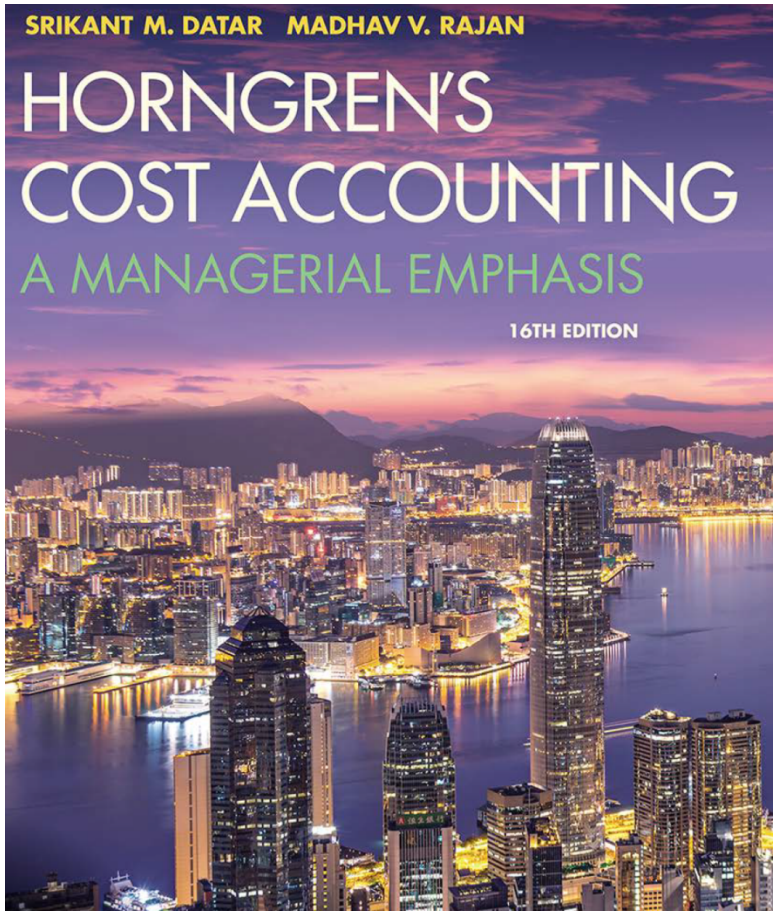
Cost Accounting

Sixteenth Edition



Chapter 10

Determining
How Costs Behave

Cost Function, Defined

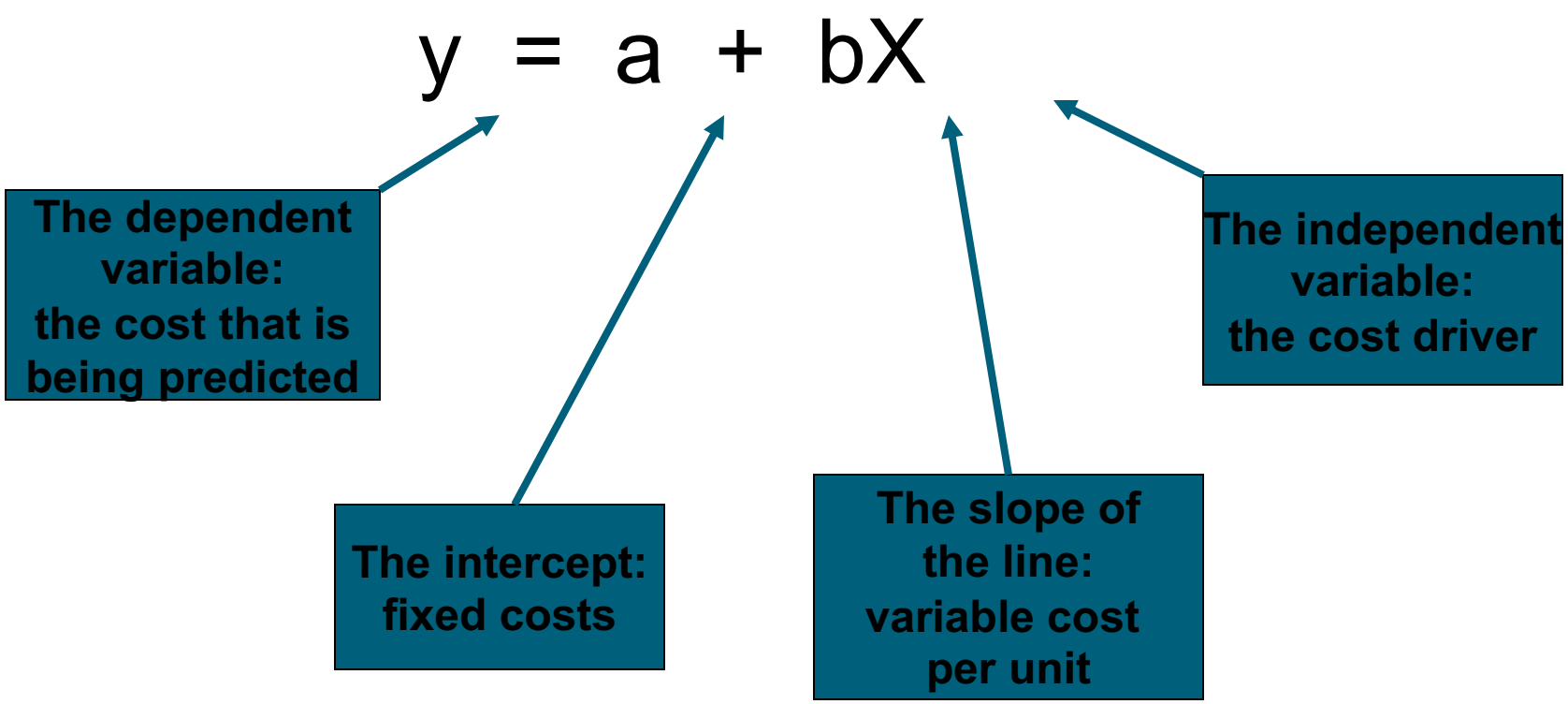
- A cost function is a mathematical description of how a cost changes with changes in the level of an activity relating to that cost.
- Managers often estimate cost functions based on two assumptions:
  - Variations in the level of a single activity (the cost driver) explain the variations in the related total costs, and
  - Cost behavior is approximated by a linear cost function within the relevant range.

Cost Terminology

From prior chapters, we are familiar with the distinction between variable and fixed costs and in this chapter, we introduce mixed costs.

- Variable costs—costs that change in total in relation to some chosen activity or output.
- Fixed costs—costs that do not change in total in relation to some chosen activity or output.
- Mixed costs—costs that have both fixed and variable components; also called semivariable costs.

