Cost Behavior
and
Cost Estimation

Types of Cost Behavior Patterns

Summary of VC and FC Behavior		
Cost	In Total	Per Unit
VC	Total VC is proportional to the activity level within the RR.	VC per unit remains the same over wide ranges of activity.
FC	Total FC remains the same even when the activity level changes within the RR.	FC per unit goes down as activity level goes up.

The Activity Base

Units
produced

Machine
hours

A measure of what
causes the
incurrence of a VC

Miles
driven

Labor
hours
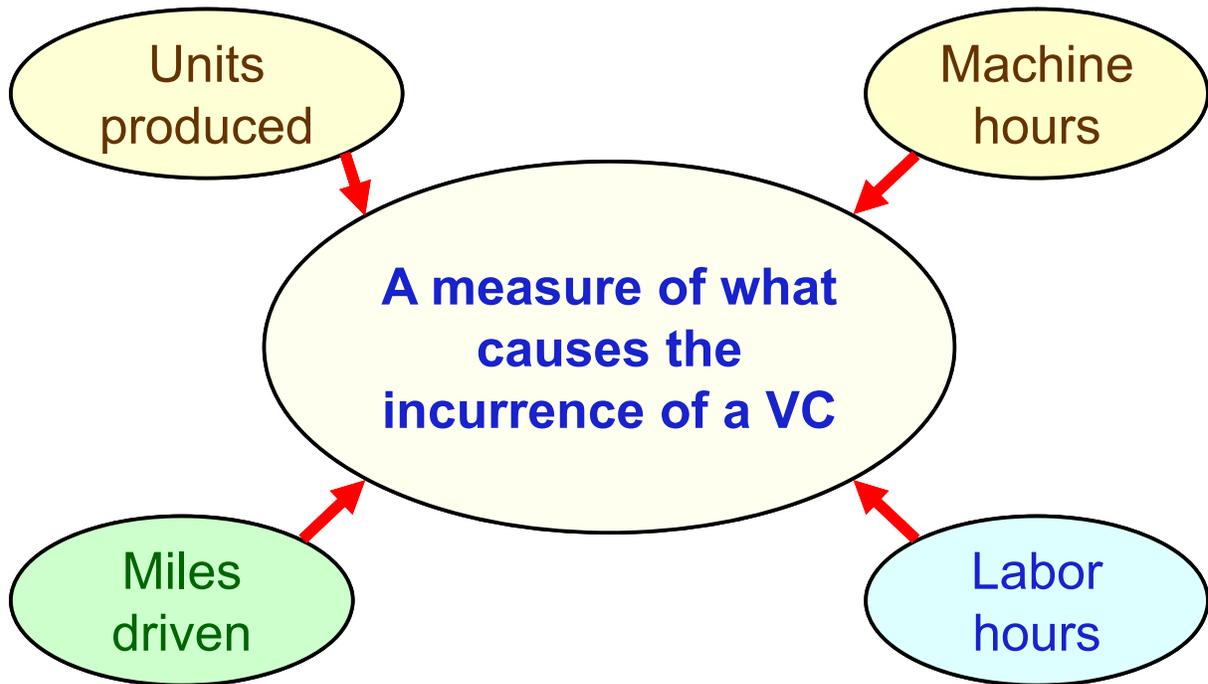
3

True VC Example

A VC is a cost whose <u>total</u> dollar amount varies in direct proportion to changes in the activity level. Supposed you had a phone bill that is based on the number of minutes talked.
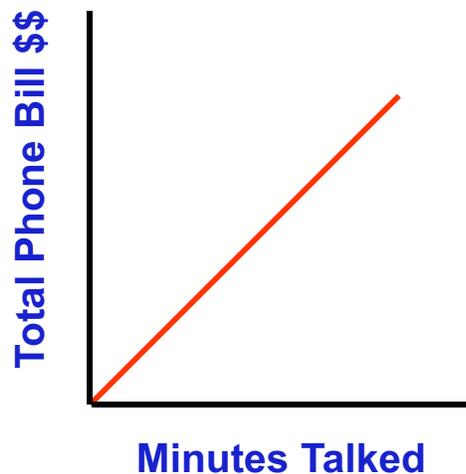
Total Phone Bill $$

Minutes Talked

4

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.

