Part III

Information for decision-making

- Alternative cost accumulation systems
- Cost-volume-profit analysis
- Relevant costs and revenues

Colin Drury

Management and Cost Accounting, 7th edition

- Chapter 7
- Chapter 8
- Pages 191 to 209 (in chapter 9)

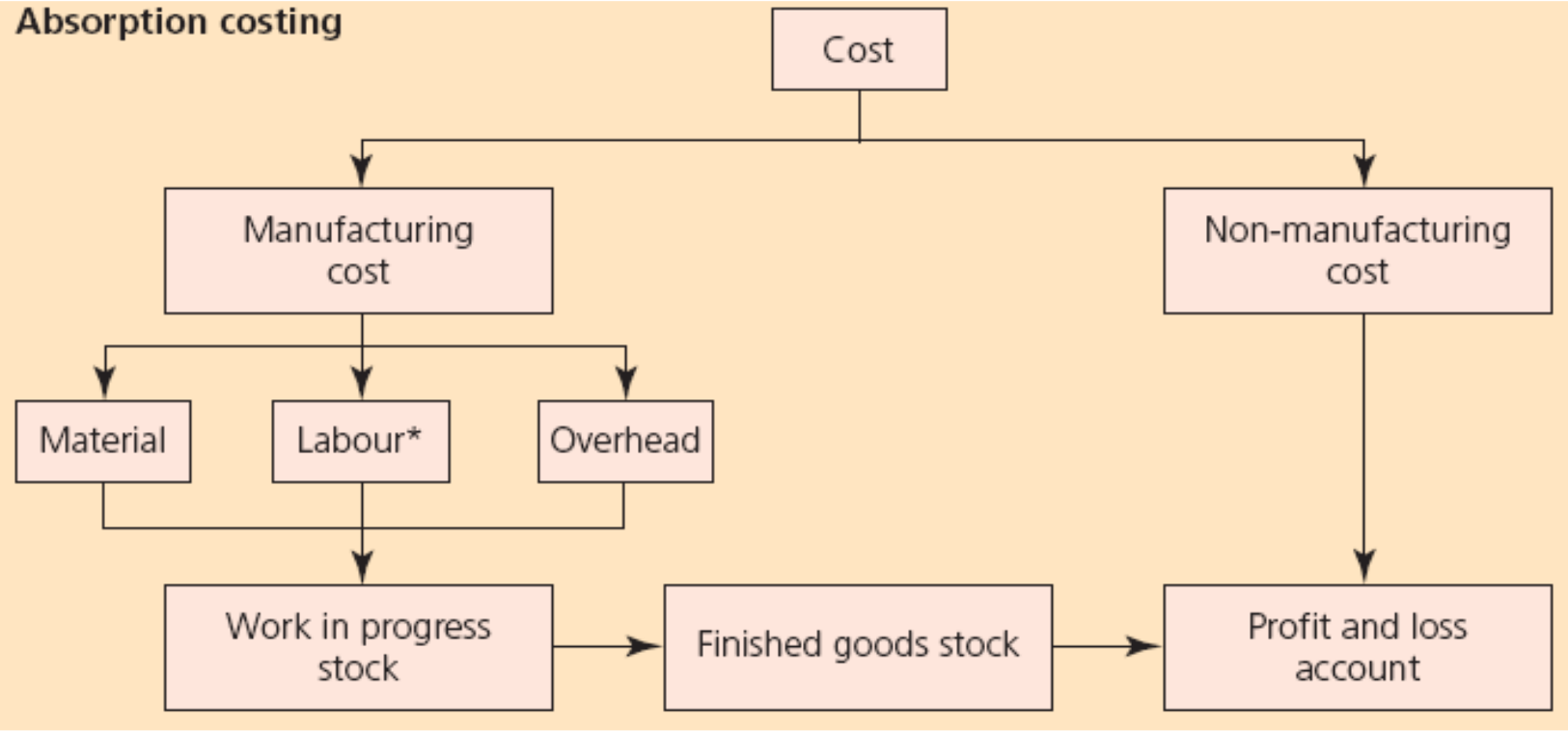
Cost accumulation systems

Objectives

- To distinguish between alternative cost accumulation systems
- To explain the treatment of under-recovery of overheads
- To explain the arguments for and against alternative cost accumulation systems

