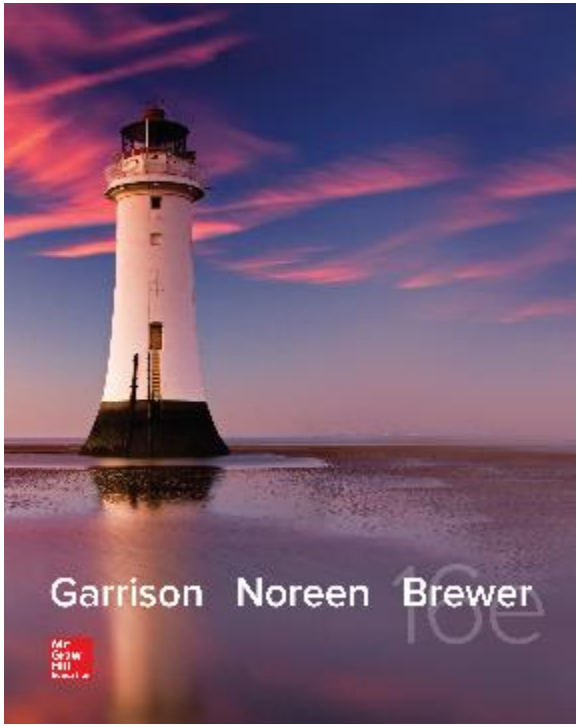
Analyzing Mixed Costs

APPENDIX 5A



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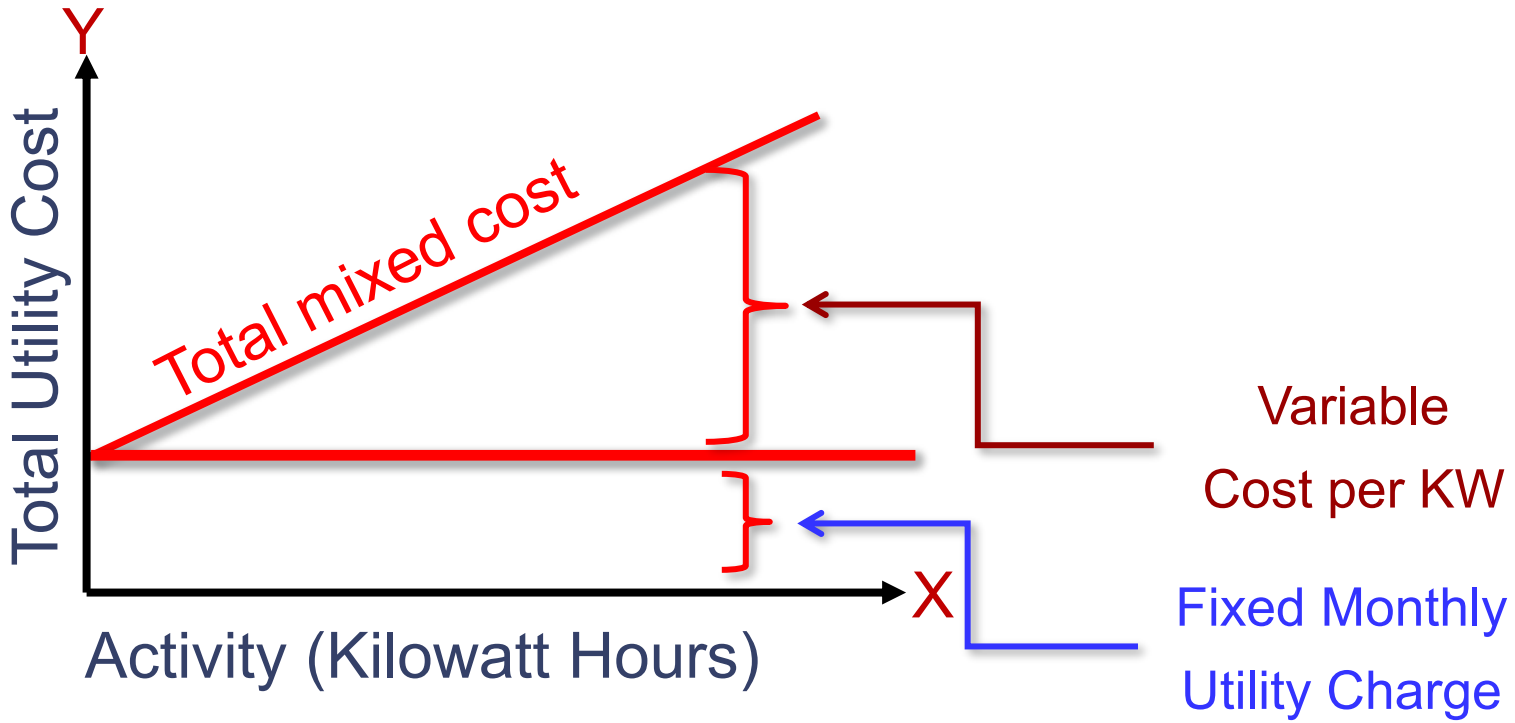
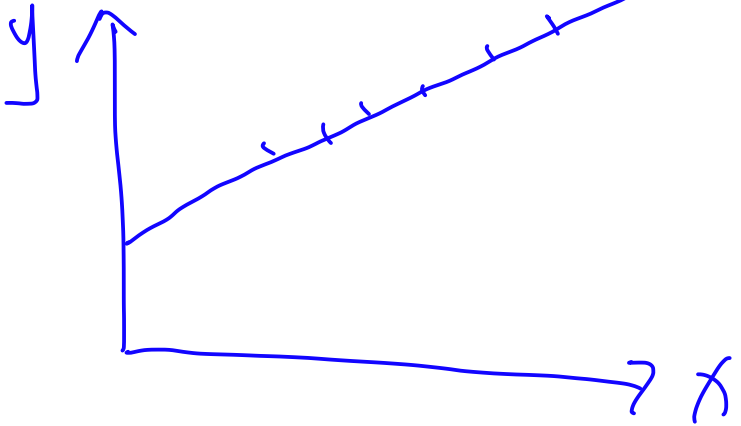
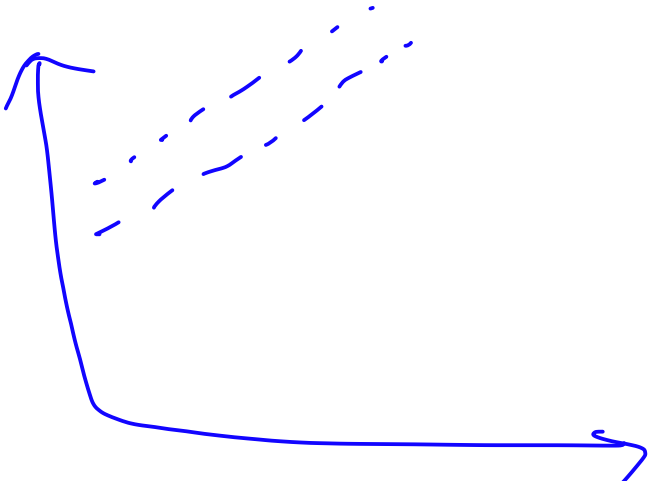
Mixed Costs – Part 1

A mixed cost contains both variable and fixed elements. Consider the example of utility cost.



cost linear $y = a + bx$





Analysis of Mixed Costs

Account Analysis and the Engineering Approach