Y-axis: Total DM Cost $$

X-axis: Volume
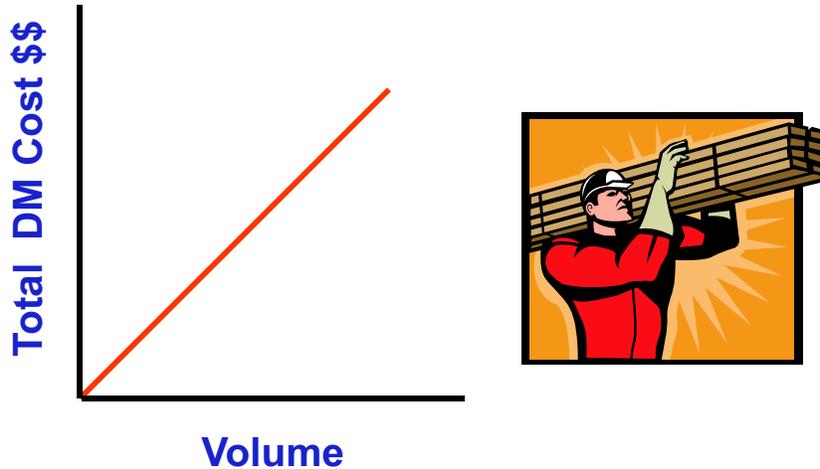
VC Per Unit Example

A VC remains constant if expressed on a per unit basis. The cost per minute talked is constant. For example, 10 cents per minute.
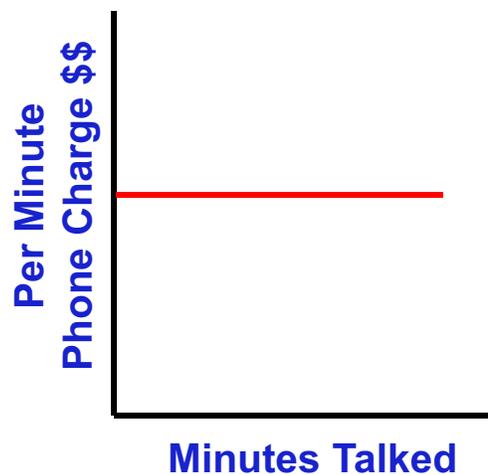
Y-axis: Per Minute Phone Charge $$

X-axis: Minutes Talked

Extent of Variable Costs

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.

Examples of Variable Costs

1. *Merchandising companies* – cost of goods sold.

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.

Step-Variable Costs

Total Cost $$ (y-axis)

Volume (x-axis)
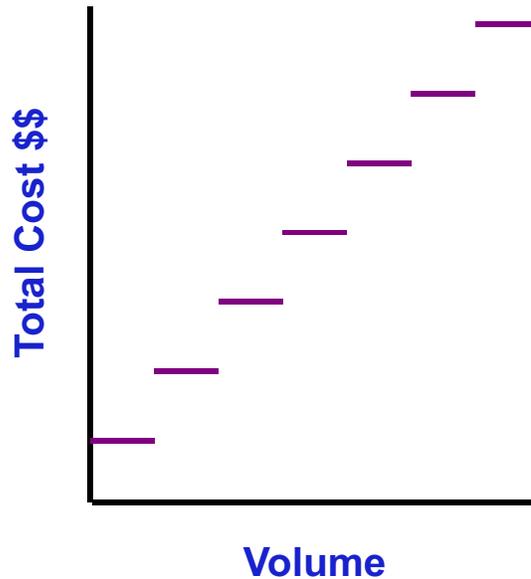
Total Fixed Costs Example

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.
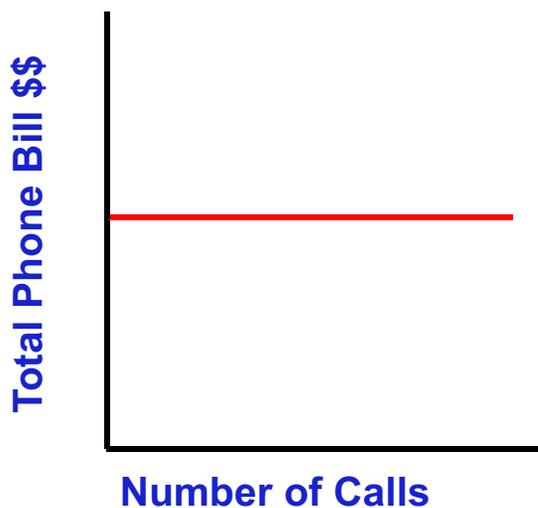
Total Phone Bill $$ (y-axis)

Number of Calls (x-axis)

FC Per Unit Example

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

Phone Charge per Call $$

Number of Local Calls

Types of Fixed Costs

Committed	Discretionary
Long-term, cannot be significantly reduced in the short term.	**May be altered in the short-term by current managerial decisions**

