the relevant range.

E5-3 The controller of Furgee Industries has collected the following monthly expense data for use in analyzing the cost behavior of maintenance costs.

<table>
<thead>
<tr>
<th>Month</th>
<th>Total Maintenance Costs</th>
<th>Total Machine Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>$2,500</td>
<td>300</td>
</tr>
<tr>
<td>February</td>
<td>3,000</td>
<td>350</td>
</tr>
<tr>
<td>March</td>
<td>3,600</td>
<td>500</td>
</tr>
<tr>
<td>April</td>
<td>4,500</td>
<td>690</td>
</tr>
<tr>
<td>May</td>
<td>3,200</td>
<td>400</td>
</tr>
<tr>
<td>June</td>
<td>4,900</td>
<td>700</td>
</tr>
</tbody>
</table>

Instructions
(a) Determine the fixed- and variable-cost components using the high-low method.
(b) Prepare a graph showing the behavior of maintenance costs, and identify the fixed- and variable-cost elements. Use 100-hour increments and $1,000 cost increments.

E5-4 Family Furniture Corporation incurred the following costs.
1. Wood used in the production of furniture.
2. Fuel used in delivery trucks.
3. Straight-line depreciation on factory building.
4. Screws used in the production of furniture.
5. Sales staff salaries.
6. Sales commissions.
7. Property taxes.
8. Insurance on buildings.
9. Hourly wages of furniture craftsmen.
10. Salaries of factory supervisors.
11. Utilities expense.
12. Telephone bill.

Instructions
Identify the costs above as variable, fixed, or mixed.

E5-5 The controller of Dousmann Industries has collected the following monthly expense data for use in analyzing the cost behavior of maintenance costs.

<table>
<thead>
<tr>
<th>Month</th>
<th>Total Maintenance Costs</th>
<th>Total Machine Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>$2,750</td>
<td>3,500</td>
</tr>
<tr>
<td>February</td>
<td>3,000</td>
<td>4,000</td>
</tr>
<tr>
<td>March</td>
<td>3,600</td>
<td>6,000</td>
</tr>
<tr>
<td>April</td>
<td>4,500</td>
<td>7,900</td>
</tr>
<tr>
<td>May</td>
<td>3,200</td>
<td>5,000</td>
</tr>
<tr>
<td>June</td>
<td>5,000</td>
<td>8,000</td>
</tr>
</tbody>
</table>

Instructions
(a) Determine the fixed- and variable-cost components using the high-low method.
(b) Prepare a graph showing the behavior of maintenance costs, and identify the fixed- and variable-cost elements. Use 2,000-hour increments and $1,000 cost increments.

E5-6 PCB Corporation manufactures a single product. Monthly production costs incurred in the manufacturing process are shown below for the production of 3,000 units. The utilities and maintenance costs are mixed costs. The fixed portions of these costs are $300 and $200, respectively.

<table>
<thead>
<tr>
<th>Production in Units</th>
<th>3,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Costs</td>
<td></td>
</tr>
<tr>
<td>Direct materials</td>
<td>$ 7,500</td>
</tr>
<tr>
<td>Direct labor</td>
<td>18,000</td>
</tr>
<tr>
<td>Utilities</td>
<td>2,100</td>
</tr>
<tr>
<td>Property taxes</td>
<td>1,000</td>
</tr>
<tr>
<td>Indirect labor</td>
<td>4,500</td>
</tr>
<tr>
<td>Supervisory salaries</td>
<td>1,900</td>
</tr>
<tr>
<td>Maintenance</td>
<td>1,100</td>
</tr>
<tr>
<td>Depreciation</td>
<td>2,400</td>
</tr>
</tbody>
</table>

Instructions
(a) Identify the above costs as variable, fixed, or mixed.
(b) Calculate the expected costs when production is 5,000 units.

E5-7 Jim Taylor wants Taylor Company to use CVP analysis to study the effects of changes in costs and volume on the company. Taylor has heard that certain assumptions must be valid in order for CVP analysis to be useful.

Instructions
(a) Prepare a memo to Jim Taylor concerning the assumptions that underlie CVP analysis.