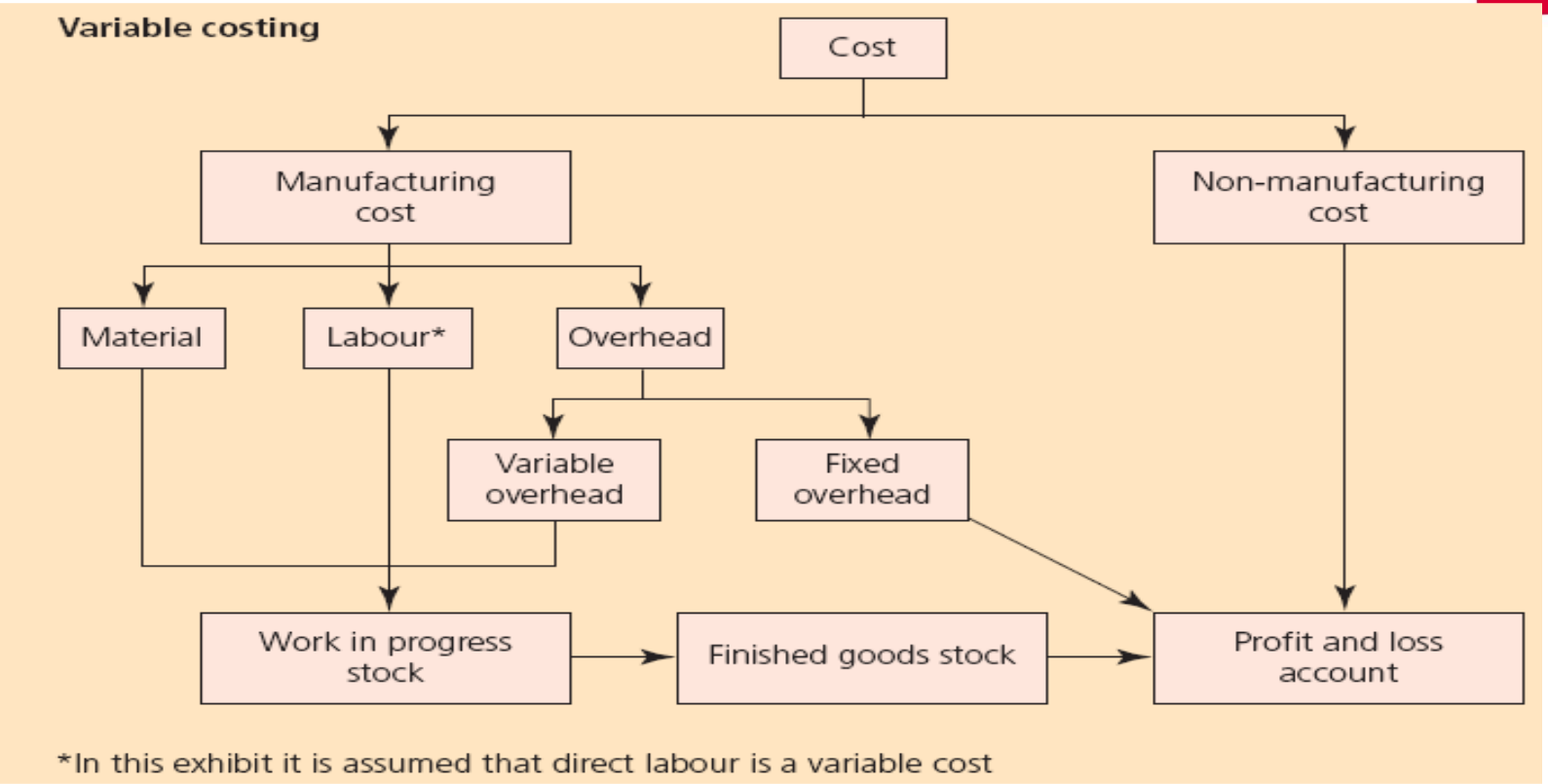
Alternative cost accumulation systems

- Full costing
- Variable costing



(Drury, 2008)

Absorption costing (also known as full costing) traces *all* manufacturing costs to products and treats non-manufacturing costs as a period cost



(Drury, 2008)

In contrast, variable costing traces all variable manufacturing costs to products and treats fixed manufacturing overheads and non-manufacturing costs as period costs; as such:

$$CGM = VMC \text{ per unit} \times \text{Real Pr}$$

where CGM= cost of goods manufactured and VMC = variable manufacturing costs

Different full costing systems*

- *Total Full Costing* *(sistema de custeio total completo)*

  It assigns variable manufacturing costs plus total manufacturing fixed costs to products; as such:

CGM = VMC per unit x Real Pr + MFC

where
CGM = Cost of goods manufactured (or product costs)
VMC = Variable manufacturing costs
MFC = Manufacturing fixed costs
Pr = Production (in units)

* This is taught in a more completed way than in Drury, 2008

Different full costing systems (cont.)

