

**Accounting**  
**Building Business Skills**

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Chapter Fourteen:  
Cost-volume-profit Relationships

PowerPoint presentation by Kate Wynn-Williams  
University of Otago, Dunedin  
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**Learning Objectives:**

- Distinguish between variable, fixed and mixed cost behaviour.
- Explain the difference between absorption costing and variable costing.
- Explain the five basic assumptions of cost-volume-profit (CVP) analysis.

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**Learning Objectives:**

- Indicate the meaning of contribution margin and identify break-even point and the use of break-even analysis.
- Give formulas for determining target net profit.

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**Learning Objectives:**

- Explain how CVP analysis is used with multiple products.
- Describe the essential features of a CVP statement of financial performance.

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**Cost Behaviour Analysis**

- How costs behave when levels of business activity change:
  - some costs change
  - some costs stay the same
- Helps in planning and choosing between alternatives
- Starts with identification of key activities and their relationships with various costs

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**Cost Behaviour Analysis**

- Variable costs – change with increases and decreases in activity level
  - e.g. direct materials, direct labour, COGS, freight costs, fuel
  - cost is identified on a per-unit basis
  - cost stays the same per unit as activity level changes
  - total costs change in proportion to change in activity level

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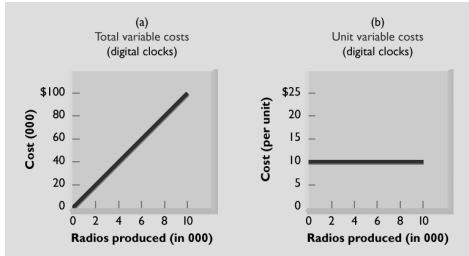
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## Cost Behaviour Analysis



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## Cost Behaviour Analysis

- Fixed costs – do not change with increases and decreases in activity level
  - e.g. rates, rent, insurance, supervisors' salaries
  - cost per unit = total cost divided by units of activity level
  - total costs stay the same
  - cost per unit changes as activity level changes

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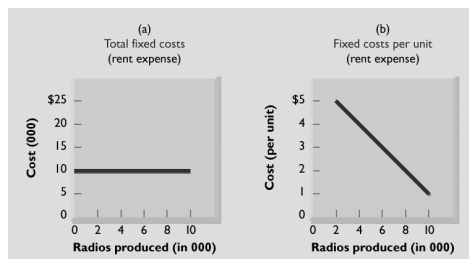
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## Cost Behaviour Analysis



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## Cost Behaviour Analysis

- Relevant range – activity levels over which the business expects to operate during the period
  - linear relationships assumed to exist between costs and activity levels within relevant range
  - variable costs per unit may change outside range (very high or low)
  - fixed costs may also change beyond relevant range

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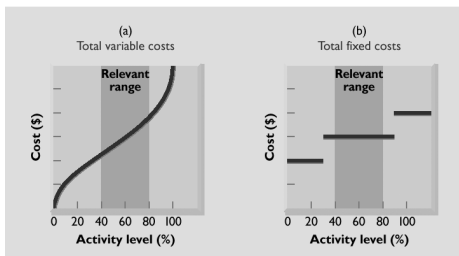
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## Cost Behaviour Analysis



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## Cost Behaviour Analysis

- Mixed costs – also called semi-variable costs
  - includes a fixed cost component plus variable cost according to activity level
  - e.g. electricity (fixed line charge plus charge per unit consumed)
  - often separated into fixed and variable components at end of period

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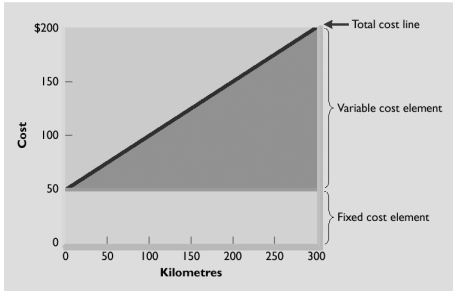
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### Cost Behaviour Analysis



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### Cost Behaviour Analysis

- Identification of costs as fixed or variable is important for business decisions:
  - effect on profitability of reduction in sales price
  - effect on activity level when expenses increase per unit to keep current profitability

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### Cost Behaviour Analysis

- minimum level of sales to cover costs
- costs of maintaining level of production for different manufacturing methods

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## Cost Behaviour Analysis

- Two methods of costing products:
  - Absorption costing – all material, labour and overhead costs = product costs
  - Variable costing – direct material, direct labour and variable overhead costs = product costs, and fixed overheads = period costs

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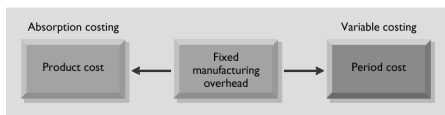
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## Cost Behaviour Analysis

- Note: both systems show selling, administration and finance expenses as period costs



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## Cost Behaviour Analysis

- Financial performance – if units produced exceed units sold:
  - absorption costing yields higher profit because cost of units sold include per-unit allocations of fixed overhead costs
  - remaining unsold inventory still carries some current period fixed overhead
  - variable costing yields lower profit because entire fixed overhead = period cost

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## Cost Behaviour Analysis

- if production = sales:
  - both systems show same profits
- if production is less than sales:
  - absorption costing yields lower profit because units sold in excess of production carry some fixed overhead from beginning inventory (previous period costs)
  - variable costing yields higher profit because fixed overhead remains the same

