



UniSA

BUSINESS
ENTERPRISE

Accounting For Decision Making

~ Topic 6 ~
Analysing Cost Behaviour



Goals for this session...

- Analyse cost behaviour to plan costs and make decisions;
- Explain contribution analysis and calculate the contribution margin for individual products, product lines and a business unit;
- Use the cost-volume-profit model to evaluate decision alternatives and for planning; and
- Understand and use the concept of operating leverage.

Analysing Profit According to Cost Behaviour



• Direct & Indirect Costs

Sales

- COGS

= Gross Profit

- Expenses

= Net Profit

• Fixed & Variable Costs

Sales

- Variable Costs

= Contribution Margin

- Fixed Costs

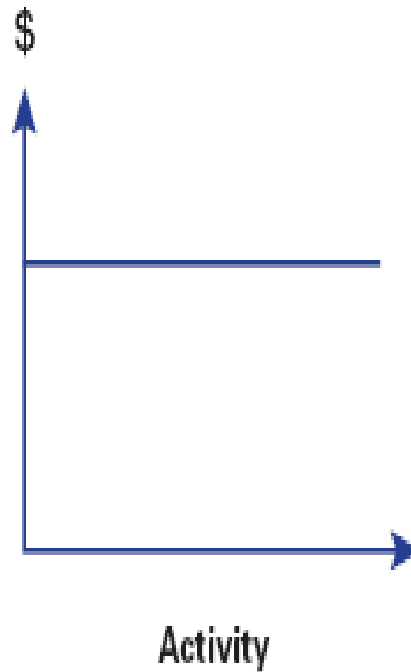
= Net Profit

Fixed & Variable costs

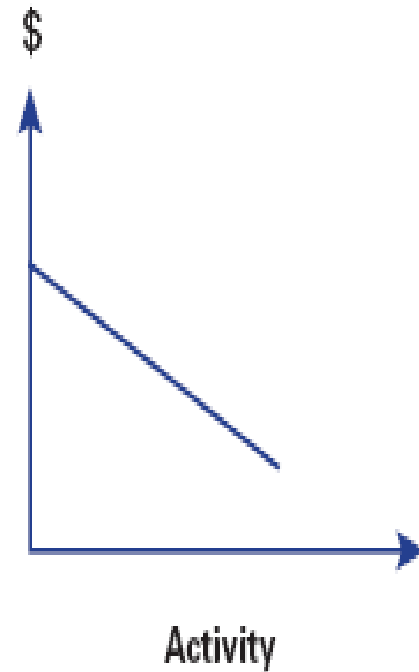
- *Fixed costs* - remain unchanged in total despite changes in the level of activity
- *Variable costs* - change in total, in direct proportion to a change in the level of activity

