

CHAPTER

# 15

# Analyzing Cost-Volume- Profit (CVP) Relationships and Marginal Contribution Break-Even (MCB)

## Learning Objectives

After reading this chapter, you should be able to:

- use marginal costing techniques to determine whether to open or close an operation;
- explain and use full-cost accounting;
- use techniques of differential cost, differential revenue, and marginal contribution;
- understand fixed, variable, and stepped cost factors of decision making;
- apply least square analysis to delineate costs.

## In Practice

*This chapter covers one of the most powerful tools that managers have at their disposal: the relationship between cost, volume, and profit in decision-making. The decisions managers make regularly involve the following:*

- *Whether or not to open and close operations*
- *The volume of sales required to break even and generate profit*
- *Menu pricing in relation to cost of sales*
- *Impact of product sales mix on product contribution*

*(continues)*

(continued)

To understand the meaning of the cost-volume-profit relationship (CVP) and marginal costing break-even (MCB), take the case of Rudy's Restaurant. Rudy and his wife Jackie opened Rudy's Restaurant 20 years ago after their only child turned five. Rudy is thinking about expanding the restaurant seating area to capture the heavy lunch traffic from the new office buildings nearby. Rudy thinks that the current wait time of 15 to 20 minutes before being seated for lunch could be turning customers away to the competition. He is also thinking about lowering menu prices to bring back old customers that the restaurant lost to the competition, but he also has concerns about increasing product costs.

On the other hand, Jackie is thinking about what to do with an open restaurant space about 50 yards from their restaurant, which they acquired in anticipation of expanding their restaurant. They had thought they could use it to cater to military personnel and their families. Unfortunately, the government closed the military base during a base closure and realignment a few months ago. The following discussion took place between them one morning before they opened the restaurant for breakfast:

**Rudy:** Jackie, I have more questions than answers for how our restaurant is doing. I don't see many of our old customers, and yet we have more opportunity to serve more people than before.

**Jackie:** I believe that the reason we are losing our old customers to the competition is that our lunch prices are higher. Don't you agree?

**Rudy:** Yes, but what can we do when gas prices and everything else is going up?

**Jackie:** Maybe we should reduce our portion sizes to compensate when we reduce prices. Better yet, why don't we ask Michael to take a look? He is the smart one in the family.

**Michael:** Mom, Dad, I can help answer your questions. We had a good lecture on cost-volume-profit last semester, and my entire dissertation is based on it. Give me few days to review cost, volume, and profit information about the business.

**Rudy:** Good, son. After lunch today you will see what I am talking about. The historical information on cost, volume, and profit are in your mother's office. Your mom would want us to drop prices and maybe advertise in the local newspaper, but how do we pay for all of this and still make money?

**Michael:** Dad, I promise I won't leave any stone unturned. I will even look at the idea of expanding the restaurant as you suggested in light of the growing competition.

## INTRODUCTION TO COST-VOLUME-PROFIT RELATIONSHIPS (CVP)

Before Michael started the analysis of his parents' business, he revisited his books and notes on the subject of CVP. A short story that his teacher told in class came to mind.

With that understanding, Michael studied the relationship between cost, volume (of output), and profit at his parents' restaurant. In your role as cost controller or manager, analyzing

this relationship can help you make decisions about many aspects of operations, including menu pricing, budgeting, and capital improvements. The analysis, sometimes abbreviated as CVP (cost-volume-profit), also lends itself to evaluating alternative courses of action. You may decide to open or close a restaurant, or to eliminate, reduce, or add services to an existing operation, based on CVP calculations. CVP analysis applies sales and cost data to reveal the relationships among cost, volume of output, and profit. The decision to invest in any of the above business options depends upon the relationships of these three factors to one another, and on the manager's objectives. Before we explain CVP, we must define certain terms we will be using throughout this chapter.

### Know Your Costs

Understanding the difference between fixed and variable costs can be critical. Kennard T. Wing, of OMG Center for Collaborative Learning, reports that a large health care system made the mistake of classifying all of its costs as variable. As a consequence, when volume dropped, managers felt that costs should be cut proportionately, and more than 1,000 people were laid off even though the workload of most of them had no direct relation to patient volume. The result was that morale of the survivors plummeted and within a year the system was scrambling to replace not only those it had let go, but many others who had quit. The point is, the accounting systems we design and implement really do affect management decisions in significant ways. A system built on a bad model of the business will either not be used or, if used, will lead to bad decisions.

*Source:* Kennard T. Wing, "Using Enhanced Cost Models in Variance Analysis for Better Control and Decision Making" *Management Accounting Quarterly*, Winter 2000, pp. 27–35. MANAGEMENT ACCOUNTING QUARTERLY (PRINT) by Kennard T. Wing. Copyright 2000 by Institute of Management Accountants. Reproduced with permission of Institute of Management Accountants in the format Textbook via Copyright Clearance Center.

## Definition of Terms

### variable costs (VC)

Production cost which changes in direct proportion to sales volume.

**fixed costs (FC)** Costs that remain constant regardless of sales volume, such as executive salaries.

**semivariable costs** Costs which vary with, but not in direct proportion to, business volume.

**stepped costs** Costs that "step up" across specific increases in production volume.

For the purpose of our illustration, we must classify all costs as either variable or fixed. **Variable costs (VC)** are those that increase or decrease in direct proportion to the volume of business, varying upwards or downwards according to and consistent with the level of business. We will use the abbreviation *VC* to refer to variable costs. **Fixed costs (FC)**, on the other hand, are nonvariable costs that stay the same no matter how great or small the volume of business. Classifying your expenses into these categories will depend on your specific operation; indeed, it is a matter of judgment.

This seems simple and straightforward. However, in practice, some costs exhibit both nonvariable and variable characteristics. Labor cost is an excellent and important example. This sort of cost behavior pattern is called **semivariable**. For the purpose of our CVP and MCB analyses, any semivariable cost will have to be separated into its fixed and variable elements. Consider that, over long periods, there is the tendency for even fixed costs to display some variability. Within a well-defined volume of the business, the costs are fixed, but once a new volume range is reached, the costs may change. Thus, in Rudy's Restaurant, for example, one manager and a supervisor may be able to deal with a lunch crowd of 350 to 450 covers as normal capacity. On the other hand, from 450 to 550 covers, one manager and two supervisors may be necessary. It is with this in mind that we introduce the term **stepped costs**. Figure 15-1 represents how costs "step up" with certain measures of volume increase.

If you have difficulty finding the amount of variable or fixed elements within the semivariable costs of production, do not worry just yet. We will explain several methods for deriving these figures in this chapter. Consider the following example.

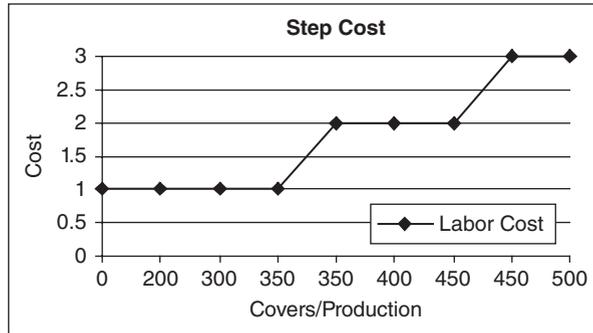


Figure 15-1 Step Cost

Michael uncovered two sets of financial books in his classroom material, one dealing with absorption costing and the other with variable costing. *Absorption costing* is generally used for external financial reports. It treats all costs as product costs regardless of whether they are variable or fixed. The decision to use the open restaurant space between Jackie and Rudy, under the absorption costing method, will consist of direct materials, direct labor, and both variable and fixed overhead. Thus, absorption costing allocates a portion of fixed overhead cost to each entree, along with variable production costs. Because absorption costing includes all costs, it is also referred to as full cost method.