E5-8 All That Blooms provides environmentally friendly lawn services for homeowners. Its operating costs are as follows.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Depreciation</td>
<td>$1,400 per month</td>
</tr>
<tr>
<td>Advertising</td>
<td>$200 per month</td>
</tr>
<tr>
<td>Insurance</td>
<td>$2,000 per month</td>
</tr>
</tbody>
</table>
Exercises 225

Weed and feed materials $12 per lawn
Direct labor $10 per lawn
Fuel $2 per lawn

All That Blooms charges $60 per treatment for the average single-family lawn.

Instructions
Determine the company's break-even point in (a) number of lawns serviced per month and (b) dollars.

E5-9 The Green Acres Inn is trying to determine its break-even point. The inn has 50 rooms that it rents at $60 a night. Operating costs are as follows.

<table>
<thead>
<tr>
<th>Cost</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries</td>
<td>$6,200 per month</td>
</tr>
<tr>
<td>Utilities</td>
<td>$1,100 per month</td>
</tr>
<tr>
<td>Deprecation</td>
<td>$1,000 per month</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$100 per month</td>
</tr>
<tr>
<td>Maid service</td>
<td>$11 per room</td>
</tr>
<tr>
<td>Other costs</td>
<td>$28 per room</td>
</tr>
</tbody>
</table>

Instructions
Determine the inn's break-even point in (a) number of rented rooms per month and (b) dollars.

E5-10 In the month of March, Style Salon services 560 clients at an average price of $120. During the month, fixed costs were $21,024 and variable costs were 60% of sales.

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

E5-11 Kare Kars provides shuttle service between four hotels near a medical center and an international airport. Kare Kars uses two 10-passenger vans to offer 12 round trips per day. A recent month's activity in the form of a cost-volume-profit income statement is shown below.

<table>
<thead>
<tr>
<th>Revenue</th>
<th>$36,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable costs</td>
<td></td>
</tr>
<tr>
<td>Fuel</td>
<td>$5,040</td>
</tr>
<tr>
<td>Tolls and parking</td>
<td>3,100</td>
</tr>
<tr>
<td>Maintenance</td>
<td>860</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>27,000</td>
</tr>
<tr>
<td>Fixed costs</td>
<td></td>
</tr>
<tr>
<td>Salaries</td>
<td>12,700</td>
</tr>
<tr>
<td>Depreciation</td>
<td>1,300</td>
</tr>
<tr>
<td>Insurance</td>
<td>1,000</td>
</tr>
<tr>
<td>Net income</td>
<td>$12,000</td>
</tr>
</tbody>
</table>

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.

E5-12 In 2013, Manhoff Company had a break-even point of $350,000 based on a selling price of $5 per unit and fixed costs of $112,000. In 2014, the selling price and the variable costs per unit did not change, but the break-even point increased to $420,000.

Instructions
(a) Compute the variable costs per unit and the contribution margin ratio for 2013.
(b) Compute the increase in fixed costs for 2014.

E5-13 Cannes Company has the following information available for September 2014.

<table>
<thead>
<tr>
<th>Cost Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit selling price of video game consoles</td>
<td>$400</td>
</tr>
<tr>
<td>Unit variable costs</td>
<td>$275</td>
</tr>
<tr>
<td>Total fixed costs</td>
<td>$52,000</td>
</tr>
<tr>
<td>Units sold</td>
<td>600</td>
</tr>
</tbody>
</table>

Compute break-even point.

Compute contribution margin and break-even point.

Compute break-even point.

Compute variable costs per unit, contribution margin ratio, and increase in fixed costs.

Prepare CVP income statements.
Instructions
(a) Compute the contribution margin per unit.
(b) Prepare a CVP income statement that shows both total and per unit amounts.
(c) Compute Cannes’ break-even point in units.
(d) Prepare a CVP income statement for the break-even point that shows both total and per unit amounts.

E5-14 Naylor Company had $210,000 of net income in 2013 when the selling price per unit was $150, the variable costs per unit were $90, and the fixed costs were $570,000. Management expects per unit data and total fixed costs to remain the same in 2014. The president of Naylor Company is under pressure from stockholders to increase net income by $52,000 in 2014.