Fixed Cost behaviour

Fixed cost behaviour



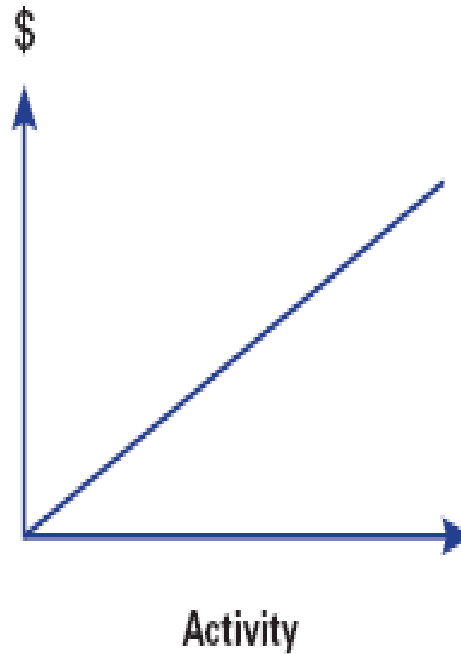
Total fixed costs



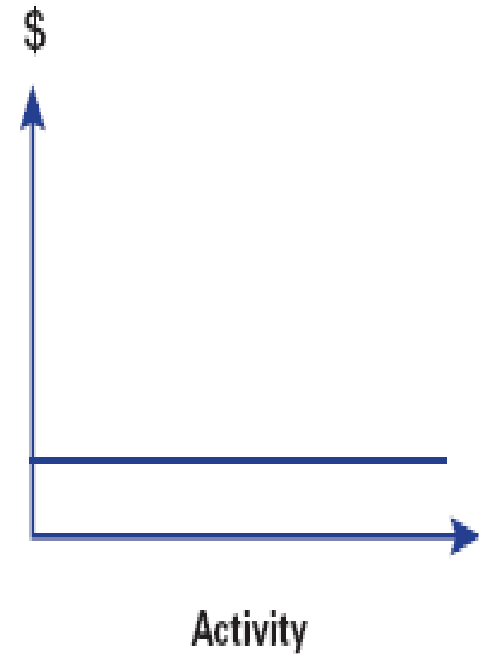
Fixed costs per unit

Variable Cost behaviour

Variable cost behaviour



Total variable costs



Variable costs per unit

Concept of Relevant range

- ❑ The **relevant range** is the range of activity over which the cost behaviour is assumed to be **valid**.
- ❑ If the activity level goes **outside** the relevant range, then the expected behaviour of costs changes — fixed (variable) costs can no longer be assumed to be fixed (variable).

e.g.

The cost per brick to build a house is \$15 if purchase less than 1,000 bricks.

If purchase over 1,000 bricks, discount may be offered.

∴ the relevant range for cost of bricks is 1 ~ 1,000 bricks.



Contribution Margin

*The difference between the **selling price** and the **variable cost** of a unit of production, being the **contribution** of the unit **towards** the **recovery** of manufacturing, selling and administration **expenses** and the attainment of the **net profit** required.*

Common decisions using Contribution Analysis

- Accept or reject a special order
- Make or buy (short-term)
- Outsourcing decisions (long-term)
- Add or delete a service, department or product
- Joint products: sell or process further
- Sales required to Break-Even

Accept or reject a special order - Example

- Operating @ 80% Capacity
- Sales = 200,000 Units
- Unit Sales Price = \$5.00
- Unit Variable Cost = \$2.50
- Fixed Costs = \$200,000
- A customer offers to purchase the balance 20% capacity @\$3.00. Should the offer be accepted?

Accept or reject a special order

- If capacity available, accept if $p > vc$
 - incremental revenue from order > incremental costs
- If capacity not available, compare incremental costs to incremental benefits
 - take account of opportunity cost of contribution margin forgone on existing sales
- Recognise any strategic / qualitative factors such as effect on existing customers

Make or buy a product or service

- ... from the previous example, the Firm has the opportunity of purchasing an additional 50,000 Units at \$2.45 per unit - should it make or buy?

Make or buy a product or service

Key considerations

- Buy if $p < \text{variable cost per unit}$ (incremental costs of buying $<$ incremental costs of production)
- Recognise fixed costs which will continue even if decide to buy (i.e. consider which costs are avoidable and unavoidable)
- Consider opportunity costs
- Evaluate strategic / qualitative factors

Add or delete a service / product or department ~ Example

- Business produces 3 Products, **A**, **B** & **C**.
- Sales, Variable & Fixed Cost information for these products are as follows:

	<u>Product A</u>	<u>Product B</u>	<u>Product C</u>	<u>Total</u>
<i>Sales</i>	90	160	145	395
<i>Variable Costs</i>	(68)	(84)	(72)	(224)
<i>Fixed Costs</i>	<u>(34)</u>	<u>(42)</u>	<u>(36)</u>	<u>(112)</u>
<i>Net Profit (Loss)</i>	(12)	34	37	59

- Should A be discontinued?