- *Based on practical capacity* *(sistema de custeio total racional)*

  It assigns variable manufacturing costs plus a share of the total manufacturing fixed costs to products, after taking into account practical capacity;

  By practical capacity we mean the production that is likely to be produced by the machine after taking into consideration unavoidable interruptions arising from machine miantenance and plant holiday closures; as such:

CGM = VMC per unit x Real Pr + MFC x (Real Pr / Practical Capacity Pr)

Different full costing systems (cont.)

- *Based on budgeted activity* *(com base em quota orçamentada)*

  It assigns variable manufacturing costs plus a share of the total manufacturing fixed costs to products, after taking into account the budgeted activity;

  By budgeted activity we mean the activity level (volume of production) based on the capacity utilization required for the next budget period; as such:

CGM= VMC per unit x Real Pr + MFC x (Real Pr / Budgeted Pr)

* Absorption costing in Drury, 2008

Under-recovery of overheads

(custos industriais não incorporados - CINI)

- Variable costing *(custeio variável)*

Under-recovery of overheads (CINI) = MFC

where MFC = Manufacturing Fixed Costs

- Total Full costing *(custeio total completo)*

Under-recovery of overheads (CINI) = 0

Under- recovery of overheads (cont.)

(custos industriais não incorporados - CINI)

- Full costing based on practical capacity *(custeio total racional)*

Under-recovery of overheads (CINI)* =
= [1 – (Pr / Practical capacity Pr)] x MFC

- Full costing based on budgeted activity

(custeio total c/base na quota orçamentada)

Under-recovery of overheads (CINI)* =
= [1 – (Pr / Budgeted Pr)] x MFC

* Note that, in this case, CINI can either be an under or over-recovery of overheads; note also that MFC = Manufacturing Fixed Costs

Example

The Smith Company produces only one product. The following information is available:

Unit selling price	10 €
Unit variable cost	6 €
Fixed costs per each period	300.000 €

Practical capacity production = 150 000 units = budgeted production

Non-manufacturing costs 100.000 €

	Period 1	Period 2
Units sold (000's)	100	150
Units produced (000's)	130	120

Unit selling price	10
Unit variable cost	6
Fixed cost per each period (000 €)	300

	P 1 (000's)	P 2 (000's)
Units sold	100	150
Units produced	130	120
Opening stock	0	30
Closing stock	30	0

Variable costing

	(000 €)	(000 €)
Opening stock	0	180
CGM (CIPA)	780	720
Closing stock	180	0
Cost of sales (CIPV)	600	900

Variable costing P & L account

	P 1 (000 €)	P 2 (000 €)
Sales	1.000	1.500
Cost of sales (CIPV)	600	900
Fixed costs (Under-recov of Ov - CINI)	300	300
Gross Profit	100	300
Non-manufacturing costs	100	100
Net profit	0	200

CGM = Cost of goods manufactured = production cost

Unit selling price	10
Unit variable cost	6
Fixed cost per each period (000 €)	300

	P 1 (000's)	P 2 (000's)
Units sold	100	150
Units produced	130	120
Opening stock	0	30
Closing stock	30	0

Total full costing *(completo)*

	(000 €)	(000 €)
Opening stock	0	249
CGM (CIPA)	1.080	1.020
Closing stock	249	0
Cost of sales (CIPV)	831	1.269

Total full costing P & L account

	P 1 (000 €)	P 2 (000 €)
Sales	1.000	1.500
Cost of sales (CIPV)	831	1.269
Fixed costs (Under-recov of Ov - CINI)	0	0
Gross Profit	169	231
Non-manufacturing costs	100	100
Net profit	69	131

Unit selling price	10
Unit variable cost	6
Fixed cost per each period (000 €)	300

	P 1 (000's)	P 2 (000's)
Units sold	100	150
Units produced	130	120
Opening stock	0	30
Closing stock	30	0

Full costing based on practical capacity *(racional)*

	(000 €)	(000 €)
Opening stock	0	240
CGM (CIPA)	1.040	960
Closing stock	240	0
Cost of sales (CIPV)	800	1.200

