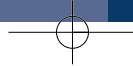


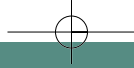


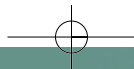
PART

two

# Management Accounting







# chapter

# 11

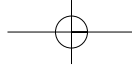
## Management accounting and cost–volume–profit relationships

### learning objectives

After studying this chapter you should be able to:

- 1** Explain the need for planning by management and the control cycle.
- 2** Identify the major differences between financial accounting and management accounting.
- 3** Explain the difference between variable and fixed cost behaviour patterns, and the simplifying assumptions made in this classification method.
- 4** Explain why expressing fixed costs on a per unit of activity basis is misleading and may result in faulty decisions.
- 5** Describe what kinds of costs are likely to have a variable cost behaviour pattern and what kinds of costs are likely to have a fixed cost behaviour pattern.
- 6** Use the high–low method to determine the cost formula for a cost that has a mixed behaviour pattern.
- 7** Explain the difference between the traditional income statement format and the contribution margin income statement format.
- 8** Explain the contribution margin and use it in CVP analysis.
- 9** Explain the meaning and significance of the break-even point and calculate the break-even point.
- 10** Explain the concept of operating leverage.





When asked by a marketing or production manager what a certain item or service activity costs, the management accountant who asks, 'Why do you want to know?' is not being smart, but being user-focused or customer-driven. Costs used for valuing inventory are different from the costs that should be considered when analysing a product modification or potential new product.

**Management accounting**, sometimes called *managerial accounting*, involves using economic and financial information to plan and control many of the activities of the entity and to support the management decision-making process. Management accounting has an internal orientation, as opposed to the primarily external orientation of financial accounting. The transactions generated by the accounting information system and used for financial reporting purposes also are used in management accounting, but management accounting is more likely to have a future orientation, such as in the preparation of budgets. As with financial accounting, management accounting has special terminology or, as many would say, *jargon*. Most of these terms relate to different types of costs. An important early lesson about management accounting is that *there are different costs for different purposes*.

In this chapter we will look briefly at the management process, identify several of the contributions that the management accountant makes to that process, and then introduce a model for cost classifications. Subsequent chapters will describe these costs and illustrate how they are used for planning, control and the decision-making processes.

**Cost-volume-profit (CVP) analysis** involves using cost behaviour patterns to interpret and forecast the changes in operating income that result from changes in revenues, costs or volume of activity. One especially important application of CVP analysis is the determination of the break-even point for a company (or one of its units or products). Because CVP analysis emphasises the cost behaviour pattern of various costs, and the impact on costs and profits of changes in the volume of activity, it is useful for planning and for evaluating actual results achieved.

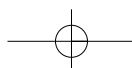
#### LEARNING OBJECTIVE 1

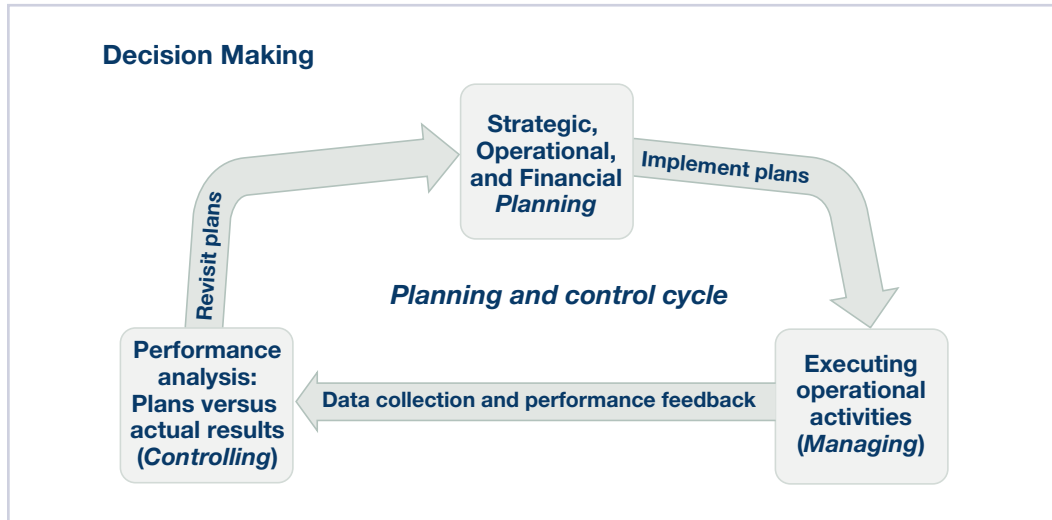
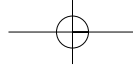
Explain the need for planning by management and the control cycle.

## Management accounting contrasted to financial accounting

Management accounting supports the internal planning (future-oriented) decisions made by management. Financial accounting has more of an accountability (or score keeping), or historical orientation, although data produced by the financial accounting process form some of the foundation on which plans are based. Planning is a key part of the **management process** and, although there are many descriptions of that process, a generally acceptable definition would include reference to the process of planning, organising and controlling an entity's activities so that the organisation can accomplish its purpose. A schematic model of the process is shown on the following page.

The diagram suggests that control is achieved through feedback. Actual results are compared to planned results and, if a variance exists between the two, then either the plan or the actions, or perhaps both, have changed. Managers, therefore, make decisions in each phase of the planning and control cycle, using information provided by the management accounting information system.





Not all of a firm's objectives are stated in financial terms, by any means. For example, market share, employee morale, absence of lay-offs, a safe working environment and responsible corporate citizenship are all-important objectives that are expressed in non-financial terms. However, many of the firm's goals will be financial in nature (e.g. Return on assets (ROA), Return on equity (ROE), growth in sales, earnings, and dividends, to name just a few). The accountant plays a major role in identifying these goals, helping to achieve them, and measuring the degree to which they have been accomplished.

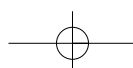
Emphasis on the future is a principal characteristic that makes management accounting different from financial accounting. Anticipating what revenues will be, and forecasting the expenses that are likely to be incurred to achieve those revenues, are critical activities of the budgeting process. Another difference between management accounting and financial accounting that is emphasised in planning is the breadth of focus. Financial accounting deals primarily with the financial statements for the organisation as a whole; management accounting is more concerned with operating units within the organisation. Thus, even though an overall company ROA objective is established, effective planning requires that the planned impact of the activities and results of each unit (division, product line, plant, sales territory and so on) of the organisation be considered.

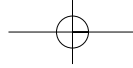
Measuring results involves the use of historical data of financial accounting and, because of the time required to perform some financial accounting processes and auditing procedures, there is usually a time lag of weeks or months between the end of an accounting period and the issuing of financial statements. However, for performance feedback to be most effective, it should be provided as quickly as possible after action has been completed. Management accounting is not constrained by generally accepted accounting principles, so approximate results can be generated quickly for use in the control process. In other words, relevant data, even though not absolutely accurate in a financial accounting sense, are useful for evaluating performance soon after an activity has been completed. Managers, being inside the firm and in the know, can cope with a level of approximation without much difficulty.

Exhibit 11-1 summarises the principal differences between management accounting and financial accounting.

## 2 LEARNING OBJECTIVE

Identify the major differences between financial accounting and management accounting.





**exhibit 11-1** MANAGEMENT ACCOUNTING COMPARED TO FINANCIAL ACCOUNTING

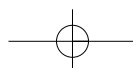
exhibit

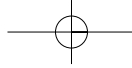
Characteristic	Management accounting	Financial accounting
Service perspective	Internal report to managers	External report to investors, creditors and other stakeholders
Time frame	Present and future for planning and control	Past—financial statements are historical
Breadth of concern	Micro—individual units of the organisation plan and act	Macro—financial statements are for the organisation as a whole
Reporting frequency and promptness	Control reports issued frequently (e.g. daily) and promptly (e.g. one day after period-end)	Audited financial statements issued annually with interim results after 6 months
Degree of precision of data used	Reasonable accuracy desired, but ‘close counts’—relevance is often more important than reliability	High accuracy desired, with time usually available to achieve it—reliability is of utmost importance enforced by the requirements of an audit
Reporting standards	None imposed because of internal and pragmatic orientation	Imposed by generally accepted accounting principles and the AASB

If time and effort have been devoted to developing a plan, it is sensible to attempt to control the activities of the organisation so that the goals of the plan are accomplished. Many of the activities of the management accountant are related to cost control; this *control* emphasis will be seen in most of the management accounting ideas that are explained in these chapters.

Another management concept relevant to the control process is that, if an individual is to be held accountable, or responsible, for the results of an activity, that individual also must have the authority to influence those results. If a manager is to be held responsible for costs incurred by a unit of the organisation, the financial results reported for that unit should not include costs incurred by other units that have been *arbitrarily* assigned to the unit being evaluated. In other words, the results should not reflect costs that the manager being held responsible cannot control.

Management accountants work extensively with people in other functional areas of the organisation. For example, industrial engineers and management accountants work together to develop **production standards**, which are the expected or allowed times and costs to make a product or perform an activity. Management accountants help production people interpret performance reports, which compare actual and planned production outputs and costs. Sales personnel, the marketing staff and management accountants are involved in estimating a future





period's sales. Human resource professionals and management accountants work together to determine the cost effect of compensation changes. And, the management accountant will play a significant role in the firm's systems development life-cycle process by providing key insight into the planning, analysis, design and implementation phases of an organisation's information systems projects. These few key examples illustrate the need for management accountants to have a breadth of knowledge and interest about the organisation and its operating environment. The examples also suggest that it is appropriate for persons in other functional areas to have a general understanding of management accounting. Helping you to achieve that general understanding is the objective of the remaining chapters of this book.

- 
- 1 What does it mean that management accounting has a different time frame from financial accounting?
  - 2 What does it mean to have feedback for control purposes?
- 

**What ?  
Does It Mean**

## Cost classifications

The term *cost* means different things to different people and, in the management planning and decision-making process, it is important to use costs that are appropriate to the situation. Likewise, management accountants should make sure that everyone involved in any given situation understands the costs being used. Exhibit 11-2 presents the cost classifications most frequently encountered and highlights the cost topics covered in this chapter.

These classifications are not mutually exclusive; a cost might be identified as a 'controllable, variable, direct, product cost', for example. Overall, this basic concept of *different costs for different purposes* is so fundamental to an understanding of the planning, control and decision-making process that the cost classification model will be presented again in each of the management accounting chapters that follow. From the perspective of this model you will be introduced to these cost concepts as they relate to the planning, control or decision-making theme being developed.

- 
- 3 What does it mean to state that there are different costs for different purposes?
- 

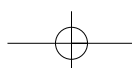
**What ?  
Does It Mean**

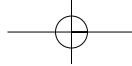
## Relationship of total cost to volume of activity

The relationship of total cost to volume of activity describes the **cost behaviour pattern**, one of the most important cost classification methods to understand. A **variable cost** is one that changes *in total* as the volume of activity changes. A cost that does not change *in total* as the volume of activity changes is a **fixed cost**. For example, raw material cost incurred to manufacture a product has a variable cost behaviour pattern, because the greater the number of units produced, the higher the total raw material costs incurred. On the other hand, factory building depreciation expense is a fixed cost because total depreciation expense will not change regardless of the level of production (unless, of course, a units of production method is used to calculate depreciation, in which case this cost would be variable). The distinction between fixed and variable cost behaviour patterns is illustrated graphically in Exhibit 11-3.

