

## Ch.5 Cost Behavior: Analysis and Use

## CHAPTER HIGHLIGHTS

A. A *variable cost* is a cost that varies, in total, in proportion to changes in the level of activity. Variable costs are constant on a *per unit* basis.

1. Activity is often measured in terms of the volume of goods produced or services provided by the organization. However, other measures of activity may be used for specific purposes such as patients admitted to a hospital, number of machinery setups performed, number of sales calls made, and so on.

2. A variable cost is shown graphically in Exhibit 5-1. Note that a variable cost is a sloping straight line that goes through zero (i.e., the origin) on the graph.

B. A *fixed cost* is a cost that remains constant in total within the relevant range. The average fixed cost per unit varies inversely with changes in activity. As activity increases, the average fixed cost per unit falls.

1. Fixed costs can be classified into committed and discretionary fixed costs.

a. *Committed fixed costs* relate to investments in facilities, equipment, and the basic organization of a company. These costs are difficult to adjust in the short-term.

b. *Discretionary fixed costs* result from annual decisions by management to spend in certain areas, such as advertising, research, and management development programs. These costs are easier to adjust than committed fixed costs.

2. Even committed fixed costs may change if the change in activity is big enough. Exhibit 5-6 illustrates this idea. However, within the band of activity known as the relevant range, total fixed cost is constant.

C. A *mixed cost* (or semivariable cost) is a cost that contains both variable and fixed cost elements. Exhibit 5-7 illustrates a mixed cost. Note that in the case of a mixed cost, the straight line representing the relation between total cost and activity does not go through zero (i.e., the origin). Examples of mixed costs include electricity, costs of processing bills, costs of admitting patients to a hospital, and maintenance.

D. The relevant range and curvilinear costs.

1. For simplicity, a strict linear relation between cost and volume is usually assumed. However, many cost relationships are curvilinear, such as illustrated in Exhibit 5-4.

2. The straight-line assumption is reasonable because any small portion of a curvilinear cost can be

approximated by a straight line. The *relevant range* is the range of activity within which a particular straight line is a valid approximation to the curvilinear cost.

E. Cost formula for a mixed cost.

1. The fixed and variable cost elements of a mixed cost can be expressed in the form of the following *cost formula*, which can be used to predict costs at all levels of activity within the relevant range:

$$Y = a + bX$$

where:

$Y$  = *dependent variable* (the total mixed cost)

$a$  = vertical intercept (the total fixed cost)

$b$  = slope of the line (the variable cost)

$X$  = *independent variable* (the activity level)

2. Each of the methods discussed below can be used to estimate the variable cost per unit,  $b$ , and the total fixed cost,  $a$ , based on data from prior periods. Then with the use of the cost formula, the expected amount of total cost,  $Y$ , can be computed for any expected activity level,  $X$ , within the relevant range.

F. The analysis of a mixed cost begins with records of past cost and activity. The first step is to plot the cost and activity data on a *scattergraph*. The cost is represented on the vertical,  $Y$ , axis and activity is represented on the horizontal,  $X$ , axis.

1. If the scattergraph plot indicates that the relation between cost and activity is approximately linear (i.e., a straight line), the analysis can proceed to the next stage of estimating the variable cost per unit of activity and the fixed cost per period.

2. A quick and dirty way to estimate the variable and fixed costs is to draw a straight line on the scattergraph plot. The intercept of the line with the vertical axis is the estimated total fixed cost. The slope of the line is the estimated variable cost per unit of activity.

G. The *high-low method* of analyzing a mixed cost is based on using the data at the highest and lowest levels of activity.

1. The high-low method uses the “rise over run” formula for the slope of a straight line. The change in cost observed between the two extremes (i.e., the rise) is divided by the change in activity (i.e., the run) to estimate the amount of variable cost. The formula is:

$$\text{Variable cost per unit of activity} = \frac{\text{Change in cost}}{\text{Change in activity}}$$



2. The estimated variable cost per unit of activity is then used to estimate the fixed cost as follows:

Total cost at the high activity level .....	\$XXX
Less variable portion:	
High activity level $\times$ variable cost ....	<u>XXX</u>
Fixed portion of the mixed cost .....	<u>\$XXX</u>

3. The high-low method is quick, but it is not reliable because it is based on costs and activity for only two periods—the periods with the highest and lowest levels of activity. Other data are ignored. Moreover, the periods with the highest and lowest levels of activity tend to be unusual and unrepresentative of typical cost behavior.

