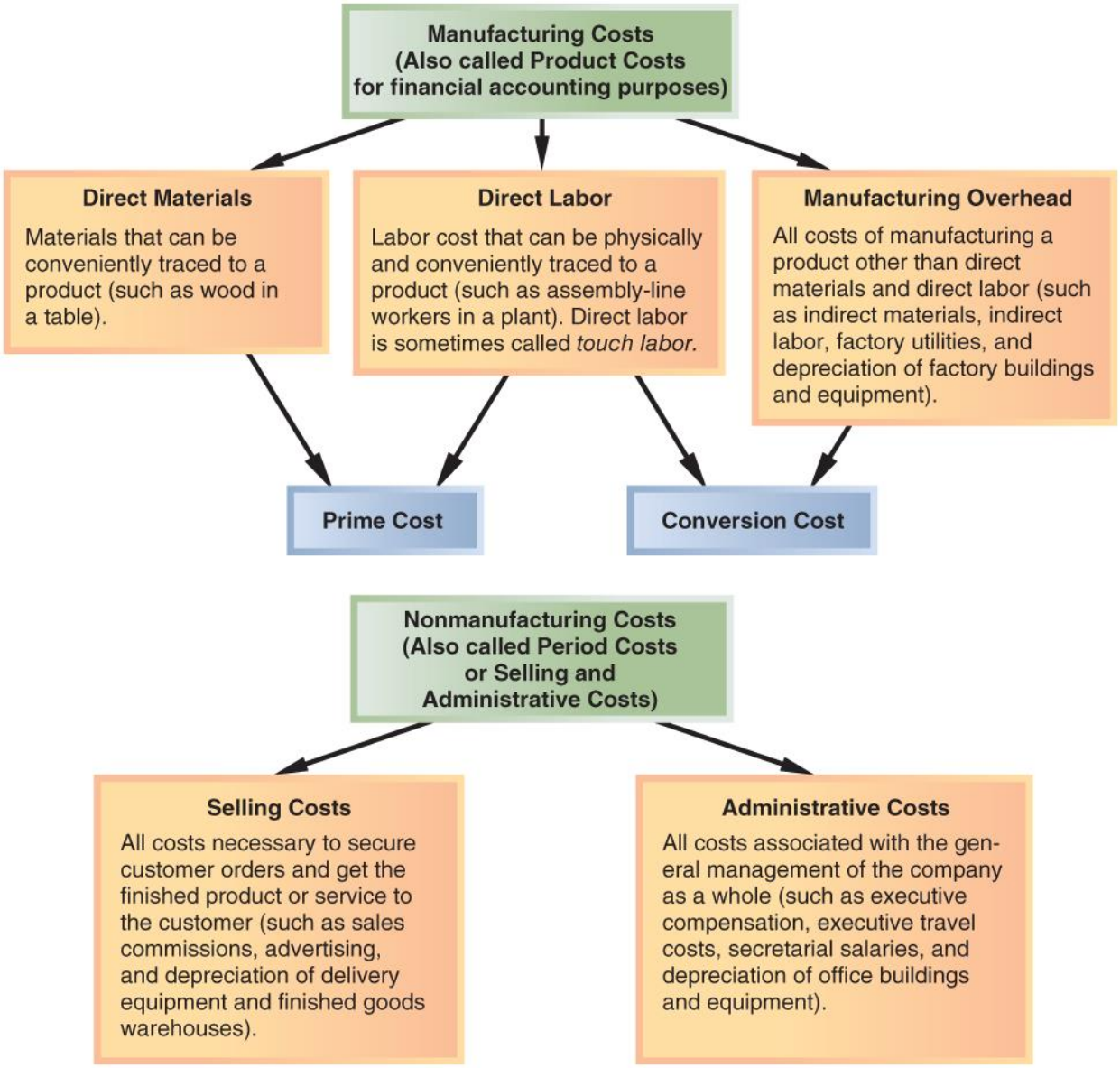
# AGENDA: MANAGERIAL ACCOUNTING AND COST CONCEPTS

A. Cost classifications for:
   1. Financial statement preparation.
   2. Predicting cost behavior.
   3. Assigning costs to cost objects.
   4. Making decisions
B. Least-squares regression computations using Microsoft Excel.
C. Cost of Quality.