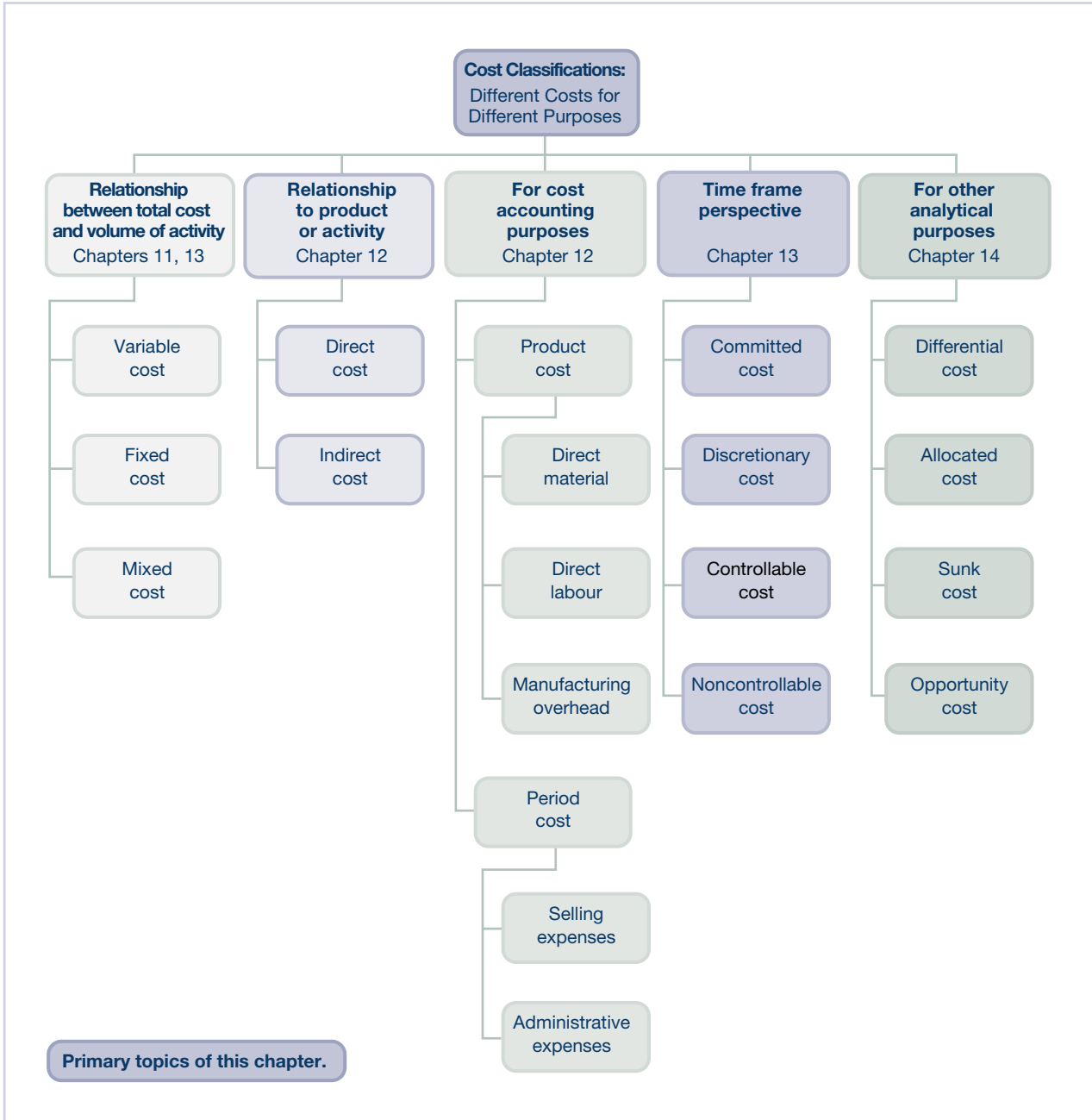
### 3 LEARNING OBJECTIVE

Explain the difference between variable and fixed cost behaviour patterns, and the simplifying assumptions made in this classification method.

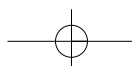




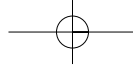
**exhibit 11-2 COST CLASSIFICATIONS—THE BIG PICTURE**



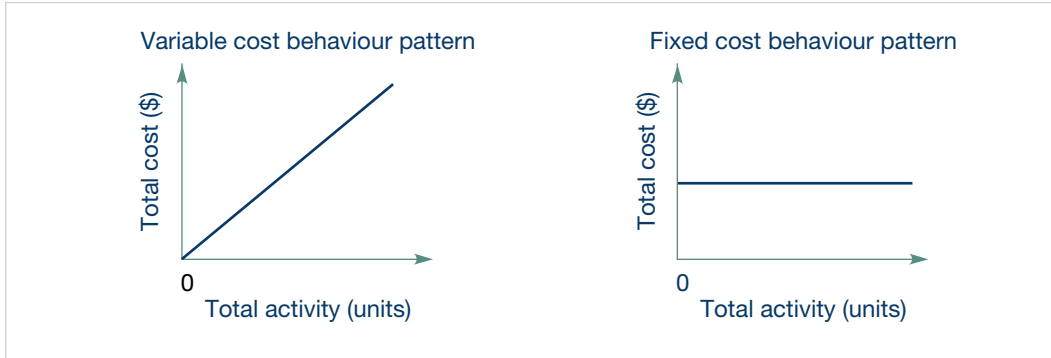
The fixed or variable label refers to the behaviour of total cost, relative to a change in activity. When referring to the behaviour of unit costs, however, the labels may be confusing, because variable costs are constant per unit but fixed costs per unit will change as the level of activity changes. Thus, it is necessary to understand the behaviour pattern on both a total cost basis and a per unit basis, as illustrated below. Variable costs change in total as activity changes but are constant per unit.







**exhibit 11-3 COST BEHAVIOUR PATTERNS**



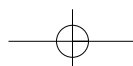
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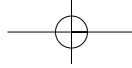
Fixed costs do not change in total as activity changes but will vary if expressed on a per unit of activity basis. ‘Activity’ is a conceptual term that can be applied to any particular aspect being measured. Units of production, kilometres travelled, hours worked, machine hours run, litres produced . . . the list is as long as it needs to be to be useful.

	<b>As Activity Changes</b>	
	<b>Total</b>	<b>Per Unit</b>
<b>Fixed Cost</b>	<i>Remains constant</i>	<i>Changes inversely</i>
<b>Variable Cost</b>	<i>Changes directly</i>	<i>Remains constant</i>

Knowledge of the cost behaviour pattern is important to the planning process, and several simplifying assumptions are usually made to facilitate the use of this analytical tool. The most significant assumption has to do with the range of activity over which the identified or assumed cost behaviour pattern exists. This is the **relevant range** assumption, and it is most applicable to fixed costs. Returning to the depreciation expense example, it is clear that at some point an increase in the volume of production would require more plant capacity, and depreciation expense would increase. On the other hand, if substantially lower production volumes were anticipated in the future, some of the factory would be closed down or converted to other use, and depreciation expense would decrease. To say that depreciation expense is fixed is to say that over some relevant range of production the total cost will not change. Different fixed expenses will have different relevant ranges over which they have a fixed cost behaviour pattern. When a cost is identified as fixed and cost projections are made based on that cost behaviour pattern classification, the limits of the relevant range assumption must be considered. The other major simplifying assumption is that the cost behaviour pattern is *linear*, not curvilinear. This assumption relates primarily to variable costs. Because of economies of scale, quantity discounts and other factors, variable costs will change slightly when expressed on a per unit basis. These changes are usually not significant but, if they are, appropriate adjustment in unit costs should be made in analyses based on cost behaviour patterns. These assumptions are illustrated and described in more detail later in this chapter.

It is clear that not all costs can be classified as either variable or fixed. Some costs are partly fixed and partly variable. Sometimes costs with this mixed behaviour pattern are called **semi-variable costs**. Water, light and electricity for the factory, for example, have a mixed behaviour pattern because, when the plant is not operating, some lights must be kept on for safety and security but,





as production increases, more electricity is required. Analytical techniques can break this type of cost into its fixed and variable components, and a **cost formula** can be developed, expressed as:

$$\begin{aligned} \text{Total cost} &= \text{Fixed cost} + \text{Variable cost} \\ &= \text{Fixed cost} + (\text{Variable rate per unit} \times \text{Activity}) \end{aligned}$$

This cost formula then can be used to forecast the total cost expected to be incurred at various levels of activity. For example, assume that it has been determined that the fixed cost for water, light and electricity is \$350 per month and that the variable rate for water, light and electricity is 30 cents per machine hour. Total estimated water, light and electricity cost for a month in which 6 000 machine hours were planned would be:

$$\text{Total cost} = \$350 + (\$0.30 \times 6\,000 \text{ machine hours}) = \$2\,150$$

**LEARNING OBJECTIVE 4**

Explain why expressing fixed costs on a per unit of activity basis is misleading and may result in faulty decisions.

Great care must be taken with the use of fixed cost per unit data because any change in the volume of activity will change the per unit cost. As a general rule, do not unitise fixed expenses because *they do not behave on a per unit basis!* For example, many of the costs of a university library—salaries, depreciation, and water, light and electricity—are fixed; to calculate the ‘cost’ of issuing a book by dividing library costs by the number of books issued in a period of time will give a misleading result, as illustrated in Exhibit 11-4. Sometimes fixed costs must be unitised, as in the development of a predetermined overhead application rate (described in Chapter 12). It is also important to recognise that the relevant range is often quite wide, and significant increases in activity can be achieved without increasing fixed costs (i.e. there are economies of scale to be achieved that result in efficiencies and a reduction of fixed cost per unit). However, whenever fixed costs are unitised, be very careful about drawing conclusions from that data.

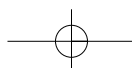
**exhibit 11-4 THE ERROR OF UNITISING FIXED COSTS**

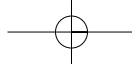
Assume a university provides a shuttle bus service between the nearest railway station and the campus. The university has entered into a contract with a regional bus company to run an hourly service during semester, with a modified service out of semester. Students need to buy a ticket to use this service, with all ticket revenue going to the university.

For an hourly service during semester:	
18 weeks x 2 semesters: \$7 500 x 18 x 2 =	\$270 000 p.a.
(14 weeks' lectures + 1 week stuvac+ 2 weeks' exams + 1 week orientation/registration)	
For a modified service other than during one week at the Christmas shutdown:	
For 15 weeks: \$2 500 x 15	\$37 500 p.a.
If 2 000 tickets were issued on average in a semester week, the 'cost' per transaction is (\$7 500/2 000)	\$3.75
If 500 tickets were issued on average in an out-of-semester week, the 'cost' per transaction is (\$2 500/500)	\$5.00

- How much does it cost to complete a transaction?
- Should the ticket prices be different in and out of semester?
- If the university administered the sale of bus tickets, what other costs would need to be included in costing the service?
- What are the risks (to the university) of delegating the responsibility for ticket sales to the bus company?

exhibit





- 4 What does it mean to say that determination of cost behaviour pattern involves some implicit assumptions?
- 5 What does it mean to develop a cost formula?

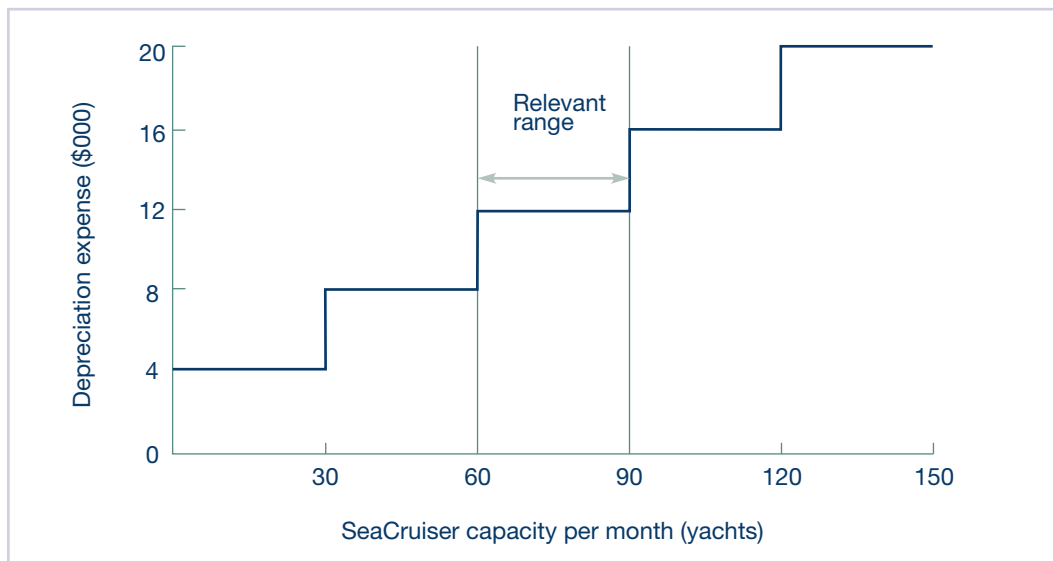
**What ?  
Does It Mean**

## Applications of cost-volume-profit analysis

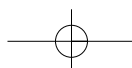
### Cost behaviour pattern: the key

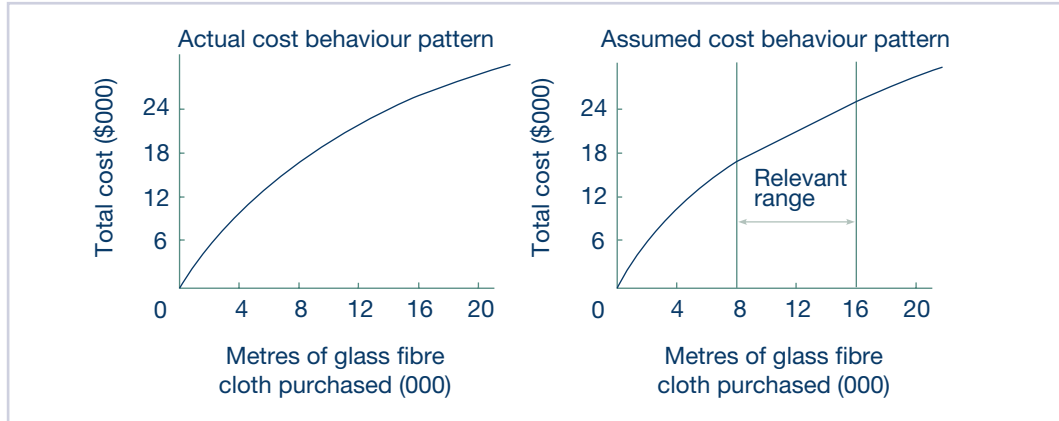
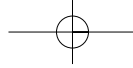
Recall the two simplifying assumptions that are made in connection with the determination of cost behaviour patterns. First, the behaviour pattern is true only within a relevant range of activity; if activity moves beyond the relevant range, the cost will change. Second, the cost behaviour pattern identified is assumed to be linear within the relevant range, not curvilinear.