In account analysis, each account is classified as either variable or fixed based on the analyst's knowledge of how the account behaves.

The engineering approach classifies costs based upon an industrial engineer's evaluation of production methods, and material, labor, and overhead requirements.

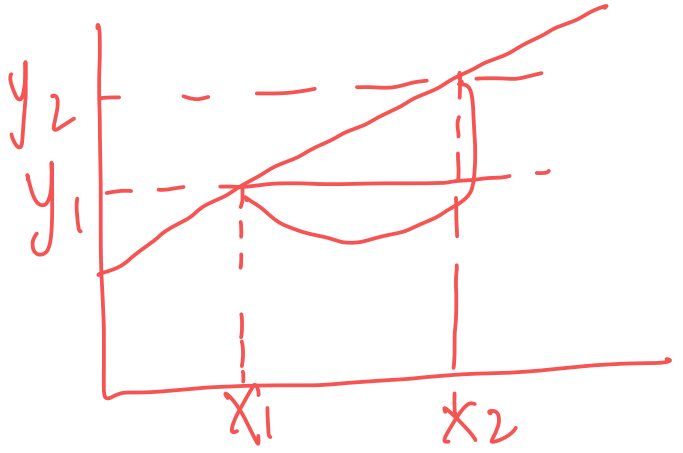
Learning Objective 10

Analyze a mixed cost using a scattergraph plot and the high-low method.