Linear Cost Function

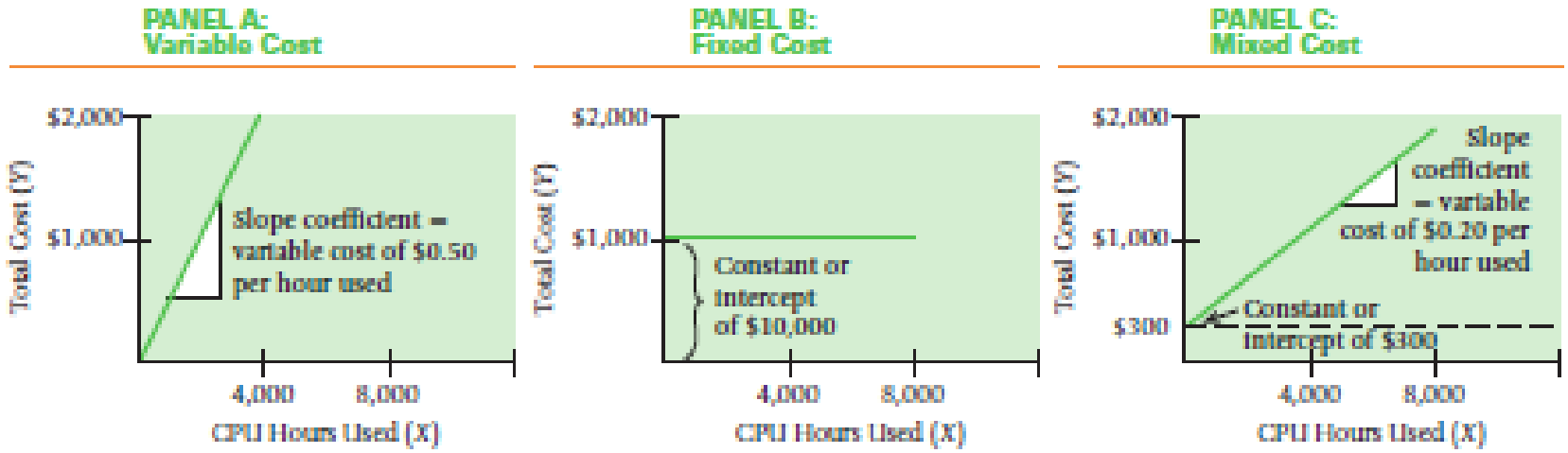


Bridging Accounting and Statistical Terminology

ACCOUNTING	STATISTICS
Variable Cost	Slope or Slope Coefficient
Fixed Cost	Intercept or Constant
Mixed Cost	Linear Cost Function

Linear Cost Functions, Illustrated

Exhibit 10.1 Examples of Linear Cost Functions



Review of Cost Classification

1. Choice of cost object—different objects may result in different classification of the same cost.
2. Time horizon—the longer the period, the more likely the cost will be variable.
3. Relevant range—behavior is predictable only within this band of activity.

Better management decisions, cost predictions and estimation of cost functions can be achieved only if managers correctly identify the factors that affect costs.

Cost Drivers and the Decision-Making Process

- To correctly identify cost drivers in order to make decisions, managers should always use a long time horizon.
- Costs may be fixed in the short run (during which time they have no cost driver), but they are usually variable and have a cost driver in the long run.
- Managers should follow the five-step decision-making process outlined in Chapter 1 to evaluate how changes can affect costs and product decisions.

Cost Estimation Methods

FOUR METHODS OF COST ESTIMATION ARE:

1. Industrial engineering method
2. Conference method
3. Account analysis method
4. Quantitative analysis methods
    1. High-low method
    2. Regression analysis

These method are not mutually exclusive and often more than one is used.

Industrial Engineering Method

- Estimates cost functions by analyzing the relationship between inputs and outputs in physical terms.
- Includes time-and-motion studies.
- Very thorough and detailed when there is a physical relationship between inputs and outputs, but also costly and time-consuming.
- Also called the work-measurement method.
- Some government contracts mandate its use.

Conference Method

- Estimates cost functions on the basis of analysis and opinions about costs and their drivers gathered from various departments of a company.
- Pools expert knowledge, increasing credibility.
- Because opinions are being used, the accuracy of the cost estimates depends largely on the care and skill of the people providing the inputs.

Account Analysis Method

- Estimates cost functions by classifying various cost accounts as variable, fixed, or mixed in respect to the identified level of activity.
- Typically, managers use qualitative rather than quantitative analysis when making these cost-classification decisions.
- Widely used because it is reasonably accurate, cost-effective, and easy to use.
- The accuracy of the account analysis method depends on the accuracy of the qualitative judgments that managers and management accountants make about which costs are fixed and which are variable.

Quantitative Analysis

- Uses a formal mathematical method to fit cost functions to past data observations.
- Advantage: results are objective.
- Advantage: most rigorous approach to estimate costs.
- Challenge: requires more detailed information about costs, cost drivers, and cost functions and is therefore more time-consuming.

