

HIGH-LOW METHOD

Key Terms and Concepts to Know

Variable, Fixed and Mixed Costs

- Many costs are clearly variable, such as direct labor and direct materials, or clearly fixed, such as rent and salaries.
- Other costs, called mixed costs, have both variable and fixed cost components. The total cost of a cell phone contract which charges a fixed amount for a certain number of minutes per month and then an additional amount per minute for additional minutes used in the month is a mixed cost.
- Mixed costs must be separated into their variable and fixed elements so that their behavior can be predicted when the activity level changes.

Least Squares Regression Method

- A rigorous, mathematical approach in which a series of data points are used to develop a regression line to predict total costs.

Scattergraph Method

- Plots a series of data points for the mixed costs and the activity that produced these costs. The Y-axis is dollars of mixed cost and the X axis is the activity level.
- A regression line is drawn by best guess through one of the data points and a point on the Y-axis with an approximately the same number of data points above and below the line.
- The point where the line crosses Y axis represents the fixed cost, the only cost incurred at zero activity. For any data point, the difference between the total mixed cost and the fixed cost is total variable cost and total variable cost divided by the activity level for the data point is variable cost per unit.

High-Low Method

- From a series of data points, uses the data points with the highest and lowest activity level (X values) to develop a regression line to predict total costs. Not a statistically valid method as only two data points from the population of data points are used.

Key Topics to Know

Separating Mixed Costs into Fixed and Variable Elements

- Mixed costs must be separated into their fixed and variable elements and a regression line developed to predict total mixed costs at various levels of activity.
- The equation of the regression line takes the form:

$$\begin{array}{rccccccc} \text{Total Cost} & = & \text{Fixed Cost} & + & \text{Variable Cost} \\ Y & = & a & + & b(X) \end{array}$$

High-Low Method

- Variable cost per unit (b) is calculated first:

$$\frac{\text{Cost \$}}{\text{Activity}} = \frac{\text{High Point \$}}{\text{activity}} - \frac{\text{Low Point \$}}{\text{activity}} = \frac{\text{Change \$}}{\text{activity}}$$

$$\frac{\text{Change in Cost \$}}{\text{Change in Activity}} = \text{Variable cost/unit}$$

- Using either the high point or low point, total fixed cost is calculated next:

$$\begin{array}{rccccccc} \text{Fixed Cost} & = & \text{Total Cost} & - & \text{Variable Cost} \\ a & = & Y & - & b(X) \end{array}$$

Example # 1

Travis Inc. employed several maintenance engineers to keep the equipment running in peak condition. Over the past eight months, Travis incurred the following maintenance cost for these engineers. Plant activity is best measured by direct labor hours.

<u>Month</u>	<u>Direct Labor Hours</u>	<u>Maintenance Cost</u>
January	1,700	\$14,300
February	1,900	\$15,200
March	1,800	\$16,700
April	1,600	\$14,000
May	1,500	\$14,300
June	1,300	\$13,000
July	1,100	\$12,800
August	1,400	\$14,200

Required: Using the high-low method, determine the fixed and variable components of the maintenance costs.

Solution #1

	<u>High</u>	-	<u>Low</u>	=	<u>Change</u>
	<u>Point*</u>		<u>Point*</u>		
<u>Cost \$</u>	<u>\$15,200</u>		<u>\$12,800</u>		<u>\$2,400</u>
<u>Activity</u>	<u>1,900</u>		<u>1,100</u>		<u>800</u>

$$\frac{\text{Change in Cost \$}}{\text{Change in Activity}} = \frac{\$2,400}{800} = \$3.00 \text{ variable cost/unit}$$

Using either the high point or low point, total fixed cost is calculated next:

Fixed Cost	=	Total Cost	-	Variable Cost
\$9,500	=	\$15,200	-	\$5,700 = \$3.00 (1,900)
OR				
\$9,500	=	\$12,800	-	\$3,300 = \$3.00 (1,100)

* The high and low points are chosen by activity, not by cost.