Under *variable costing*, on the other hand, only those costs that vary with output are treated as product costs. This would usually include direct materials, direct labor and the variable portion of overhead. Fixed overhead is not treated as a product cost under this method. Rather, fixed overhead is treated as a period cost and, like selling and administrative expenses, it is charged off in its entirety against revenue each period. Variable costing is sometimes referred to as direct costing or marginal costing.

To complete this summary comparison of absorption and variable costing, we need to briefly consider the handling of selling and administrative expenses. These expenses are never treated as product cost, regardless of the costing method. Thus under either method, both variable and fixed selling and administrative expenses are always treated as period costs and deducted from revenues as incurred.

In the case of Rudy's Restaurant, Michael noted the following data:

*Number of covers each month = 6,000*

*Variable costs per cover:*

Direct product	= \$2
Direct labor	= \$4
Variable overhead	= \$1
Variable selling and administrative expenses	= \$3

*Fixed costs per month:*

Fixed overhead	= \$30,000
Fixed selling and administrative expenses	= \$10,000

*Calculations:*

1. Compute the entree product cost under absorption costing
2. Compute the entree product cost under variable costing

*Solution**Absorption Costing:*

Direct materials	=	\$2
Direct labor	=	\$4
Variable overhead	=	\$1
Total variable cost	=	\$7
Fixed overhead cost (\$30,000 ÷ 6,000 covers)	=	\$5
Entree product cost	=	\$12

*Variable Costing*

Direct materials	=	\$2
Direct labor	=	\$4
Variable overhead	=	\$1
Entree product cost	=	\$7

(Under variable costing, the \$30,000 fixed overhead cost will be charged in total against income as a period expense along with selling and administrative expenses.)

To understand how income statements prepared under the absorption and variable costing approaches are different, Michael applied the financial data from Rudy's Restaurant. See Figures 15-2 and 15-3.

Entrees in beginning inventory .....	0
Entrees produced .....	6,000
Entrees sold .....	5,000
Entrees in ending inventory .....	1,000
Selling price per entree .....	\$20
Selling and administrative expenses:	
Variable per entree .....	\$3
Fixed per year .....	\$10,000

	Absorption Costing	Variable Costing
Entree product cost:		
Direct materials .....	\$ 2	\$ 2
Direct labor .....	4	4
Variable manufacturing overhead .....	1	1
Fixed manufacturing overhead (\$30,000 / 6,000 entrees) .....	5	-
Entree product cost .....	<u>\$ 12</u>	<u>\$ 7</u>

**Figure 15-2** Income Statement

Several facts can be learned by examining the financial statements in Figure 15-3:

1. Under the absorption costing method, if inventories increase, some of the fixed production costs of the current period will not appear on the income statement as part of cost of goods sold. Instead, these costs are deferred to a future period and are carried

Variable manufacturing costs: 1,000 entrees x \$7 per entree .....	\$ 7,000
Fixed manufacturing overhead costs: 1,000 entrees x \$5 per entree .....	5,000
Total value of ending inventory .....	<u>\$ 12,000</u>

Absorption Costing		
Sales (5,000 entrees x \$20 per entree)		\$ 100,000
Less cost of goods sold:		
Beginning inventory	\$ 0	
Add cost of goods manufactured		
(6,000 entrees x \$12 per entree)	<u>72,000</u>	
Goods available for sale	72,000	
Less ending inventory		
(1,000 entrees x \$12 per entree)	<u>12,000</u>	
Cost of goods sold		<u>60,000</u>
Gross margin		40,000
Less selling and administrative expenses		
(5,000 entrees x \$3 per entree variable + \$10,000 fixed)		<u>25,000</u>
Net operating income		<u>\$ 15,000</u>
Variable Costing		
Sales (5,000 entrees x \$20 per entree)		\$ 100,000
Less variable expenses:		
Variable cost of goods sold:		
Beginning inventory	\$ 0	
Add variable manufacturing costs		
(6,000 entrees x \$7 per entree)	<u>42,000</u>	
Goods available for sale	42,000	
Less ending inventory		
(1,000 entrees x \$7 per entree)	<u>7,000</u>	
Variable cost of goods sold		<u>35,000</u>
Variable selling and administrative expenses (5,000 entrees x \$3 per entree)	<u>15,000</u>	<u>50,000</u>
Contribution margin		50,000
Less fixed expenses:		
Fixed manufacturing overhead	30,000	
Fixed selling and administrative expenses	<u>10,000</u>	<u>40,000</u>
Net operating income		<u>\$ 10,000</u>

Note the difference in ending inventories. Fixed manufacturing overhead cost at \$5 per entree is included under the absorption approach. This explains the difference in ending inventory and in net operating income (1,000 entrees x \$5 per entree = \$5,000).

Figure 15-3 Income Statement

on the balance sheet as part of the inventory account. Such a deferral of costs is known as *fixed production overhead cost deferred in inventory*. The process can be explained by referring to the data from Rudy's Restaurant. During the current period, Rudy's Restaurant produced 6,000 entrees (also called units) but sold only 5,000 entrees, thus leaving 1,000 unsold entrees in the ending inventory.

Under the absorption costing method, each entree produced was assigned \$5 of fixed overhead cost (see the entree cost computations above). Therefore, each of the 1,000 entrees going into inventory at the end of the period has \$5 in fixed production overhead cost attached to it, or a total of \$5,000 for the 1,000 entrees. This fixed production overhead cost of the current period is deferred in the inventory to the next period, when, hopefully, these entrees will be taken out of inventory and sold. The deferral of \$5,000 of fixed production overhead costs can be clearly seen by analyzing the ending inventory under the absorption costing method.

In summary, under absorption costing, of the \$30,000 in fixed production overhead costs incurred during the period, only \$25,000 (5,000 entrees sold × \$5 per entree) has been included in cost of goods sold. The remaining \$5,000 (1,000 entrees not sold × \$5 per entree) has been deferred in inventory to the next period.

2. Under the variable costing method, the entire \$30,000 of fixed production overhead costs has been treated as an expense of the current period (see the bottom portion of the variable costing income statement).
3. The ending inventory figure under the variable costing method is \$5,000 lower than it is under the absorption costing method. The reason is that under variable costing, only the variable production costs are assigned to entrees of product and therefore included in inventory.

Variable production costs: 1,000 entrees  $\times$  \$7 per entree \$ 7,000

The \$5,000 difference in ending inventories explains the difference in net operation income reported between the two costing methods. Net operation income is \$5,000 higher under absorption costing since, as explained above, \$5,000 of fixed production overhead cost has been deferred in inventory to the next period.

4. The absorption costing income statement makes no distinction between fixed and variable costs; therefore, it is not well suited for CVP computations, which are important for good planning and control. To develop data for CVP analysis, it would be necessary to spend considerable time reworking and reclassifying costs on the absorption income statement.
5. The variable costing approach to costing entrees of product works very well with the contribution approach to the income statement, since both concepts are based on the idea of classifying costs by behavior. The variable costing data in Figure 15-3 could be used immediately in CVP computations.

Essentially, the difference between the absorption and variable costing methods centers on timing. Advocates of variable costing say that fixed production costs should be expensed immediately in total, whereas advocates of absorption costing say that fixed production costs should be charged against revenues gradually as entrees are sold. Any entrees not sold under absorption costing result in fixed production costs being inventoried and carried forward on the balance sheet as assets to the next period.

After one week of compiling and examining data from Rudy's Restaurant, Michael called a meeting with his parents to discuss the approach he would be taking to answer their question regarding the use of the vacant space.

**Michael:** Mom? Dad? I have some calculations I would like to show you.

**Jackie:** Will this take long? I only have an hour before lunch starts.

**Michael:** Well, we can at least get started. The data in Figure 15-3 should help explain why I am going to use the variable costing method instead of the absorption costing method.