Instructions
(a) Compute the number of units sold in 2013.
(b) Compute the number of units that would have to be sold in 2014 to reach the stockholders’ desired profit level.
(c) Assume that Naylor Company sells the same number of units in 2014 as it did in 2013. What would the selling price have to be in order to reach the stockholders’ desired profit level?

E5-15 Cottonwood Company reports the following operating results for the month of August: sales $400,000 (units 5,000); variable costs $210,000; and fixed costs $90,000. 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 units sold.
2. Reduce variable costs to 45% of sales.

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

E5-16 Glacial Company estimates that variable costs will be 62.5% of sales, and fixed costs will total $600,000. The selling price of the product is $4.

Instructions
(a) Prepare a CVP graph, assuming maximum sales of $3,200,000. (Note: Use $400,000 increments for sales and costs and 100,000 increments for units.)
(b) Compute the break-even point in (1) units and (2) dollars.
(c) Compute the margin of safety in (1) dollars and (2) as a ratio, assuming actual sales are $2 million.

E5-17 Oak Bucket Co., a manufacturer of wood buckets, had the following data for 2013:

<table>
<thead>
<tr>
<th>Sales</th>
<th>2,600 units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales price</td>
<td>$40 per unit</td>
</tr>
<tr>
<td>Variable costs</td>
<td>$16 per unit</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>$19,500</td>
</tr>
</tbody>
</table>

Instructions
(a) What is the contribution margin ratio?
(b) What is the break-even point in dollars?
(c) What is the margin of safety in dollars and as a ratio?
(d) If the company wishes to increase its total dollar contribution margin by 30% in 2014, by how much will it need to increase its sales if all other factors remain constant?

(CGA adapted)

Visit the book’s companion website, at www.wiley.com/college/weygandt, and choose the Student Companion site to access Exercise Set B and Challenge Exercises.
**P5-1A** Telly Savalas owns the Bonita Barber Shop. He employs four barbers and pays each a base rate of $1,000 per month. One of the barbers serves as the manager and receives an extra $500 per month. In addition to the base rate, each barber also receives a commission of $4.50 per haircut.

Other costs are as follows.

- Advertising: $200 per month
- Rent: $1,100 per month
- Barber supplies: $0.30 per haircut
- Utilities: $175 per month plus $0.20 per haircut
- Magazines: $25 per month

Telly currently charges $10 per haircut.

**Instructions**

(a) Determine the variable costs per haircut and the total monthly fixed costs.

(b) Compute the break-even point in units and dollars.

(c) Prepare a CVP graph, assuming a maximum of 1,800 haircuts in a month. Use increments of 300 haircuts on the horizontal axis and $3,000 on the vertical axis.

(d) Determine net income, assuming 1,700 haircuts are given in a month.

**P5-2A** Jorge Company bottles and distributes B-Lite, a diet soft drink. The beverage is sold for 50 cents per 16-ounce bottle to retailers, who charge customers 75 cents per bottle. For the year 2014, management estimates the following revenues and costs.

| Sales | $1,800,000 |
| Direct materials | 430,000 |
| Direct labor | 360,000 |
| Manufacturing overhead—variable | 380,000 |
| Manufacturing overhead—fixed | 280,000 |
| Selling expenses—variable | $70,000 |
| Selling expenses—fixed | 65,000 |
| Administrative expenses—variable | 20,000 |
| Administrative expenses—fixed | 60,000 |

**Instructions**

(a) Prepare a CVP income statement for 2014 based on management's estimates. (Show column for total amounts only.)

(b) Compute the break-even point in (1) units and (2) dollars.

(c) Compute the contribution margin ratio and the margin of safety ratio. (Round to nearest full percent.)

(d) Determine the sales dollars required to earn net income of $180,000.

**P5-3A** Dousmann Corp.'s sales slumped badly in 2014. For the first time in its history, it operated at a loss. The company's income statement showed the following results from selling 500,000 units of product: sales $2,500,000; total costs and expenses $2,600,000; and net loss $100,000. Costs and expenses consisted of the amounts shown below.