Examples	Examples
Depreciation on Equipment and Real Estate Taxes	**Advertising and Research and Development**
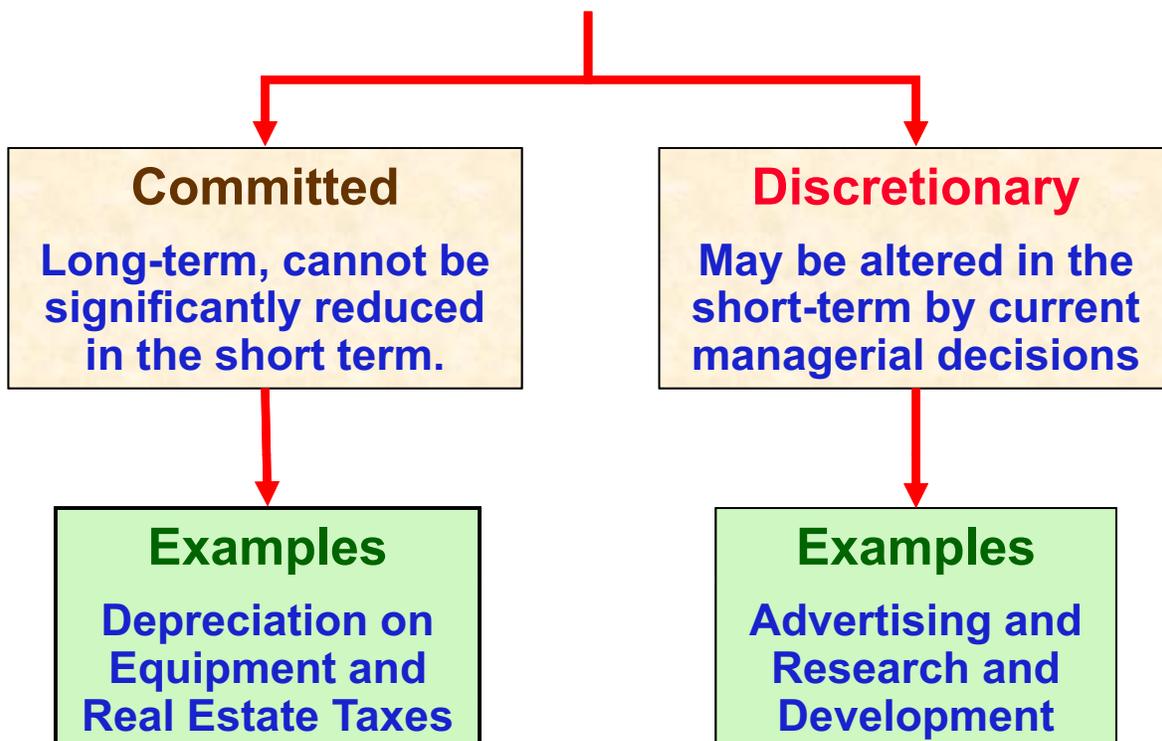
The Linearity Assumption and the Relevant Range

