

CHAPTER 3

COST BEHAVIOR: ANALYSIS AND USE

AGENDA

1. Cost behavior patterns
2. Analysis of mixed costs
3. Contribution format income statement

COST BEHAVIOR PATTERNS

To predict how costs react to changes in activity, costs are often classified as variable or fixed.

Variable costs

Activity base (cost driver) is a measure of whatever causes the incurrence of variable cost.

True variable costs

The amount of a true variable cost used during the period varies in direct proportion to the activity level. The overage charge on a cell phone bill was one example of a true variable cost.

Step-variable costs

A step-variable cost is a resource that is obtainable only in large chunks and whose costs change only in response to fairly wide changes in activity. For example, maintenance workers are often considered to be a variable cost, but this labor cost does not behave as a true variable cost.

See Exhibit 3-3

Linearity Assumption

Fixed costs

Types of fixed costs

Committed fixed costs relate to investment in plant, equipment, and basic administrative structure. It is difficult to reduce these fixed costs in the short-term. Examples include:

- Equipment depreciation.
- Real estate taxes.
- Salaries of key operating personnel.

Discretionary fixed costs arise from annual decisions by management to spend in certain areas. These costs can often be reduced in the short-term. Examples include:

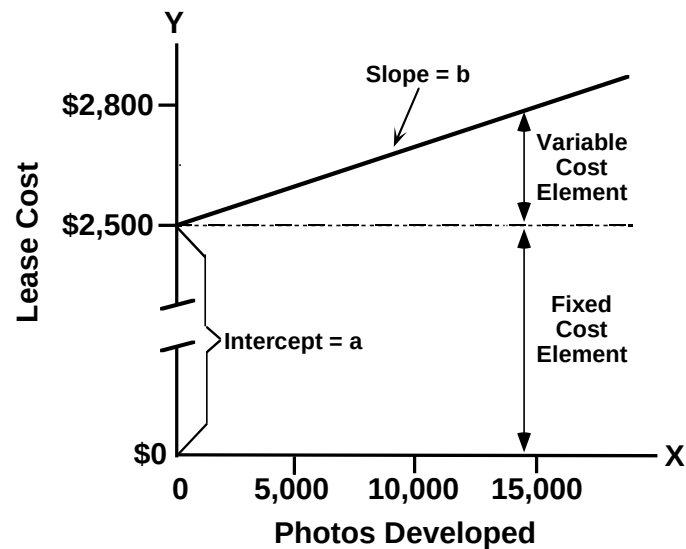
- Advertising; public relations.
- Research; management development programs.

Fixed cost and the relevant range

Mixed costs

A mixed (or semi-variable) cost contains elements of both variable and fixed costs.

Example: Lori Yang leases an automated photo developer for \$2,500 per year plus 2¢ per photo developed.



Equation of a straight line: $Y = a + bX$

$$Y = \$2,500 + \$0.02X$$

ANALYSIS OF MIXED COSTS

Scattergraph method

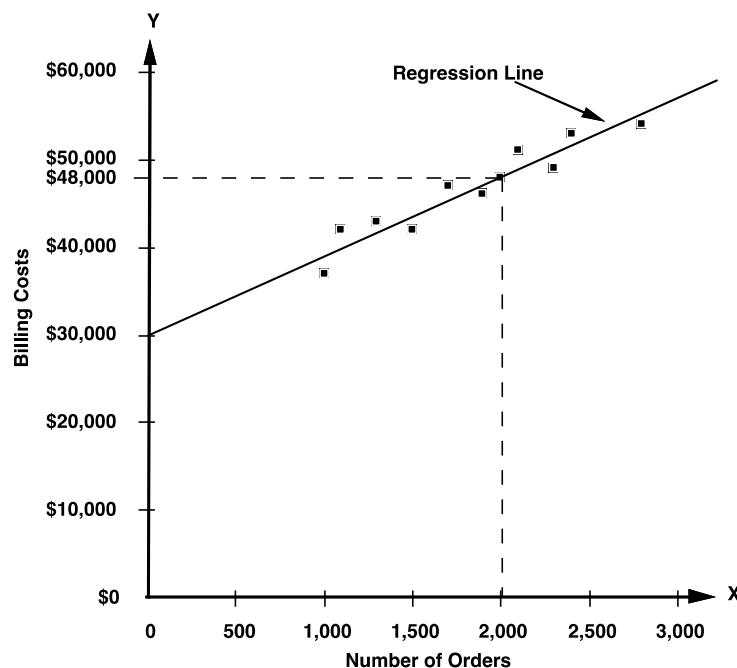
As the first step in the analysis of a mixed cost, cost and activity should be plotted on a scattergraph. This helps to quickly diagnose the nature of the relation between cost and activity.