The relevant range idea relates to the level of activity over which a particular cost behaviour pattern exists. For example, if the production capacity of the plant of Cruisers Ltd is 90 Sea Cruiser yachts per month, additional equipment would be required if production of 120 yachts per month were required. The investment in additional equipment would result in an increase in depreciation expense. On the other hand, if long-term demand for yachts could be satisfied with a capacity of only 50 yachts per month, it is likely that management would 'mothball' (or dispose of), some of the present capacity and depreciation expense would fall. The following graph illustrates a possible relationship between depreciation expense and capacity. The relevant range for depreciation expense of \$12 000 per month is production capacity of 60 to 90 yachts. As long as capacity remains in this range, the total fixed expense for depreciation will not change, but if capacity changes to another relevant range, then the amount of this fixed expense also will change.



Continued...





The linearity assumption means that the cost behaviour pattern will plot as a straight line within the relevant range. Although applicable to both fixed and variable costs, the significance of this assumption is best illustrated with a variable cost such as raw materials, for example, fibreglass cloth. Because of quantity discounts and invoicing efficiencies, the cost per unit of the raw material will decrease as the quantity purchased increases. This is illustrated in the left graph of the second set of graphs above. For analytical purposes, however, it may be assumed that the cost is linear within a relevant range, as shown in the right graph. Even though the cost per metre does vary slightly at different activity levels, for purposes of using cost–volume–profit analytical techniques, it will be assumed constant per metre (variable in total) when purchases total between 8 000 and 16 000 metres per month.

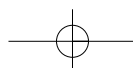
It is clear that if these assumptions are overlooked, or if costs are incorrectly classified or described, the results of the analytical process illustrated later in this chapter will be inaccurate. Cost–volume–profit analysis is a valuable tool to use in many situations, but the cost behaviour assumptions made are crucial to the validity and applicability of its results, and they must be kept in mind when evaluating these results.

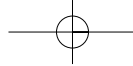
**LEARNING OBJECTIVE 5**

Describe what kinds of costs are likely to have a variable cost behaviour pattern and what kinds of costs are likely to have a fixed cost behaviour pattern.

Generally speaking, raw materials and direct labour costs of manufacturing units of product are variable costs. In addition, some elements of overhead (see the discussion of overhead in Chapter 12 for more detail) will have a variable cost behaviour pattern. For example, maintenance and housekeeping materials used, as well as the variable portion of water, light and electricity, will be a function of the level of activity. Other overhead costs are fixed, including depreciation expense, supervisory salaries, and the fixed portion of water, light and electricity costs.

Selling, general, administrative, and other operating expenses also fit both patterns. Sales commissions, for example, could vary in proportion to sales revenue or the quantity of product sold. Alternatively, sales people could earn a basic salary plus a commission on sales over a set number of units sold or dollar amount of sales. In this case, the cost of the salesperson’s salary is a composite of a fixed amount (base salary) plus variable amount (true commission). The wages associated with employees who process orders or handle payments from customers may be variable if those functions are organised so that the number of workers can be expanded or contracted rapidly in response to changes in sales volume; typically, where there are a number of permanent full-time staff, and casual staff are employed when required, in peak periods. Business organisation (and reward for services provided), therefore, predicts the nature of the expense classification. On the other hand, advertising costs usually are fixed (committed) in the short run; once approved, the money is spent, and it is difficult to relate specific sales volume changes





directly to advertising expenditures. The whole advertising campaign can be evaluated after the fact (was the money well spent?) but, on an individual product level, this is almost an impossible task, so, advertising is most often treated as a fixed cost.

## Estimating cost behaviour patterns

A particular cost's estimated behaviour pattern is determined by analysing cost and activity over a period of time. One of the analytical techniques involves using a scattergram to identify high and low cost volume data and then simple arithmetic is used to compute the variable rate and cost formula. This 'high-low' method is illustrated in Exhibit 11-5. More complex techniques, including simple and multiple regression analysis, also can be used but, at some point, the perceived increase in accuracy is offset by the simplifying assumptions involved in using the cost formula for planning and control purposes.

**6** LEARNING OBJECTIVE

Use the high-low method to determine the cost formula for a cost that has a mixed behaviour pattern.

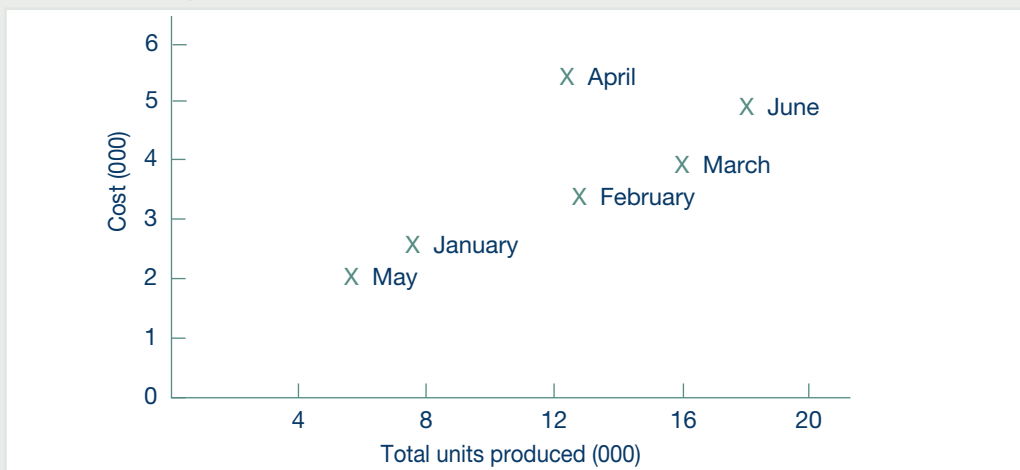
**exhibit 11-5** HIGH-LOW METHOD OF ESTIMATING A COST BEHAVIOUR PATTERN

**Assumption:**

During the months of January through June, the following water, light and electricity costs were incurred at various service levels:

Month	Total Water, Light, Elect Cost \$	Total Production Volume (billable hours)
January	2 500	8 000
February	3 500	13 000
March	4 000	16 000
April	5 500	12 000
May	2 000	6 000
June	5 000	18 000

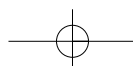
**I. The scattergram**

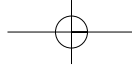


It can be observed in the scattergram that a cost-volume relationship does exist because of the approximate straight-line pattern of most of the observations. However, the April data do not

*Continued...*

exhibit





fit the pattern. This may be due to an error or some unusual condition. This observation is an 'outlier' and will be ignored in the calculation of the cost formula because of its variation from the cost-volume relationship that exists between the other data.

## II. Calculation of the variable cost behaviour pattern

The high-low method of calculating the variable cost behaviour pattern, or variable cost rate, relates the change in cost to the change in activity, using the highest and lowest *relevant* observations.

$$\begin{aligned} \text{Variable rate} &= \frac{\text{High cost} - \text{Low cost}}{\text{High activity} - \text{Low activity}} \\ &= \frac{\$5\,000 - \$2\,000}{18\,000 \text{ hrs} - 6\,000 \text{ hrs}} \\ &= \$3\,000/12\,000 \text{ units} \\ &= \$0.25 \text{ per unit} \end{aligned}$$

## III. The cost formula

Knowing the variable rate, the fixed cost element can be calculated at either the high or low set of data, and the cost formula can then be developed, because total cost is equal to variable cost plus fixed cost.

At 18 000 units of activity, the total variable cost is 18 000 hours  $\times$  \$0.25 per hour = \$4 500.

Fixed cost calculation:

$$\begin{aligned} \text{Total cost at 18 000 hours} &= \$5\,000 \\ \text{Variable cost at 18 000 hours} &= \underline{4\,500} \\ \text{Fixed cost} &= \underline{\underline{\$ 500}} \end{aligned}$$

At 6 000 hours of activity, the total variable cost is 6 000 hours  $\times$  \$0.25 per hour = \$1 500.

Fixed cost calculation:

$$\begin{aligned} \text{Total cost at 6 000 hours} &= \$2\,000 \\ \text{Variable cost at 6 000 hours} &= \underline{1\,500} \\ \text{Fixed cost} &= \underline{\underline{\$ 500}} \end{aligned}$$

The cost formula for water, light and electricity is:

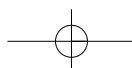
$$\begin{aligned} \text{Total cost} &= \text{Fixed cost} + \text{Variable cost} \\ &= \$500 + \$0.25 \text{ per hour produced} \end{aligned}$$

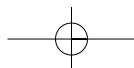
This cost formula now can be used to estimate total utility costs at any level of activity (within the relevant range). For example, if production volume for the month of July is expected to be 14 000 hours, the estimated total utility cost would be:

$$\begin{aligned} \text{Total cost} &= \text{Fixed cost} + \text{Variable cost} \\ &= \$500 + (\$0.25 \times 14\,000) \\ &= \$4\,000 \end{aligned}$$

Note that it is considered a coincidence if the cost formula explains total cost accurately at points not used in the high-low calculation. This is because the calculation assumes a linear relationship between the observations used and, in practice, *exact* linearity will not exist.

In this example, the application of the high-low method has been applied to activity measured in hours. It could just as easily have been applied to activity measured in units produced or hours worked.





## A modified income statement format

The traditional income statement format classifies costs according to the reason (function) they were incurred: cost of goods sold, selling expenses, administrative expenses, research and development expenses, and so on. The income statement format used in CVP analysis is frequently referred to as the **contribution margin format**, and classifies costs according to their behaviour pattern—variable or fixed. The alternative formats are:

Traditional Format (expenses classified by function)		Contribution Margin Format (expenses classified by cost behaviour pattern)	
\$		\$	
Revenues	_____	Revenues	_____
Cost of goods sold	_____	Variable expenses	_____
Gross profit	_____	Contribution margin	_____
Operating expenses	_____	Fixed expenses	_____
Operating income	_____	Operating income	_____

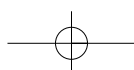
**7 LEARNING OBJECTIVE**  
Explain the difference between the traditional income statement format and the contribution margin income statement format.

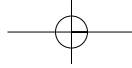
Revenues and operating income (income before interest and taxes) are the same under either alternative. The difference is in the classification of expenses: functional in the traditional format and according to cost behaviour pattern in the contribution margin format. Although the behaviour pattern classification could be carried beyond operating income to other income and expense, and income taxes, it usually is not, because the greatest benefits of the contribution margin approach are realised in the planning and control and evaluation processes applied to a firm's operations.

The contribution margin format derives its name from the difference between revenues and variable expenses. **Contribution margin** means that this amount is the contribution to fixed expenses and operating income from the sale of product or provision of service. The key to this concept lies in understanding cost behaviour patterns. As revenue increases as a result of selling more products or providing more services, variable expenses will increase proportionately, and so will contribution margin. However, *fixed expenses will not increase* because they are not a function of the level of revenue-generating activity.

Use of the traditional income statement model can result in misleading and erroneous conclusions when changes in activity levels are being considered, because it is assumed that all expenses change in proportion to changes in activity. This error is made because cost behaviour patterns are not disclosed. The error is avoided when the contribution margin model is used correctly. For example, assume that a firm currently has revenues of \$100 000 and operating income of \$10 000. If revenues were to drop by 20 per cent to \$80 000, a quick conclusion would be that operating income also would decline by 20 per cent, to \$8 000. However, analysis using the contribution margin format results in a much more accurate, and disturbing, result:

	Current results	Results assuming a 20% decline in revenue
	\$	\$
Revenues	100 000	80 000
Variable expenses (60%)	60 000	48 000
Contribution margin (40%)	40 000	32 000
Fixed expenses	30 000	30 000
Operating income	<u>10 000</u>	<u>2 000</u>





Because fixed expenses did not change (the firm did not move into a different relevant range), the \$8 000 reduction in contribution margin resulting from the 20 per cent reduction in revenues carried right through to reduce operating income by the same dollar amount. This is an example of why it is misleading to think of fixed costs on a per unit basis. Although the management cannot ignore fixed costs, it must be recognised that they behave differently from variable costs.

The **contribution margin ratio** is the ratio of contribution margin to revenues. Think of the ratio as the portion of each sales dollar that remains after covering the variable costs and which is available to cover fixed costs or provide for profits. This ratio can be used to calculate directly the change in contribution margin for a change in revenues. Continuing with the same data used above, a \$12 000 increase in revenue would result in a \$4 800 ( $40\% \times \$12\ 000$ ) increase in contribution margin and a \$4 800 increase in operating income.