**Rudy:** Wait a minute, son—the absorption method generates higher profit. Isn't that what we want?

**Michael:** Dad, you and I know that, but the accounting rules view the situation a little differently. If we produce more than we sell, the accounting rules require that we take some of the fixed production cost (depreciation, taxes, insurance, managers salaries, and so on), and assign it to units that end up in inventories at period end.

**Jackie:** You mean that instead of appearing on the income statement as an expense, some of the fixed production costs—in our batch of soups—winds up on the balance sheet as inventories?

**Michael:** Precisely, Mom. Therefore, we are showing profits that should not be part of our decision making regarding whether to use the empty space.

**Rudy:** Why can't we be consistent? I thought accountants were conservative. Since when was it conservative to call an expense an asset?

**Michael:** Well, I didn't invent these methods. The bank requires that you follow certain accounting rules in preparing these reports. This might come out sounding wrong to you, but we could use different rules for our own internal reports.

**Jackie:** Rules are rules, especially in accounting.

**Michael:** Yes and no. For our internal reports, it might be better to use different rules than we use for the report we send to the bank. As you know, fixed production cost is not really the cost of any particular unit of product. These costs are incurred to have the capacity to make products during a particular period and will be incurred even if we did not use the empty restaurant space. Moreover, whether a unit is made or not, the fixed production costs will be exactly the same.

**Rudy:** Okay son, you've convinced us. Jackie, are you on board?

**Jackie:** Yes, I think our son is approaching this from a smart perspective.

## CVP Relationships

To explain CVP relationships, we will introduce the following scenario: Assume that there was a recession, during which you closed individual restaurants or profit centers within your hotel. Now, all the major business magazines have declared that the recession is over. For your individual restaurants, however, the decision of whether to reopen is yet to be made.

In the above scenario, some restaurants will wait too long in order to be assured of at least breaking even based on their full costs when they do reopen. An undue delay will extend the agony of laid-off employees and will cause the loss of market share as the recovery proceeds. On the other side, another restaurant might rush to reopen and, in the process, book new business at prices that may fail to cover the variable costs of operation. This can do further damage to the financial health of the business. The middle ground is to reopen at the marginal contribution break-even point (MCB), where the incremental revenues that can be generated by reopening equal or exceed the direct and indirect costs of reopening.

In our example above, we mentioned that most restaurants would reopen if they were assured of at least breaking even on their full costs. But this is misleading: It is incorrect to use full-cost accounting to decide when to reopen the restaurant, especially in a hotel situation with multiple outlets.

## Full-Cost Accounting

Managers are accustomed to seeing full-cost statements because they are responsible for the long-term perspective, and over the long term, revenues must cover all costs. But there is a danger in using full-cost accounting in decisions that involve the following decisions:

- When to open or close a restaurant
- Whether to buy something from an outside vendor or produce it in-house (the make-or-buy decision)
- When to eliminate one menu and introduce another

The danger of the full-cost trap is that full-cost accounting allocates fixed costs and indirect costs between products or cost centers. The allocation might be prudent and equitable if it is based on direct costs or revenues, but closing a restaurant or eliminating a menu item may not cause those costs to disappear. For example, if you pay rent or a mortgage, those expenses will not disappear just because the business is closed due to economic circumstances.

Another problem with full-cost accounting is that it tends to disguise the relationship between cost and volume by making it appear linear. Costs are depicted as purely variable, rising in a straight line directly proportional to business volume. This is not the case. Nearly every element of cost falls somewhere between purely fixed and purely variable. CVP and MCB techniques

### Discussion Point

What are the relationships among costs, volume, and profit?

depict these cost relationships more accurately. The manager should, when in doubt, employ the techniques of differential analysis, discussed in the next section.

## Differential Analysis

Differential analysis is a tool for escaping the rigidity of full-cost accounting and for estimating how costs and revenues actually behave in response to a change in some variable of the business, such as volume, price, or product mix. Differential techniques deliberately exclude costs and revenues, which do not change within the relevant range of operating alternatives. We will use labor cost, which usually exhibits a combination of both variable and fixed tendencies, to explain how this works.

The prerequisites of this technique include eliminating overly broad assumptions. This is important because not every one of your expenses will be relevant to every decision you make. The objective is to include only costs and revenues that will be affected by the changes in the specific operation. Differential analysis, or incremental analysis, is a way of more accurately assessing the situation because it integrates a commonsense evaluation of how each element of cost and revenue will behave in the relevant conditions.

For example, music and entertainment expenses are generally considered a direct and variable cost. However, if entertainment cost is on a “take or pay” basis, it is a fixed cost to be excluded from a differential cost analysis. As another example, a rooms manager’s wages are usually considered an indirect and fixed cost. However, if management is contemplating operating without a rooms manager, the savings in wages should be included in a differential cost analysis. Sunk costs should also be excluded.

## Sunk Costs

**sunk cost** A cost that has already been incurred and that cannot be changed by any decision made now or in the future.

**Sunk costs** are costs that have already been incurred and cannot be changed by any decision made now or in the future. Since sunk costs cannot be changed by any decision, they are not differential costs. Therefore, sunk costs can and should be ignored when making a decision.

To illustrate a sunk cost, assume that a restaurant paid \$10,000 for pizza equipment several years ago. The equipment was used to make a pizza that is now obsolete and is no longer being sold. Even though in hindsight the purchase of the equipment may have been unwise, the \$10,000 cost has already been incurred and cannot be undone. It would be unwise to continue making the obsolete product in a misguided attempt to recover the original cost of the equipment. In short, the \$10,000 originally paid for the equipment is a sunk cost that should be ignored in decision-making.

### A Practical View

Hal Arkes, a psychologist at Ohio University, asked 61 college students to assume they had mistakenly purchased tickets for both a \$50 and a \$100 ski trip for the same weekend. They could go on only one of the ski trips and would have to throw away the unused ticket. He further asked them to assume that they would actually have more fun on the \$50 trip. Most of the students reported that they would go on the less-enjoyable \$100 trip. The larger cost mattered more to the students than having more fun. However, the sunk cost of the tickets should have been totally irrelevant in this decision. No matter which trip was selected, the actual total cost was \$150—the cost of both tickets. Since this cost does not differ between the alternatives, it should be ignored. Like these students, most managers have a great deal of difficulty ignoring sunk costs when making decisions.

*Source:* John Gourville and Dilip Soman, “Pricing and the Psychology of Consumption,” *Harvard Business Review*, September 2002, pp. 92–93.

Now we will use Figure 15-4 to illustrate the relationships of CVP in four restaurants. Restaurant B is Rudy's Restaurant. The first column lists all the costs and denotes them with V for variable cost or F for fixed cost. Please note that most of these costs may in fact be semivariable, and thus dependent on the volume of production.

Looking at the chart, you might assume that higher sales or lower variable cost will automatically yield higher profit. In fact, the food and beverage cost and sales information for Restaurant B looks like a better result compared to Restaurants C and D, yet Restaurant B lags behind all restaurants in terms of income or profit before taxes. Restaurant A is a bit better, but it is still behind C and D.

For Restaurant B, Michael might recommend that his parents lower menu prices to attract more business, thereby increasing variable expenses. Food and beverage costs are variable, so if you reduce your menu price without reducing portion sizes, you get a higher menu cost. Restaurant B could also focus on reducing overall operational cost by providing substandard service, but of course this is likely to turn customers away. However, the key to surviving in a fierce economy is an understanding of your business limitations in terms of cost, volume, and profit objectives. Almost every restaurant experiences different limitations and characteristics of CVP objectives.