Example: Piedmont Wholesale Florists has maintained records of the number of orders and billing costs in each quarter over the past several years.

<i>Quarter</i>	<i>Number of Orders</i>	<i>Billing Costs</i>
Year 1—1st	1,500	\$42,000
2nd	1,900	\$46,000
3rd	1,000	\$37,000
4th	1,300	\$43,000
Year 2—1st	2,800	\$54,000
2nd	1,700	\$47,000
3rd	2,100	\$51,000
4th	1,100	\$42,000
Year 3—1st	2,000	\$48,000
2nd	2,400	\$53,000
3rd	2,300	\$49,000

These data are plotted, with the activity (number of orders) on the horizontal X axis and the cost (billing costs) on the vertical Y axis.

A COMPLETED SCATTERGRAPH



High-low method

EXAMPLE: Kohlson Company has incurred the following shipping costs over the past eight months:

	<i>Units Sold</i>	<i>Shipping Cost</i>
January	6,000	\$66,000
February	5,000	\$65,000
March	7,000	\$70,000
April	9,000	\$80,000
May	8,000	\$76,000
June	10,000	\$85,000
July	12,000	\$100,000
August	11,000	\$87,000

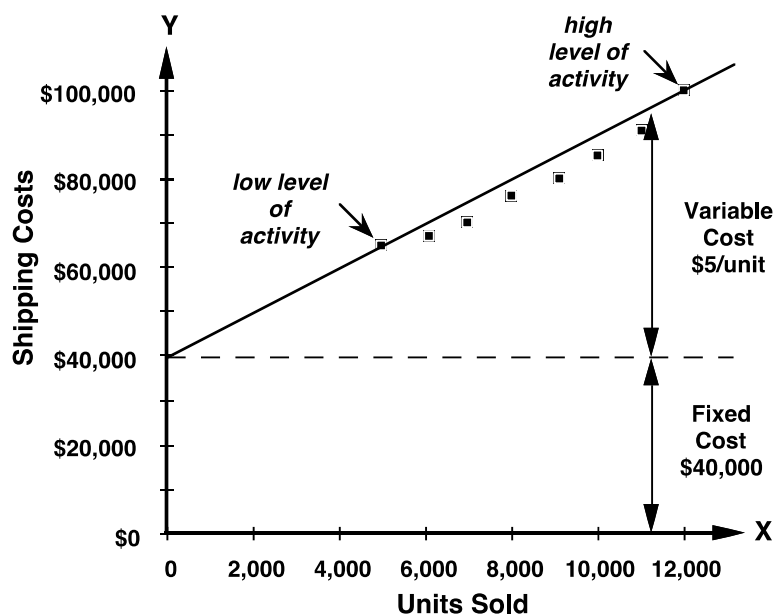
With the high-low method, only the periods in which the lowest activity and the highest activity occurred are used to estimate the variable and fixed components of the mixed cost.

$$\text{Variable cost} = \text{Change in cost} / \text{Change in activity}$$

The cost formula for shipping cost is:

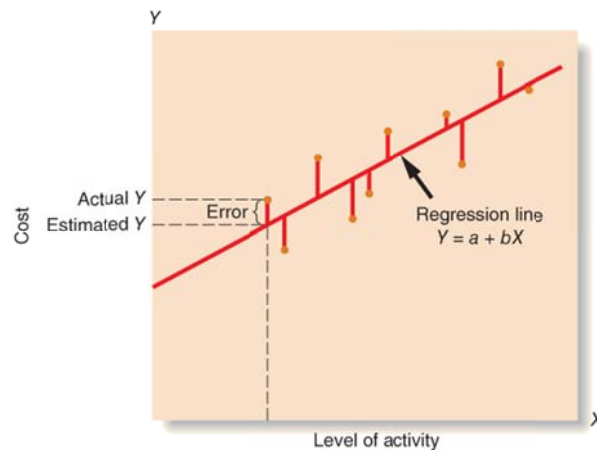
$$Y = \$40,000 + \$5X$$

Evaluation of the high-low method



Least-squares regression method

The least-squares regression method for analyzing mixed costs uses mathematical formulas to determine the regression line that minimizes the sum of the squared “errors.”