<table>
<thead>
<tr>
<th>Total</th>
<th>Variable</th>
<th>Fixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of goods sold</td>
<td>$2,140,000</td>
<td>$1,540,000</td>
</tr>
<tr>
<td>Selling expenses</td>
<td>250,000</td>
<td>92,000</td>
</tr>
<tr>
<td>Administrative expenses</td>
<td>210,000</td>
<td>68,000</td>
</tr>
<tr>
<td>$2,600,000</td>
<td>$1,700,000</td>
<td>$900,000</td>
</tr>
</tbody>
</table>

Management is considering the following independent alternatives for 2015.

1. Increase unit selling price 20% with no change in costs, expenses, and sales volume.
2. Change the compensation of salespersons from fixed annual salaries totaling $150,000 to total salaries of $60,000 plus a 5% commission on sales.

**Instructions**

(a) Compute the break-even point in dollars for 2014.

(b) Compute the break-even point in dollars under each of the alternative courses of action. (Round all ratios to nearest full percent.) Which course of action do you recommend?
P5-4A Mary Willis is the advertising manager for Bargain Shoe Store. She is currently working on a major promotional campaign. Her ideas include the installation of a new lighting system and increased display space that will add $24,000 in fixed costs to the $270,000 currently spent. In addition, Mary is proposing that a 5% price decrease ($40 to $38) will produce a 20% increase in sales volume (20,000 to 24,000). Variable costs will remain at $24 per pair of shoes. Management is impressed with Mary’s ideas but concerned about the effects that these changes will have on the break-even point and the margin of safety.

**Instructions**

(a) Compute the current break-even point in units, and compare it to the break-even point in units if Mary’s ideas are used.

(b) Compute the margin of safety ratio for current operations and after Mary’s changes are introduced. (Round to nearest full percent.)

(c) Prepare a CVP income statement for current operations and after Mary’s changes are introduced. (Show column for total amounts only.) Would you make the changes suggested?

P5-5A Mozena Corporation has collected the following information after its first year of sales. Sales were $1,500,000 on 100,000 units; selling expenses $250,000 (40% variable and 60% fixed); direct materials $511,000; direct labor $290,000; administrative expenses $270,000 (20% variable and 80% fixed); manufacturing overhead $350,000 (70% variable and 30% fixed). Top management has asked you to do a CVP analysis so that it can make plans for the coming year. It has projected that unit sales will increase by 10% next year.

**Instructions**

(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 $200,000. 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?

P5-6A Kaiser Industries carries no inventories. Its product is manufactured only when a customer’s order is received. It is then shipped immediately after it is made. For its fiscal year ended October 31, 2014, Kaiser’s break-even point was $1.3 million. On sales of $1.2 million, its income statement showed a gross profit of $180,000, direct materials cost of $400,000, and direct labor costs of $500,000. The contribution margin was $180,000, and variable manufacturing overhead was $50,000.

**Instructions**

(a) Calculate the following:
   (1) Variable selling and administrative expenses.
   (2) Fixed manufacturing overhead.
   (3) Fixed selling and administrative expenses.

(b) Ignoring your answer to part (a), assume that fixed manufacturing overhead was $100,000 and the fixed selling and administrative expenses were $80,000. The marketing vice president feels that if the company increased its advertising, sales could be increased by 25%. What is the maximum increased advertising cost the company can incur and still report the same income as before the advertising expenditure?

   (CGA adapted)

P5-1B The Sasoon Barber Shop employs four barbers. One barber, who also serves as the manager, is paid a salary of $3,000 per month. The other barbers are paid $1,500 per month. In addition, each barber is paid a commission of $3 per haircut. Other monthly costs are store rent $700 plus 60 cents per haircut, depreciation on equipment $400, barber supplies 40 cents per haircut, utilities $300, and advertising $100. The price of a haircut is $10.

**Instructions**

Determine variable and fixed costs, compute break-even point, prepare a CVP graph, and determine net income.