Relevant Range
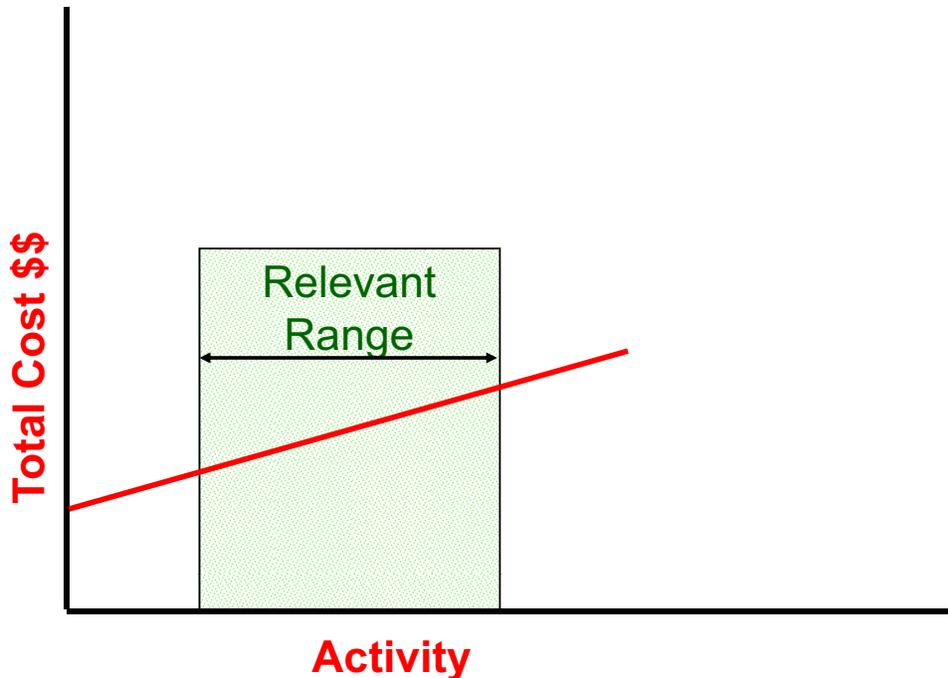
Total Cost $$

Activity

Prepare an Income Statement Using the CM Format

	Total	Unit
Revenue	$ 100,000	$ 50
Less: VC	60,000	30
CM	$ 40,000	$ 20
Less: FC	30,000	
Net Income	$ 10,000	

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

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Contribution (CM) Format

Comparison of the Contribution Income Statement with the Traditional Income Statement

Traditional Approach (costs organized by function)		Contribution Approach (costs organized by behavior)	
Sales	$ 100,000	Sales	$ 100,000
Less CGS (product)	70,000	Less VC	60,000
Gross margin	$ 30,000	Contribution margin	$ 40,000
Less S&A (period)	20,000	Less FC	30,000
Net operating income	$ 10,000	Net operating income	$ 10,000

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

Total Utility Cost (Y axis)

Activity (Kilowatt Hours) (X axis)

Total mixed cost

Variable Cost per KW

Fixed Monthly Utility Charge

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 × 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

Maintenance Cost 1,000's of Dollars

Patient-days in 1,000's

Scattergraph Method

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**

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

$$Y = \$10{,}000 + \$1.25X$$

Total maintenance cost

Number of patient days

High-Low Method

Month	Hours of Maintenance	Total Maintenance Cost
January	625	$ 7,950
February	500	7,400
March	700	8,275
April	550	7,625
May	775	9,100
June	800	9,800
High Level	800	$ 9,800
Low Level	500	7,400
Change	300	$ 2,400