## AN OVERVIEW OF COST CLASSIFICATIONS IN CHAPTER 2

| *Purpose of classification* | *Cost classifications* |
|---|---|
| Preparing an income statement and balance sheet | • Product costs<br>  • Direct materials<br>  • Direct labor<br>  • Manufacturing overhead<br>• Period costs (nonmanufacturing costs)<br>  • Selling costs<br>  • Administrative costs |
| Predicting changes in cost due to changes in activity | • Variable costs<br>• Fixed costs<br>• Mixed costs |
| Assigning costs | • Direct costs<br>• Indirect costs |
| Making decisions | • Differential costs<br>• Sunk costs<br>• Opportunity costs |

## MANUFACTURING COST CLASSIFICATIONS FOR EXTERNAL REPORTING




## COST CLASSIFICATIONS TO PREDICT COST BEHAVIOR

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

## VARIABLE COSTS

Variable cost behavior can be summarized as follows:

| *Variable Cost Behavior* | |
|---|---|
| *In Total* | *Per Unit* |
| Total variable cost increases and decreases in proportion to changes in activity. | Variable cost per unit is constant. |

EXAMPLE: A company manufactures microwave ovens. Each oven requires a timing device that costs $30. The cost per unit and the total cost of the timing device at various levels of activity (i.e., number of ovens produced) would be:

| *Cost per Timing Device* | *Number of Ovens Produced* | *Total Variable Cost—Timing Devices* |
|---|---|---|
| $30 | 1 | $30 |
| $30 | 10 | $300 |
| $30 | 100 | $3,000 |
| $30 | 200 | $6,000 |

## FIXED COSTS

Fixed cost behavior can be summarized as follows:

| *Fixed Cost Behavior* | |
|---|---|
| *In Total* | *Per Unit* |
| Total fixed cost is not affected by changes in activity (i.e., total fixed cost remains constant even if activity changes). | Fixed cost per unit decreases as the activity level rises and increases as the activity level falls. |

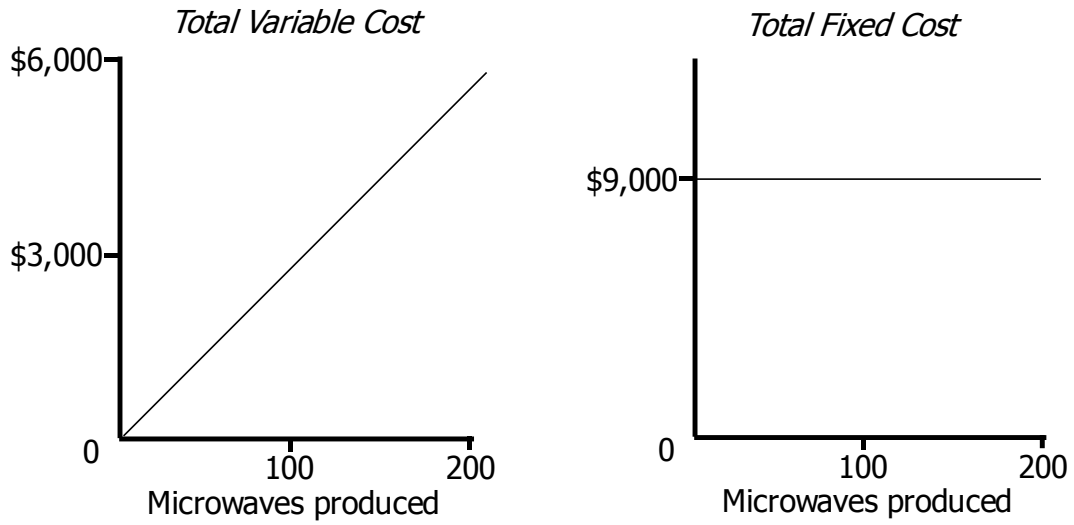
EXAMPLE: Assume again that a company manufactures microwave ovens. The company pays $9,000 per month to rent its factory building. The total cost and the cost per unit of rent at various levels of activity would be:

| *Rent Cost per Month* | *Number of Ovens Produced* | *Rent Cost per Oven* |
|---|---|---|
| $9,000 | 1 | $9,000 |
| $9,000 | 10 | $900 |
| $9,000 | 100 | $90 |
| $9,000 | 200 | $45 |