	<u>Product A</u>	<u>Product B</u>	<u>Product C</u>	Total
<i>Sales</i>	90	160	145	395
<i>Variable Costs</i>	(68)	(84)	(72)	(224)
<i>Contribution</i>	22	76	73	171
<i>Fixed Costs</i>				(112)
<i>Net Profit (Loss)</i>				59

- Since A provides a *positive contribution* it should not be dropped
- If A is discontinued the result would be:

• Contribution from Product B	76,000
• Contribution from Product C	<u>73,000</u>
	149,000

Less:

• Fixed Costs	<u>112,000</u>
• Net Profit	<u>37,000</u>

Add or delete a service / product or department

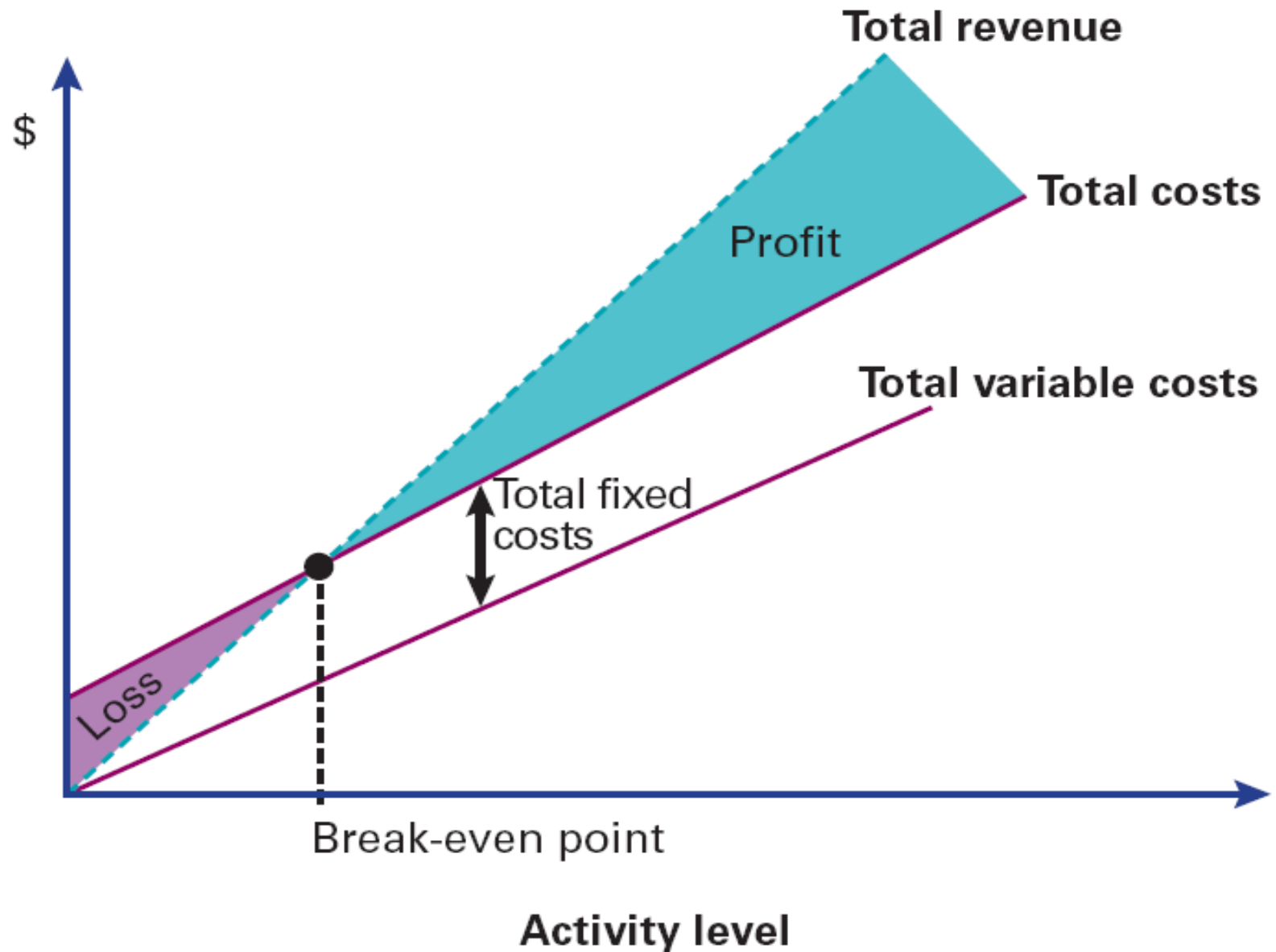
Key principles:

- Calculate the incremental costs associated with the service or department (in the short-run mainly variable costs).
- Calculate the incremental costs with the revenue earned by the service or department.
- Add the new service or department if...
incremental revenue > the incremental costs
- Drop an existing product or department if...
incremental revenue < incremental costs
- Evaluate strategic / qualitative factors

Break-Even Analysis

- "Break-Even Point"...
- The volume of sales where the total revenues and expenses are equal, and the operation "breaks even"
- At this level of sales, there is no profit or loss
- Can be calculated for an entire organisation or individual projects.

