

Z - Chapter 18 Outline - scanned pdf (An 2 adjusted for document error in setup)

**I. Identifying Cost Behavior (CVP analysis)**

- A. Cost-volume-profit analysis is a tool to predict how changes in costs and sales levels affect profit.
  - 1. CVP looks at how income (profit) is affected by four factors: volume (number of units sold); sales price per unit; variable costs per unit; and fixed costs (total).
  - 2. Conventional CVP analysis requires costs be classified as either fixed or variable with respect to production or sales volume.
- B. Fixed Costs
  - 1. Total fixed costs do not change when volume of activity changes (within a relevant range).
  - 2. Fixed cost *per unit* of output decreases as volume increases (and vice versa).
  - 3. When fixed cost are graphed (Exhibit 18.1) they are represented by a horizontal line with no slope (cost remains constant at all levels of volume within the relevant range).
  - 4. Fixed costs per unit decrease as production increases. This drop is known as economies of scale.
- C. Variable Costs
  - 1. Variable costs change in proportion to changes in volume of activity.
  - 2. Variable cost *per unit* stays the same, but the *total* amount of variable cost changes with the level of production.
  - 3. When variable costs are graphed, (Exhibit 18.2). they are represented by a straight line starting at the zero-cost level. The line rises as volume increases.
- D. Mixed Costs
  - 1. Include both fixed and variable cost components.
  - 2. When volume and cost are graphed, the mixed cost is represented by a straight line with an upward slope. Start of line is at fixed cost point (or amount of total cost when volume is zero). As the volume of activity increases, mixed cost line increases at an amount equal to the variable cost per unit.
  - 3. Mixed costs are often separated into fixed and variable components when included in a CVP analysis.
- E. Step-wise Costs
  - 1. Fixed within a relevant range of the current production volume. If production volume expands significantly, total costs go up by a lump-sum amount (stair-step cost).
  - 2. Treated as either fixed or variable cost in CVP analysis; depends on width of range and requires judgment.

**II. Measuring Cost Behavior**—CVP analysis identifies and measures costs using their fixed and variable components. Three methods are commonly used to estimate fixed and variable costs.

- A. Scatter Diagram
  - 1. Graph of unit volume and cost (Exhibit 18-5).
  - 2. Each point reflects total costs and number of units during a period.
  - 3. Estimated line of cost behavior—line “fits” the points visually.
    - a. Total cost is greater than zero when no units are produced.
    - b. Increases in proportion to increases in units produced.

B. High-low Method – uses just two points to estimate the cost equation: the highest and lowest volume levels.

1. *Step 1:* Identify the highest and lowest volume levels. Note that these may not be the highest or lowest costs.
2. *Step 2:* Compute the slope (variable cost per unit) using the high low volume levels

$$\text{Variable cost per unit} = \frac{\text{high volume costs} - \text{low volume costs}}{\text{high volume units} - \text{low volumes units}}$$

3. *Step #3:* Compute the total fixed costs by computing the total variable costs at either the high or low volume level and then subtracting that amount from the total costs at that volume level. Use the cost equation.

$$\text{Total costs} = \text{Fixed costs} + \text{variable cost per unit} \times \# \text{ of units}$$

4. Method is easier to apply and often useful for quick cost estimates.

C. Regression (least-squares regression)— statistical method for identifying cost behavior.

1. Cost equation can be calculated using most spreadsheet programs. Illustrated in Appendix 18A using Excel®
2. Cost equation may differ slightly from those determined using the scatter diagram and high-low methods; may be superior due to use of all data points available.

### III. Contribution Margin and Break-Even Analysis

A. Contribution Margin

1. Computed as sales minus variable costs.
2. The amount by which a product's unit selling prices exceeds its total unit variable cost. This excess amount goes to cover fixed costs and any excess is income.
3. Contribution margin per unit is computed as:

$$\text{CM per unit} = \text{Selling price per unit} - \text{variable costs per unit}$$