## 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.

## A GRAPHIC VIEW OF COST BEHAVIOR




## RELEVANT RANGE

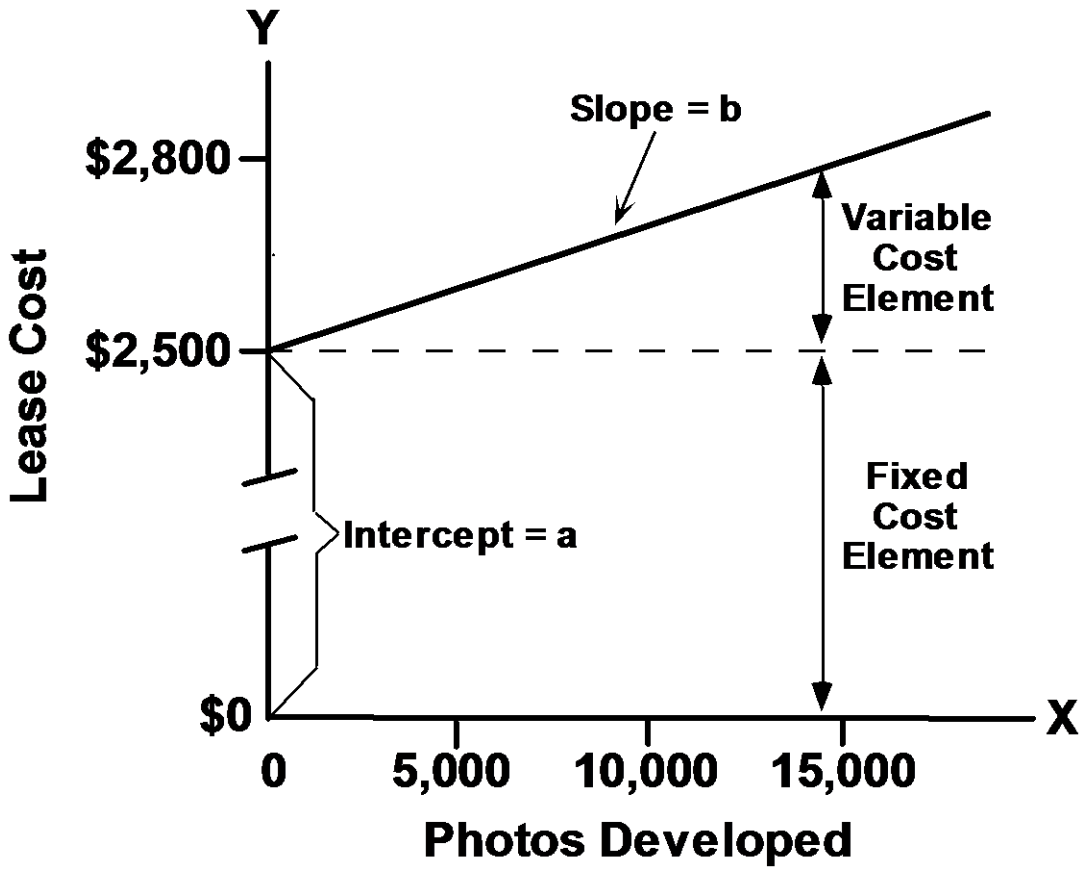
If activity changes enough, fixed costs may change. For example, if microwave production were doubled, another factory building might have to be rented.

**The relevant range is the range of activity within which the assumptions that have been made about variable and fixed costs are valid. For example, the relevant range within which total fixed factory rent is $9,000 per month might be 1 to 200 microwaves produced per month.**