Diagnosing Cost Behavior with a Scattergraph Plot

Assume the following hours of maintenance work and the total maintenance costs for six months.

Month	Hours of Maintenance	Total Maintenance Cost
January	625	$ 7,950
February	450	7,400
March	700	8,275
April	550	7,625
May	775	9,100
June	850	9,800



$$b = \frac{9800 - 7400}{850 - 450} = 6$$

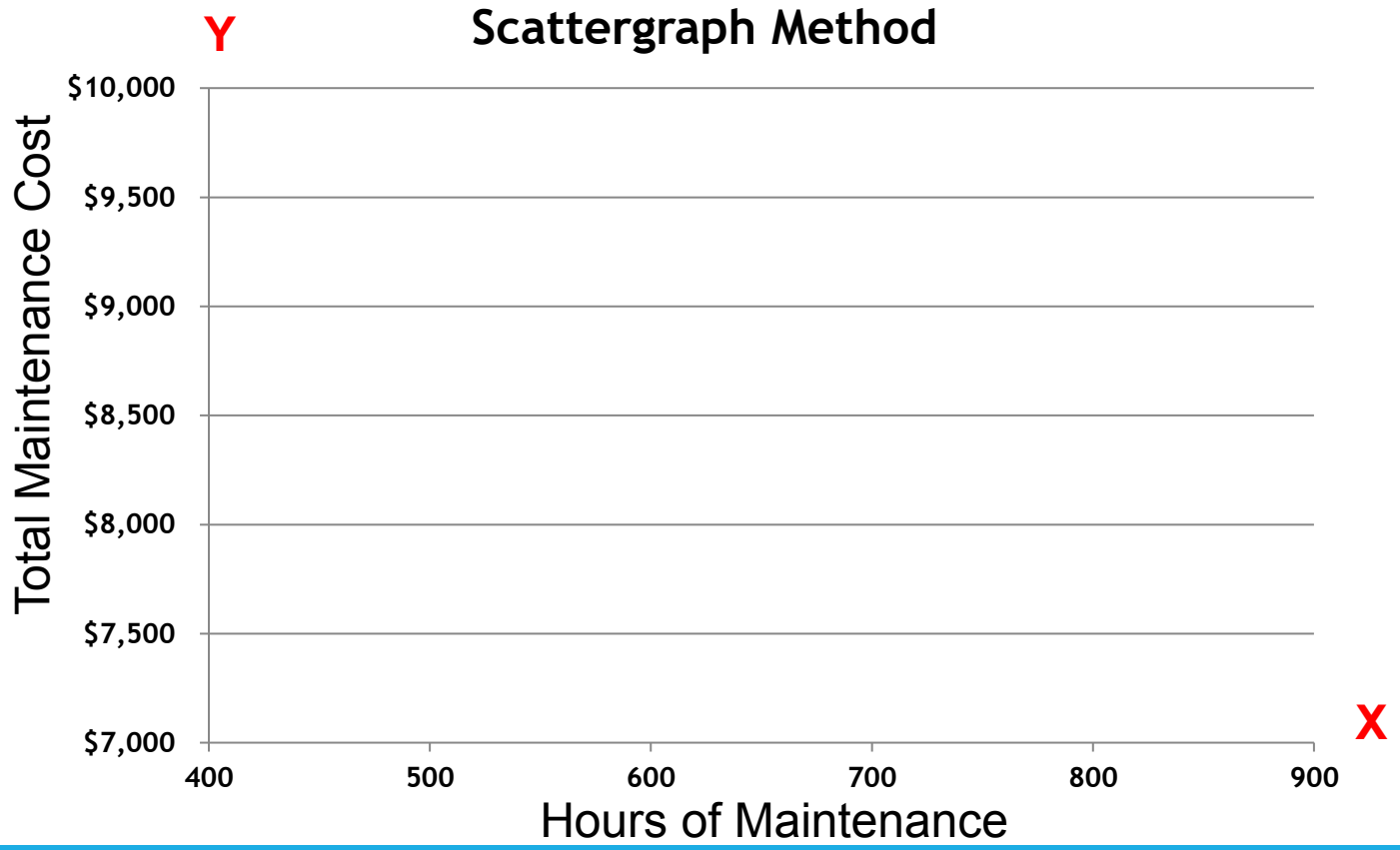
$x_1 y_1$ $\quad 7400 = a + 6 \times 450 \Rightarrow a = 4700$