As stated earlier, the technique of CVP analysis helps management set prices. Some of the issues surrounding prices were discussed in Chapter 13. It must be remembered, however, that the concept of CVP is not a one-time exercise. You will need to review the system frequently when prices escalate, when labor costs change, or when any other major cost adjustment is made. The CVP technique is based on the assumption of fixed selling prices. When these fixed selling prices change, CVP must be reevaluated. From the above illustration, you can see that a balanced combination of cost, volume, and profit objectives is going to be the key to how management makes the decision about when to reopen. Later in this chapter we will explore the middle ground of MCB analysis.

Restaurants usually use cover amounts to determine an average check amount, which is a standard piece of data you will use often in your work. An average check is the total revenue during a meal period divided by the number of guests served. Assume that Rudy's Restaurant (Restaurant B) is only open for lunch. We know Restaurant B's total food and beverage sales from Figure 15-4: \$147,360. If Restaurant B served 17,968 covers for lunch, the average food, beverage, and combined food and beverage checks will emerge as follows:

$$\begin{array}{lcl} \text{food average check} & = \frac{\$120,000}{17,968} & = \$6.68 \\ \text{beverage average check} & = \frac{\$27,360}{17,938} & = \$1.52 \\ \text{combined average check} & = \frac{\$147,360}{17,968} & = \$8.20 \end{array}$$

The same method of calculations used above can also be applied in least square analysis, which is discussed below. In this case, instead of dividing revenue by covers, you will divide costs by covers.

At this point we must ask ourselves this question: If an expense, such as repair and maintenance costs, consists of both variable and fixed costs, what method should we use to untangle the variable and fixed components? Again, we will return to least square analysis, which is a statistical method of deriving the relationship between two or more correlated sets of data. It is used to calculate values of one variable when given values of the others. For each type of semivariable cost, such as maintenance, you can show the correlation between restaurant covers (production volume) and the incurring of expenditure (cost per cover).

### ⑩ Discussion Point

List examples of costs typically classified as fixed or variable. Do they always behave according to those classifications? Why or why not?

**THE RESTAURANT INDUSTRY DOLLARS - monthly data**

		A		B		C		D	
		Full service restaurant (average check per person under \$10)		Full service restaurant (average check per person over \$10)		Limited service fast food restaurant		Cafeteria restaurant	
		Dollar	%	Dollar	%	Dollar	%	Dollar	%
<b>Sales</b>									
	Food sales	\$150,000.00	86.20	\$120,000.00	77.20	\$85,000.00	97.50	\$80,000.00	98.70
	Beverage sales	\$20,700.00	13.80	\$27,360.00	22.80	\$2,125.00	2.50	\$1,040.00	1.30
<b>Characteristic Total</b>		\$170,700.00	100.00	\$147,360.00	100.00	\$87,125.00	100.00	\$81,040.00	100.00
<b>Expenses</b>									
<b>V</b>	Cost of food sold	\$49,503.00	29.00	\$39,492.48	26.80	\$27,095.88	31.10	\$25,284.48	31.20
<b>V</b>	Cost of beverage sold	\$5,974.50	3.50	\$9,283.68	6.30	\$609.88	0.70	\$405.20	0.50
<b>V</b>	Salaries and wages	\$50,527.20	29.60	\$41,408.16	28.10	\$22,913.88	26.30	\$23,339.52	28.80
<b>V</b>	Employees benefits	\$8,193.60	4.80	\$6,778.56	4.60	\$2,178.13	2.50	\$4,295.12	5.30
<b>V</b>	Direct operating expenses	\$10,754.10	6.30	\$10,462.56	7.10	\$4,704.75	5.40	\$2,269.12	2.80
<b>F</b>	Music and entertainment	\$512.10	0.30	\$1,031.52	0.70	\$87.13	0.10	\$0.00	0.00
<b>F</b>	Marketing	\$4,779.60	2.80	\$4,126.08	2.80	\$4,269.13	4.90	\$3,484.72	4.30
<b>V</b>	Utility services	\$5,291.70	3.10	\$3,978.72	2.70	\$2,439.50	2.80	\$3,727.84	4.60
<b>F</b>	Restaurant occupancy costs	\$9,729.90	5.70	\$8,399.52	5.70	\$5,750.25	6.60	\$4,214.08	5.20
<b>V</b>	Repairs and maintenance	\$3,072.60	1.80	\$3,094.56	2.10	\$1,394.00	1.60	\$1,539.76	1.90
<b>F</b>	Depreciation	\$4,267.50	2.50	\$3,094.56	2.10	\$1,742.50	2.00	\$972.48	1.20
<b>F</b>	Other operating expenses/(income)	(\$682.80)	(0.40)	(\$147.36)	(0.10)	\$0.00	0.00	\$324.16	0.40
<b>F</b>	General and administration	\$5,633.10	3.30	\$6,336.48	4.30	\$3,310.75	3.80	\$4,457.20	5.50
<b>F</b>	Corporate overhead	\$3,584.70	2.10	\$2,947.20	2.00	\$1,916.75	2.20	\$810.40	1.00
<b>F</b>	Interest	\$1,024.20	0.60	\$884.16	0.60	\$522.75	0.60	\$81.04	0.10
<b>F</b>	Other	\$512.10	0.30	\$736.80	0.50	\$348.50	0.40	\$0.00	0.00
	Income before income taxes	\$8,022.90	4.70	\$5,452.32	3.70	\$7,841.25	9.00	\$5,834.88	7.20
<b>Total</b>		\$170,700.00	100.00	\$147,360.00	100.00	\$87,125.00	100.00	\$81,040.00	100.00

**Figure 15-4** Restaurant Industry Dollars Per Month

No method is perfect because factors other than volume of production may influence cost. For example, in one month there may be an exceptionally long run of needed repairs, but in another, there may be very few needed repairs. This could depend on employees' competency levels and training. This and other similar irregular occurrences must clearly temper any conclusions with any methods.

## Calculating VC by the Least Squares Approach

The calculations necessary for obtaining an average of variable or fixed cost by least squares are rather involved. However, since they normally are carried out infrequently (probably only once a year), and a quite objective result is obtained, this extra refinement is probably justified.

Below is an outline of the procedures for applying least squares to a calculation of VC. We will use repair and maintenance costs from Rudy's Restaurant (B) to illustrate the calculation. We start from the assumption that the total covers are approximately 1,710 for five weeks. Assume that Figure 15-5 applies to Restaurant B for five weeks. Follow these steps:

**Figure 15-5** Calculating VC by Least Square Approach

Column A Repair & maintenance costs (y)	Column B Number of covers (x)	Column C Restaurant cover capacity or # of units (x <sup>2</sup> )	Column D Column A x Column B or (xy)
\$264	350	122,500	92,400
\$300	410	168,100	123,000
\$150	100	10,000	15,000
\$280	400	160,000	112,000
\$400	450	202,500	180,000
Total = \$1394	Total = 1,710	Total = 663,100	Total = 522,400

- Calculate the weekly average output of covers:  $\frac{\sum x}{n}$
- Obtain the weekly average cost:  $\frac{\sum y}{n}$
- Square the number of units of production or restaurant cover capacity for each week and find the weekly average:  $\frac{\sum X^2}{n}$
- For each week, multiply the number of covers by costs per cover and find the weekly average:  $\frac{\sum xy}{n}$
- Use the results from lines a, b, c, and d in the following formula to find the variable element:

$$VC = \frac{(d) - ((a) \times (b))}{(c) - (a)^2}$$

The following are the answers:

$$\text{Step a} = \frac{1,710}{5} = 342$$

$$\text{Step b} = \frac{1,394}{5} = 278.8$$

$$\text{Step c} = \frac{663,100}{5} = 132,620$$

$$\text{Step d} = \frac{522,400}{5} = 104,480$$

The variable element is found as shown below:

$$\text{VC} = \frac{104,480 - (341) \times (278.8)}{(132,620) - (342)^2}$$

$$\text{VC} = \frac{9,130.40}{15,656.00} = \$0.583 \text{ cents, approximately}$$

The method of least squares is likely to give the most accurate separation of fixed and variable elements in a semivariable cost. An average cost per cover in our table is approximately \$0.82. This is derived by dividing Column A of Figure 15-5 by Column B. The variable element, the most important part of CVP analysis, is \$0.583.