## 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: $Y = a + bX$

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

## SCATTERGRAPH METHOD

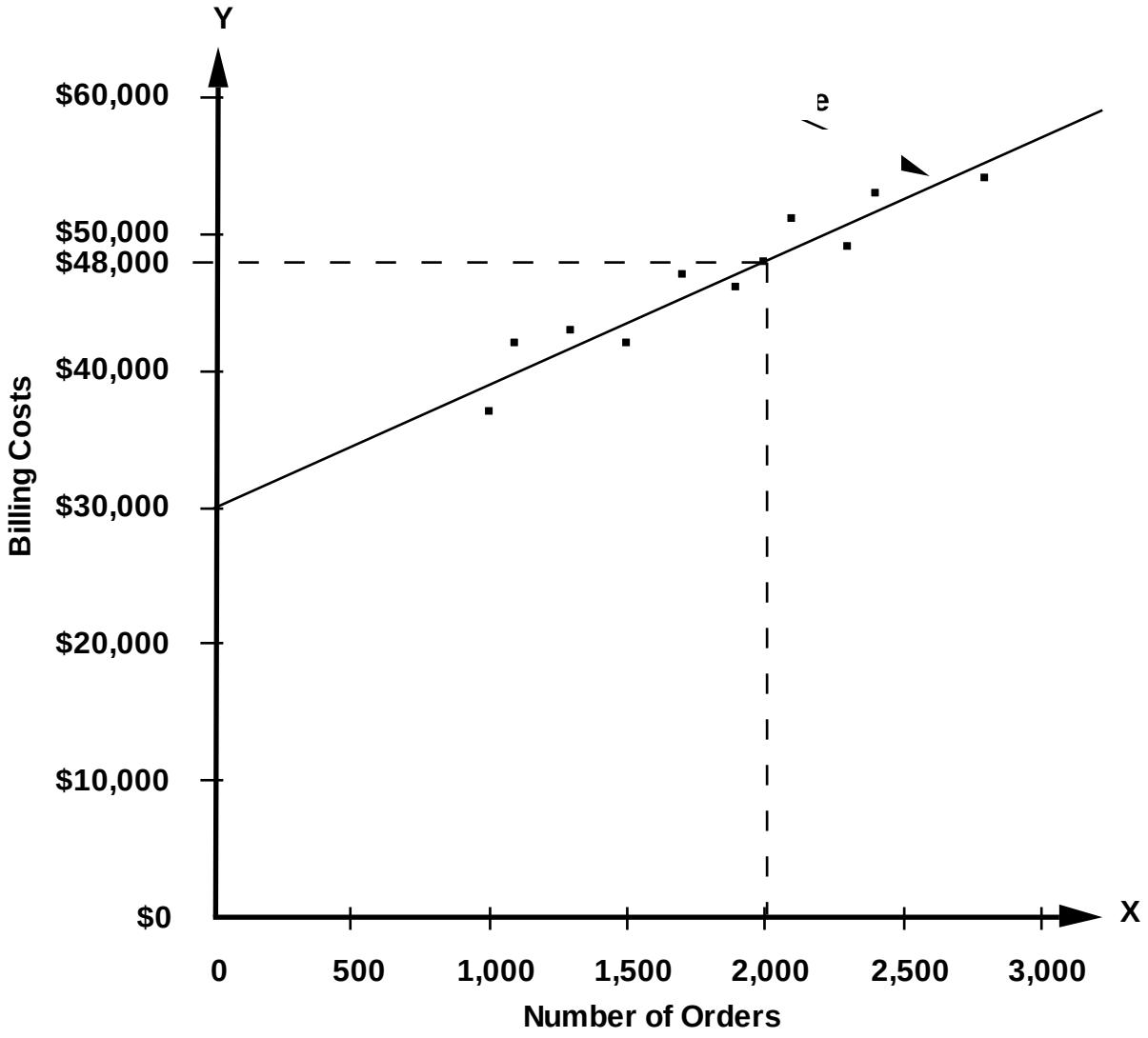
As the first step in the analysis of a mixed cost, cost and activity should be plotted on a scattergraph. This helps to quickly diagnose the nature of the relation between cost and activity.

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

| *Quarter* | *Number of Orders* | *Billing Costs* |
|---|---|---|
| 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 on the next page, with the activity (number of orders) on the horizontal X axis and the cost (billing costs) on the vertical Y axis.

## A COMPLETED SCATTERGRAPH




The relation between the number of orders and the billing cost is approximately linear. (A straight line that seems to reflect this basic relation was drawn with a ruler on the scattergraph.)

Because a straight line seems to be a reasonable fit to the data, we can proceed to estimate the variable and fixed elements of the cost using one of the following methods.