Full costing based on practical capacity P & L account

	P 1 (000 €)	P 2 (000 €)
Sales	1.000	1.500
Cost of sales (CIPV)	800	1.200
Fixed costs (Under-recov of Ov - CINI)	40	60
Gross Profit	160	240
Non-manufacturing costs	100	100
Net profit	60	140

Profit comparisons (variable and full costing)

	P 1	P 2
Sales (000's)	100	150
Production (000's)	130	120
Closing stock (000's)	30	0

Net profit (000 €)

	P 1	P 2	P1 + P2
Variable costing	0	200	200
Total full costing*(completo)*	69	131	200
Full costing based on practical capacity *(racional)*	60	140	200

- Where production exceeds sales (increasing stock levels) the full costing systems produce higher profits (period 1 of previous example)

- Where sales exceed production (declining stock levels) the variable costing system produces higher profits (period 2 of previous example)

Profit comparisons (variable and full costing) (cont.)

• Whenever production equals sales (no changes in stock levels) profits are the same for any costing system

•With a system of variable costing, profit is a function of sales volume only, whereas with full costing, profit is a function of both sales and production volumes

Some arguments in support of variable costing

- Variable costing removes from profit the effect of stock changes
- Variable costing avoids fixed overheads being capitalized in unsaleable stocks

Some arguments in support of full costing

- Full costing avoids fictitious losses being reported (e.g stocks accumulated for seasonal sales)
- Production of goods is not possible if fixed manufacturing costs are not incurred
- Consistent with the rules and procedures used for inventory valuation (external reporting)

Conclusion

1. Choice depends on the circumstances

    - Volatile sales and changing stock levels favour variable costing for internal monthly or quarterly profit measurement.

    - Seasonal sales where stocks are built up in advance favours full costing

2. Debate only applies to internal reporting as for external reporting full costing is required

    - For instance, IAS 2 requires full costing based on practical capacity (sistema de custeio racional)

Cost-volume-profit analysis

Objectives

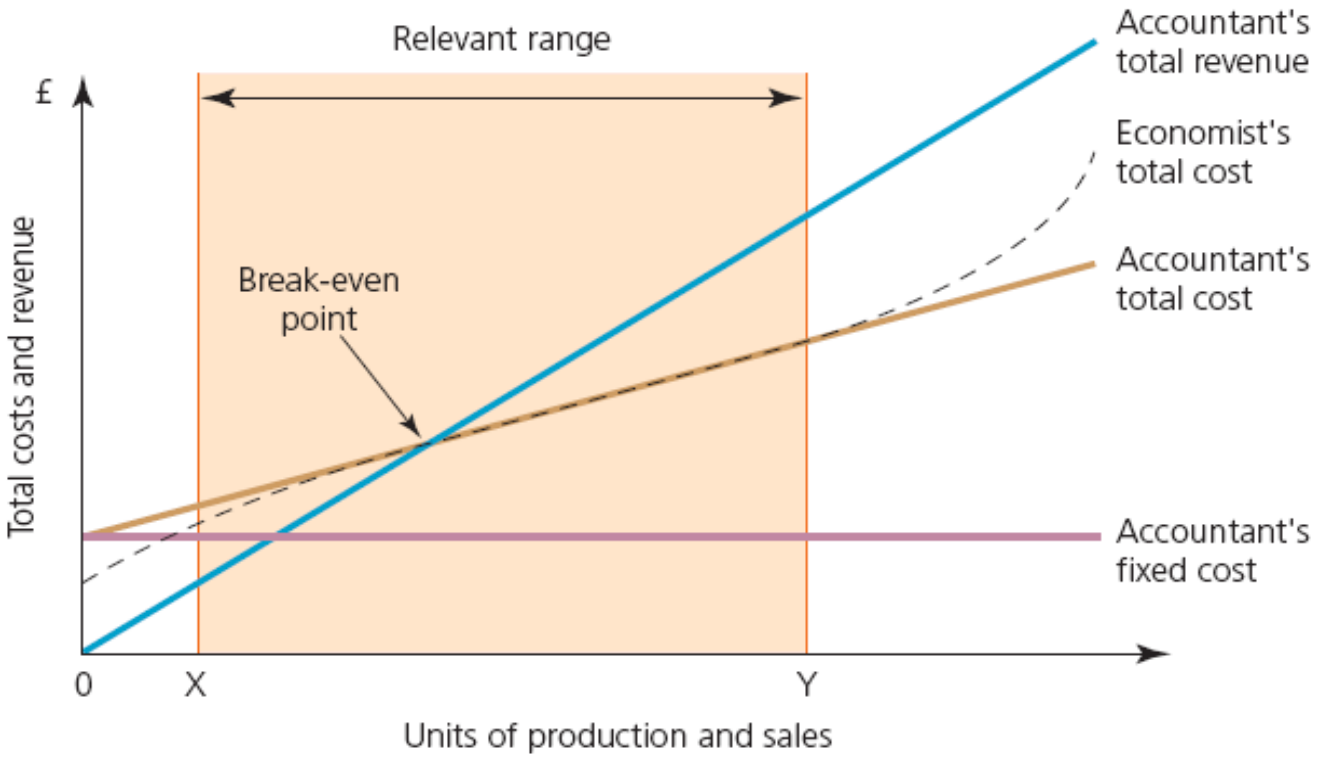
- To determine the break-even point and explain the concept
- To determine the margin of safety and explain the concept
- Multi-product cost-volume-profit analysis
- To understand cost-volume-profit analysis assumptions