H. The *least-squares regression method* of analyzing a mixed cost fits a straight line, called a *regression line*, to cost and activity data using a formula explained in the appendix to the chapter.

1. The least-squares regression formula calculates the slope and intercept of the straight line that minimizes the sum of the squared errors from the regression line. Because the computations are fairly complex, it is a good idea to use statistical software or a spreadsheet to do the calculations.

2. *Multiple regression* analysis should be used when more than one factor causes a cost to vary.

I. The *contribution approach* to preparation of an income statement emphasizes cost behavior.

#### True or False

Enter a T or an F in the blank to indicate whether the statement is true or false.

- \_\_\_ 1. A variable cost is a cost that changes, in total, in proportion to changes in the activity level.
- \_\_\_ 2. In cost analysis, activity is the dependent variable and cost is the independent variable.
- \_\_\_ 3. Within the relevant range, the higher the activity level, the lower the average fixed cost per unit.
- \_\_\_ 4. Contribution margin and gross margin mean the same thing.
- \_\_\_ 5. Contribution margin is the difference between sales and variable expenses.
- \_\_\_ 6. Discretionary fixed costs arise from annual decisions by management to spend in certain areas.
- \_\_\_ 7. Advertising is a committed fixed cost.
- \_\_\_ 8. A mixed cost is a cost that contains both manufacturing and non-manufacturing costs.
- \_\_\_ 9. In order for a cost to be variable, it must vary with either units produced or services provided.
- \_\_\_ 10. The contribution approach to the income statement organizes costs according to behavior, rather than according to function.

True/False	1	2	3	4	5	6	7	8	9	10
	T	F	T	F	T	T	F	F	F	T

1. The *traditional format* for an income statement groups expenses into the functional categories—cost of goods sold on the one hand and selling and administrative expenses on the other hand:

Sales .....	\$XXX
Cost of goods sold .....	<u>XXX</u>
Gross margin .....	<u>XXX</u>
Selling and administrative expense ..	<u>XXX</u>
Net operating income .....	<u>\$XXX</u>

2. In contrast, the *contribution approach* to the income statement groups expenses according to whether they are variable or fixed.

Sales .....	\$XXX
Variable expenses .....	<u>XXX</u>
Contribution margin .....	<u>XXX</u>
Fixed expenses .....	<u>XXX</u>
Net operating income .....	<u>\$XXX</u>

3. Note that the *contribution margin* is the difference between sales and variable costs.

4. The contribution approach is very useful in internal reports because it emphasizes cost behavior. As you will see in later chapters, this is very important in planning, budgeting, controlling operations, and in performance evaluation. However, the traditional format that emphasizes cost by function must be used in external reports.

#### Multiple Choice

Choose the best answer or response by placing the identifying letter in the space provided.

- \_\_\_ 1. A company's cost formula for maintenance is  $Y = \$4,000 + \$3X$ , where  $X$  is machine-hours. During a period in which 2,000 machine-hours are worked, the expected maintenance cost would be: a) \$12,000; b) \$6,000; c) \$10,000; d) \$4,000.
- \_\_\_ 2. The costs associated with a company's basic facilities, equipment, and organization are known as: a) committed fixed costs; b) discretionary fixed costs; c) mixed costs; d) variable costs.
- \_\_\_ 3. Last year, Barker Company's sales were \$240,000, its fixed costs were \$50,000, and its variable costs were \$2 per unit. During the year, 80,000 units were sold. The contribution margin was: a) \$200,000; b) \$240,000; c) \$30,000; d) \$80,000.
- \_\_\_ 4. Which of the following is an example of a discretionary fixed cost? a) depreciation on equipment; b) rent on a factory building; c) salaries of top management; d) items a, b, and c are all discretionary fixed costs; e) none of the above.
- \_\_\_ 5. In March, Espresso Express had electrical costs of \$225 when the total volume was 4,500 cups of coffee served. In April, electrical costs were \$227.50 for 4,750 cups of coffee. Using the high-low method, what is the estimated fixed cost of electricity per month? a) \$200; b) \$180; c) \$225; d) \$150.

Multiple Choice	1	2	3	4	5
	C	A	D	E	B