### A Practical View

#### Soup Nutsy

Pak Melwani and Kumar Hathiramani, former silk merchants from Bombay, opened a soup store in Manhattan after watching a *Seinfeld* episode featuring the Soup Nazi. The episode parodies a real-life soup vendor, Ali Yeganeh, whose loyal customers put up with hour-long lines and "snarling customer service." Melwani and Hathiramani approached Yeganeh about turning his soup kitchen into a chain, but they were rebuffed gruffly. Instead of giving up, the two hired a French chef with a repertoire of 500 soups and opened a store called Soup Nutsy. For \$6 per serving, Soup Nutsy offers 12 homemade soups each day, such as sherry crab bisque and Thai coconut shrimp soup. Melwani and Hathiramani reported that in their first year of operation, they netted a profit of \$210,000 on sales of \$700,000. They reported that it costs about \$2 per serving to make the soup. Thus, their variable expense ratio is one-third (\$2 cost ÷ \$6 selling price). If so, what are their fixed expenses? We can answer that question as follows:

sales = variable expenses + fixed expenses + profits

$$\$700,000 = \left(\frac{1}{3} \times \$700,000\right) + \text{fixed expenses} + \$210,000$$

$$\text{fixed expenses} = \$700,000 - \left(\frac{1}{3} \times \$700,000\right) - \$210,000 = \$256,667$$

With this information, you can determine that Soup Nutsy's break-even point is about \$385,000 of sales. This gives the store a comfortable margin of safety of 45 percent of sales.

*Source:* Silva Sansoni, "The Starbucks Soup?" *Forbes*, July 7, 1997, pp. 90–91. Reprinted by Permission of Forbes Magazine © 2008 Forbes LLC.

**marginal cost** The amount of output, at any given volume, by which aggregate costs are changed if the volume of output is increased or decreased by one unit, subject to the condition that fixed cost does not change with the increase in volume.

## MARGINAL CONTRIBUTION BREAK-EVEN POINT (MCB)

Now, with an understanding of CVP, we will focus on the marginal contribution break-even point. **Marginal cost** is defined as the amount of output, at any given volume, at which aggregate costs are changed if the volume of output is increased or decreased by one unit. Marginal costing systems are based on the classification of costs into fixed and

variable, as shown in our example above. The fixed costs are excluded, and only the marginal, variable costs are considered in determining the cost of products and services. MCB can be more than a simple tool. It can be an approach for dealing with uncertainty intelligently and finding a middle ground. There are always difficulties in estimating uncertain variables, such as customer demand, but by specifying the levels of other variables that affect the revenues of a restaurant, a required or minimum level can be found for the unknown quantity.

In the examples in this section, we will illustrate ways in which MCB analysis can be applied to sales, profit, cost, and selling price problems and how it can be used to help make a sound decision for employing the idle restaurant space Jackie is concerned about—for planning advertising to boost sales and for expanding product offerings. MCB is not a cure-all; it is only one of the many tools available to restaurant managers. However, it is a good tool with which to begin approaching decision-making problems.

Returning to Rudy's Restaurant, imagine that the vacant restaurant Jackie referred to has kitchen equipment sufficient to produce a catering business or a new steak house. Estimated fixed costs for this vacant facility are \$5,000 per month. Michael has been given the task of determining the opportunity to open a steak house using this equipment. Michael estimates that menu items will sell for approximately \$25 per cover. The variable costs of product and labor combined are estimated at \$8 per selling price of \$25. At present, Michael feels certain that the market for this steak house menu is 400 covers per day, which translates to 146,000 covers per year. The physical capacity of the vacant space is approximately 600 covers per day.

## Simple MCB Analysis

Should the restaurant open a steak house in the vacant space? To begin to answer this question, we need to find the contribution margin (CM) for the steak house menu. CM is simply what is left of revenue to cover fixed costs and profit after variable costs have been subtracted, as follows:

$$\text{CM} = \text{revenue} - \text{VC}$$

When you subtract fixed costs (FC) from the CM, you get gross profit or income before taxes, as in Figure 15-4. You can then calculate the break-even level by dividing fixed costs by the CM. You can express the CM on a per-cover basis or as a percentage of sales. If you express CM on a per-cover basis, the break-even volume will be expressed in covers. If it is expressed as a percentage of sales, the break-even volume will be in dollars. We will look at the steak house project to see how this works.

Figure 15-6 provides preliminary equations.

Note that you can get the break-even dollar total by multiplying the break-even volume in covers by the selling price, or you can get the number of covers by dividing total break-even revenue dollars by price.

What is the answer to the steak house question? The simple answer is that Rudy and Jackie should go ahead with the project. Why? To break even they need to capture approximately 294 covers per day, or only 73.5 percent of the projected market of 400 covers per day. Of course, they need to be sure their projected market is not wishful thinking! Also, they will be operating well under the restaurant's physical capacity of 600 covers per day at break-even. The steak house project ought to be able to make a profit using the vacant facility if it can capture more than 73.5 percent of the projected market. With production and sales at full capacity, the steak house should make a profit of \$7,650 per day before taxes ( $306 \text{ covers} \times \$25 = \$7,650$ ) since all fixed costs will be covered at the 294 covers level.

Figure 15-6 Simple MCB Analysis

Contribution as percent of revenue	Contribution on a per cover basis
$CM = \text{revenue (price)} - \text{variable cost (VC)}$	$CM\% = \frac{\text{price} - VC}{\text{price}}$
$CM = \$25 - \$8 = \$17$	$CM\% = \frac{\$25 - \$8}{\$25} = \frac{\$17}{\$25} = 68\%$
$\text{Break-even volume} = \frac{FC}{CM}$	$\text{Break-even} = \frac{FC}{CM\%} = \frac{\$5,000}{68\%} = \frac{\$5,000}{.68}$
$\text{Break-even} = \frac{\$5,000}{\$17} = 294.12 \text{ covers}$	$\text{Break-even} = \$7,352.94 \text{ dollars}$

As an added advantage, if the previous restaurant had a decent reputation, the new operation should attract guests and enjoy quick recognition. Perhaps Michael can take advantage of the previous restaurant's reputation by ensuring that the promotional and public relations campaigns are done correctly.

## MCB Applied to Uncertainty

The typical break-even approach develops the volume needed to produce no profit and no loss. But every restaurant is in business to make a profit. Using the steak house example, suppose the owners would like a 5 percent profit margin on the project. The original contribution margin for the menu was 68 percent, but that was at zero profit. In effect, the 5 percent profit acts like a variable cost, so we must adjust the CM percentage accordingly: 68 percent – 5 percent = 63 percent. Now we can calculate the desired 5 percent profit margin using the percent of revenue approach as follows:

$$\text{break-even} = \frac{FC}{CM\%} = \frac{5,000}{63\%} = \$7,936.51 \text{ or } 317 \text{ covers at the } \$25 \text{ price}$$

This is still below the steak house's capacity. Michael should now look at the market and make a judgment based on the probability of selling that many steaks.

## Dollar Profit Objective

What happens if Michael wants a fixed dollar profit of \$5,000 per month? In this case, we treat the profit as a fixed cost, so we have to add it to the fixed cost established for the steak house: \$5,000 + \$5,000 = \$10,000. We can now calculate the fixed dollar profit volume using the per cover approach as follows:

$$\text{Break-even} = \frac{FC}{CM} = \frac{\$10,000}{\$17} = 588.24 \text{ covers or } \$14,706 \text{ revenue}$$

Again, this is below capacity. Michael must estimate the likelihood of selling this many steaks.

