Cost Behavior
and
Cost Estimation

Types of Cost Behavior Patterns

<table>
<thead>
<tr>
<th>Cost</th>
<th>In Total</th>
<th>Per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VC</td>
<td>Total VC is proportional to the activity level within the RR.</td>
<td>VC per unit remains the same over wide ranges of activity.</td>
</tr>
<tr>
<td>FC</td>
<td>Total FC remains the same even when the activity level changes within the RR.</td>
<td>FC per unit goes down as activity level goes up.</td>
</tr>
</tbody>
</table>
A VC is a cost whose total dollar amount varies in direct proportion to changes in the activity level. Suppose you had a phone bill that is based on the number of minutes talked.
True Variable Costs

Direct materials is a true or proportionately VC because the total cost of direct material used during a period will vary in direct proportion to the level of production activity.

VC Per Unit Example

A VC remains constant if expressed on a per unit basis. The cost per minute talked is constant. For example, 10 cents per minute.
The proportion of VCs **differs** across organizations. For example . . .

A public utility with large investments in equipment will tend to have *fewer* VCs.

A manufacturing company will often have *many* VCs.

A service company will normally have a *high proportion* of VCs.

A merchandising company usually will have a *high proportion* of VCs, like cost of sales.

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**Examples of Variable Costs**

2. *Manufacturing companies* – direct materials, direct labor, and variable overhead.
3. *Merchandising and manufacturing companies* – commissions, shipping costs, and clerical costs, such as invoicing.
4. *Service companies* – supplies, travel, and clerical.
Total Fixed Costs Example

A FC is a cost whose total dollar amount remains constant as the activity level changes. Suppose your monthly phone bill is fixed and does not change, no matter how many calls you make.
**FC Per Unit Example**

Average FCs per unit decrease as the activity level increases. The FC per local call decreases as more local calls are made.

![Graph showing decrease in phone charge per call with increase in number of local calls]

**Types of Fixed Costs**

- **Committed**: Long-term, cannot be significantly reduced in the short term.
  - Examples: Depreciation on Equipment and Real Estate Taxes

- **Discretionary**: May be altered in the short-term by current managerial decisions
  - Examples: Advertising and Research and Development
The Linearity Assumption and the Relevant Range

Prepare an Income Statement Using the CM Format

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>$100,000</td>
<td>$50</td>
</tr>
<tr>
<td>Less: VC</td>
<td>60,000</td>
<td>30</td>
</tr>
<tr>
<td>CM</td>
<td>$40,000</td>
<td>$20</td>
</tr>
<tr>
<td>Less: FC</td>
<td>30,000</td>
<td></td>
</tr>
<tr>
<td>Net Income</td>
<td>$10,000</td>
<td></td>
</tr>
</tbody>
</table>

The CM format emphasizes cost behavior. CM covers FCs and provides for Net Income.
Uses of the Contribution (CM) Format

The CM income statement format is used as an internal planning and decision making tool. Uses of this approach include:

1. CVP analysis
2. Budgeting
3. Segmented reporting of profit data
4. Special decisions such as pricing and make-or-buy analysis

### Contribution (CM) Format

<table>
<thead>
<tr>
<th>Traditional Approach</th>
<th>Contribution Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traditional Approach</strong> (costs organized by function)</td>
<td><strong>Contribution Approach</strong> (costs organized by behavior)</td>
</tr>
<tr>
<td>Sales $100,000</td>
<td>Sales $100,000</td>
</tr>
<tr>
<td>Less CGS (product) $70,000</td>
<td>Less VC $60,000</td>
</tr>
<tr>
<td>Gross margin $30,000</td>
<td>Contribution margin $40,000</td>
</tr>
<tr>
<td>Less S&amp;A (period) $20,000</td>
<td>Less fixed $30,000</td>
</tr>
<tr>
<td>Net operating income $10,000</td>
<td>Net operating income $10,000</td>
</tr>
</tbody>
</table>

- Used primarily for external reporting.
- Used primarily by management.
Mixed Costs

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

Where:
- \( Y \) = the total mixed cost
- \( a \) = the total FC (the \( Y \) intercept)
- \( b \) = the VC per unit of activity (the slope of the line)
- \( X \) = the level of activity

Mixed Costs Example

If your fixed monthly utility charge is $40, your VC is $0.03 per kwh, and your monthly activity level is 2,000 kwh, what is the amount of your utility bill?

\[
Y = a + bX
\]

\[
Y = $40 + ($0.03 \times 2,000)
\]

\[
Y = $100
\]
Scattergraph Method

Use one data point to estimate the total level of activity and the total cost.

- Total maintenance cost = $11,000
- Intercept = FC: $10,000
- Patient days = 800

Make a quick estimate of VC per unit and determine the cost equation.

Total maintenance at 800 patients = $11,000
Less: Fixed cost = $10,000
Estimated total variable cost for 800 patients = $1,000

VC per unit = \( \frac{\$1,000}{800} \) = $1.25/patient-day

\[ Y = \$10,000 + \$1.25X \]
High-Low Method

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

\[
\frac{\$2,400}{300} = \$8.00/\text{hour}
\]

Total FC = Total Cost – Total VC

Total FC = $9,800 – ($8/hour \times 800 hours)

Total FC = $9,800 – $6,400

Total FC = $3,400
High-Low Method

The Cost Equation for Maintenance

\[ Y = $3,400 + $8.00X \]

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 \textit{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 \textit{minimizes the sum of the squared errors}. 
Regression Method

- Software can be used to fit a regression line through the data points.
- The cost analysis objective is the same: \( Y = a + bX \)

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.

\( R^2 \) is the percentage of the variation in total cost explained by the activity.

\( R^2 \) varies from 0% to 100%, and the higher the percentage the better.