Cost-volume-profit analysis can be of assistance in answering questions such as:

- How many units must be sold to break-even?
- What would be the effect on profits if we reduce our selling price and sell more units?
- What sales volume is required to meet the additional fixed charges arising from an advertising campaign?

i.e., if sales volume changes what are the effects on the level of profits in the short run

CVP analysis



(Drury, 2008)

Relevant range refers to the output range at which the firm expects to be operating within the short run; within this range, it is assumed that either the selling price and the variable cost per unit are the same, as well as the amount of fixed costs

CVP analysis (cont.)

Example 1

Fixed costs per annum	€ 60 000
Unit selling price	€ 20
Unit variable cost	€ 10
Relevant range	4 000 - 12 000 units

1. **Break-even point (ponto crítico das vendas)**

$$\frac{\text{Fixed costs}}{\text{Contribution per unit*}} = \text{€ 60 000/ € 10 = 6 000 units}$$

$$\frac{\text{Fixed costs}}{\left(1 - \frac{\text{unit variable cost}}{\text{unit selling price}}\right)} = \text{€ 60 000/ 0,5} = 120\,000\ €$$

* = unit selling price – unit variable cost (margem de contribuição unitária)

Profit and Loss for decision-making in short term (Variable Costing)

1. Sales
2. Cost of sales (COGS)
3. **Gross Margin**
4. Non-manufacturing variable costs
    a) Selling
    b) Administrative
5. **Contribution Margin**
6. Fixed Costs
    a) Under-recovery of overheads
    b) Selling
    c) Administrative
7. **Operating Profit**
    a) Financial Costs
8. **Profit Before Taxes**

CVP analysis

Example 1

Fixed costs per annum	€ 60 000
Unit selling price	€ 20
Unit variable cost	€ 10
Relevant range	4 000 - 12 000 units