Graphically...





Finding the Breakeven Point

Example ~ Yummy Lollies

- Unit Selling Price is \$0.50
- Unit Variable Cost is \$0.40
- Monthly Fixed Costs include:
 - Rent \$1,000
 - Wages & Salaries \$4,500
 - Other Fixed Expenses \$500
- *How many Units need to be sold in order to Break Even?*
- *What level of Sales is required to Break-Even?*
- Equation Method
- Graphical Method

The Break-Even Point

Breakeven Point:

... in Units: $BE = FC / \text{Unit Contribution}$

... in \$: $BE = FC / CMR$

- Deriving these...

Breakeven Point in Units:

Total Cost = Fixed cost + Variable Costs

Total Cost – Variable Cost = Fixed Cost

(# Units x Total Cost/Unit) – (# Units x Variable Cost/Unit) = Fixed Cost

Units (Total Cost/Unit – Variable Cost/Unit) = Fixed Cost

$\therefore \# \text{ Units} = \frac{\text{Fixed Cost}}{(\text{Total Cost/Unit} - \text{Variable Cost/Unit})}$

... in Units: $BE = FC / \text{Unit Contribution}$

Breakeven Point in \$:

$$\text{Total Sales} = \text{Total Cost} = \text{Fixed cost} + \text{Variable Costs}$$

$$\text{Total Sales} - \text{Variable Cost} = \text{Fixed Cost}$$

$$\text{Sales} (1 - \frac{\text{Variable Cost}}{\text{Sales}}) = \text{Fixed Cost}$$

$$\text{Sales} = \frac{\text{Fixed Cost}}{(1 - \text{Variable Cost}/\text{Sales})} = \frac{\text{Fixed Cost}}{(\text{CMR})}$$

$$\dots \text{ in \$: } BE = FC/CMR$$



Example: Yummy Lollies...

To illustrate breakeven analysis, let's assume Yummy Lollies Ltd (YLL) produces and sells mini chocolate frogs. The selling price and costs are shown below:

Selling Price (per unit)	\$0.50
Variable Cost (per unit)	<u>0.40</u>
Contribution Margin (per unit)	0.10

Monthly Fixed Expenses:

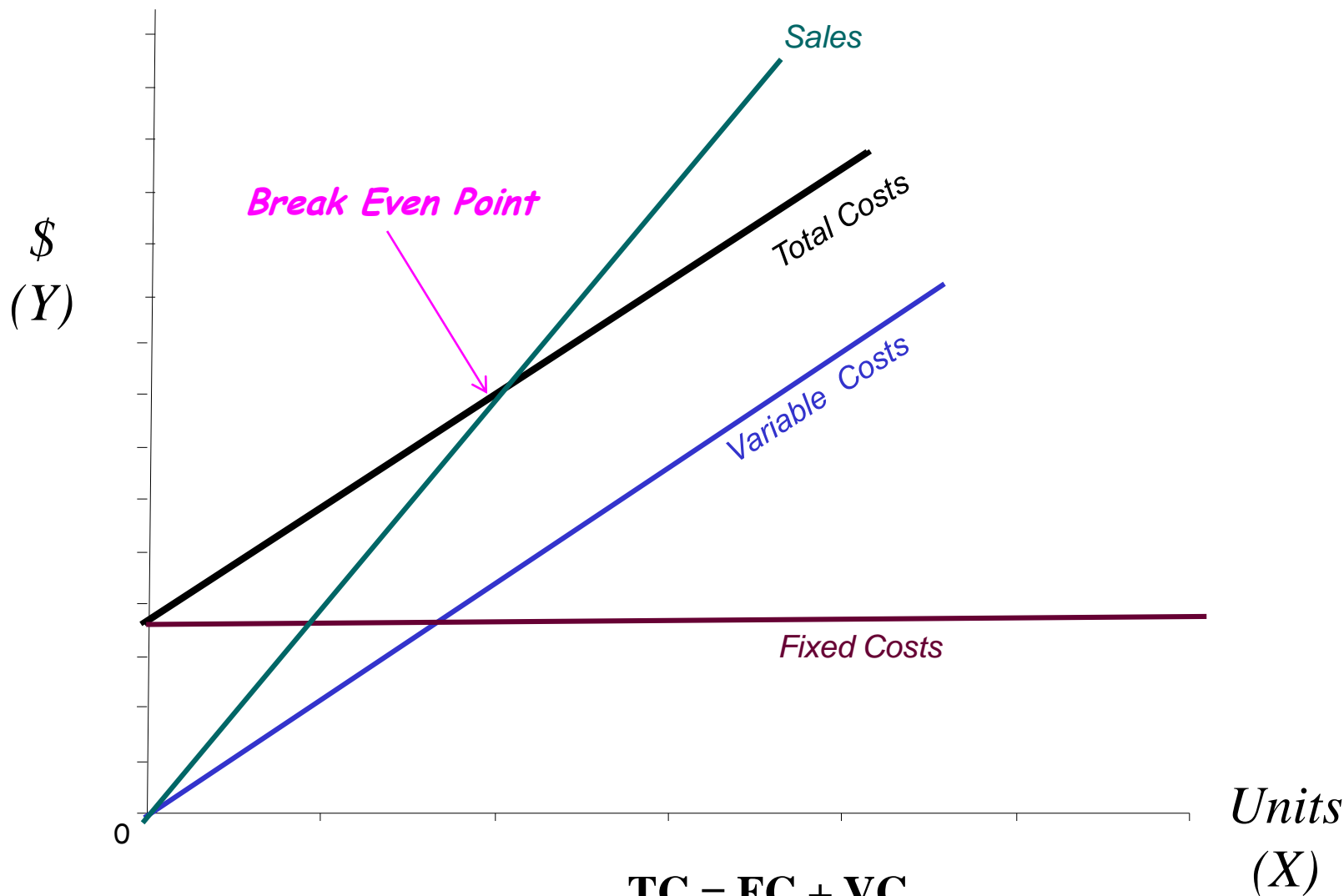
Rent	\$1,000	
Wages & Salaries (Admin & Selling)	4,500	
Other Fixed Expenses	<u>500</u>	
Total Monthly Fixed Expenses		<u>\$6,000</u>

Yummy Lollies...

$$\begin{aligned}
 \text{Number of units sold} &= \frac{\text{Fixed costs}}{\text{Contribution margin per unit}} \\
 \text{(to break even)} & \\
 &= 6,000 / 0.10 \\
 &= \underline{\underline{60,000 \text{ units}}}
 \end{aligned}$$

$$\begin{aligned}
 \text{Sales revenue} &= \frac{\text{Fixed costs}}{\text{Contribution margin ratio}} \\
 \text{(to break even)} & \\
 &= \frac{6,000}{(0.10/0.50)} \\
 &= \underline{\underline{\$30,000}}
 \end{aligned}$$