Practice Problems

Practice Problem #1

Active Company accumulated the following data for a delivery truck.

	<u>Miles Driven</u>	<u>Total Cost</u>		<u>Miles Driven</u>	<u>Total Cost</u>
January	10,000	\$15,000	March	9,000	\$12,500
February	8,000	\$14,500	April	7,500	\$13,000

- Required:
- a) Determine the equation to predict total costs for the delivery truck.
 - b) Calculate the total costs be if 12,187 miles were driven.

Practice Problem #2

When the Tom-Tom Company's controller was asked to budget the cost of manufacturing supplies for the next year, she plotted supplies cost and units produced by month for the year. She then drew a regression line through the point she plotted for November when the supplies cost was \$21,000 and 5,000 drum sets were produced.

- Required: If the regression line intersected the Y axis at \$6,000, determine the equation of the regression line.

Practice Problem #3

Data concerning Nelson Company's activity for the first six months of the year appear below:

	<u>Machine Hours</u>	<u>Electrical Cost</u>
January	4,000	\$3,120
February	6,000	4,460
March	4,800	3,500
April	5,800	5,040
May	3,600	2,900
June	4,200	3,200

- Required: Using the high-low method of analysis, estimate the variable electrical cost per machine hour.

True / False Questions

1. The equation for a mixed cost is total fixed costs + variable cost per unit × units of activity = total cost.
True False
2. The high-low method uses cost and activity data from just two data points to establish the formula for a mixed cost.
True False
3. Mixed costs are included in cost of goods sold on the income statement.
True False
4. Analyzing mixed costs is only necessary when preparing a contribution income statement.
True False
5. The high-low method uses the highest and lowest data points based on cost.
True False
6. The high-low method uses the highest and lowest costs regardless of whether they are from the data points with the highest and lowest activity levels.
True False

Multiple Choice Questions

1. A mixed cost
 - a) is fixed over a wider range of activity than a step cost.
 - b) is a fixed cost over the relevant range and a variable cost everywhere else.
 - c) contains both fixed and variable components.
 - d) always increases on a per unit basis.

2. The per-unit amount of three different production costs for Jones, Inc., are as follows:

<u>Production</u>	<u>Cost A</u>	<u>Cost B</u>	<u>Cost C</u>
20,000	\$12.00	\$15.00	\$20.00
80,000	\$12.00	\$11.25	\$5.00

What type of cost is each of these three costs?

- a) Cost A is mixed, Cost B is variable, Cost C is mixed
 - b) Cost A is fixed, Cost B is mixed, Cost C is variable.
 - c) Cost A is fixed, Cost B is variable, Cost C is mixed.
 - d) Cost A is variable, Cost B is mixed, Cost C is fixed.

3. A graph of the relationship between total cost and activity level is called a
 - a) Relevant range.
 - b) Scattergraph.
 - c) Contribution margin graph.
 - d) Dependent variable.

4. Bud uses the high-low method of estimating costs. Bud had total costs of \$50,000 at its lowest level of activity, when 5,000 units were sold. When, at its highest level of activity, sales equaled 12,000 units, total costs were \$78,000. Bud would estimate variable cost per unit as
 - a) \$10.00
 - b) \$6.50
 - c) \$4.00
 - d) \$7.53

5. Which of the following is a variable cost?
 - a) A cost that is \$20,000 when production is 50,000, and \$20,000 when production is 70,000.
 - b) A cost that is \$20,000 when production is 50,000, and \$28,000 when production is 70,000.