Example: Montrose Hospital operates a cafeteria for employees. Management would like to know how cafeteria costs are affected by the number of meals served.

	<i>Meals Served</i> X	<i>Total Cost</i> Y
April	4,000	\$9,500
May	1,000	\$4,000
June	3,000	\$8,000
July	5,000	\$10,000
August	10,000	\$19,500
September	7,000	\$14,000

Statistical software or a spreadsheet program can do the computations required by the least-squares method. The results in this case are:

Intercept (fixed cost)	\$2,433
Slope (variable cost)	\$1.68
R^2	0.99

The fixed cost is therefore \$2,433 per month and the variable cost is \$1.68 per meal served, or:

$$Y = \$2,433 + \$1.68X,$$

where X is meals served.

R^2 is a measure of the goodness of fit of the regression line. In this case, it indicates that 99% of the variation in cafeteria costs is due to the number of meals served. This suggests an excellent fit.

Contribution format income statement

Traditional versus contribution income statement

Traditional Format		Contribution Format	
Sales	\$12,000	Sales	\$12,000
Cost of goods sold*	<u>6,000</u>	Variable expenses:	
Gross margin	6,000	Cost of goods sold	\$6,000
Selling and administrative expenses:		Variable selling	600
Selling	\$3,100	Variable administrative	<u>400</u>
Administrative	<u>1,900</u>	Contribution margin	<u>7,000</u>
Net operating income	<u>\$ 1,000</u>	Fixed expenses:	5,000
		Fixed selling	2,500
		Fixed administrative	<u>1,500</u>
		Net operating income	<u>\$ 1,000</u>

*For a manufacturing company, the cost of goods sold would include some variable costs, such as direct materials, direct labor, and variable overhead, and some fixed costs, such as fixed manufacturing overhead. Income statement formats for manufacturing companies will be explored in greater detail in a subsequent chapter.

Problem 1: Cost behavior

Neptune Rentals operates a boat rental service. Consider the following costs of the company over the relevant range of 5,000 to 8,000 hours of operating time for its boats:

	Hours of Operating Time			
	5,000	6,000	7,000	8,000
Total costs:				
Variable costs	\$ 20,000	\$?	\$?	\$?
Fixed costs	<u>168,000</u>	<u>?</u>	<u>?</u>	<u>?</u>
Total costs	<u>\$188,000</u>	<u>\$?</u>	<u>\$?</u>	<u>\$?</u>
Cost per hour:				
Variable cost	\$?	\$?	\$?	\$?
Fixed cost	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>
Total cost per hour	<u>\$?</u>	<u>\$?</u>	<u>\$?</u>	<u>\$?</u>

Required:

Compute the missing amounts, assuming that cost behavior patterns remain unchanged within the relevant range of 5,000 to 8,000 hours.

PROBLEM 3-12 Cost Behavior; High-Low Method; Contribution Format Income Statement [LO1, LO3, LO4]

Morrissey & Brown, Ltd., of Sydney is a merchandising company that is the sole distributor of a product that is increasing in popularity among Australian consumers. The company's income statements for the three most recent months follow:

Morrissey & Brown, Ltd. Income Statements For the Three Months Ended September 30			
	July	August	September
Sales in units	4,000	4,500	5,000
Sales revenue	A\$400,000	A\$450,000	A\$500,000
Cost of goods sold	240,000	270,000	300,000
Gross margin	160,000	180,000	200,000
Selling and administrative expenses:			
Advertising expense	21,000	21,000	21,000
Shipping expense	34,000	36,000	38,000
Salaries and commissions	78,000	84,000	90,000
Insurance expense	6,000	6,000	6,000
Depreciation expense	15,000	15,000	15,000
Total selling and administrative expenses	154,000	162,000	170,000
Net operating income	A\$ 6,000	A\$ 18,000	A\$ 30,000

(Note: Morrissey & Brown, Ltd.'s Australian-formatted income statement has been recast in the format common in the United States. The Australian dollar is denoted here by A\$.)

Required

1. Identify each of the company's expenses (including cost of goods sold) as either variable, fixed, or mixed.
2. Using the high-low method, separate each mixed expense into variable and fixed elements. State the cost formula for each mixed expense.
3. Redo the company's income statement at the 5,000-unit level of activity using the contribution format.