(LO 1, 3, 5, 6), AN
Instructions
(a) Determine the variable costs per haircut and the total monthly fixed costs.
(b) Compute the break-even point in units and dollars.
(c) Prepare a CVP graph, assuming a maximum of 1,800 haircuts in a month. Use increments of 300 haircuts on the horizontal axis and $3,000 increments on the vertical axis.
(d) Determine the net income, assuming 1,800 haircuts are given in a month.

P5-2B All Frute Company bottles and distributes Frute Ade, a fruit drink. The beverage is sold for 50 cents per 16-ounce bottle to retailers, who charge customers 70 cents per bottle. For the year 2014, management estimates the following revenues and costs.

Sales $2,500,000
Direct materials 360,000
Direct labor 450,000
Manufacturing overhead—variable 270,000
Manufacturing overhead—fixed 380,000
Selling expenses—variable $80,000
Selling expenses—fixed 250,000
Administrative expenses—variable 40,000
Administrative expenses—fixed 150,000

Instructions
(a) Prepare a CVP income statement for 2014 based on management’s estimates. (Show column for total amounts only.)
(b) Compute the break-even point in (1) units and (2) dollars.
(c) Compute the contribution margin ratio and the margin of safety ratio.
(d) Determine the sales dollars required to earn net income of $624,000.

P5-3B Olgivie Company had a bad year in 2013. For the first time in its history, it operated at a loss. The company’s income statement showed the following results from selling 60,000 units of product: sales $1,800,000; total costs and expenses $2,010,000; and net loss $210,000. Costs and expenses consisted of the amounts shown below.

<table>
<thead>
<tr>
<th>Total</th>
<th>Variable</th>
<th>Fixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of goods sold</td>
<td>$1,350,000</td>
<td>$930,000</td>
</tr>
<tr>
<td>Selling expenses</td>
<td>480,000</td>
<td>125,000</td>
</tr>
<tr>
<td>Administrative expenses</td>
<td>180,000</td>
<td>115,000</td>
</tr>
<tr>
<td>$2,010,000</td>
<td>$1,170,000</td>
<td>$840,000</td>
</tr>
</tbody>
</table>

Management is considering the following independent alternatives for 2014.
1. Increase unit selling price 25% with no change in costs, expenses, and sales volume.
2. Change the compensation of salespersons from fixed annual salaries totaling $200,000 to total salaries of $20,000 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 2013.
(b) Compute the break-even point under each of the alternative courses of action.

P5-4B Alma Ortiz is the advertising manager for CostLess Shoe Store. She is currently working on a major promotional campaign. Her ideas include the installation of a new lighting system and increased display space that will add $18,000 in fixed costs to the $216,000 currently spent. In addition, Alma is proposing that a 10% price decrease (from $30 to $27) will produce an increase in sales volume from 20,000 to 24,000 units. Variable costs will remain at $12 per pair of shoes. Management is impressed with Alma’s ideas but concerned about the effects that these changes will have on the break-even point and the margin of safety.

Instructions
(a) Compute the current break-even point in units, and compare it to the break-even point in units if Alma’s ideas are used.
(b) Compute the margin of safety ratio for current operations and after Alma’s changes are introduced. (Round to nearest full percent.)
(c) Prepare a CVP income statement for current operations and after Alma’s changes are introduced. (Show column for total amounts only.) Would you make the changes suggested?
Isaac Corporation has collected the following information after its first year of sales. Sales were $1,800,000 on 100,000 units; selling expenses $400,000 (30% variable and 70% fixed); direct materials $456,000; direct labor $250,000; administrative expenses $484,000 (50% variable and 50% fixed); manufacturing overhead $480,000 (40% variable and 60% fixed). Top management has asked you to do a CVP analysis so that it can make plans for the coming year. It has projected that unit sales will increase by 20% next year.

Instructions
(a) Compute (1) the contribution margin for the current year and the projected year, and (2) the fixed costs for the current year. (Assume that fixed costs will remain the same in the projected year.)
(b) Compute the break-even point in units and sales dollars.
(c) The company has a target net income of $213,000. 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 $100,000 and would change its manufacturing overhead costs to 10% variable and 90% fixed (assume total manufacturing overhead cost is $480,000, 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 $400,000, 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.