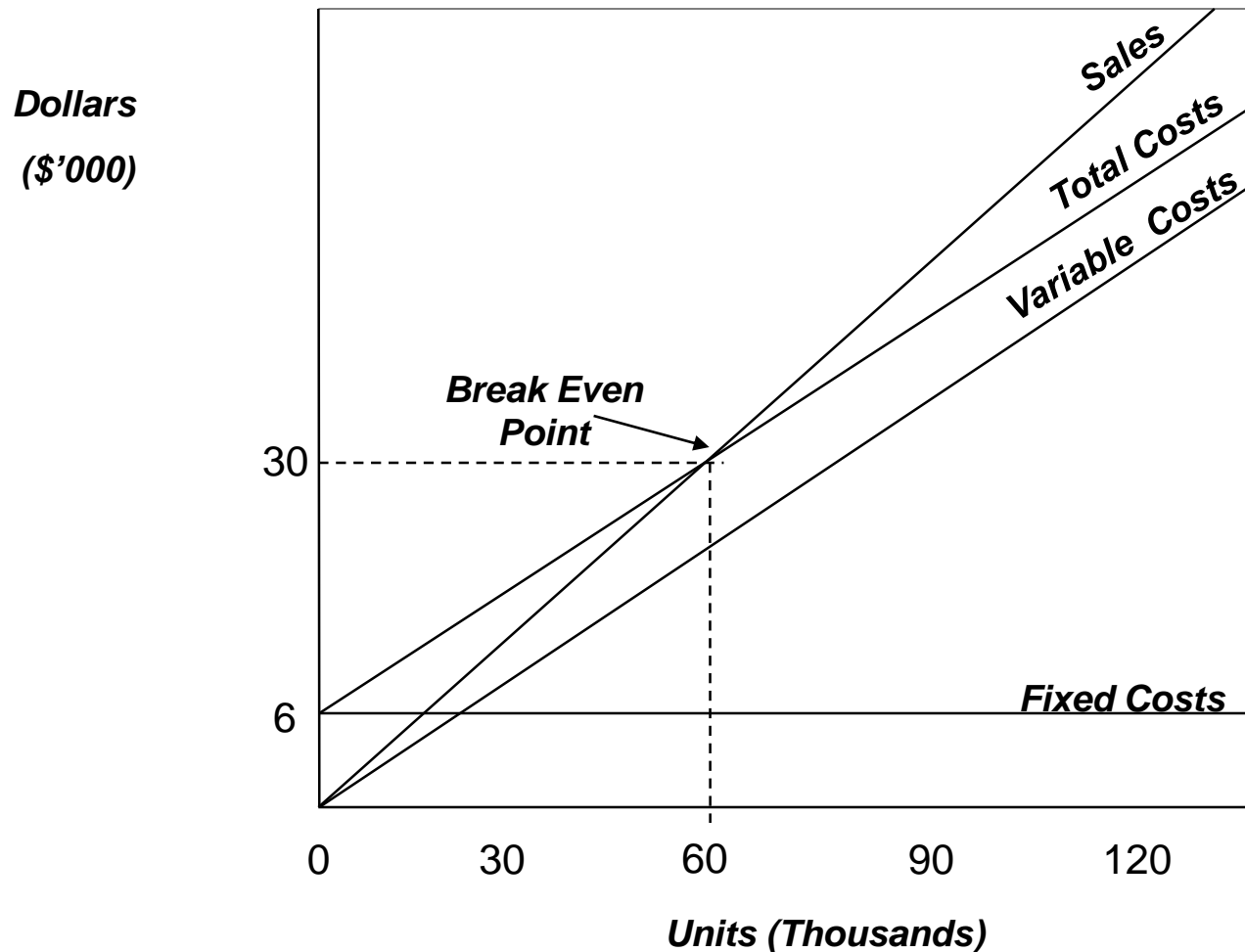
Graphically...



$$TC = FC + VC$$


or $Y = a + bX$

Finding the Breakeven Point - Graphical Method





Yummy Lollies ~ Analysis



To breakeven YLL needs to sell 60,000 frogs or achieve sales revenue of \$30,000. By selling 60,000 frogs at \$0.50 each, the company will earn \$30,000 sales revenue, which will be just enough to cover the variable costs of \$24,000 (60,000 frogs x the variable cost per unit \$0.40) plus the fixed costs of \$6,000.



Another CVP Example

Ryans Music provides individual music lessons in the homes of clients. The following data is provided with respect to the last 12 months of activity ending 30 June 2014

<i>Unit selling price*</i>	<i>\$45</i>
<i>unit labour cost</i>	<i>\$30</i>
<i>annual fixed costs</i>	<i>\$18000</i>
<i>unit sheet music costs</i>	<i>\$3</i>

**Each unit is equal to one half-hour lesson.*

Required...