## Maximum Out-of-Pocket Cost

Suppose that Michael can forecast sales rather accurately. Michael estimates that the steak house can generate 500 covers per day. What out-of-pocket expenses can it incur and still break even? The formula will be as follows:

$$B(\text{volume}) = \frac{FC}{CM}$$

$$B(\text{volume}) \times CM = FC$$

$$CM = \frac{FC}{B(\text{volume})}$$

Now we can find the CM for these circumstances:

$$CM = \frac{\$5,000}{500} = \$10$$

Subtracting the CM of \$10 from the selling price of \$25, we get \$15, the variable cost the steak house can incur on each unit and still break even. Similarly, if a \$5,500 profit is desired at the proposed volume, we find that the contribution margin equals \$10,500 divided by 500 covers, or \$21. At this level of desired profit, variable costs must be held to \$4 per cover. This example shows how to use break-even to help set product specifications. By isolating the allowable cost structure, you can determine the right menu restrictions and engineer the menu to the cost requirements; this topic was covered at length in Chapter 13.

## Selling Price

Assume again that variable costs for producing the steaks are \$8 per cover and there are \$5,000 in fixed costs. Add to those data the known sales volume of 500 covers and a desire to make a profit of \$7,000 per month. What must the selling price be?

$$CM = \frac{FC}{B(\text{volume})} = \frac{\$5,000 + \$7,000}{500} = \frac{\$12,000}{500 \text{ covers}} = \$24$$

The price must equal variable cost plus fixed cost: \$8 + \$24 = \$32. Now you can compare this \$32 selling price to the existing local competitors' prices to determine whether the steak house has a good chance of selling at that price or whether the specifications must be altered to get the price down. This approach also works well for vendor bidding. Chapter 5 explores that subject in detail.

## Advertising Decisions

Advertising is typically a fixed cost. Any added fixed costs raise a restaurant's break-even point and thus require added revenue (or lowered variable costs) to pay for them. The money for fixed costs comes from the contribution margin. In the steak house example, the CM percentage is 68. Thus, \$1.47 additional dollars of revenue are required to cover each additional dollar of fixed cost: \$1.00 divided by 68 percent = \$1.47. If the steak house project's CM percentage were 50, it would take \$2 to cover each additional fixed cost dollar. So, if the restaurant is considering a \$500 expenditure for an ad, it will need  $1.47 \times \$500$ , or \$735, in extra sales just to cover the cost of the advertisement. Remember Chapter 2 that when saving money, there is a cost in producing sales. Instead, Michael must know how much the restaurant must take in to be only as well off as they would be without any advertisement. This approach provides a built-in standard for judging the results of advertising. If, after an appropriate period, added sales are not enough to justify the cost of the advertisement, the effort can be abandoned.

## Labor Costs

So far the examples have been simple and straightforward. The restaurant business, alas, is not. In the traditional version of break-even analysis, a variable cost generally includes items such as material, labor, and some overhead. In reality, some of these costs may not be variable over the operating range of the restaurant. Figure 15-7 shows the figures from the original steak house example with expanded detail.

**Figure 15-7** Labor Costs

Menu price		\$25.00
Variable costs:		
Recipe or material cost	\$4.20 per cover	
Overhead cost	\$.30 cents per cover	
Labor cost	\$3.50 per cover	
Total variable cost		\$8.00
Fixed cost per month		\$5,000

The labor cost is based on an FTE of a crew of 12 people (front- and back-of-the-house personnel). See the Chapter 14 on staff planning for how FTE should be calculated. For simplicity's sake, assume that each employee makes \$116.67 per day. This is determined in Figure 15-8.

**Figure 15-8** Pay Per Employee

Total wages	= (\$3.50 × 400 covers)	= \$1,400
Pay per employee	= \$1,400 / 12	= \$116.67
Rates per 8 hour shift		= \$14.58

We assumed originally that at any level of production, total variable costs were \$8 per cover. In reality, however, staff cannot be shifted that smoothly. Thus, in a narrow range of production, some labor costs become fixed. (In Chapter 14 on staff planning you saw a detailed treatment of how this happens.) This fact can change the break-even point of the steak house. It also affects the contribution margin and pricing, promotion, and other decisions.

Using a simple traditional approach, it looked as though the break-even point was 294.12 covers. It also appeared that, if another 200 meals were prepared and sold, the steak house would make a profit of \$3,400 (200 covers × \$17 contribution margin per cover). In reality, however, the original break-even point represents the effective capacity of the steak house. An extra 200 covers could be produced only if a new crew were put on at an additional cost of \$1,400 per day. At the 494.12 cover level we could actually find a new result, shown in Figure 15-9.

The steak house could actually be merely breaking even. Here, the labor could essentially become a fixed cost; overhead, materials, and other employee benefits are the true variable costs. The CM for the steak house has changed dramatically. You need to be aware of volume levels at which these changes would occur for your establishment.

In general, this analysis tells us that the important thing to keep in mind when using break-even is the true nature of the restaurant cost structure, not the academic numbers in a textbook. Some restaurants have a flexible labor force, and standard analysis works well. In many others, such as those with a union workforce, idle labor cannot be manipulated smoothly, and management must treat such costs differently. In many small restaurants, certain skilled

**Figure 15-9** Steakhouse Break-Even Point

Sales (494 covers @ \$25 per person)	\$12,350.00
Less material cost @ \$4.20 per cover	\$2,074.80
Less overhead cost @ \$.30 per cover	\$148.20
Less labor cost: (24 crew @ \$14.58 per hr.)	\$2,799.36
Less employee meals and other costs	\$6,994.31
Fixed costs (allocated per # of days opened - 15)	\$333.33
Profit	\$0.00

workers cannot be laid off without being lost to competitors. The key to success is to increase revenue to help cover costs. Pricing these necessary extra sales and making sound advertising decisions can be greatly aided by using the variations of break-even analysis discussed.

Break-even analysis requires, above all, a realistic calculation of costs, both in amount and in type. If the steak house in the example above were to generate the additional 200 covers for which it has available labor capacity and sell them at a price above the variable cost, it would make profit. As long as new business is added to an existing vacancy capacity, any contribution to cover fixed costs will increase profit, or at least offset losses in other operations. Management must also consider selling the idle equipment or leasing the empty space. Whatever decision is reached, the point is to enhance the financial status of the restaurant owners.

## The Advantages and Disadvantages of Break-even Analysis

The major problem is that no restaurant exists in a vacuum. There are alternative uses for the restaurant's funds and resources in almost every case. For example, in the case of the steak house, the vacant space could be leased to another company for some return. It could also be used for a different cuisine. We must, therefore, always consider not only the value of an individual project, but also how it compares to other uses of the funds and facilities.

Break-even analysis does not permit proper examination of cash flows. It is generally accepted in financial theory that the appropriate way to make investment or capital decisions is to consider the value of a proposed project's anticipated cash flows. While a complete discussion of cash flow is beyond the scope of this book, the following comments could help Michael consider the alternatives.