## What ? Does It Mean

- 6 What does it mean to rearrange the income statement model from the traditional format to the contribution margin format?
- 7 What does it mean to state that the contribution margin model is more useful than the traditional model for determining the effect on operating income of changes in activity?

### LEARNING OBJECTIVE 8

Explain the contribution margin and use it in CVP analysis.

We have already established the importance of distinguishing fixed costs from variable cost in management accounting. In view of its importance, it should come as no surprise that a cost formula has been developed which allows assessment of the impacts of various changes to expected outcomes in all types of scenarios.

Typical questions that need to be resolved in the process of managing a business include:

- What is the contribution unit amount and per cent ratio?
- What would the impact of a change in selling price be on profit, given the probability of a change in the volume of sales?
- What would the impact of a change in selling price be on profit, given the probability of a change in the volume of sales, if the fixed costs of advertising were also to be increased?
- What is the volume of sales needed to cover total costs?
- If there is a change in either fixed or variable costs or both, what impact would that have on the sales volume needed to cover costs?
- What must sales volume be to achieve a target after tax profit?

One formula can solve ALL these questions:  $Sx = VCx + FC + P$

Where S = selling price per unit

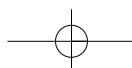
VC = variable costs per unit

FC = Fixed costs

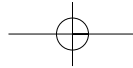
P = Profit

x = volume of units

To illustrate the use of the formula, assume that management wants to know the operating income from a product that has the following revenue, cost and volume characteristics:







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Selling price per case	\$ 15
Variable expenses per case	9
Fixed expenses associated with the product	\$40 000
Sales volume in cases	9 000 cases

$$\begin{aligned}
 Sx &= VCx + FC + P & \text{OR simplified: } x(S - VC) - FC &= P \\
 (15 \times 9\,000) &= (9 \times 9\,000) + 40\,000 + P & 9\,000(15-9) - 40\,000 &= P \\
 P &= \$14\,000 & \$14\,000 &= P
 \end{aligned}$$

Now assume that management wants to know what sales volume is necessary to achieve break even. This is where total revenue equals total cost or the point at which profit is zero.

$$\begin{aligned}
 Sx &= VCx + FC + P & \text{OR simplified: } x(S - VC) &= P + FC \\
 15x &= 9x + 40\,000 + 0 & x &= P + FC / (S - VC) \\
 x(15 - 9) &= 40\,000 & x &= 0 + 40\,000 / (15 - 9) \\
 x &= 40\,000 / (15 - 9) & x &= 6\,666.66 \\
 x &= 6\,666.7 & & \\
 x &= 6\,667 \text{ units rounded to} & x &= 6\,667 \text{ units rounded to} \\
 & \text{next complete unit} & & \text{the next complete unit} \\
 \text{In dollars } 6\,667 \text{ units} \times \$15 & & \text{In dollars } 6\,667 \times \$15 & \\
 = \$100\,005 & & = \$100\,005 & \\
 \text{Covers } 40\,000 + 6\,667 \times 9 = 100\,003 & & &
 \end{aligned}$$

Another situation may require working with a variety of products where control is maintained by having a standard contribution margin. In this case, we can regard selling price as being 100 per cent, with variable expenses expressed as a percentage of that selling price.

To illustrate the use of the formula, assume that management wants to know the operating income from a product that has the following revenue and cost characteristics in respect of many products with a uniform contribution margin ratio:

	<b>\$</b>
Sales	135 000 (100%)
Variable expenses per case	81 000 (60%)
Fixed expenses associated with the product	40 000

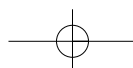
$$\begin{aligned}
 \text{Sales} &= \text{Total VC} + FC + P & \text{OR} & \text{Simplified: Sales} - \text{Total VC} - FC = P \\
 135\,000 &= 81\,000 + 40\,000 + P & & 135\,000 - 81\,000 - 40\,000 = P \\
 \$14\,000 &= P & & \$14\,000 = P
 \end{aligned}$$

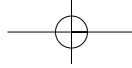
This could also be solved with percentages:

$$\begin{aligned}
 FC + P &= 40\% S \\
 P &= 0.4 \times 135\,000 - 40\,000 \\
 P &= \$14\,000
 \end{aligned}$$

**8** What does it mean that fixed expenses should not be unitised because they don't behave that way?

**What ?  
Does It Mean**




**LEARNING OBJECTIVE 9**

Explain the meaning and significance of break-even point and calculate the break-even point.

The **break-even point** is usually expressed as the amount of revenue that must be realised for the firm (or product or activity or group of products or activities) to have neither profit nor loss (i.e. operating income equal to zero). The break-even point is useful to managers because it expresses a minimum revenue target, and managers frequently find it easier to think in terms of revenues rather than variable and fixed expenses. In addition, the amount of sales (or revenues) generated by the firm is easily determined on a daily basis from the accounting system.

Once again, the formula can be used to solve the problem.

	\$
Selling price per unit	12
Variable expenses per unit	8
Total fixed expenses	45 000

$Sx = VCx + FC + P$  or simplified:  $x(S - VC) - FC = P$  and simplified further:  $x = FC + P / S - VC$

$$x = \frac{\$45\,000 + \$0}{(12-8)}$$

$$x = 11\,250 \text{ units}$$

or sales revenue at break-even point = break-even units  $\times$  unit revenue

$$\$135\,000 = 11\,250 \times 12$$

Most firms' plan for certain desired levels of operating income and would not be satisfied to simply break even. As illustrated earlier, the contribution margin model can be used to determine total revenues and sales volume in units for any amount of desired operating income. The break-even formula also can be easily modified to determine these amounts by adding the desired operating income to the numerator. To illustrate, assume the same information as above and a desired operating income of \$10 000. Operating income is profit before tax.

$Sx = VCx + FC + P$  or simplified  $x(S - VC) - FC = P$  and simplified further:  $x = FC + P / S - VC$

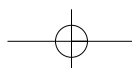
$$x = \frac{\$45\,000 + \$10\,000}{(12-8)}$$

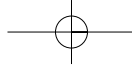
$$x = 13\,750 \text{ units}$$

or  $13\,750 \times \$12 = \$165\,000$

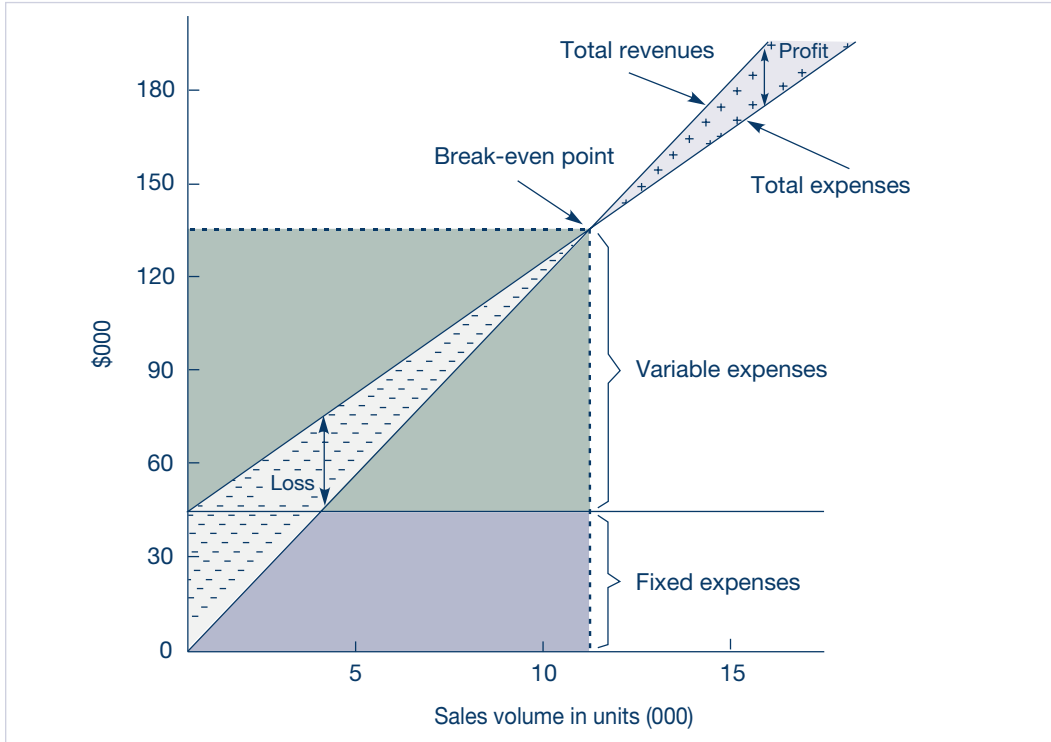
Break-even analysis is frequently illustrated in graphical format, as illustrated in Exhibits 11-6 and 11-7, with data from the above example. Note that, in these graphs, the horizontal axis is sales volume in units, and the vertical axis is total dollars. In Exhibit 11-6, the horizontal line represents fixed expenses of \$45 000, and variable expenses of \$8 per unit are added to fixed expenses to produce the total expense line. Revenues start at the origin and rise at the rate of \$12 per unit, in proportion to the sales volume in units. The intersection of the total expense line and the total revenue line is the break-even point. The sales volume required to break even (11 250 units) is on the horizontal axis directly below this point, and total revenues required to break even (\$135 000) can be read on the vertical axis opposite the intersection.

The amount of operating income or loss can be read as the dollar amount of the vertical distance between the total revenue line and total expense line, for the sales volume actually achieved. Sometimes the area between the two lines is marked as 'profit area' or 'loss area'.



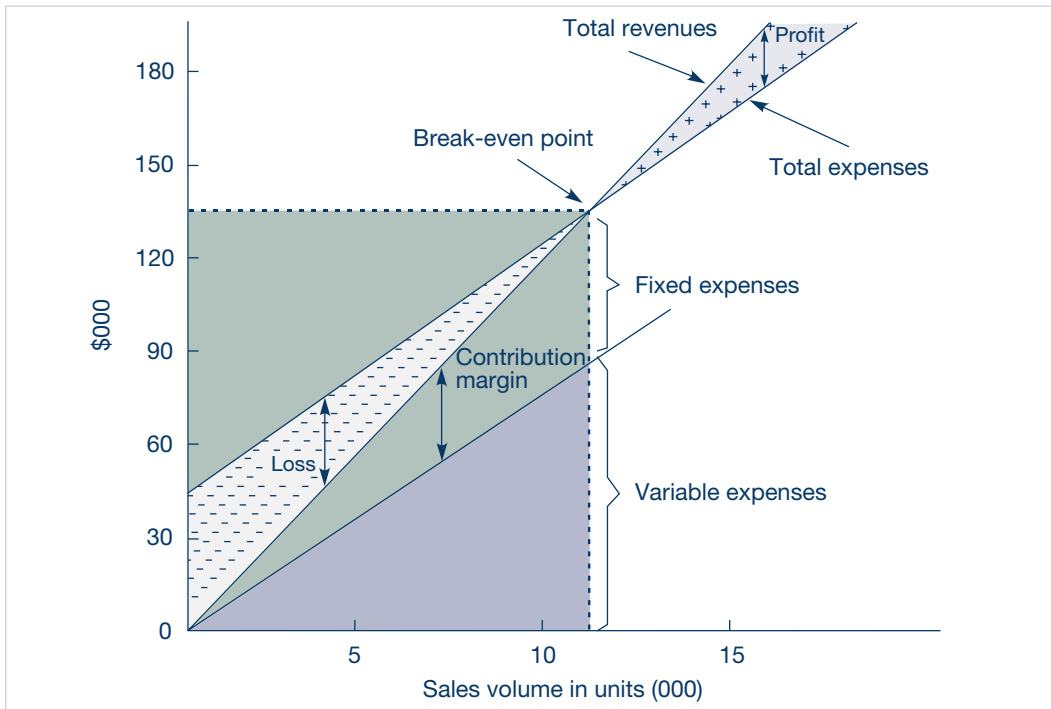


**exhibit 11-6** BREAK-EVEN GRAPH

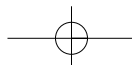


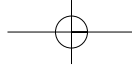
exhibit

**exhibit 11-7** BREAK-EVEN GRAPH FEATURING CONTRIBUTION MARGIN



exhibit





Note that the loss area begins with an amount equal to total fixed expenses of \$45 000 (at a sales volume of zero units). As unit sales increase, the loss decreases by the contribution margin per unit of \$4, until the break-even point is achieved—then the profit increases by the contribution margin per unit.

Exhibit 11-7 is another version of the break-even graph. The variable expense line begins at the origin, with fixed expenses added to total variable expenses. Although expenses are rearranged compared to Exhibit 11-6, the total expense line stays the same, and the break-even point and the profit and loss areas are the same. This version permits identification of contribution margin and shows how contribution margin grows as volume increases.