- c) A cost that is \$20,000 when production is 50,000, and \$40,000 when production is 70,000.
 - d) A cost that is \$40,000 when production is 50,000, and \$40,000 when production is 70,000.
6. Which of the following is a mixed cost?
- a) A cost that is \$20.00 per unit when production is 50,000, and \$20.00 per unit when production is 80,000.
 - b) A cost that is \$20.00 per unit when production is 50,000, and \$12.50 per unit when production is 80,000.
 - c) A cost that is \$20.00 per unit when production is 50,000, and \$16.25 per unit when production is 80,000.
 - d) A cost that is \$40.00 per unit when production is 50,000, and \$40.00 per unit when production is 80,000.

Solutions to Practice Problems

Practice Problem #1

a)

$$\begin{array}{r}
 \text{Cost \$} \\
 \text{Activity}
 \end{array}
 \quad
 \begin{array}{r}
 \text{High Point} \\
 \$15,000 \\
 10,000
 \end{array}
 \quad
 -
 \quad
 \begin{array}{r}
 \text{Low Point} \\
 \$13,000 \\
 7,500
 \end{array}
 \quad
 =
 \quad
 \begin{array}{r}
 \text{Change} \\
 \$2,000 \\
 2,500
 \end{array}$$

$$\frac{\text{Change in Cost \$}}{\text{Change in Activity}} = \frac{\$2,000}{2,500} = \$0.80 \text{ variable cost/unit}$$

Using either the high point or low point, total fixed cost is calculated next:

$$\begin{array}{r}
 \text{Fixed Cost} \\
 \$7,000
 \end{array}
 =
 \begin{array}{r}
 \text{Total Cost} \\
 \$15,000
 \end{array}
 -
 \begin{array}{r}
 \text{Variable Cost} \\
 \$8,000
 \end{array}
 = \$0.80 (10,000)$$

OR

$$\begin{array}{r}
 \$7,000 \\
 \text{Fixed Cost}
 \end{array}
 =
 \begin{array}{r}
 \$13,000 \\
 \text{Total Cost}
 \end{array}
 -
 \begin{array}{r}
 \$6,000 \\
 \text{Variable Cost}
 \end{array}
 = \$0.80 (7,500)$$

The equation is: $Y = \$7,000 + \$0.80(X)$

b)

$$\begin{array}{r}
 \text{Total Cost} \\
 Y \\
 \$16,750
 \end{array}
 =
 \begin{array}{r}
 \text{Fixed Cost} \\
 a \\
 \$7,000
 \end{array}
 +
 \begin{array}{r}
 \text{Variable Cost} \\
 b(X) \\
 \$9,750 = \$0.80 (12,187)
 \end{array}$$

Practice Problem #2:

Since the Y intercept is known, use the equation to solve for the variable cost per unit:

$$\begin{aligned}
 Y &= a + b(X) \\
 \$21,000 &= \$6,000 + 5000b \\
 b &= \$3.00
 \end{aligned}$$

The equation will be:

$Y = \$6,000 + \$3(X)$ where X is the number of units produced and Y is the total mixed cost.

Practice Problem #3:

$$\begin{array}{r} \text{Cost \$} \\ \hline \text{Activity} \end{array} \quad \begin{array}{r} \text{High Point} \\ \hline \$4,460 \\ 6,000 \end{array} \quad - \quad \begin{array}{r} \text{Low Point} \\ \hline \$2,900 \\ 3,600 \end{array} \quad = \quad \begin{array}{r} \text{Change} \\ \hline \$1,560 \\ 2,400 \end{array}$$

$$\frac{\text{Change in Cost \$}}{\text{Change in Activity}} = \frac{\$1,560}{2,400} = \$0.65 \text{ variable cost/unit}$$

Solutions to True / False Problems

1. True
2. True
3. False – mixed costs may be part of cost of goods sold as well as selling and administrative costs.
4. True
5. False - the high-low method uses the highest and lowest data points based on activity.
6. False – the high-low method uses the costs associated with the highest and lowest activity points, regardless of whether these costs are the highest or lowest costs for any data point.

Solutions to Multiple Choice Questions

1. C
2. D
3. B
4. C
5. B
6. C