1. High-low method.
2. Least-squares regression method.

## ANALYSIS OF MIXED COSTS: HIGH-LOW METHOD

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

| | *Units Sold* | *Shipping Cost* |
|---|---|---|
| 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.

| | *Units Sold* | *Shipping Cost* |
|---|---|---|
| High activity level, July..... | 12,000 | $100,000 |
| Low activity level, February | 5,000 | 65,000 |
| Change ..... | 7,000 | $ 35,000 |

$$\text{Variable cost} = \frac{\text{Change in cost}}{\text{Change in activity}} = \frac{\$35{,}000}{7{,}000 \text{ units}} = \$5 \text{ per unit}$$

Fixed cost = Total cost - Variable cost element

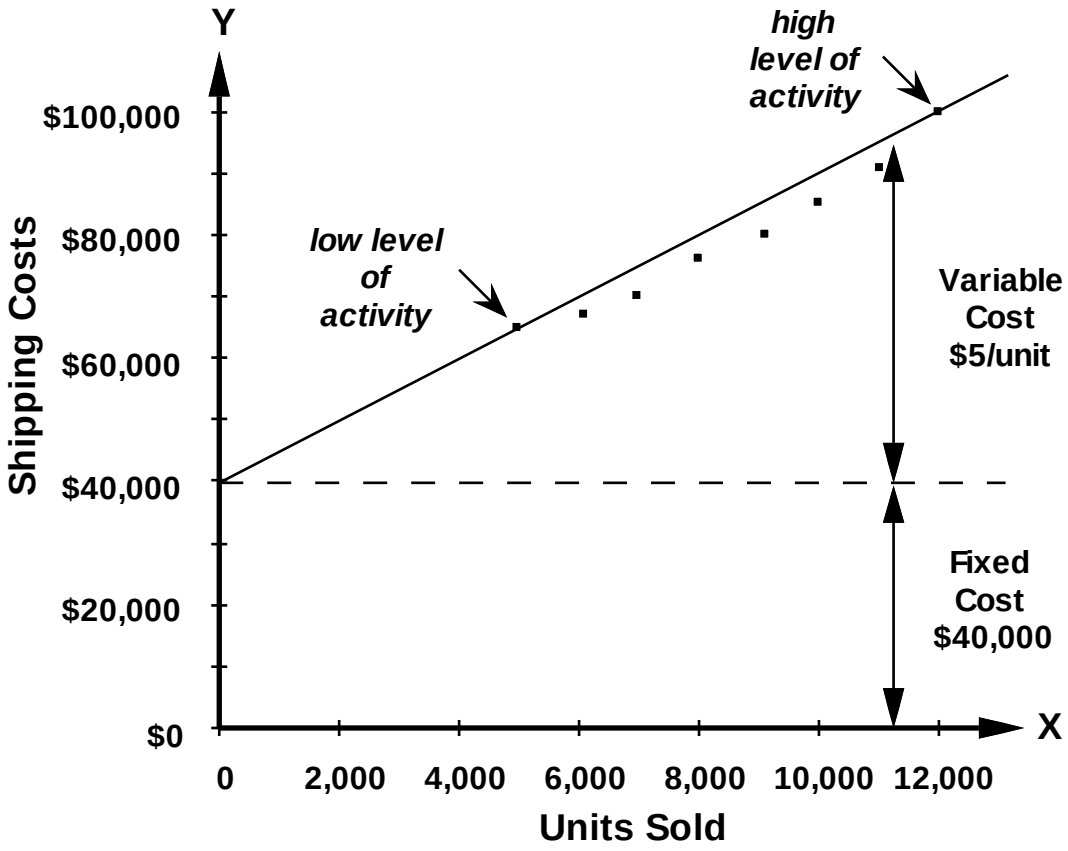
= $100,000 - (12,000 units × $5 per unit)

= $40,000

The cost formula for shipping cost is:

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

## EVALUATION OF THE HIGH-LOW METHOD

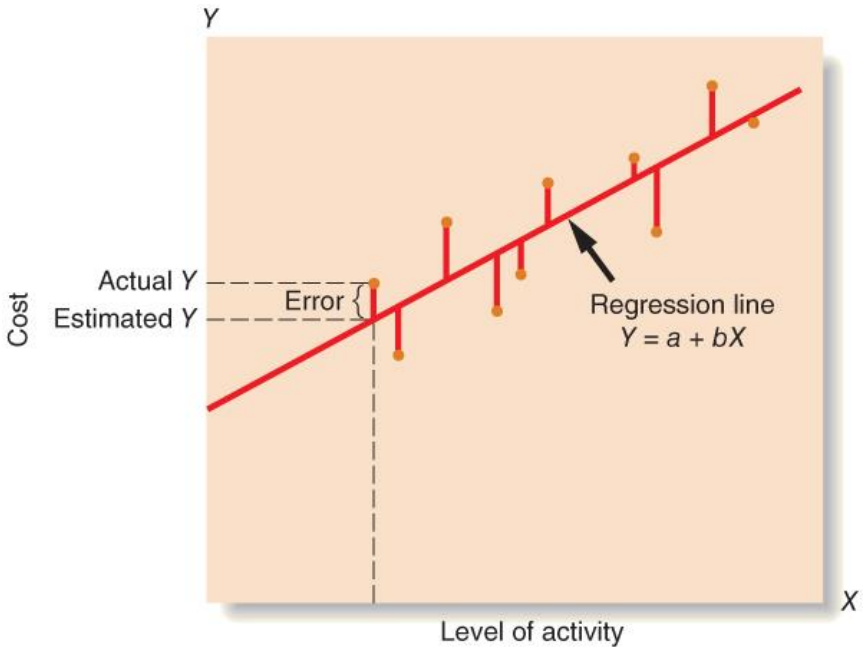



The high-low method suffers from two major defects:

1. It throws away all but two data points.
2. The periods with the highest and lowest volumes are often unusual.

## 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."



# TRADITIONAL VERSUS CONTRIBUTION INCOME STATEMENT

| Traditional Format | | | Contribution Format | | |
|---|---|---|---|---|---|
| Sales | | $12,000 | Sales | | $12,000 |
| Cost of goods sold* | | 6,000 | Variable expenses: | | |
| Gross margin | | 6,000 | Cost of goods sold | $6,000 | |
| Selling and administrative expenses: | | | Variable selling | 600 | |
| Selling | $3,100 | | Variable administrative | 400 | 7,000 |
| Administrative | 1,900 | 5,000 | Contribution margin | | 5,000 |
| Net operating income | | $ 1,000 | Fixed expenses: | | |
| | | | Fixed selling | 2,500 | |
| | | | Fixed administrative | 1,500 | 4,000 |
| | | | Net operating income | | $ 1,000 |

*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.

# COST CLASSIFICATIONS FOR ASSIGNING COSTS TO COST OBJECTS

## COST OBJECT

A cost object is anything for which cost data are desired.

Examples of cost objects:

- Products
- Customers
- Departments
- Jobs

## DIRECT COSTS

A direct cost is a cost that can be easily and conveniently traced to a particular cost object.

Examples of direct costs:

- The direct costs of a Ford SUV would include the cost of the steering wheel purchased by Ford from a supplier, the costs of direct labor workers, the costs of the tires, and so on.
- The direct costs of a hospital's radiology department would include X-ray film used in the department, the salaries of radiologists, and the costs of radiology lab equipment.

## INDIRECT COSTS

An indirect cost is a cost that cannot be easily and conveniently traced to a particular cost object.

Examples of indirect costs:

- Manufacturing overhead, such as the factory managers' salary at a multi-product plant, is an indirect cost of any one product.
- General hospital administration costs are indirect costs of the radiology lab.

# COST CLASSIFICATIONS FOR DECISION-MAKING

## DIFFERENTIAL COST

Every decision involves choosing from among at least two alternatives. Any cost that differs between alternatives is a differential cost. Only the differential costs are relevant in making a decision.

EXAMPLE: Bill is currently employed as a lifeguard, but he has been offered a job in an auto service center in the same town. When comparing the two jobs, the differential revenues and costs are:

| | *Life-guard* | *Auto Service Center* | *Differential costs and revenues* |
|---|---|---|---|
| Monthly salary ..... | $1,200 | $1,500 | $300 |
| Monthly expenses: | | | |
| Commuting ..... | 30 | 90 | 60 |
| Meals | 150 | 150 | 0 |
| ..... | | | |
| ..... | | | |
| Apartment rent..... | 450 | 450 | 0 |
| Uniform rental..... | 0 | 50 | 50 |
| Sunscreen..... | 10 | 0 | (10) |
| Total monthly expenses..... | 640 | 740 | 100 |
| Net monthly income..... | $ 560 | $ 760 | $200 |

## OPPORTUNITY COST

An opportunity cost is the potential benefit given up when selecting one course of action over another.