Six Steps in Estimating a Cost Function Using Quantitative Analysis

1. Choose the dependent variable. (the cost to be predicted and managed)
2. Identify the independent variable. (the level of activity or cost driver)
3. Collect data on the dependent variable and the cost driver.
4. Plot the data to observe the general relationship.
5. Estimate the cost function using two common forms of quantitative analysis: the high-low method or regression analysis.
6. Evaluate the cost driver of the estimated cost function.

High-Low Method

- Simplest method of quantitative analysis.
- Uses only the highest and lowest observed values.
- “Fits” a line to data points which can be used to predict costs.
- Three steps in the high-low method to obtain the estimate of the cost function.

Steps in the High-low Method
(1 of 3)

Calculate the slope coefficient (the variable cost per unit of activity).

Slope coefficient = Difference between costs associated with highest and lowest observations of the cost driver / Difference between highest and lowest observations of the cost driver.

If we had high activity of 100 at cost of $2,500 and low activity of 80 at cost of $2,100, our formula for variable cost per unit of activity would be:

($2,500 - $2,100) / (100 – 80) or 400 / 20 = $20.00

Steps in the High-Low Method
(2 of 3)

The second step is to calculate the constant (the total fixed costs).

Total cost from either the highest or lowest activity level – (Variable Cost per unit of activity X Activity associated with above total cost) = Fixed Costs

Continuing our example, let's calculate fixed costs using both the high and low levels of activity:

High: $2,500 – ($20 x 100) = $500 fixed costs

Low: $2,100 – ($20 x 80) = $500 fixed costs

Steps in the High-Low Method
(3 of 3)

The third and final step in the high-low method is to summarize by writing a linear equation:

Y = Fixed Costs + (Variable cost per unit of Activity * Activity) or Y = FC + (VC/U * X)

In our example, our equation would look like this:

Y = $500 + ($20 * X)

If we wondered what costs would be at a 120 level of activity, we'll simply plug that number for X in our equation: Y = $500 + ($20 * 120) or Y = $2,900

Regression Analysis Method

- Regression analysis is a statistical method that measures the average amount of change in the dependent variable associated with a unit change in one or more independent variables.
- Regression analysis is more accurate than the high-low method because the regression equation estimates costs using information from ALL observations whereas the high-low method uses only TWO observations.

Types Of Regression Analysis

- Simple regression estimates the relationship between the dependent variable and ONE independent variable
- Multiple regression estimates the relationship between the dependent variable and TWO OR MORE independent variables.

Regression analysis is widely used because it helps managers understand why costs behave as they do and what managers can do to influence them.

Regression Analysis: Terminology

- Goodness of fit indicates the strength of the relationship between the cost driver and costs.
- Residual term measures the difference between actual cost and estimated cost for each observation.
- The smaller the residual term, the better is the fit between the actual cost observations and estimated costs.

Nonlinear Cost Functions, Defined

- Cost functions are not always linear.
- A nonlinear cost function is a cost function for which the graph of total costs is not a straight line within the relevant range.
- Some examples of nonlinear cost functions follow.

Nonlinear Cost Functions, Examples (1 of 2)

1. Economies of scale (produce double the number of advertisements for less than double the cost).
2. Quantity discounts (direct material costs rise but not in direct proportion to increases in quantity due to the nonlinear relationship caused by the quantity discounts).
3. Step cost functions—resources increase in “lot-sizes”, not individual units.

Nonlinear Cost Functions, Examples (2 of 2)

4. Learning curve—a function that measures how labor-hours per unit decline as units of production increase because workers are learning and becoming better at their jobs.
5. Experience curve—measures the decline in the cost per unit of various business functions as the amount of these activities increases. It is a broader application of the learning curve that extends to other business functions in the value chain such as marketing, distribution and customer service.

Nonlinear Cost Functions, Illustrated

Exhibit 10.9 Examples of Nonlinear Cost Functions