Mega Electronix carries no inventories. Its product is manufactured only when a customer’s order is received. It is then shipped immediately after it is made. For its fiscal year ended October 31, 2014, Mega’s break-even point was $2.4 million. On sales of $2 million, its income statement showed a gross profit of $400,000, direct materials cost of $600,000, and direct labor costs of $700,000. The contribution margin was $150,000, and variable manufacturing overhead was $200,000.

Instructions
(a) Calculate the following:
1. Variable selling and administrative expenses.
2. Fixed manufacturing overhead.
3. Fixed selling and administrative expenses.
(b) Ignoring your answer to part (a), assume that fixed manufacturing overhead was $100,000 and the fixed selling and administrative expenses were $80,000. The marketing vice president feels that if the company increased its advertising, sales could be increased by 15%. What is the maximum increased advertising cost the company can incur and still report the same income as before the advertising expenditure?

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 1–4.)
WCP5 The Vice President for Sales and Marketing at Waterways Corporation is planning for production needs to meet sales demand in the coming year. He is also trying to determine how the company’s profits might be increased in the coming year. This problem asks you to use cost-volume-profit concepts to help Waterways understand contribution margins of some of its products and to decide whether to mass-produce certain products.

Go to the book’s companion website, www.wiley.com/college/weygandt, to find the remainder of this problem.
Management Decision-Making

Decision-Making at Current Designs

**BYP5-1** Bill Johnson, sales manager, and Diane Buswell, controller, at Current Designs are beginning to analyze the cost considerations for one of the composite models of the kayak division. They have provided the following production and operational costs necessary to produce one composite kayak.

- Kevlar® $250 per kayak
- Resin and supplies $100 per kayak
- Finishing kit (seat, rudder, ropes, etc.) $170 per kayak
- Labor $420 per kayak
- Selling and administrative expenses—variable $400 per kayak
- Selling and administrative expenses—fixed $119,700 per year
- Manufacturing overhead—fixed $240,000 per year

Bill and Diane have asked you to provide a cost-volume-profit analysis, to help them finalize the budget projections for the upcoming year. Bill has informed you that the selling price of the composite kayak will be $2,000.

**Instructions**

(a) Calculate variable costs per unit.
(b) Determine the contribution margin per unit.
(c) Using the contribution margin per unit, determine the break-even point in units for this product line.
(d) Assume that Current Designs plans to earn $270,600 on this product line. Using the contribution margin per unit, calculate the number of units that need to be sold to achieve this goal.
(e) Based on the most recent sales forecast, Current Designs plans to sell 1,000 units of this model. Using your results from part (c), calculate the margin of safety and the margin of safety ratio.

Decision-Making Across the Organization

**BYP5-2** Creative Ideas Company has decided to introduce a new product. The new product can be manufactured by either a capital-intensive method or a labor-intensive method. The manufacturing method will not affect the quality of the product. The estimated manufacturing costs by the two methods are as follows.

<table>
<thead>
<tr>
<th></th>
<th>Capital-Intensive</th>
<th>Labor-Intensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials</td>
<td>$5 per unit</td>
<td>$5.50 per unit</td>
</tr>
<tr>
<td>Direct labor</td>
<td>$6 per unit</td>
<td>$8.00 per unit</td>
</tr>
<tr>
<td>Variable overhead</td>
<td>$3 per unit</td>
<td>$4.50 per unit</td>
</tr>
<tr>
<td>Fixed manufacturing costs</td>
<td>$2,524,000</td>
<td>$1,550,000</td>
</tr>
</tbody>
</table>

Creative Ideas’ market research department has recommended an introductory unit sales price of $32. The incremental selling expenses are estimated to be $502,000 annually plus $2 for each unit sold, regardless of manufacturing method.

**Instructions**

With the class divided into groups, answer the following.

(a) Calculate the estimated break-even point in annual unit sales of the new product if Creative Ideas Company uses the:
   (1) Capital-intensive manufacturing method.
   (2) Labor-intensive manufacturing method.
(b) Determine the annual unit sales volume at which Creative Ideas Company would be indifferent between the two manufacturing methods.
(c) Explain the circumstance under which Creative Ideas should employ each of the two manufacturing methods.