EXAMPLE: Linda has a job in the campus bookstore and is paid $65 per day. One of her friends is getting married and Linda would like to attend the wedding, but she would have to miss a day of work. If she attends the wedding, the $65 in lost wages will be an opportunity cost of attending the wedding.

EXAMPLE: The reception for the wedding mentioned above will be held in the ballroom at the Lexington Club. The manager of the Lexington Club had to decide between accepting the booking for the wedding reception or accepting a booking for a corporate seminar. The hall could have been rented to the corporation for $600. The lost rental revenue of $600 is an opportunity cost of accepting the reservation for the wedding.

## SUNK COST

A sunk cost is a cost that has already been incurred and that cannot be changed by any decision made now or in the future. Sunk costs are irrelevant and should be ignored in decisions.

EXAMPLE: Linda has already purchased a ticket to a rock concert for $35. If she goes to the wedding, she will be unable to attend the concert. The $35 is a sunk cost that she should ignore when deciding whether or not to attend the wedding. [However, any amount she can get by reselling the ticket is NOT a sunk cost. And while she should ignore the $35 sunk cost, she should not ignore the enjoyment she would get if she were to attend the concert.]

## APPENDIX 2A: LEAST-SQUARES REGRESSION COMPUTATIONS

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

| | *Meals Served X* | *Total Cost 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.

# APPENDIX 2B: QUALITY COSTS

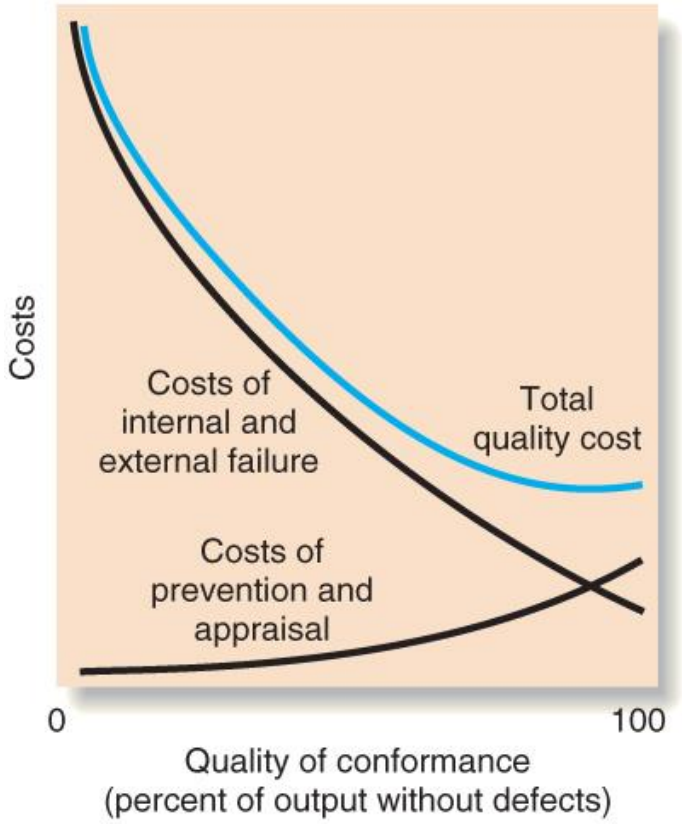
- The costs of correcting defective units *before they reach customers* are called internal failure costs. Examples:
  - Scrapped units.
  - Rework of defective units.
- Costs that are incurred by releasing defective units to customers are called external failure costs. Examples:
  - Costs of fixing products under warranty.
  - Loss of sales due to a tarnished reputation.
- The costs of internal and external failures can be avoided by:
  - Preventing defects.
  - Finding defective units before they are released.

  The costs associated with these activities are called prevention costs and appraisal costs, respectively.
- Generally, prevention is the best policy. It is usually far easier and less expensive to prevent defects than to fix them.