The key to the break-even point calculation (and graphic presentation) is that fixed expenses remain fixed in total, regardless of the level of activity, subject to the relevant range assumption. In addition to that assumption, the linearity and constant **sales mix** assumptions also must be considered. In spite of these simplifications, the contribution margin model and cost behaviour pattern concepts are among the most important management accounting ideas to understand and to be able to apply. The manager encounters many situations in which cost-volume-profit analysis supports decisions that contribute to the achievement of the organisation's objectives. One of these applications is described in Business in Practice—The 1-Cent Sale.



### THE 1-CENT SALE

The manager of a fast food and soft ice-cream business operating in a city when a 1-cent sale is held in July shows an understanding of cost-volume-profit relationships. Ice-cream sundaes are featured—two for the price of one, plus 1 cent. None of the other menu items are on sale.

Those sundaes usually sell for a price of \$1.25 to \$1.75 but, even with generous estimates, it is hard to come up with variable costs (ice-cream, topping, cup and spoon) much greater than 30 per cent of the usual selling price. So, even when the price is effectively cut in half, there is still a positive contribution margin. And what happens to the store's fixed costs during the sale? They are probably not affected at all. The fixed costs (including workers' wages) will be incurred whether or not extra customers come in for the sundae special. And, of course, many of those customers probably will buy other items at the regular price.

The net result of the special promotion is that the store builds traffic and business at a time of otherwise low activity (assuming that normal demand for sundaes is low in July). All of the additional sales volume generates a positive contribution margin, fixed expenses are the same as they would have been without the promotion, and operating income is increased over what it otherwise would have been.

## What ? Does It Mean

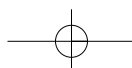
9 What does it mean to break even?

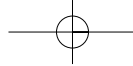
### LEARNING OBJECTIVE 10

Explain the concept of operating leverage.

## Operating leverage

When an entity's revenues change because the volume of activity changes, variable expenses and contribution margin will change proportionately. But, the presence of fixed expenses, which do not change as the volume of activity changes, means that operating income will change proportionately more than the change in revenues. This magnification of the effect on operating income of a change in revenues is called **operating leverage**. This was illustrated in the discussion of the contribution margin format income statement example earlier in this chapter (pages 345–346).





It showed a 20 per cent decline in volume, with revenues, variable expenses and contribution margin also declining by 20 per cent, but operating income declined 80 per cent (from \$10 000 to \$2 000). Note the similarity of operating leverage to financial leverage, explained in Chapter 8, in which fixed interest expense causes a proportionately greater change in ROE than the percentage change in ROA resulting from any given change in operating income.

Just as high financial leverage increases the risk that a firm may not be able to meet its required interest payments, high operating leverage increases the risk that a small percentage decline in revenues will cause a relatively larger percentage decline in operating income. *The higher a firm's contribution margin ratio, the greater its operating leverage.* Management can influence the operating leverage of a firm by its decisions about incurring variable versus fixed costs. For example, if a firm substitutes automated production equipment for employees, it has changed a variable cost (assuming the employees could be laid off if demand for the firm's products declined) to a fixed cost (the machine will depreciate, be insured and be included in the insurance premiums, whether or not it is being used), and it has increased its contribution margin ratio and operating leverage. If the management of a firm anticipates a decline in demand for the firm's products or services, it may be reluctant to change its cost structure by shifting variable costs to fixed costs, even though productivity increases could be attained, because the equipment has to be operating to realise the benefits of productivity gains.

**exhibit 11-8 OPERATING LEVERAGE**

Assume that two companies make similar products, but that the companies have adopted different cost structures. Company A's product is made in a labour-intensive operation with relatively high variable costs but relatively low fixed costs, and Company B's product is made in a capital-intensive operation with relatively low variable costs but relatively high fixed costs. Each firm presently sells 10 000 units of product. Cost structures are given below.

	Company A— Lower Operating Leverage		Company B— Higher Operating Leverage	
	Per Unit		Per Unit	
	\$		\$	
Revenue	50	10 000 units sold	50	10 000 units sold
Variable expenses	35		20	
Contribution margin	<u>15</u>	30%	<u>30</u>	60%
Fixed expenses	<u>50 000</u>		<u>200 000</u>	

**1. Operating income**

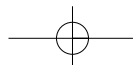
$Sx - VCx - FC = P$	or simplified	$x(S - VC) - FC = P$
$P = 10\ 000(50 - 35) - 50\ 000$		$P = 10\ 000(50 - 20) - 200\ 000$
$P = \$100\ 000$		$P = \$100\ 000$

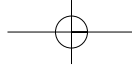
**2. Effect on operating income of a 10% increase in volume from 10 000 to 11 000 units**

$P = 11\ 000(50 - 35) - 50\ 000$	$P = 11\ 000(50 - 20) - 200\ 000$
$P = \$115\ 000$	$P = \$130\ 000$
$P$ increased by 15%	$P$ increased by 30%

Continued...

exhibit





Since the contribution margin ratio was twice as large in the second business, the effect of changes in volume (scale) is twice as large.

This is the case for growth in sales as well as for losses in market.

**3. Assume this time that volume dropped 20% from current levels of 10 000 units  
Operating profit for both businesses could be determined according to the formula**

$$\begin{aligned}
 P &= x(S - VC) - FC \\
 P &= 8\,000(50 - 35) - 50\,000 \\
 P &= \$70\,000 \\
 P &\text{ has decreased by } 30\%
 \end{aligned}$$

$$\begin{aligned}
 P &= x(S - VC) - FC \\
 P &= 8\,000(50 - 20) - 200\,000 \\
 P &= \$40\,000 \\
 P &\text{ has decreased by } 60\%
 \end{aligned}$$

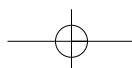
The effect of different cost structures on operating leverage is illustrated in Exhibit 11-8. Observe that, with the alternative cost structures and a volume of 10 000 units, Company A and Company B achieved an identical amount of operating income of \$100 000. This exhibit illustrates an important element of the decision-making process, involving the trade-off between fixed cost (capital intensive) and variable cost (labour intensive) alternatives and is referred to as the **indifference point**. The indifference point is found by setting the cost structure (total cost) of each alternative (Company A and Company B in this example) equal to one another and solving for the volume of activity that equates total cost. For example:

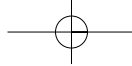
$$\begin{array}{rcl}
 \text{Company A} & = & \text{Company B} \\
 \hline
 \text{Fixed costs +} & & \text{Fixed costs +} \\
 \text{(Variable cost per unit} \times \text{Volume)} & & \text{(Variable cost per unit} \times \text{Volume)} \\
 \$50\,000 + (\$35 \times \text{Volume}) & = & \$200\,000 + (\$20 \times \text{Volume}) \\
 \$15 \times \text{Volume} & = & \$150\,000 \\
 \text{Volume} & = & 10\,000 \text{ units}
 \end{array}$$

Parts 2 and 3 of Exhibit 11-8 illustrate that, as a change in volume moves each company away from the indifference point, the effect on operating income is more dramatic, with Company B's higher proportion of fixed cost to variable cost relative to Company A. The relatively higher operating leverage provides for a faster accumulation of operating income for increases in volume, but also indicates that operating income will decrease faster when volume decreases. Microsoft's performance during the 1990s is a good example of the effect that operating leverage can have on an organisation's profit. During this period of time, Microsoft's profits grew by an average annual rate of 47 per cent, which was much faster than the 38 per cent average annual rate of growth in sales. Another example is described in Business in Practice—Cost Structures of Emerging Technologies. The effect of operating leverage on operating income is a key information component in the selection of a cost structure.

**What ?  
Does It Mean**

**10** What does it mean to state that a firm has a relatively high degree of operating leverage?

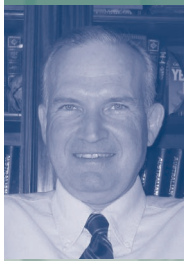




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## The Insider's View



IKE BAIN

### WHAT ROLE DOES ACCOUNTING INFORMATION PLAY IN MY JOB?

It's vital to know the cost of sales and never to judge how well a business is doing simply by its turnover. I know of one retailer who did billions of dollars in sales but barely made a profit. Often Dick Smith Electronics or Australian Geographic were making more profit than large retailers doing many times our turnover. Whenever I was approached by people with great ideas that 'would add lots of sales to the business', the first thing I did was start from the bottom profit line and work up the profit and loss statement. I wanted to know how much profit the product or venture would add to the business—the sales were secondary.

It's vital to be very familiar with all the costs of the business if you want to make a profit and be successful. A few years ago, I was invited to join the board of a new enterprise planning to retail via the Internet. I found their monthly expenses were already \$400 000. They told me they expected to do \$70 000 business in the first week—although I felt they would be lucky to do \$7 000—and were vague about when they might expect to break even. One of their partners told me, 'Ike, things have changed. In this new era, you may never have to make a profit—it's how much potential you have to make a profit some time in the future that's important'. The business never listed and we all know what happened to the dot com boom.

*Ike Bain*

*formerly of Australian Geographic Pty Ltd and Dick Smith Electronics Pty Ltd*

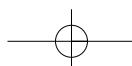
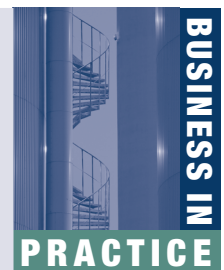
### COST STRUCTURES OF EMERGING TECHNOLOGIES

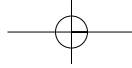
The demise of many Internet based dot-com companies by late in the year 2000 was a technological phenomenon that history has seen repeated several times. Over a century ago, the railroads provided an early lesson as reported by Hal Varian:

*In the 1880s there were more kilometres of railroad track laid than in any other decade in American history. By the 1890s there were more kilometres in bankruptcy than in any other decade.*

*Why do we always seem to over-invest in new technologies? In the case of railroads, the major economic force at work was economies of scale. The primary costs associated with a railroad are the fixed costs—the cost of servicing the debt incurred in laying the track and buying the rolling stock. In the late 1880s, about two-thirds of the total costs of operating a railroad were fixed.*

*Continued...*





*When fixed costs are high, large companies have an inherent advantage, since (as volume increases) they have a lower total cost per shipment. The railroads recognised this and invested heavily in building capacity. But once the capacity was installed, there was inevitable cutthroat competition for freight. There was no way around the fact that there was just too much rail stock relative to demand. Companies went bankrupt, wiping out their obligation to make debt payments, leading to even more aggressive pricing. The industry sank into a slump from which it took decades to recover. (What can be learned from this episode?) The railroad boom and bust arose because there were large fixed costs and a commodity product—freight transportation. Since there were many providers, price wars were all too likely. The cost structure of this industry bears a remarkable resemblance to long-haul fibre optics. The big fixed cost comes from laying the fibre, with (variable) operating expenses being relatively small. This is a recipe for price wars, and indeed, the cost of long-distance telephony—especially in negotiated contracts for large business—has been plummeting.*

*Many of the dot-com start-ups have invested heavily in building a technology infrastructure to support their business-to-consumer activities. The resulting cost structures provide a high degree of operating leverage and the opportunity for a very big pay-off once the revenues from their venture produce enough contribution margin to exceed fixed costs. Of course generating enough revenue proved to be a major challenge for many dot-com start-ups. The large number of business failures illustrates the high risk of high operating leverage.*

Source: [www.nytimes.com](http://www.nytimes.com), 'Economic Scene: Technology Rise and Fall is as American as the Model T', 14 December 2000, by Hal R. Varian. Copyright 2000, by the New York Times Co. Reprinted by permission.

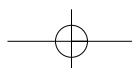
## SO WHAT DO YOU THINK ?

? Having worked in a large bank since leaving school, John Montevieu recently decided to take up a retrenchment offered due to the need for staff cutbacks. John has often thought of starting his own wedding car hire business (Beautiful Bridal Cars) and sees the money on offer as the perfect opportunity to finally pursue his dream. Over the years John has developed a penchant for old-style cars, having purchased two 1950 Jaguars, which he has spent many hours keeping in pristine condition. John has decided to use the retrenchment money to acquire an additional Jaguar (Jag S-Type), as well as two Daimlers, a sedan and a limousine, to cater for larger groups. While the retrenchment money will go some way to acquiring these assets and the various business set-up costs incurred, John still needs to take out a loan with the bank.

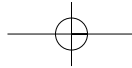
### Part A

While John is quietly confident that his business will be successful, he is a little uncertain in regards to how expenses will be incurred and what fees he should charge to hire the vehicles. John has identified the following expenses:

- Vehicle registration
- Vehicle insurance
- Petrol
- Drinks







- Vehicle repairs and maintenance
- Salary of an assistant (hired on a full-time basis)
- Driver/chauffeur costs
- Advertising
- Cleaning costs
- Rent of garage space to store cars
- Administration costs
- Loan repayments.

In order to determine the fees to charge, and to make predictions as to the profitability of the company, John's first priority was to classify each of the costs expected to be incurred as either a fixed cost (i.e. cost incurred irrespective of the number of times each car is hired) or a variable cost (i.e. a cost that is incurred each time the cars are hired).