- a. Assuming selling prices and costs remain the same as for 2014, calculate the number of units that are required to be sold in 2015 to break even.

$$(FC = \$18,000; VC = \$30 + \$3 = \$33)$$

$$BE \text{ (Units)} = \frac{FC}{\text{Unit sales} - VC}$$

$$\text{Break even (Units)} = \$18\,000 / (\$45 - \$33) = \mathbf{1500 \text{ units}}$$

b. If 4000 units were 'conducted' in 2014, what profit would be achieved?

(profit = total sales - total vc - FC)

$[4000 \text{ units} \times (\$45 - \$33)] - \$18\,000 = \$30\,000 \text{ profit}$

c. For 2015, Ryans expects the **unit labour cost to increase by \$2** but, because of local competitive forces, does not wish to increase the unit selling price. With some careful management, Ryans hopes to reduce annual fixed costs to **\$15 000**. Calculate the **number of music lessons** that would need to be performed in 2015 in order to match the 2014 profit.

($VC = \$33 + \$2 = \$35$; $FC = 15\ 000$; 2013 profit = $\$30\ 000$)

profit = total sales - total vc - FC

profit + FC = (total sales - total vc)

profit + FC = # units sold \times (unit sales - unit vc)

$(\$30\ 000 + \$15\ 000) / (\$45 - \$35) = \underline{4\ 500\ units}$

The concept of Operating Leverage

- Cost structure of an organisation is the relative proportion of fixed & variable costs
- Cost structure has a significant effect on the sensitivity of its profits to changes in volume sold
- Rule of thumb - the greater the proportion of fixed costs, the greater the impact on profit from a given % change in sales revenue

Operating Leverage...

**the extent to which an organisation uses
Fixed Costs in its capital structure**

- Operating Leverage refers to the ability of an organisation to generate an increase in net profit when sales revenue increases
- Operating Leverage factor =
$$\frac{\text{Contribution Margin}}{\text{Net Profit}}$$

Example:

	<i>Organisation</i>		
	<u><i>A</i></u>	<u><i>B</i></u>	<u><i>C</i></u>
<i>Sales</i>	<i>500,000</i>	<i>500,000</i>	<i>500,000</i>
<i>Variable Costs</i>	<u><i>300,000</i></u>	<u><i>400,000</i></u>	<u><i>50,000</i></u>
<i>Contribution Margin</i>	<i>200,000</i>	<i>100,000</i>	<i>450,000</i>
<i>Fixed Costs</i>	<u><i>150,000</i></u>	<u><i>50,000</i></u>	<u><i>400,000</i></u>
<i>Net Profit</i>	<u><i>50,000</i></u>	<u><i>50,000</i></u>	<u><i>50,000</i></u>

1. *What is the Operating Leverage factor for each organisation?*
2. *What is the effect on Net Profit of an increase in Sales Revenue of 8% in each of the three organisations?*
3. *What are the implications of organisations with a high Operating Leverage?*

The operating leverage factor for each of these three organisations is:

Organisation	Contribution Margin	Profit	Operating Leverage Factor
A	\$200,000	\$50,000	4
B	\$100,000	\$50,000	2
C	\$450,000	\$50,000	9

Assuming sales revenue increases by 8% in each organisation, the resulting effect on net profit can be calculated as:

Organisation	Sales Increase	Leverage Factor	Profit Change
A	+8%	4	+32%
B	+8%	2	+16%
C	+8%	9	+72%

Organisation B with its low proportion of fixed costs, high variable costs and low contribution margin ratio shows a relatively low increase in profit. Organisation C on the other hand, has high fixed costs, low variable costs and a high contribution margin ratio - with a correspondingly high increase in profit.

Uses of Break-even data

- identifying the number of products or services **required to be sold** to meet break-even or profit targets
- planning products and **allocating resources** by focusing on those products that contribute more to profitability
- determining the impact on **profit of changes** in the mix of fixed and variable costs
- **pricing** products.

Basic Assumptions of CVP Analysis

- Linearity
- Costs can be categorised as fixed and variable
- Relevant Range
- Sales is the only cost driver
- The sales mix remains constant.

Today's cases...

- **Case 16.2: Prestige Telephone Company**
- **Case 18.6: Midwest Office Products**