B. Contribution margin ratio

1. The percent of each sales dollar that remains after deducting unit variable costs.
2. Contribution margin ratio is computed as:

$$\text{CM \%} = \frac{\text{CM per unit}}{\text{sales price per unit}}$$

C. Break-Even Point

1. Break-even point
  - a. Sales level at which total sales equals total costs, resulting in
  - b. Can be expressed either in units or dollars of sales.
2. Formula method to compute break-even point

a. Break-even units =  $\frac{\text{Fixed costs}}{\text{CM per unit}}$

b. Break-even sales dollars =  $\frac{\text{Fixed costs}}{\text{CM\%}}$

D. Contribution Margin Income Statement Method (Exhibit 18.13)

1. Differs from a conventional income statement in two ways:
    - i. Classifies costs and expenses as variable and fixed
    - ii. Reports contribution margin
- Sales
- Variable Costs
- Contribution Margin
- Fixed Costs
- Income

E. Cost-Volume-Profit Chart (also called a break-even graph or chart) (Exhibit 18.14)

1. Total costs—line starts at the fixed costs level on the vertical axis. Slope is the variable cost per unit.
2. Total sales—line starts at zero on the vertical axis (zero units and zero dollars of sales). Slope equals the selling price per unit.
3. CVP chart provides key observations:
  - a. Break-even point – where total cost line and total sales line intersect.
  - b. Income or loss – vertical distance between sales line and total cost line at any level of units sold. As number of units sold increase, loss area decreases or profit area increases.
  - c. Maximum productive capacity – largest units on CVP chart. Point where we expect largest sales and income.
4. Changes in Estimates – CVP analysis uses past data for estimates of the future to make decisions. We can change these estimates to see how sensitive results are to a change in estimate.

IV. Applying Cost-Volume-Profit Analysis

A. Margin of safety can be expressed in units, dollars, or as a percent of predicted level of sales. It is the expected sales minus break-even sales. It is the amount that sales can decline before the company incurs a loss.

1. Margin of Safety = Expected sales – break-even sales
2. Margin of Safety Rate (%) =  $\frac{\text{Margin of Safety}}{\text{Expected Sales}}$

B. Computing Income from Expected Sales and Costs

1. Sales (# units sold × unit selling price)
- Variable Costs (# units sold × unit variable cost)
- Contribution Margin
- Fixed Costs
- Income

**C.** Computing Sales for a Target Income

1. Sales (in dollars) required for target income equals:

$$\frac{\text{fixed costs} + \text{target income}}{\text{CM Ratio}}$$

2. Sales (in units) required for target income equals

$$\frac{\text{fixed costs} + \text{target income}}{\text{CM per unit}}$$

**D.** Evaluating Business Strategies—knowing the effects of changing some estimates used in CVP analysis by substituting new estimated amounts (in total or per unit as appropriate) in the related formula can be helpful in making predictions. Can also use the contribution margin income statement.

**E.** Sales Mix and Break-Even—Modify basic CVP analysis when company produces and sells more than one type of product.

1. Sales mix – proportion of sales volume for each product.
2. Weighted-average contribution margin per unit – combines per unit contribution margins of each product by their weights in the sales mix.
  - a. Equals contribution margin per unit times sales mix percent
  - b. Break-even point in units = fixed costs divided by weighted average contribution margin per unit.

**F.** Assumptions in Cost-Volume-Profit Analysis

1. CVP analysis relies on several assumptions:
  - a. Costs can be classified as variable or fixed.
  - b. Costs are linear within the relevant range.
  - c. Units produced are sold.
  - d. Sales mix is constant.

**III.**

**Decision Analysis—Degree of Operating Leverage**

- A. Useful tool in assessing the effect of changes in the level of sales on income is the degree of operating leverage computation.
- B. Degree of operating leverage (DOL) is computed as:

$$\frac{\text{Contribution margin (dollars)}}{\text{Income}}$$

- C. Use DOL to measure the effect of changes in the level of sales on income by multiplying DOL by the percentage change in sales.

**IV.**

**Variable Costing and Performance Reporting**—contribution margin income statement, also known as a variable costing income statement.

- A. Variable costing—only variable costs relating to production are included in product costs.
- B. Includes direct materials, direct labor and variable overhead costs.
- C. Fixed overhead costs are excluded from product costs.

- D. GAAP (external reporting) requires absorption costs whereby product costs include direct materials, direct labor, and all overhead (fixed and variable).
- E. Converting Income under Variable Costing to Income under Absorption Costing
  - 1.  $\text{Income under absorption costing} = \text{income under variable costing} + \text{fixed overhead cost in ending inventory} - \text{fixed overhead cost in beginning inventory}$ .