**Required:**

Assume that John has asked you for assistance in understanding how his expenses will be incurred. Can you assist John by classifying each of the above costs as either fixed or variable?

**Part B**

After being informed as to how costs were likely to behave, John proceeded to make predictions as to the magnitude of each cost. John estimated costs based on his experience repairing the two Jaguars he has owned for years. All costs represent average costs expected to be incurred each time a vehicle is hired for a 2.5-hour period. The estimated costs are summarised below.

Yearly fixed expenses

CAR	Jag Mark 5 \$	Jag Mark 8 \$	Jag S-Type \$	Daimler Sedan \$	Daimler Limo \$
Registration	650	550	770	628	930
Insurance	1 350	1 567	1 500	1 331	1 950

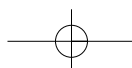
Other fixed expenses:

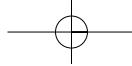
Rent	\$15 000
Administration	\$ 5 000
Salary of assistant	\$40 000
Loan repayments	\$ 9 000
Advertising	\$ 2 000

Variable expenses (incurred each time vehicle is hired)

CAR	Jag Mark 5 \$	Jag Mark 8 \$	Jag S-Type \$	Daimler Sedan \$	Daimler Limo \$
Repairs/ maintenance	30	32	28	35	45
Driver/ chauffeur costs	75	75	75	75	75
Petrol	15	16	15	17	20
Drinks	20	20	20	20	20
Cleaning costs	30	30	30	30	30

*Continued...*



**Required:**

John is unsure how much to charge for hiring each vehicle. Calculate the hiring charge for each vehicle if John wants to receive a contribution margin ratio of 60 per cent for each vehicle.

**Part C**

While a 60 per cent contribution margin ratio was desirable, John felt that these fees were too high and decided to charge the following fees for each vehicle.

Vehicles	Rate* \$	Rate for each extra $\frac{1}{2}$ hour \$
Jaguar Mark 5	395	80
Jaguar Mark 8	320	70
Jaguar S Type	290	60
Daimler Sedan	320	70
Daimler Limousine	495	70

\* For 2.5 hours

While John charges customers an additional amount for each extra half hour, his main concern is that the vehicles might not be hired enough times for the company to at least break even. Hence, in analysing the cost–volume–profit relationships for the business, John asks you to assume that all cars will only be hired for the basic 2.5-hour period.

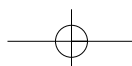
**Required:**

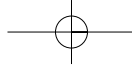
- 1 Analyse each vehicle separately and assess how many times each vehicle needs to be hired in order to break even. Assume that rent, administration, the salary of the assistant and loan repayments are distributed evenly between the five cars.
- 2 Recalculate the break-even point for each vehicle if the loan repayment cost is only split between the three vehicles that were acquired.
- 3 If it is expected that each vehicle is hired the same amount of times, how many times would each vehicle need to be hired in order for Beautiful Bridal Cars to break even.
- 4 If the Jag Mark 8, Jag S-Type, and Daimler sedan are expected to be twice as popular as the other two vehicles, how many times would each vehicle need to be hired in order for Beautiful Bridal Cars to break even?
- 5 John has not included a wage for himself in the list of expenses. Assuming John was earning \$45 000 per year when he left the bank, how many vehicles need to be hired per year in order for John to generate at least the same income as he was earning at the bank? Assume the same sales mix as in Item 4.

**Part D**

After operating for six months, John decides to evaluate the profitability of his company, and reassess the hiring fee for each vehicle. His records reveal the following details in relation to the hiring of each vehicle:

CAR	Jag Mark 5	Jag Mark 8	Jag S-Type	Daimler Sedan	Daimler Limo
Number of times hired	30	80	85	60	38
Extra hours hired	10	30	25	20	10





John has become aware that a competitor is charging customers substantially less to hire the same cars. Specifically, the Prestige Wedding Car Hire Company, which has been in operation for 20 years, is charging the following prices to hire the same vehicles.

Vehicles	Rate* \$
Jaguar Mark 5	350
Jaguar Mark 8	300
Jaguar S-Type	270
Daimler sedan	280
Daimler limousine	450

\* For 2.5 hours

**Required:**

- 1 Calculate the profit generated by the Beautiful Bridal Car Company over the first six months of operation. Assume each vehicle was only hired for 2.5 hours.
- 2 Determine which expenses are likely to increase if vehicles are hired for longer than 2.5 hours. Assuming that the extra expense is incurred in proportion to the variable expenses listed (i.e. an extra 20 per cent of the cost indicated for 2.5 hours for each extra half hour), recalculate the profit generated by the Beautiful Bridal Car Company over the first six months of operation, when extra hire time is considered.
- 3 What actions could John take to improve his company's profitability?
- 4 Given business has been slower than expected, John is also considering whether to hire the assistant on a casual rather than a full-time basis.
  - (a) How would this decision affect the operating leverage of Beautiful Bridal Cars?
  - (b) Would the new operating leverage position be good for John, given the performance of his company to date? Discuss.

Turn to Appendix 4, page 570 to compare your answers with our views.

**M**anagement is the process of planning, organising and controlling an organisation's activities to accomplish its goals. Management accounting supports the management process.

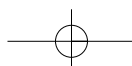
Management accounting differs from financial accounting in several ways. Management accounting has an internal orientation, a future perspective, and often focuses on individual units within the firm rather than on the organisation as a whole. Reasonably accurate data are acceptable for internal analysis, and performance reports tend to be issued on a frequent basis for management control and decision-making.

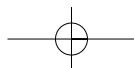
There are different costs for different purposes. Cost terminology is important to understand if cost data are to be used appropriately.

The behaviour pattern of a cost relates to the change in total cost for a change in activity. Variable costs change, in total, as activity changes. Fixed costs remain constant in total as activity changes. Assumptions about linearity and relevant range are implicit when a cost is described as variable or fixed.

*Continued...*

Recap





Many costs have a mixed behaviour pattern (i.e. they are partly variable and partly fixed). A cost formula expresses the total amount of a cost for a given level of activity by combining the fixed and variable elements of the total cost. It is inappropriate, and may be misleading, to express a fixed cost on a per unit basis because, by definition, a fixed cost is constant over a range of activity.

Cost–volume–profit (CVP) analysis uses knowledge about cost behaviour patterns to interpret and forecast changes in operating income resulting from changes in revenue, cost or the volume of activity.

When a particular cost is partly fixed and partly variable, the high–low method can be used to develop a cost formula that recognises both the variable and fixed elements of the cost.

The contribution margin format income statement reclassifies the functional cost categories of the traditional income statement to cost behaviour pattern categories. Contribution margin is the difference between revenues and variable expenses. Unless there are changes in the composition of variable expenses, contribution margin changes in proportion to the change in revenues.

The profit formula [ $Sx = VCx + FC + P$ ] provides a framework for analysing the effect of revenue, cost and volume changes on operating income. A key to using this model is that fixed costs are recognised only in total; they are not unitised.

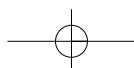
The contribution margin ratio sometimes can be used to determine the effect of a volume change on operating income more quickly and more easily than using unit revenue and variable expense and volume.

The break-even point is the total sales volume (in units or dollars) at which operating income is zero. Using the contribution margin model, or the profit formula model, the break-even point is achieved when total contribution margin is equal to fixed expenses or sales revenue equals variable costs plus fixed costs. Break-even analysis also can be illustrated graphically to provide a visual representation of profit and loss areas and to demonstrate the impact of the contribution margin per unit on operating income (or loss).

*Operating leverage* describes the percentage change in operating income for a given percentage change in revenues. Since fixed expenses do not change when revenues change, operating income changes by a greater percentage amount than revenues. The higher a firm's fixed expenses relative to its variable expenses, the greater the operating leverage and the greater the risk that a change in the level of activity will cause a relatively larger change in operating income than with less leverage. Operating leverage can influence management's decisions about whether to incur variable costs or fixed costs.

## Key Terms

<b>break-even point</b>	<b>348</b>	<b>management accounting</b>	<b>334</b>
<b>contribution margin</b>	<b>345</b>	<b>management process</b>	<b>334</b>
<b>contribution margin format</b>	<b>345</b>	<b>operating leverage</b>	<b>350</b>
<b>contribution margin ratio</b>	<b>346</b>	<b>production standard</b>	<b>336</b>
<b>cost behaviour pattern</b>	<b>337</b>	<b>relevant range</b>	<b>339</b>
<b>cost formula</b>	<b>340</b>	<b>sales mix</b>	<b>350</b>
<b>cost–volume–profit (CVP) analysis</b>	<b>334</b>	<b>semi-variable cost</b>	<b>339</b>
<b>fixed cost</b>	<b>337</b>	<b>variable cost</b>	<b>337</b>
<b>indifference point</b>	<b>352</b>		





Students can visit this comprehensive site for resources directly related to the text.

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International articles related to this topic are available on the Online Learning Centre at [www.mhhe.com/au/marshall](http://www.mhhe.com/au/marshall).

## Exercises

**E11.1 Cost classifications.** For each of the following costs, tick the column(s) that most likely apply.

Cost	Variable	Fixed
Wages of assembly-line workers	_____	_____
Depreciation—plant equipment	_____	_____
Glue and thread	_____	_____
Delivery costs	_____	_____
Raw materials handling costs	_____	_____
Salary of public relations manager	_____	_____
Production run set-up costs	_____	_____
Plant water, light and electricity	_____	_____
Electricity cost of retail stores	_____	_____
Research and development expense	_____	_____

**E11.2 Cost classifications.** For each of the following costs, tick the column(s) that most likely apply.

Cost	Variable	Fixed
Raw materials	_____	_____
Staples used to secure packed boxes of product	_____	_____
Factory cleaners' wages	_____	_____
Order processing clerks' wages	_____	_____
Advertising expenses	_____	_____
Production workers' wages	_____	_____

Continued...

**3** LEARNING OBJECTIVE

EASY     
 Routine cognitive skills.

**3** LEARNING OBJECTIVE

EASY     
 Routine cognitive skills.





Cost	Variable	Fixed
Production supervisors' salaries	_____	_____
Sales force commissions	_____	_____
Maintenance supplies used	_____	_____
Managing Director's salary	_____	_____
Electricity cost	_____	_____
Land taxes for:		
Factory	_____	_____
Office	_____	_____

**LEARNING OBJECTIVE 3**

**EASY** ●○○  
Routine cognitive skills.

**E11.3 Estimating costs based on behaviour patterns.** Ryan estimates that the costs of insurance, licence and depreciation to operate his car total \$320 per month and that the petrol, oil and maintenance costs are 44 cents per kilometre. Ryan also estimates that, on average, he drives his car 1 400 kilometres per month.

**Required:**

- (a) How much cost would Ryan expect to incur during April if he drove the car 1 529 kilometres?
- (b) Would it be meaningful for Ryan to calculate an estimated average cost per kilometre for a typical 1 400-kilometre month? Explain your answer.

**LEARNING OBJECTIVE 3**

**EASY** ●○○  
Routine cognitive skills.

**E11.4 Estimating costs based on behaviour patterns.** The following table shows the amount of cost incurred in March for the cost items indicated. During March, 4 000 units of the firm's single product were manufactured.

	\$
Raw materials	20 800
Factory depreciation expense	40 500
Direct labour	49 600
Production manager's salary	5 000
Computer rental expense	3 100
Maintenance supplies used	600

**Required:**

- (a) How much cost would you expect to be incurred for each of the above items during April, when 5 600 units of the product are planned for production?
- (b) Calculate the average total cost per unit for the 4 000 units manufactured in March. Explain why this figure would not be useful to a manager interested in predicting the cost of producing 5 600 units in April.

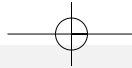
**LEARNING OBJECTIVE 7**

**HARD** ●●●  
Analytical cognitive skills.

**E11.5 Understanding CVP relationships.** Calculate the missing amounts for each of the following firms:

*Note:  $Sx - VCx = CMx$  is the relationship applied to units. The relationship holds true for total sales revenue and total variable costs. Let  $S = 100\%$ ;  $VC$  would also be converted into a percentage of sales and then  $CM$  would be a contribution margin per cent.*





	Sales	Variable Costs	Contribution Margin Ratio	Fixed Costs	Operating Income (Loss)
	\$	\$	%	\$	\$
Firm A	320 000	?	32	?	38 300
Firm B	?	465 050	?	118 000	71 950
Firm C	134 000	?	26	36 700	?
Firm D	?	59 000	20	?	(4 920)

**E11.6 Understanding CVP relationships.** Calculate the missing amounts for each of the following firms:

	Units Sold	Selling Price	Variable Costs Per Unit	Contribution Margin	Fixed Costs	Operating Income (Loss)
	\$	\$	\$	\$	\$	\$
Firm A	11 200	24.00	?	100 800	41 300	?
Firm B	8 400	?	18.20	?	64 500	32 940
Firm C	?	7.30	4.20	10 850	?	(6 750)
Firm D	4 720	?	51.25	41 064	48 210	?