(CMA adapted)
Managerial Analysis

BYP5-3 The condensed income statement for the Peri and Paul partnership for 2014 is as follows.

Peri and Paul Company
Income Statement
For the Year Ended December 31, 2014

Sales (240,000 units) $1,200,000
Cost of goods sold 800,000
Gross profit 400,000
Operating expenses
Selling $280,000
Administrative 150,000 430,000
Net loss ($30,000)

A cost behavior analysis indicates that 75% of the cost of goods sold are variable, 42% of the selling expenses are variable, and 40% of the administrative expenses are variable.

Instructions
(Round to nearest unit, dollar, and percentage, where necessary. Use the CVP income statement format in computing profits.)

(a) Compute the break-even point in total sales dollars and in units for 2014.

(b) Peri has proposed a plan to get the partnership “out of the red” and improve its profitability. She feels that the quality of the product could be substantially improved by spending $0.25 more per unit on better raw materials. The selling price per unit could be increased to only $5.25 because of competitive pressures. Peri estimates that sales volume will increase by 25%. What effect would Peri’s plan have on the profits and the break-even point in dollars of the partnership? (Round the contribution margin ratio to two decimal places.)

(c) Paul was a marketing major in college. He believes that sales volume can be increased only by intensive advertising and promotional campaigns. He therefore proposed the following plan as an alternative to Peri’s: (1) Increase variable selling expenses to $0.59 per unit, (2) lower the selling price per unit by $0.25, and (3) increase fixed selling expenses by $40,000. Paul quoted an old marketing research report that said that sales volume would increase by 60% if these changes were made. What effect would Paul’s plan have on the profits and the break-even point in dollars of the partnership?

(d) Which plan should be accepted? Explain your answer.

Real-World Focus

BYP5-4 The Coca-Cola Company hardly needs an introduction. A line taken from the cover of a recent annual report says it all: If you measured time in servings of Coca-Cola, “a billion Coca-Cola’s ago was yesterday morning.” On average, every U.S. citizen drinks 363 8-ounce servings of Coca-Cola products each year. Coca-Cola’s primary line of business is the making and selling of syrup to bottlers. These bottlers then sell the finished bottles and cans of Coca-Cola to the consumer.

In the annual report of Coca-Cola, the information shown below was provided.

The Coca-Cola Company
Management Discussion

Our gross margin declined to 61 percent this year from 62 percent in the prior year, primarily due to costs for materials such as sweeteners and packaging.

The increases [in selling expenses] in the last two years were primarily due to higher marketing expenditures in support of our Company’s volume growth.

We measure our sales volume in two ways: (1) gallon shipments of concentrates and syrups and (2) unit cases of finished product (bottles and cans of Coke sold by bottlers).
Instructions
Answer the following questions.
(a) Are sweeteners and packaging a variable cost or a fixed cost? What is the impact on the contribution margin of an increase in the per unit cost of sweeteners or packaging? What are the implications for profitability?
(b) In your opinion, are marketing expenditures a fixed cost, variable cost, or mixed cost to The Coca-Cola Company? Give justification for your answer.
(c) Which of the two measures cited for measuring volume represents the activity index as defined in this chapter? Why might Coca-Cola use two different measures?


Instructions
Read the article and answer the following questions.
(a) What aspect of Barnes and Noble’s current structure puts it at risk if electronic books become a significant portion of book sales?
(b) What was Barnes and Noble’s primary competitive advantage in a “paper book” world? How has this advantage been eliminated by e-books?
(c) What event do the authors say might eventually be viewed as the big turning point for e-books?
(d) What amount does Barnes and Noble earn on a $25 hardcover book? How much would it likely earn on an e-book version of the same title? What implications does this have for Barnes and Noble versus its competitors?
(e) What two mistakes does the author suggest that Barnes and Noble made that left it ill-prepared for an e-book environment?