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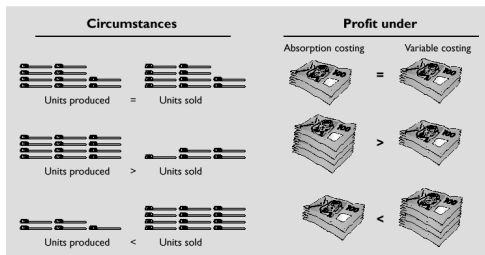
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## Cost Behaviour Analysis



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## Cost Behaviour Analysis

- Variable costing used for internal decisions:
  - managers focus on cost behaviours of each cost item
  - not allowed for external reports
- Absorption costing required for external financial reports:
  - fixed overhead costs seen as product costs in same manner as direct materials and direct labour

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## Cost-Volume-Profit Analysis

- CVP Analysis – how changes in costs and volume affect profits
- Underlying assumptions:
  - costs and revenues are linear within relevant range
  - all costs identifiable as variable or fixed
  - costs affected only by changes in activity level
  - all units produced are sold
  - constant sales mix if more than one product

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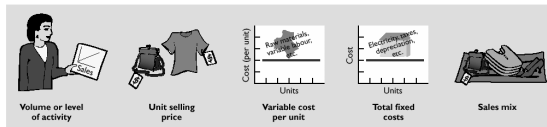
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## Cost-Volume-Profit Analysis



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## Cost-Volume-Profit Analysis

- Contribution margin = revenue less variable costs
  - calculate per unit: how much of each sales dollar is left to contribute towards fixed costs and profits
  - or as ratio: what per cent of each sales dollar is left to contribute towards fixed costs and profits

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## Cost-Volume-Profit Analysis

$$\text{Unit selling price} - \text{Unit variable cost} = \text{Contribution margin per unit}$$

$$\text{Contribution margin per unit} + \text{Unit selling price} = \text{Contribution margin ratio}$$

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## Cost-Volume-Profit Analysis

- Break-even analysis – determines level of activity where total revenues equal total costs
  - at break-even point, zero profit/loss
  - expressed in sales dollars or sales units
  - determined by mathematical equation,
  - by contribution margin, or
  - by cost-volume-profit graph

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## Cost-Volume-Profit Analysis

- Mathematical equation – basic formula is:

$$\text{Break-even sales} = \text{Variable costs} + \text{Fixed costs}$$

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### Cost-Volume-Profit Analysis

- Break-even sales can be defined as:
  - required level of sales dollars, or
  - required units of sales volume
- in equation, variable costs can be expressed as a dollar amount or as proportion of sales revenue

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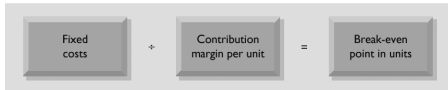
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### Cost-Volume-Profit Analysis

- Contribution margin technique – basic formula is:



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### Cost-Volume-Profit Analysis

- Break-even point can also be defined in terms of sales dollars, by using contribution margin ratio:

$$\frac{\text{fixed costs}}{\text{contribution margin ratio}}$$

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### Cost-Volume-Profit Analysis

- Graphic presentation – break-even point determined visually at intersection of:
  - total sales revenue line, and
  - total costs line (fixed plus variable)

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### Cost-Volume-Profit Analysis

- level of activity (units) recorded on horizontal axis, and
- dollars (revenues and costs) recorded on vertical axis
- net profit and loss at all levels of activity is also visually portrayed

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### Cost-Volume-Profit Analysis

- Margin of safety = difference between expected sales and break-even sales
  - can be expressed in dollars or as ratio
- adequacy of margin of safety depends on the business
  - e.g. competitive position, general economic conditions

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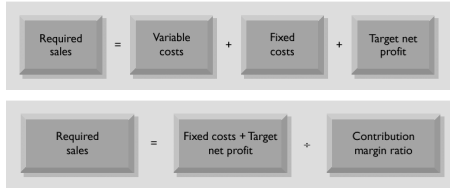
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### Cost-Volume-Profit Analysis

- Target Net Profit – profit objective for the product line
  - expand break-even analysis by adding target net profit to total costs



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### Cost-Volume-Profit Analysis

- CVP for profit planning – management can quickly predict effects of such events as:
  - changes in sales revenues and costs
  - matching competitor's discount on sales price per unit
  - investing in equipment (fixed costs) in order to reduce labour (variable costs)
  - changes in profitability with changes in variable or fixed costs

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### Cost-Volume-Profit Analysis

- CVP and multiple products – management can use break-even point with 2+ products to analyse sales mix for highest profitability
  - based on assumption of constant sales mix
  - sales mix = relative combination of the different products sold

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### Cost-Volume-Profit Analysis

- need to calculate weighted average unit contribution margin (CM) over all products
- weighted average unit CM =  
$$\frac{\text{total CM for sales mix}}{\text{number of units in the sales mix}}$$



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### Cost-Volume-Profit Analysis

- Limited resources – best use of resources to maximise net profits:
  - if limitations on some part of business
  - e.g. floorspace, labour, machine hours
  - use CM per unit of limited resource:  
$$\frac{\text{CM per unit}}{\text{amount of resource needed for each unit}}$$
  - total CM = units of limited resource X CM per unit of limited resource

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### Cost-Volume-Profit Analysis

- CVP Statement of Financial Performance – for internal decision-making only
  - expenses classified as variable or fixed
  - financial reports for external use classify expenses by function (e.g. COGS, selling expenses) and do not show contribution margin (CM)

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