**E11.7 Calculate selling price of new product with a target CM ratio**

Note:  $Sx - VCx = CMx$  is the relationship applied to units. The relationship holds true for total sales revenue and total variable costs. Let  $S = 100\%$ ;  $VC$  would also be converted into a per cent of sales and then  $CM$  would be a contribution margin per cent.

Seaport Ltd makes and sells a large number of consumer products. The firm's average contribution margin ratio is 35 per cent. Management is considering adding a new product that will require an additional \$15 000 per month of fixed expenses and will have variable expenses of \$7.80 per unit.

**Required:**

- (a) Calculate the selling price that will be required for the new product if it is to have a contribution margin ratio equal to 35 per cent.
- (b) Calculate the number of units of the new product that would have to be sold if the new product is to increase the firm's monthly operating income by \$6 000.

**E11.8 Calculate selling price of new product; what-if questions; break-even.** Hancock Corp has annual revenues of \$275 000, an average contribution margin ratio of 34 per cent, and fixed expenses of \$100 000.

**Required:**

- (a) Management is considering adding a new product to the company's product line. The new item will have \$8.25 of variable costs per unit. Calculate the selling price that will be required if this product is not to affect the average contribution margin ratio.
- (b) If the new product adds an additional \$30 600 to Hancock's fixed expenses, how many units of the new product must be sold at the price calculated in Part (a) to break even on the new product?

Continued...

**7 LEARNING OBJECTIVE**

MEDIUM ●●○

**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.

**7, 8 LEARNING OBJECTIVES**

MEDIUM ●●○

**Analytical skills of:**

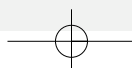
- analysing
- reasoning logically
- conceptualising issues.

**8 LEARNING OBJECTIVE**

EASY ●○○

**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.





- (c) If 20 000 units of the new product could be sold at a price of \$13.75 per unit, and the company's other business did not change, calculate Hancock's total operating income and average contribution margin ratio.
- (d) Describe how the analysis of adding the new product would be complicated if it were to 'steal' some volume from existing products.

**LEARNING OBJECTIVE 8**

**EASY** — ●○○

**Analytical skills of:**

- solving problems.

**Personal skills of:**

- thinking strategically.

**E11.9 Special promotion—effects of a two-for-one sale.** Barb and Jan's ice-cream shop charges \$1.25 for a cone. Variable expenses are \$0.35 per cone, and fixed costs total \$1 800 per month. A 'sweetheart' promotion is being planned for the second week of February. During this week, a person buying a cone at the regular price would receive a free cone for a friend. It is estimated that 400 additional cones would be sold and that 600 cones would be given away. Advertising costs for the promotion would be \$120.

**Required:**

- (a) Calculate the effect of the promotion on operating income for the second week of February.
- (b) Do you think the promotion should occur? Explain your answer.

**LEARNING OBJECTIVE 8**

**EASY** — ●○○

**Analytical skills of:**

- solving problems.

**Personal skills of:**

- thinking strategically.

**E11.10 Special promotion—effects of a 1-cent sale.** The management of Primo's Prime Pizzeria is considering a special promotion for the last two weeks of May, which is normally a relatively low demand period. The special promotion would involve selling two medium pizzas for the price of one, plus 1 cent. The medium pizza normally sells for \$9.99 and has variable expenses of \$3.00. Expected sales volume without the special promotion is 400 medium pizzas per week.

**Required:**

- (a) Calculate the total contribution margin generated by the normal volume of medium pizzas in a week.
- (b) Calculate the total number of medium pizzas that would have to be sold during the 1-cent sale to generate the same amount of contribution margin that results from the normal volume.
- (c) What other factors should management consider in evaluating the strengths and weaknesses of the special promotion?

## Problems

**LEARNING OBJECTIVE 6**

**EASY** — ●○○

**Analytical skills of:**

- identifying
- finding
- evaluating
- organising
- managing information and evidence.

**P11.11 High-low method.** A department of Gamma Ltd incurred the following costs for the month of February. Variable costs, and the variable portion of mixed costs, are a function of the number of units of activity.

Activity level in units	5 000
Variable costs	\$10 000
Fixed costs	30 000
Mixed costs	20 000
Total costs	<u>\$60 000</u>

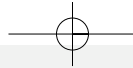
During April the activity level was 8 000 units, and the total costs incurred were \$70 500.

**Required:**

- (a) Calculate the variable costs, fixed costs and mixed costs incurred during April.
- (b) Use the high-low method to calculate the cost formula for mixed cost.







**P11.12 High-low method—missing amounts.** The following data have been extracted from the records of Puzzle Ltd:

	June	November
Production level, in units	<u>12 000</u>	<u>18 000</u>
Variable costs	\$21 000	\$ ?
Fixed costs	?	31 000
Mixed costs	18 000	?
Total costs	<u>\$70 000</u>	<u>\$88 000</u>

**Required:**

- (a) Calculate the missing costs.
- (b) Calculate the cost formula for mixed cost using the high-low method.
- (c) Calculate the total cost that would be incurred for the production of 20 000 units.
- (d) Identify the two key cost behaviour assumptions made in the calculation of your answer to Part (c).

**P11.13 Prepare a contribution margin format income statement—answer what-if questions.** Shown below is an income statement in the traditional format for a firm with a sales volume of 8 000 units. Cost formulas also are shown.

	\$
Revenues	32 000
Cost of goods sold (\$6 000 + \$2.10/unit)	<u>22 800</u>
Gross profit	9 200
Operating expenses:	
Selling (\$1 200 + \$0.10/unit)	2 000
Administration (\$4 000 + \$0.20/unit)	<u>5 600</u>
Operating income	<u>1 600</u>

**Required:**

- (a) Prepare an income statement showing *both* the contribution margin and the net profit.
- (b) Calculate the contribution margin per unit and the contribution margin ratio.
- (c) Calculate the firm's operating income (or loss) if the volume changed from 8 000 units to:
  1. 12 000 units
  2. 4 000 units.
- (d) Refer to your answer to Part (a) for total revenues of \$32 000. Calculate the firm's operating income (or loss) if unit selling price and variable expenses per unit do not change, and total revenues:
  1. Increase by \$12 000
  2. Decrease by \$7 000.

**P11.14 Prepare a contribution margin format income statement—answer what-if questions.** Shown below is an income statement in the traditional format for a firm with a sales volume of 15 000 units.

	\$
Revenues	105 000
Cost of goods sold (\$8 000 + \$3.60/unit)	<u>62 000</u>
Gross profit	43 000
Operating expenses:	
Selling (\$1 500 + \$0.80/unit)	13 500
Administration (\$4 000 + \$0.50/unit)	<u>11 500</u>
Operating income	<u>18 000</u>

Continued...

**6 LEARNING OBJECTIVE**

EASY — ●○○

**Analytical skills of:**

- identifying
- finding
- evaluating
- organising
- managing information and evidence.

**7, 8 LEARNING OBJECTIVES**

MEDIUM — ●●○

**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.

**7, 8 LEARNING OBJECTIVES**

MEDIUM — ●●○

**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.





**Required:**

- (a) Prepare an income statement in the contribution margin format.
- (b) Calculate the contribution margin per unit and the contribution margin ratio.
- (c) Calculate the firm's operating income (or loss) if the volume changed from 15 000 units to:
  1. 20 000 units
  2. 10 000 units.
- (d) Refer to your answer to Part (a) when total revenues were \$105 000. Calculate the firm's operating income (or loss) if unit selling price and variable expenses do not change, and total revenues:
  1. Increase by \$15 000
  2. Decrease by \$10 000.

LEARNING OBJECTIVES 7, 8, 9

MEDIUM ●●○

**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.

**P11.15** Prepare a contribution margin format income statement—calculate break-even point. Presented below is the income statement for Big Whig Ltd for the month of August:

	\$
Sales (10 000 units)	65 000
Cost of goods sold (all variable)	<u>46 000</u>
Gross profit	19 000
Operating expenses	24 000
Variable	<u>6 000</u>
Fixed	<u>18 000</u>
Operating loss	<u>(5 000)</u>

Based on an analysis of cost behaviour patterns, it has been determined that the company's contribution margin ratio is 20 per cent.

**Required:**

- (a) Rearrange the above income statement to the contribution margin format.
- (b) If sales increase by 30 per cent, what will be the firm's operating income?
- (c) Calculate the amount of revenue required for Big Whig Ltd to break even.

LEARNING OBJECTIVES 7, 8, 9

MEDIUM ●●○

**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.

**P11.16** Prepare a contribution margin format income statement—calculate break-even point. Presented below is the income statement for Doc Ltd for March:

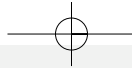
	\$
Sales (20 000 units)	80 000
Cost of goods sold (all variable)	<u>42 000</u>
Gross profit	38 000
Operating expenses	32 000
Variable	<u>14 000</u>
Fixed	<u>18 000</u>
Operating income	<u>6 000</u>

Based on an analysis of cost behaviour patterns, it has been determined that the company's contribution margin ratio is 30 per cent.

**Required:**

- (a) Rearrange the above income statement to the contribution margin format.
- (b) Calculate operating income if sales volume increases by 8 per cent. (*Note: Do not construct an income statement to determine your answer.*)
- (c) Calculate the amount of revenue required for Doc Ltd to break even.





**P11.17 CVP analysis—what-if questions; break even.** Penta Co makes and sells a single product. The current selling price is \$15 per unit. Variable expenses are \$9 per unit, and fixed expenses total \$27 000 per month.

**Required:**

(Unless otherwise stated, consider each requirement separately.)

- (a) Calculate the break-even point, expressed in terms of total sales dollars and sales volume.
- (b) Calculate the monthly operating income (or loss) at a sales volume of 5 400 units per month.
- (c) Calculate monthly operating income (or loss) if a \$2 per unit reduction in selling price results in a volume increase to 8 400 units per month.
- (d) What questions would have to be answered about the cost-volume-profit analysis simplifying assumptions before adopting the price-cut strategy of Part (c)?
- (e) Calculate monthly operating income (or loss) that would result from a \$1 per unit price increase and a \$6 000 per month increase in advertising expenses, both relative to the original data. Assume a sales volume of 5 400 units per month.
- (f) Management is considering a change in the sales force compensation plan. Currently, each of the firm's two salespersons is paid a salary of \$2 500 per month. Calculate the monthly operating income (or loss) that would result from changing the compensation plan to a salary of \$400 per month, plus a commission of \$0.80 per unit, assuming a sales volume of:
  1. 5 400 units per month.
  2. 6 000 units per month.
- (g) Assuming that the sales volume of 6 000 units per month achieved in Part (f) could also be achieved by increasing advertising by \$1 000 per month instead of changing the sales force compensation plan, which strategy would you recommend? Explain your answer.

**P11.18 CVP analysis—what-if questions; sales mix issue.** Kiwi Co makes a single product that sells for \$32 per unit. Variable costs are \$20.80 per unit, and fixed costs total \$47 600 per month.

**Required:**

- (a) Calculate the number of units that must be sold each month for the firm to break even.
- (b) Calculate operating income if 5 000 units are sold in a month.
- (c) Calculate operating income if the selling price is raised to \$33 per unit, advertising expenditures are increased by \$7 000 per month, and monthly unit sales volume becomes 5 400 units.
- (d) Assume that the firm adds another product to its product line and that the new product sells for \$20 per unit, has variable costs of \$14 per unit, and causes fixed expenses in total to increase to \$63 000 per month. Calculate the firm's operating income if 5 000 units of the original product and 4 000 units of the new product are sold each month. For the original product, use the selling price and variable cost data given in the problem statement.
- (e) Calculate the firm's operating income if 4 000 units of the original product and 5 000 units of the new product are sold each month.
- (f) Explain why operating income is different in Parts (d) and (e), even though sales totalled 9 000 units in each case.

**7, 8, 9** LEARNING OBJECTIVES

**MEDIUM** — ●●○

**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.

**Personal skills of:**

- strategic thinking.

**7, 8, 9** LEARNING OBJECTIVES

**HARD** — ●●●

**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.





**LEARNING OBJECTIVES** 7, 8, 9

**HARD** ●●●

**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.

**Personal skills of:**

- strategic thinking
- flexibility.

**P11.19 CVP application—expand existing product line?** Campus Canvas Ltd currently makes and sells two models of backpacks. Data applicable to the current operation are summarised in the columns below labelled *Current Operation*. Management is considering adding a Value model to its current Luxury and Economy models. Expected data if the new model is added are shown in the columns labelled *Proposed Expansion*.