If the discounted value of the cash flows exceeds the required investment outlay in cash, then the project is acceptable. To understand the meaning of discounted value of cash flow, take the following example: A dollar received today is more valuable than a dollar received a year from now because if Rudy and Jackie have a dollar today, they can put it in the bank and have more than a dollar a year from now. Since dollars today are worth more than dollars in the future, Rudy and Jackie must weigh cash flows that are received at different times so that they can be compared. If Rudy and Jackie's bank pays 5 percent interest, then a deposit of \$1,000 today will be worth \$1,050 one year from now. This can be expressed as follows:  $F_1 = P(1 + r)$ , where  $F_1$  = the balance at the end of one period,  $P$  = the amount invested now, and  $r$  = the rate of interest per period. If the investment made now by Rudy and Jackie is \$1,000 in a savings account that earns 5 percent interest, then  $P = \$1,000$  and  $r = 0.05$ . Under these conditions,  $F_1 = \$1,050$ , the amount to be received in one year. The \$1,000 present outlay is called the present value, or discounted value, of the \$1,050 amount to be received in one year. What if the \$1,050 is left in the bank for a second year? In that case, by the end of the second year the original \$1,000 deposit will have grown to \$1,102.50. This can be derived by  $F_n = P(1 + r)^n$ , where  $n = 2$  years and the interest rate is 5 percent per year. The balance in two years will be computed as follows:  $F_2 = \$1,000(1 + 0.05)^2 = \$1,102.50$ .

The reason for the greater interest earned during the second year is that during the second year, interest is paid on the interest. Thus, the \$50 interest earned during the first year has been left in the account and added to the original \$1,000 deposit when computing interest for the second year. This is known as **compound interest**. In this case, the compounding is annual. The more frequently compounding is done, the more rapidly the balance will grow. Michael can view his parents' investment in two ways. He can view it either in terms of its future value or in terms of its present value. If we know the present value of the sum (such as our \$1,000 deposit), the future value in  $n$  years can be computed by using the above equation. But what if the tables are reversed, and we know the future value of some amount but we do not know its present value? For example, assume Michael knows that his parents will receive \$50,000 two years from now. Rudy and Jackie know that the future value of this sum is \$50,000, since this is the amount they will be receiving two years from now. But what is the sum's present value? What is it worth right now? The present value of the sum to be received in the future can be computed as follows:

$$\text{Present value} = \frac{Fn}{(1+r)^2} = \frac{\$50,000}{(1+0.05)^2} = \frac{\$50,000}{1.1025} = \$45,351.47$$

The present value of a \$50,000 amount to be received by Rudy and Jackie two years from now is \$45,351.47, if the interest rate is 5 percent. In effect, \$45,351.47 received right now is equivalent to \$50,000 received two years from now if the rate of return is 5 percent. The process of finding the present value of a future cash flow, which Michael just completed, is called discounting. Michael has discounted the \$50,000 to its present value of \$45,351.47. The 5 percent interest that we have used to find this present value is called the discount rate.

Michael, a student like you, has been able to examine many possible options for his parents. How about you? Can you do the same?

There are other objections to break-even analysis, as noted throughout our discussion. Break-even analysis makes many restrictive assumptions about CVP relationships; in normal use it is basically a negative technique, defining constraints rather than looking at benefits. It is essentially a static tool for analyzing a single short period. What all this theory boils down to is that break-even analysis is too simplistic a technique to be used to make final investment decisions.

What is break-even analysis good for, then? It has its place: It is a simple and cheap screening device. Discounted cash flow techniques require lots of time, and it may be expensive to compile data for them. Break-even analysis can tell you whether or not it is worthwhile to do more intensive and costly analysis.

Break-even analysis provides a basis for designing product specifications. Each menu item has implications for the operations' costs. Costs affect price and marketing feasibility. Break-even analysis permits comparison of different sets of possible specifications before final decisions are made. For example, the steak house project could be tested in terms of portion sizes and steak specifications, and then compared to what the market can bear in terms of selling prices or customers' perceived value. Alternatively, the steak house could be compared to a seafood or Italian restaurant's potential in the area.

Break-even analysis serves as a substitute for estimating an unknown factor in making project decisions. In deciding whether to go ahead on a project or skip it, there are always variables to be considered: demand, costs, price, and other factors such as expertise and space constraints. When most expenses can be determined, only two missing variables remain: profit (or cash flow) and demand. Demand is usually difficult to estimate correctly. By deciding that profit must at least be zero, the break-even point, you can then fairly simply find the demand you must have to make the project a reasonable or worthwhile undertaking. If you can then

estimate whether the demand will exceed that break-even point, you are making a more informed decision about how to proceed.

## SUMMARY

Marginal cost analysis determines the economic viability of opening or closing an operation, in whole or in part. This technique allows management to project when revenue generated by an outlet will exceed the costs of reopening. This is accomplished by accurately analyzing the behavior of semivariable costs, which are often erroneously designated as either fixed or variable.

The least squares method is presented to differentiate the fixed and variable components of semivariable costs. While the least squares approach is fairly accurate, it requires greater effort. However, this method helps to demonstrate the common fallacy of simply accepting fixed and variable cost assumptions without closely examining the accuracy of these assumptions.

Managers are accustomed to seeing full-cost statements because they are responsible for the long-term perspective, and over the long term, revenues must cover all costs. But there is a danger in using full-cost accounting in decisions that involve CVP.

To avoid the rigidity of using full-cost accounting, managers generally apply the concept of sunk cost and Marginal cost analysis. Sunk costs are costs that have already been incurred and cannot be changed by any decision made now or in the future. And marginal cost is the amount of output, at any given volume, at which aggregate costs are changed if the volume of output is increased or decreased by one unit.

Both sunk and marginal cost approach can be more than a simple tool. It can be an approach for dealing with uncertainty intelligently and finding a middle ground in setting selling price, making advertising decisions, and deciding on affordable labor rate.

There are always difficulties in estimating uncertain variables, such as customer demand, but by specifying the levels of other variables that affect the revenues of a restaurant, a required or minimum level can be found for the unknown quantity.

The major problem is that no restaurant exists in a vacuum. There are alternative uses for the restaurant's funds and resources in almost every case. Break-even analysis does not permit proper examination of cash flows. It is generally accepted in financial theory that the appropriate way to make investment or capital decisions is to consider the value of a proposed project's anticipated cash flows. If the discounted value of the cash flows exceeds the required investment outlay in cash, then the project should be acceptable.

## CHAPTER QUESTIONS

### Discussion Questions

1. When is it beneficial to lower sales prices?
2. How can labor be viewed as both a fixed and a variable expense?
3. What are the advantages of using differential analysis?
4. What is marginal costing?
5. What is meant by *the full-cost trap*?

6. Define differential analysis.
7. Define fixed, variable, and semivariable costs.

## Critical Thinking Questions

1. What is the potential problem with using full-cost accounting to determine when to open or close an operation?
2. Why is it valuable to differentiate fixed from variable expenses?
3. When might it be advantageous to keep an operation open when full-cost accounting analysis indicates it will not be profitable?
4. How do stepped costs affect break-even analysis?
5. If the fixed costs of an operation are \$7,000, and the contribution margin is 35 percent, what is the level of sales required to break even?
6. If the check average could be increased to \$15, how many covers will be required to break even?
7. Using MCB analysis, and assuming that a profit margin of 6 percent is desired to justify opening or reopening the facility, what is the dollar volume required?
8. If a fixed profit of at least \$3,000 is required to justify opening the facility, what is the dollar volume required to meet this objective?
9. If fixed costs are \$4,000, desired profit is \$5,000, check average is \$10, and the estimated number of covers is 1,500, what is the variable cost percentage that must be maintained to reach this objective?

## Objective Questions

1. All cost categories may be properly designated as fixed or variable. True or False?
2. Fixed costs are fixed in direct proportion to sales. True or False?
3. It is desirable to use full-cost accounting in deciding when to reopen a restaurant in a hotel. True or False?
4. The results achieved through the least squares approach can be taken at face value. True or False?
5. True variable costs will retain the same cost percentage regardless of fluctuations in business. True or False?