$x_2 y_2$ $\quad 9800 = a + 6 \times 850 \Rightarrow a = 4700$

$$y = 4700 + 6x$$

Scattergraph Plot

Plot the data points on a graph (Total Cost *Y* "dependent variable" vs. Activity *X "independent variable"*).

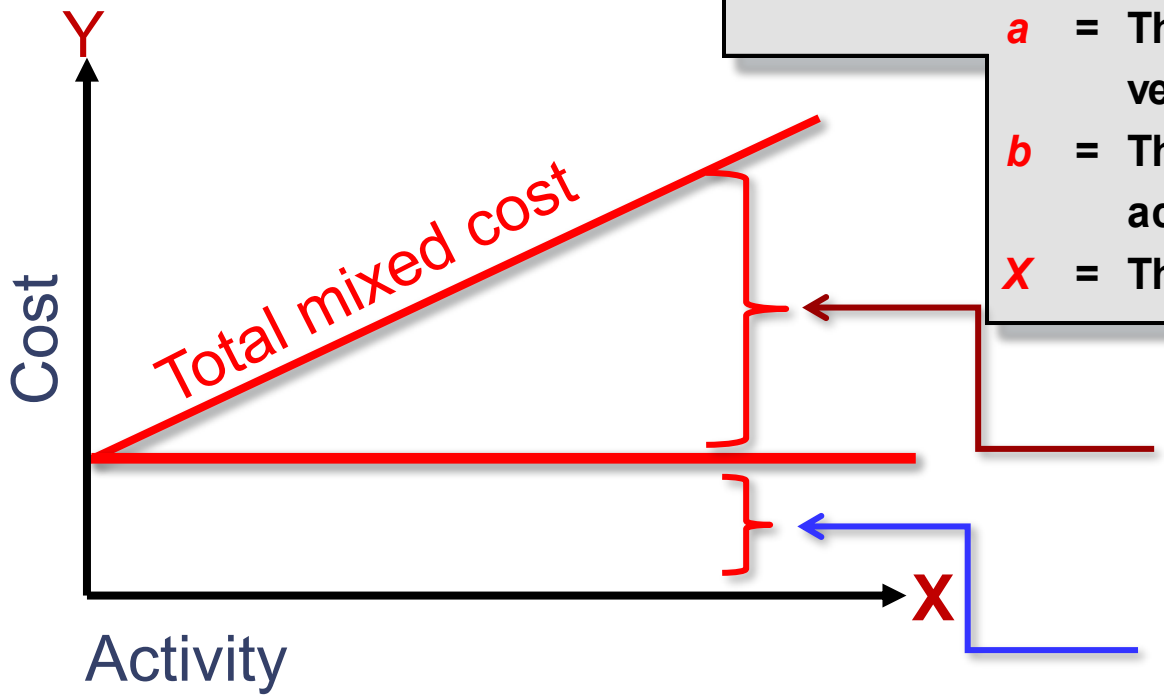


Mixed Costs – Part 2

The total mixed cost line can be expressed as an equation: $Y = a + bX$

Where:

- Y = The total mixed cost.
- a = The total fixed cost (the vertical intercept of the line).
- b = The variable cost per unit of activity (the slope of the line).
- X = The level of activity.