# EXAMPLES OF QUALITY COSTS

| Prevention Costs | Internal Failure Costs |
|---|---|
| Systems development | Net cost of scrap |
| Quality engineering | Net cost of spoilage |
| Quality training | Rework labor and overhead |
| Quality circles | Reinspection of reworked products |
| Statistical process control activities | Retesting of reworked products |
| Supervision of prevention activities | Downtime caused by quality problems |
| Quality data gathering, analysis, and reporting | Disposal of defective products |
| Quality improvement projects | Analysis of the cause of defects in production |
| Technical support provided to suppliers | Re-entering data because of keying errors |
| Audits of the effectiveness of the quality system | Debugging software errors |
| **Appraisal Costs** | **External Failure Costs** |
| Test and inspection of incoming materials | Cost of field servicing and handling complaints |
| Test and inspection of in-process goods | Warranty repairs and replacements |
| Final product testing and inspection | Repairs and replacements beyond the warranty period |
| Supplies used in testing and inspection | Product recalls |
| Supervision of testing and inspection activities | Liability arising from defective products |
| Depreciation of test equipment | Returns and allowances arising from quality problems |
| Maintenance of test equipment | Lost sales arising from a reputation for poor quality |
| Plant utilities in the inspection area | |
| Field testing and appraisal at customer site | |

# TRADING-OFF QUALITY COSTS



## QUALITY COST REPORTS

- Quality cost reports summarize prevention costs, appraisal costs, internal failure costs, and external failure costs that would otherwise be hidden in general overhead.
  - Managers are often surprised by how much defects cost.
  - The report helps identify where the biggest quality problems lie.
  - The report helps managers assess how resources should be distributed. If internal and external failure costs are high relative to prevention and appraisal costs, more should probably be spent on prevention and appraisal.
- Because quality cost reports are largely an attention-directing device, the costs do not have to be precise.
- Unfortunately, the cost of lost sales due to external failures is usually excluded from the reports due to measurement difficulties.

# SAMPLE QUALITY COST REPORT

Ventura Company
Quality Cost Report
For Years 1 and 2

| | Year 1 | | Year 2 | |
|---|---|---|---|---|
| | Amount | Percent* | Amount | Percent* |
| Prevention costs: | | | | |
| Systems development | $ 270,000 | 0.54% | $ 400,000 | 0.80% |
| Quality training | 130,000 | 0.26% | 210,000 | 0.42% |
| Supervision of prevention activities | 40,000 | 0.08% | 70,000 | 0.14% |
| Quality improvement projects | 210,000 | 0.42% | 320,000 | 0.64% |
| Total prevention cost | 650,000 | 1.30% | 1,000,000 | 2.00% |
| Appraisal costs: | | | | |
| Inspection | 560,000 | 1.12% | 600,000 | 1.20% |
| Reliability testing | 420,000 | 0.84% | 580,000 | 1.16% |
| Supervision of testing and inspection | 80,000 | 0.16% | 120,000 | 0.24% |
| Depreciation of test equipment | 140,000 | 0.28% | 200,000 | 0.40% |
| Total appraisal cost | 1,200,000 | 2.40% | 1,500,000 | 3.00% |
| Internal failure costs: | | | | |
| Net cost of scrap | 750,000 | 1.50% | 900,000 | 1.80% |
| Rework labor and overhead | 810,000 | 1.62% | 1,430,000 | 2.86% |
| Downtime due to defects in quality | 100,000 | 0.20% | 170,000 | 0.34% |
| Disposal of defective products | 340,000 | 0.68% | 500,000 | 1.00% |
| Total internal failure cost | 2,000,000 | 4.00% | 3,000,000 | 6.00% |
| External failure costs: | | | | |
| Warranty repairs | 900,000 | 1.80% | 400,000 | 0.80% |
| Warranty replacements | 2,300,000 | 4.60% | 870,000 | 1.74% |
| Allowances | 630,000 | 1.26% | 130,000 | 0.26% |
| Cost of field servicing | 1,320,000 | 2.64% | 600,000 | 1.20% |
| Total external failure cost | 5,150,000 | 10.30% | 2,000,000 | 4.00% |
| Total quality cost | $9,000,000 | 18.00% | $7,500,000 | 15.00% |

*As a percentage of total sales. In each year sales totaled $50,000,000.