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

$$\frac{\$2,400}{300} = \$8.00/hour$$
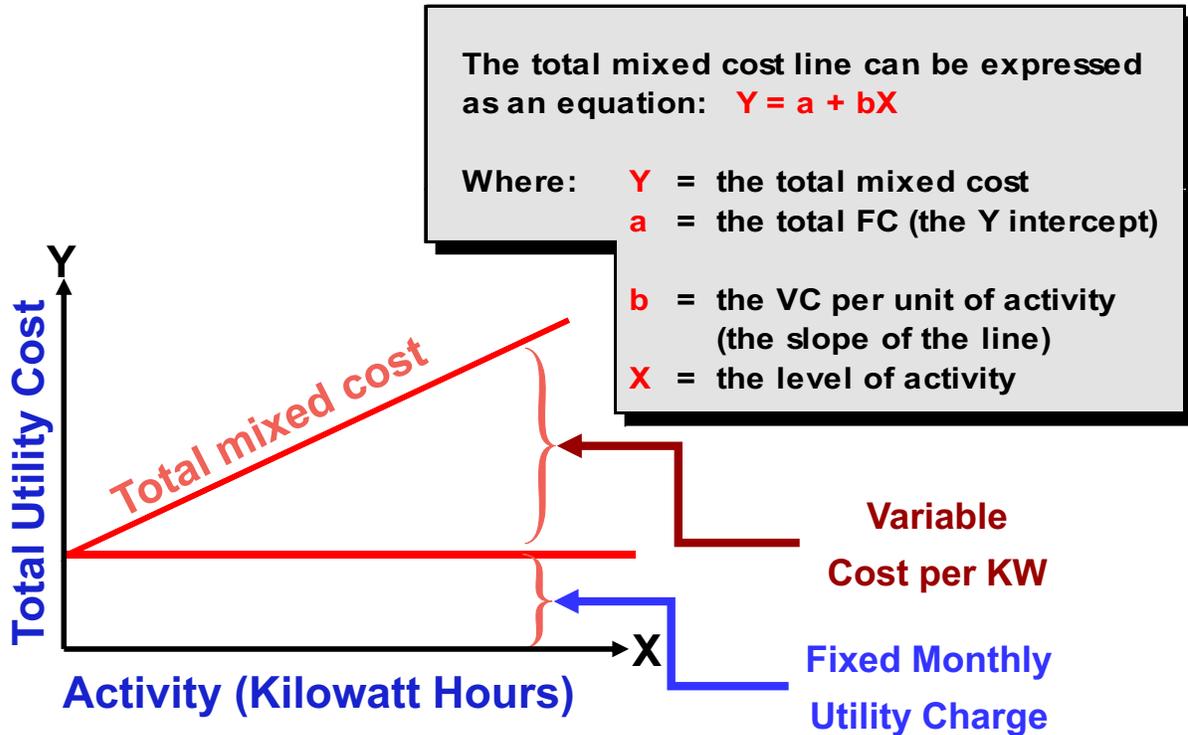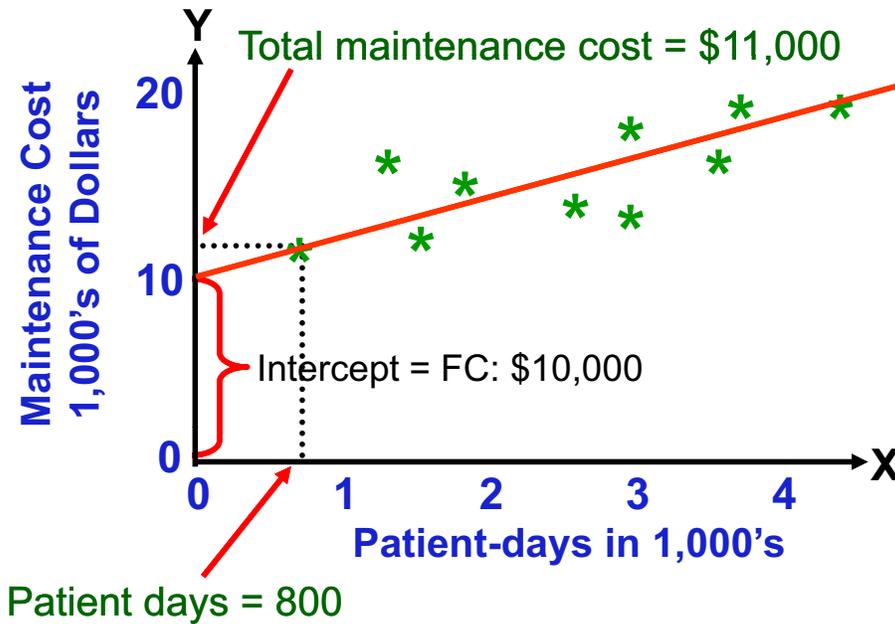
High-Low Method

Month	Hours of Maintenance	Total Maintenance Cost
High Level	800	$ 9,800
Low Level	500	7,400
Change	300	$ 2,400

Total FC = Total Cost – Total VC

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

Total FC = $9,800 – $6,400

Total FC = $3,400
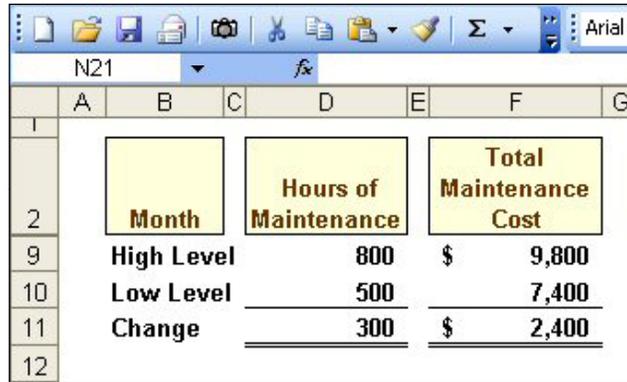
High-Low Method

	Month	Hours of Maintenance		Total Maintenance Cost
9	High Level	800	$	9,800
10	Low Level	500		7,400
11	Change	300	$	2,400

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 *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*.

Regression Method

- Software can be used to fit a regression line through the data points.

- The cost analysis objective is the same: $Y = a + bX$
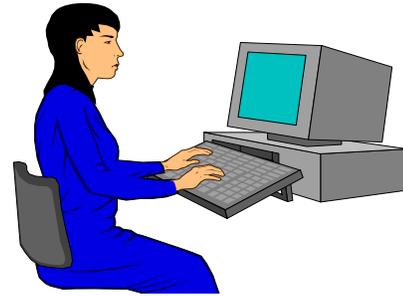
> Regression also provides a statistic, called the R^2, which is a measure of the goodness of fit of the regression line to the data points.

25

Regression Method

> 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.

26