Variable Portion of Mixed Cost

Fixed Portion of Mixed Cost

Mixed Costs – Solution

If your fixed monthly utility charge is $40, your variable cost is $0.03 per kilowatt hour, and your monthly activity level is 2,000 kilowatt hours, what is the amount of your utility bill?

$$Y = a + bX$$

$$Y = \$40 + (\$0.03 \times 2{,}000)$$

$$Y = \$100$$

The High-Low Method – Select High and Low Values

Month	Hours of Maintenance	Total Maintenance Cost
January	625	$ 7,950
February	450	7,400
March	700	8,275
April	550	7,625
May	775	9,100
June	850	9,800
High	850	$ 9,800
Low	450	7,400
Change	400	$ 2,400

The *variable cost per hour* of maintenance is equal to the change in cost divided by the change in hours.

$$\frac{\$2,400}{400} = \$6.00/\text{hour}$$

The High-Low Method – Fixed Cost

Month	Hours of Maintenance	Total Maintenance Cost
High	850	$ 9,800
Low	450	7,400
Change	400	$ 2,400

Total Fixed Cost = Total Cost – Total Variable Cost

Total Fixed Cost = $9,800 – ($6/hour × 850 hours)

Total Fixed Cost = $9,800 – $5,100

Total Fixed Cost = $4,700

The High-Low Method – Calculation

Month	Hours of Maintenance	Total Maintenance Cost
High	850	$ 9,800
Low	450	7,400
Change	400	$ 2,400

The Cost Equation for Maintenance

$$Y = \$4{,}700 + \$6.00X$$

Quick Check 1

Sales salaries and commissions are $10,000 when 80,000 units are sold, and $14,000 when 120,000 units are sold. Using the high-low method, what is the variable portion of sales salaries and commission?

a. $0.08 per unit

b. $0.10 per unit

c. $0.12 per unit

d. $0.125 per unit

Quick Check 1a

Sales salaries and commissions are $10,000 when 80,000 units are sold, and $14,000 when 120,000 units are sold. Using the high-low method, what is the variable portion of sales salaries and commission?

a. $0.08 per unit

b. $0.10 per unit

c. $0.12 per unit

d. $0.125 per unit

$4,000 ÷ 40,000 units
= $0.10 per unit

Quick Check 2

Sales salaries and commissions are $10,000 when 80,000 units are sold, and $14,000 when 120,000 units are sold. Using the high-low method, what is the fixed portion of sales salaries and commissions?

a. $ 2,000

b. $ 4,000

c. $10,000

d. $12,000

Quick Check 2a

Sales salaries and commissions are $10,000 when 80,000 units are sold, and $14,000 when 120,000 units are sold. Using the high-low method, what is the fixed portion of sales salaries and commissions?

a. $ 2,000
b. $ 4,000
c. $10,000
d. $12,000

Total cost	**=**	**Total fixed cost + Total variable cost**
$14,000	**=**	**Total fixed cost + ($0.10 × 120,000 units)**
Total fixed cost	**=**	**$14,000 - $12,000**
Total fixed cost	**=**	**$2,000**

Learning Objective 11

Analyze a mixed cost using a scattergraph plot and the least-squares regression method

Least-Squares Regression Method

A method used to analyze mixed costs if a scattergraph plot reveals an approximately linear relationship between the *X* and *Y* variables.

This method uses ***all*** of the data points to estimate the fixed and variable cost components of a mixed cost.

The goal of this method is to fit a straight line to the data that *minimizes the sum of the squared errors*.

Least-Squares Regression Method (Part 2)

Excel can be used to estimate the intercept (fixed cost) and slope (variable cost per unit) that minimize the sum of the squared errors.

The cost analysis objective is the same: $Y = a + bX$

Least-squares regression also provides a statistic, called the R^2, which is a measure of the goodness of fit of the regression line to the data points.

Least-Squares Regression Method (Part 3)

A *regression line* of the form $Y = a + bX$ is fitted to the data, where a (the intercept) represents the total fixed cost and b (the slope) represents the variable cost per unit of activity.

In our Maintenance Cost example, The slope b is $6.02, and represents the estimated variable maintenance cost per hour of maintenance. The intercept a is $4,395.67, and represents the estimated fixed monthly maintenance cost.

Note that the R^2 is approximately 0.92, which is quite good and indicates that 92% of the variation in maintenance cost is explained by the variation in maintenance hours.

Comparing Results From the Two Methods

The two methods just discussed provide different estimates of the fixed and variable cost components of a mixed cost.

This is to be expected because each method uses differing amounts of the data points to provide estimates.

Least-squares regression provides the most accurate estimate because it uses all the data points.

End of Appendix 5A