Critical Thinking

Communication Activity

BYP5-6 Your roommate asks for your help on the following questions about CVP analysis formulas.
(a) How can the mathematical equation for break-even sales show both sales units and sales dollars?
(b) How do the formulas differ for contribution margin per unit and contribution margin ratio?
(c) How can contribution margin be used to determine break-even sales in units and in dollars?

Instructions
Write a memo to your roommate stating the relevant formulas and answering each question.

Ethics Case

BYP5-7 Scott Bestor is an accountant for Westfield Company. Early this year, Scott made a highly favorable projection of sales and profits over the next 3 years for Westfield’s hot-selling computer PLEX. As a result of the projections Scott presented to senior management, the company decided to expand production in this area. This decision led to dislocations of some plant personnel who were reassigned to one of the company’s newer plants in another state. However, no one was fired, and in fact the company expanded its work force slightly.

Unfortunately, Scott rechecked his computations on the projections a few months later and found that he had made an error that would have reduced his projections substantially. Luckily, sales of PLEX have exceeded projections so far, and management is satisfied with its decision. Scott, however, is not sure what to do. Should he confess his honest mistake and jeopardize his possible promotion? He suspects that no one will catch the error because sales of PLEX have exceeded his projections, and it appears that profits will materialize close to his projections.

Instructions
(a) Who are the stakeholders in this situation?
(b) Identify the ethical issues involved in this situation.
(c) What are the possible alternative actions for Scott? What would you do in Scott’s position?
All About You

BYP5-8 Cost-volume-profit analysis can also be used in making personal financial decisions. For example, the purchase of a new car is one of your biggest personal expenditures. It is important that you carefully analyze your options.

Suppose that you are considering the purchase of a hybrid vehicle. Let's assume the following facts: The hybrid will initially cost an additional $4,500 above the cost of a traditional vehicle. The hybrid will get 40 miles per gallon of gas, and the traditional car will get 30 miles per gallon. Also, assume that the cost of gas is $3.60 per gallon.

Instructions
Using the facts above, answer the following questions.
(a) What is the variable gasoline cost of going one mile in the hybrid car? What is the variable cost of going one mile in the traditional car?
(b) Using the information in part (a), if “miles” is your unit of measure, what is the “contribution margin” of the hybrid vehicle relative to the traditional vehicle? That is, express the variable cost savings on a per-mile basis.
(c) How many miles would you have to drive in order to break even on your investment in the hybrid car?
(d) What other factors might you want to consider?

Answers to Chapter Questions

Answers to Insight and Accounting Across the Organization Questions

p. 200 Gardens in the Sky Q: What are some of the variable and fixed costs that are impacted by hydroponic farming? A: Compared to traditional methods, hydroponic farming would reduce the use of pesticides, herbicides, fuel, and water. Soil erosion would be eliminated, and land requirements would drop. But, fixed costs related to constructing greenhouses, suitable vertical planters, as well as investments in artificial lighting could be high.

p. 204 Skilled Labor Is Truly Essential Q: Would you characterize labor costs as being a fixed cost, a variable cost, or something else in this situation? A: Because these labor costs are essentially unchanged for most levels of production, they are primarily fixed. However, it could be described as being a “step function.” If production gets too far outside the normal range, workers’ hours will change. If production goes too low, hours are cut, and if it goes too high, overtime hours are needed.

p. 211 Charter Flights Offer a Good Deal Q: How did FlightServe determine that it would break even with 3.3 seats full per flight? A: FlightServe determined its break-even point with the following formula: Fixed costs / Contribution margin per seat occupied = Break-even point in seats.

p. 215 How a Rolling Stones’ Tour Makes Money Q: What amount of sales dollars are required for the promoter to break even? A: Fixed costs = $1,200,000 + $400,000 = $1,600,000

Contribution margin ratio = 80%

Break-even sales = $1,600,000 / .80 = $2,000,000

Answers to Self-Test Questions

1. d  2. c  3. a  4. d  5. a  
6. c  7. c  8. d
9. a  [(100,000 × $12) − $300,000 − $200,000]  10. c  (200,000 × $4 × 25%)  11. c  ($100 × 30%)
12. b  13. a  14. b  

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