	Current Operation		Proposed Expansion		
	Luxury	Economy	Luxury	Economy	Value
Selling price per unit	\$20	\$12	\$20	\$12	\$15
Variable expenses per unit	8	7	8	7	8
Annual sales volume—units	10 000	20 000	6 000	17 000	8 000
Fixed expenses for year	Total of \$70 000		Total of \$84 000		

**Required:**

- Calculate the company's current total overall contribution margin and the current average contribution margin ratio.
- Calculate the company's current amount of operating income.
- Calculate the company's current break-even point in dollar sales.
- Explain why the company might incur a loss, even if the sales amount calculated in Part (c) was achieved and selling prices and costs didn't change.
- Calculate the company's total operating income under the proposed expansion.
- Based on the proposed expansion data, would you recommend adding the Value model? Why or why not?
- Would your answer to Part (f) change if the Value model sales volume were to increase to 10 000 units annually, and all other data remain the same? Why or why not?

**LEARNING OBJECTIVES** 8, 9

**HARD** ●●●

**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.

**Personal skills of:**

- strategic thinking.

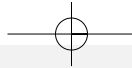
**P11.20 CVP application—eliminate product from operations?** Muscle Beach Ltd makes three models of high-performance weight-training benches. Current operating data are summarised below:

	MegaMuscle	PowerGym	ProForce
Selling price per unit	\$170	\$220	\$310
Contribution margin per unit	\$51	\$77	\$62
Monthly sales volume	4 000 units	3 000 units	1 000 units
Fixed expenses per month	Total \$468 000		

**Required:**

- Calculate the contribution margin ratio of each product.
- Calculate the firm's overall contribution margin ratio with the current sales mix. [*The usual formula:*  
 $Sx = VCx + FC + P$   
*can be modified for total sales revenue as follows:*  
 $100\% = VC\% + FC + P$ ]
- Calculate the firm's monthly break-even point in sales dollars. [*The usual formula:*  
 $Sx = VCx + FC + P$   
*can be modified for total sales revenue as follows:*  
 $100\% = VC\% + FC + P$  BE(in dollars) =  $FC/\%CM$ ]
- Calculate the firm's monthly operating income.





- (e) Management is considering the elimination of the ProForce model, due to its low sales volume and low contribution margin ratio. As a result, total fixed expenses can be reduced to \$420 000 per month. Assuming that this change would not affect the other models, would you recommend the elimination of the ProForce model? Explain your answer.
- (f) Assume the same facts as in Part (e). Assume also that the sales volume for the PowerGym model will increase by 500 units per month if the ProForce model is eliminated. Would you recommend the elimination of the ProForce model? Explain your answer.

**P11.21 CVP analysis—effects of changes in cost structure; break even.** Greene Co makes and sells a single product. The current selling price is \$32 per unit. Variable expenses are \$20 per unit, and fixed expenses total \$43 200 per month. Sales volume for January totalled 4 100 units.

**Required:**

- (a) Calculate operating income for January.
- (b) Calculate the break-even point in terms of units sold and total revenues.
- (c) Management is considering installing automated equipment to reduce direct labour cost. If this were done, variable expenses would drop to \$14 per unit, but fixed expenses would increase to \$67 800 per month.
  1. Calculate operating income at a volume of 4 100 units per month with the new cost structure.
  2. Calculate the break-even point in units with the new cost structure.
  3. Why would you suggest that management seriously consider investing in the automated equipment and accept the new cost structure?
  4. Why might management not accept your recommendation but decide instead to maintain the old cost structure?

**P11.22 CVP analysis—effects of change in cost structure; break even.** Hucker Ltd produces small-scale replicas of vintage automobiles for collectors and museums. Finished products are based on a 1/20th scale of originals. The firm’s income statement showed the following:

	\$
Revenues (1 500 units)	840 000
Variable expenses	<u>462 000</u>
Contribution margin	378 000
Fixed expenses	<u>290 000</u>
Operating income	<u><u>88 000</u></u>

An automated stamping machine has been developed that can efficiently produce body frames, hoods and doors to the desired scale. If the machine is leased, fixed expenses will increase by \$30 000 per year. The firm’s production capacity will increase, which is expected to result in a 20 per cent increase in sales volume. It is also estimated that labour costs of \$28 per unit could be saved, because less polishing and finishing time will be required.

**Required:**

- (a) Calculate the firm’s current contribution margin ratio and break-even point in terms of revenues.
- (b) Calculate the firm’s contribution margin ratio and break-even point in terms of revenues if the new machine is leased.
- (c) Calculate the firm’s operating income assuming that the new machine is leased.
- (d) Do you believe that management of Hucker Ltd should lease the new machine? Explain your answer.

**8, 9, 11** LEARNING OBJECTIVES

**MEDIUM** — ●●○

**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.

**Personal skill of:**

- strategic thinking.

**Appreciative skill of:**

- applying disciplinary and multidisciplinary perspectives.

**8, 9** LEARNING OBJECTIVES

**MEDIUM** — ●●○

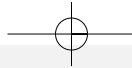
**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.

**Personal skill of:**

- strategic thinking.




**LEARNING OBJECTIVES** 8, 9

**MEDIUM** — ●●○

**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.

**P11.23** The following information relates to a family owned restaurant in Melbourne.

Manager's salary	\$82 500 p.a.
Interest	Loan of \$150 000 at an interest rate of 12% p.a.
Depreciation	Equipment, furniture and fittings with a cost of \$180 000 depreciated over 4 years
Licence	\$7 500 p.a.
Insurance	\$9 000 p.a.
Maintenance	\$6 000 p.a.
Other salaries	\$42 000 p.a.
Variable costs	75% of revenue
Before tax operating profit target	50% of owners' equity of \$180 000

**Required:**

- What sales revenue does the restaurant have to generate in order to make its before tax operating profit target?
- The restaurant is closed for four weeks of the year. For the rest of the year it is open every day except Monday. The restaurant has 50 seats and averages two sittings every day and three sittings on the weekend. What must the average cover price be in order to achieve the target profit level?

**LEARNING OBJECTIVES** 8, 9

**MEDIUM** — ●●○

**Analytical skills of:**

- analysing
- reasoning logically
- conceptualising issues.

**P11.24** Hobart's new Thrifty Hotel has 60 rooms and, historically, has achieved an average annual occupancy rate of 60 per cent. The hotel's assets have a book value of \$2 700 000 and the owners expect a 'return on assets' of 21 per cent after tax (tax is currently 30 per cent). The hotel has several fixed costs, which include 15 per cent per annum interest charged on a bank loan of \$1 500 000 and \$240 000 annual depreciation, and other fixed costs of \$383 100.

The hotel manager believes that the 60 per cent occupancy level will again be achieved next year and estimates that, at this level of activity, variable operating expenses will be \$510 000.

**Required:**

Assuming the hotel is open 365 days of the year, calculate the room rate that should be charged in order to provide the owners with their target profit level.

**LEARNING OBJECTIVES** 8, 9

**EASY** — ●○○

**Analytical skills of:**

- interpreting data.

**Appreciative skills of:**

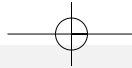
- thinking and acting critically
- appreciating ethical dimensions of situations.

**P11.25 CVP application—allow special discount?** Assume that you are a sales representative for Saturn Candy Company. One of your customers is interested in buying some candy that will be given to the members of a high school Substance Abuse Awareness Club. The club members will be marching in a community parade and will give the candy to children who are watching the parade. Your customer has asked that you discount the normal selling price of the candy to be given to the club by 35 per cent. You know that the contribution margin ratio of the candy, based on the regular selling price, is 50 per cent.

**Required:**

Identify the strengths and weaknesses of complying with the customer's request, and state the recommendation you would make to your sales manager.





**P11.26 Comparison of operating leverage and financial leverage.** The concept of financial leverage was introduced in Chapter 7 and expanded upon in Chapter 9. In this chapter, the concept of leverage was expanded to include operating leverage.

**Required:**

- (a) Describe the risks associated with operating leverage.
- (b) Outline the similarities and differences between operating leverage and financial leverage. *(Hint: Compare Exhibit 11-8 to the discussion and analysis in Exhibits 7-3 and 10-3.)*

**P11.27 Understanding the effects of operating leverage.** Clarke Ltd and Spence Ltd compete within the same industry and had the following operating results in 2005:

	Clarke Ltd	Spence Co Ltd
	\$	\$
Sales	420 000	420 000
Variable expenses	<u>84 000</u>	<u>252 000</u>
Contribution margin	336 000	168 000
Fixed expenses	<u>294 000</u>	<u>126 000</u>
Operating income	<u><u>42 000</u></u>	<u><u>42 000</u></u>

**Required:**

- (a) Calculate the break-even point for each firm in terms of revenue.
- (b) What observations can you draw by examining the break-even point of each firm, given that they earned an equal amount of operating income on identical sales volumes in 2005?
- (c) Calculate the amount of operating income (or loss) that you would expect each firm to report in 2006 if sales were to:
  1. Increase by 20 per cent
  2. Decrease by 20 per cent.
- (d) Using the amounts computed in requirement (c) above, calculate the increase or decrease in the amount of operating income expected in 2006 from the amount reported in 2005.
- (e) Explain why an equal percentage increase (or decrease) in sales for each firm would have such differing effects on operating income.
- (f) Calculate the ratio of contribution margin to operating income for each firm in 2005. *(Hint: Divide contribution margin by operating income.)*
- (g) Multiply the expected increase in sales of 20 per cent for 2006 by the ratio of contribution margin to operating income for 2005 computed in requirement (f) for each firm. *(Hint: Multiply your answer in requirement (f) by 0.2.)*
- (h) Multiply your answer in requirement (g) by the operating income of \$42 000 reported in 2005 for each firm.
- (i) Compare your answer in requirement (h) with your answer in requirement (d). What conclusions can you draw about the effects of operating leverage from the steps you performed in requirements (f), (g), and (h)?

**10** LEARNING OBJECTIVE

MEDIUM — ●●○

Routine report writing.

**Analytical skills of:**

- identifying
- finding
- evaluating
- organising
- managing information and evidence.

**8, 9, 11** LEARNING OBJECTIVES

HARD — ●●●

**Analytical skills of:**

- identifying
- finding
- evaluating
- organising
- managing information
- interpreting data.




**LEARNING OBJECTIVE 11**
**HARD** ●●●

**Computer literacy.**
**Personal skills of:**

- ability to focus on outcomes
- think creatively.

**P11.28 Break-even analysis, CVP application using Internet tools.** You have recently been engaged by Dominic's Italian Cafe to evaluate the financial impact of adding gourmet pizza items to the menu. A survey of the clientele indicates that demand for the product exists at an average selling price of \$18 per pizza. Fixed costs related to new equipment would be \$12 000 per month. Variable costs for ingredients, labour and electricity for the oven would average \$6 per pizza. You decide that a good starting point is to conduct an initial break-even analysis on the new project.

Knowing that many commercial Internet companies provide free downloads or online demos of their products for your evaluation and testing pleasure, you decide to conduct the break-even analysis using break-even calculators that have been located at several web sites.

**Required:**

- (a) Calculate the break-even point in pizzas per month and print your results, using the online break-even analysis tools at each of the following web sites:
1. [www.anz.com.au/australia/business/calculator/businessbenchmark/](http://www.anz.com.au/australia/business/calculator/businessbenchmark/)
  2. [www.calculatorweb.com/calculators/profitcalc/](http://www.calculatorweb.com/calculators/profitcalc/)
  3. [http://www.toolkit.cch.com/text/P06\\_7000.asp](http://www.toolkit.cch.com/text/P06_7000.asp)
- (b) Calculate the break-even point in pizzas per month and print your results, using the break-even chart analysis spreadsheet available at the following web site:
1. Go to [www.jaxworks.com](http://www.jaxworks.com), the Small Business Spreadsheet Factory.
  2. Click on the 'Downloads' link to access the list of free spreadsheets and other files.
  3. Scroll down the file list and download the file 'Breakeven Chart Analysis' for Excel.
- (c) Write a comparative analysis of each of the four tools that you used to calculate the break-even point. You might discuss strengths, weaknesses, usefulness and user interaction of each tool.
- (d) Dominic's now is interested in the amount of operating income available from the gourmet pizza operation if sales are initially expected to be 2 000 pizzas each month. Calculate the operating income and print your results, using the Excel file 'Contribution Income Analysis' available at [www.jaxworks.com](http://www.jaxworks.com).
- (e) Dominic's now would like to understand the effect on operating income if certain changes in costs or volume occur. Use the 'Contribution Income Analysis' Excel spreadsheet to evaluate each of the following independent cases assuming sales are initially expected to be 2 000 pizzas each month.
1. Selling price is lowered by 10 per cent and pizza sales are expected to increase by 5 per cent.
  2. Selling price is increased to \$20 and pizza sales are expected to decrease by 20 per cent.
  3. Higher-quality ingredients are used at a cost of \$8 per pizza and pizza sales are expected to increase to 2 200 pizzas per month.
  4. A more efficient pizza oven is available that would reduce the electricity used in baking each pizza. Variable costs would be reduced to \$5 per pizza. The more efficient oven would increase the fixed costs to \$15 000 per month.
- (f) Write a memo to Dominic's explaining the results of your analysis.