## Multiple Choice Questions

1. Which of the following accounting methods excludes costs and revenues that do not change within the relevant range of operating alternatives?
  - A. Accrual accounting
  - B. Full-cost accounting

- 
- C. Cash-flow accounting  
D. Differential analysis
2. The amount of output, at any given volume, at which the aggregate costs are changed if the volume of output is increased or decreased by one unit is called
- A. Marginal costs.  
B. Regression analysis.  
C. Variable costs.  
D. Fixed costs.
3. Contribution margin percentage equals
- A. Fixed costs / variable costs.  
B.  $1 - \text{variable cost percentage}$ .  
C. Sales / expenses.  
D. None of the above.
4. Determine the break-even point given the following information: Fixed costs: \$400,000; variable cost percentage: 70
- A. \$1,000,000  
B. \$571,428.57  
C. \$680,000  
D. \$1,333,333.33
5. Determine the number of covers required to break even given the following information: Fixed costs: \$300,000; CM percentage: 40; check average: \$20
- A. 37,500  
B. 39,862  
C. 75,000  
D. 35,500
6. If the check average in Question 5 is raised to \$25, how many covers are needed to break even?
- A. 37,500  
B. 39,862  
C. 35,500  
D. 30,000
7. Determine the break-even point given the following information: Fixed costs: \$300,000; CM percentage: 40; desired profit margin: 6 percent
- A. \$882,353  
B. \$856,853  
C. \$652,174  
D. \$783,762
8. Given the following information, determine the break-even selling price: Fixed costs: \$10,000; number of covers: 1,000; variable cost: \$7 per cover
- A. \$20  
B. \$17

- C. \$15  
D. \$18
9. How much additional revenue must be generated to justify an advertisement costing \$500, given a variable cost percentage of 55?
- A. More than \$2,000  
B. More than \$1,000  
C. More than \$1,111  
D. More than \$1,222
10. Break-even analysis does not factor in
- A. Profit for the owner.  
B. All labor costs.  
C. Cash flows.  
D. All of the above.

## CASE STUDIES

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### Case Study 1: Cost Classification

The following is a list of typical cost categories in the food-service industry:

#### Expenses

Cost of food sold  
 Cost of beverage sold  
 Salaries and wages  
 Employees benefits  
 Direct operating expenses  
 Music and entertainment  
 Marketing/advertising  
 Utility services—gas, others  
 Trash removal  
 Repairs and maintenance  
 Depreciation  
 China and glassware  
 General and administrative costs  
 Rent  
 Interest expenses

#### **Your task:**

Prepare an answer sheet as shown below. For each cost item, indicate whether that cost would be variable or fixed in behavior (that is, would it fluctuate substantially or not over a fairly wide range of volume of production?), and then whether it would be a selling cost or an administrative cost. If it is an administrative cost, indicate whether it would be direct or indirect with respect to units of product for pricing purposes. Two sample answers are provided for illustration.

Cost Item	Variable or Fixed	Selling Cost	Administrative Cost	Production Cost	
				Direct	Indirect
Cost of Food Sold	V	Yes	No	Yes	No
Depreciation	F	No	Yes	No	Yes

## Case Study 2: Making the Business Decision (Breaking Even)

Tracy Chen began dabbling in pastry making several years ago as a hobby. Her pastry is quite creative, and it has been so popular with friends and others that she has decided to quit her job with a travel agency and prepare pastry full-time. She will be giving up her salary from the travel agency, a steady \$2,000 per month.

Ms. Chen has found a small building near her former employer to rent for her pastry shop at \$400 per month. She estimates that for all her specially selected pastries, the ingredient cost will be \$0.50 per finished piece. She plans to hire workers to produce the pastries at a labor rate of \$7.50 per hour, and it will take 8 hours to produce 12 dozen sets of ten assorted pastries. The retail selling price for each pastry is \$2.50. To sell her pastries, Ms. Chen is of the opinion that she must advertise heavily in the local area. An advertising agency states that it will handle advertising for a fee of \$200 per month. Her brother will sell the pastries at the counter and to local businesses for a commission of \$5 per dozen pastries.

Ms. Chen already owns the production equipment, which she purchased several years ago. This equipment will depreciate at a rate of \$50 per month. A phone installed in the shop for taking orders will cost \$20 per month. In addition, a recording device will be attached to the phone for taking after-hours messages. The phone company will charge Ms. Chen \$0.40 for each message recorded.

Ms. Chen has some money in savings that is earning interest of \$5,000 per year. These savings will be withdrawn and used to get the business going. For the time being, Ms. Chen does not intend to draw any salary for herself.

### Your task:

1. Do you think that Ms. Chen should open the pastry shop, and what advice would you give her?
2. What is her break-even point?

## Case Study 3: The Decision to Shut Down or Continue to Operate

The Seafood Restaurant is a popular restaurant in the Monterey area, with an average of 1,000 covers daily and an average food check of \$20 per cover. During the winter months from December until March, the restaurant can hardly pay its bills because tourism is very low. This downturn affects the whole Monterey area. Mr. Jacob, the owner, has tried to attract the local community to eat at the restaurant during the winter months by writing a new menu, offering discounts, and increasing advertisement. Unfortunately, his efforts have not worked.

Mr. Jacob's variable expenses are \$8 per menu item; fixed overhead costs total \$5,000 per month. Due to the current low level of sales, Mr. Jacob is thinking about closing down the restaurant during the four months that he is losing money. If Mr. Jacob does close down the restaurant, it is estimated that fixed overhead costs can be reduced

to \$1,000 per month. Start-up costs at the end of the shutdown period would total \$2,000. Since the Seafood Restaurant uses just-in-time purchasing, product waste or spoilage would only be \$1,000, and no inventories on hand are expected.

**Your task:**

1. Calculate the break-even point.
2. Would you advise Mr. Jacob to close the restaurant or continue to operate?

### Case Study 4: Cost and Pricing Decisions

Mary and Elizabeth own a catering business called M and E Catering Services. Their core business is catering parties. The catering business is very seasonal, with a heavy schedule during the summer months and holidays and a lighter schedule at other times. One of the major events M and E's customers request is a cocktail party. The standard cocktail party lasts three hours, and M and E hires one worker for every six guests, which works out to one-half hour of labor per guest. These workers are hired only as needed and are paid only for the hours they actually work. Mary and Elizabeth offer a standard cocktail party with an estimated cost per guest as follows:

Food and beverage	= \$20
Labor at \$12 per hour for 0.5 hours	= \$6
Overhead at \$14 per hour for 0.5 hours	= \$7
<b>Total cost</b>	<b>= \$33</b>

When bidding on cocktail parties, M and E adds a 15 percent markup to yield a price of \$37.95 per guest. They are confident about their estimates of the costs of food, beverages, and labor but not as comfortable with their estimate of overhead cost. The \$14 overhead cost per labor hour was determined by dividing total overhead expenses for the last 12 months by total labor hours for the same period. Monthly data concerning overhead costs and labor hours follow:

MONTH	LABOR HOURS	OVERHEAD EXPENSES
January	2,500	\$55,000
February	2,800	59,000
March	3,000	60,000
April	4,200	64,000
May	4,500	67,000
June	5,500	71,000
July	6,500	74,000
August	7,500	77,000
September	7,000	75,000
October	4,500	68,000
November	3,100	62,000
December	6,500	74,400
<b>Total</b>	<b>57,600</b>	<b>806,400</b>

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M and E has received a request to bid on a 180-guest fundraising cocktail party to be given next month by an important local charity. The party would last the usual three hours. They would like to win this contract because the guest list for this charity event includes many prominent individuals whom they would like to land as future clients. M and E is confident that these potential customers would be favorably impressed by their company service standard at the event.

**Your task:**

1. Estimate the contribution to profit of a standard 180-guest cocktail party if M and E charges the usual price of \$37.95 per guest. In other words, by how much would their overall profit increase?
2. How low could M and E bid for the charity event in terms of a price per guest and still not lose money on the event itself?
3. The individual who is organizing the event has indicated that he has already received a bid of under \$30 per guest from another catering company. Do you think M and E should bid below its normal \$37.95 per guest for the event? Why or why not?