2. How many units to be sold to obtain a €30 000 profit?

3. Additional sales volume to meet € 8 000 additional fixed advertising charges:

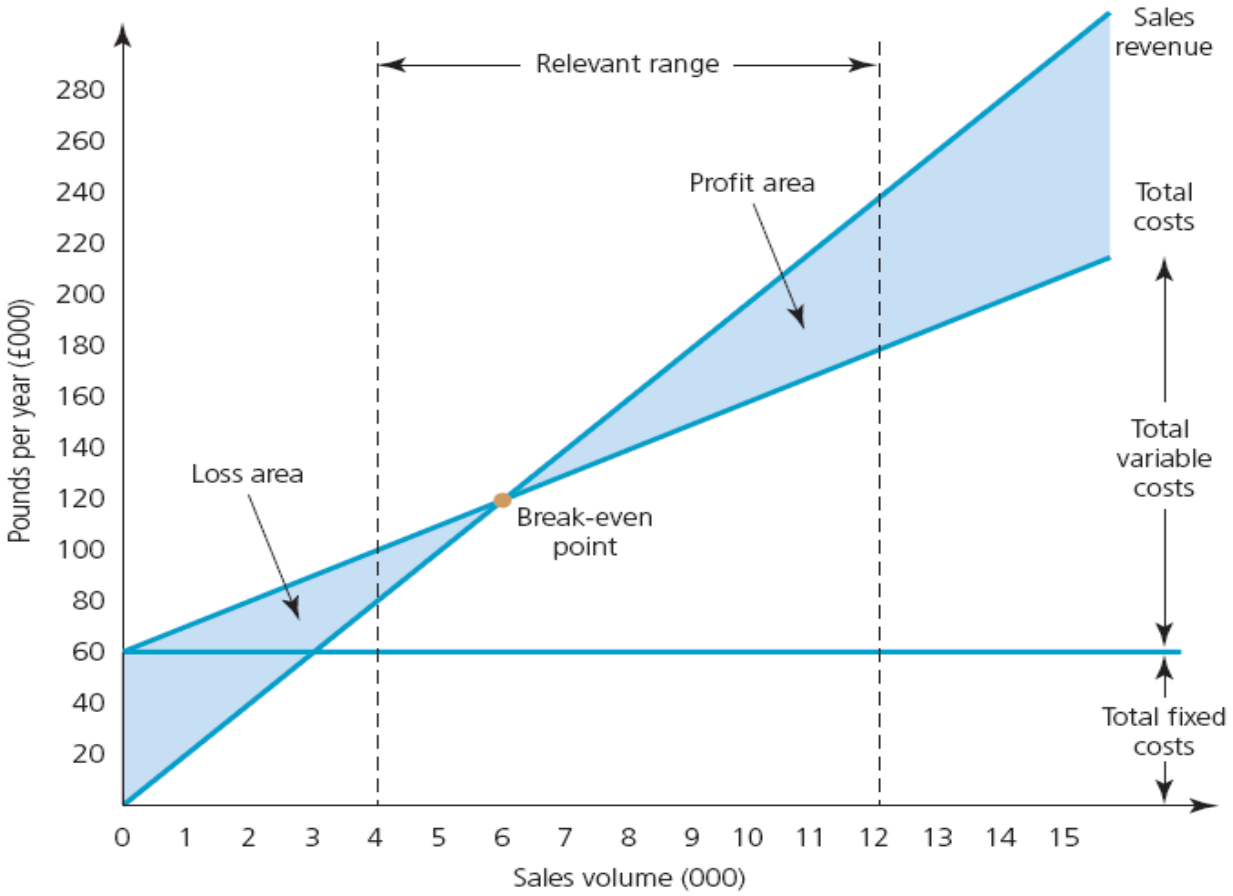
4. If unit fixed costs and revenues are not given, the break-even point (expressed in sales values) can be calculated as follows:

$$\frac{\text{Total fixed costs}}{\text{Total contribution}} \times \text{Total sales}$$

5. Margin of safety (indicates how much sales may decrease before a loss occurs)

$$\frac{\text{Expected sales - Break-even sales}}{\text{Expected sales}} = \frac{(Q - Q^*)}{Q}$$

If in previous example, sales are expected to be 8 000 units, margin of safety = 25%


Relevant range
Sales revenue
Profit area
Total costs
Total variable costs
Total fixed costs
Loss area
Break-even point
Pounds per year (£000)
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Sales volume (000)

(Drury, 2008)

CVP analysis assumptions

1. All other variables remain constant
   - e.g. production efficiency, price levels, production methods

2. Single product, or constant sales mix

3. Costs can be accurately divided into their fixed and variable elements

4. Unit variable cost and selling price are constant per unit of output and fixed costs do not alter

5. Profits are calculated on a variable costing basis

6. The analysis applies over the relevant range only

7. Units produced = units sold

Multi-product cost-volume-profit analysis

Example

	Product X	Product Y
Unit contribution	€12	€ 8
Actual sales mix	25%	75%

Fixed costs are €180 000

BEP = € 180 000 / € 9 (a) = 20 000 units

[a] (25% × € 12) + (75% × € 8)

Relevant costs and decision-making

Objectives:

- To recall the concepts of relevant and irrelevant costs (and revenues), as well as opportunity costs

- To analyse:
  1. Special selling price decisions
  2. Product-mix decisions when capacity constraints exist
  3. Decisions on replacement of equipment
  4. Outsourcing (make or buy) decisions
  5. Discontinuation decisions

Relevant costs

- Relevant costs (and revenues) are required for non-routine decisions such as:
  - Replacing existing equipment
  - Making a component within the company or buying from an outside supplier
  - Introducing a new product or service
  - Discontinuing a product or a channel of distribution
- Relevant costs and revenues = those that will be affected by a particular decision
  - Therefore, only incremental/differential cash flows should be considered
- Decisions should also be based on qualitative factors

Opportunity costs

- Exist whenever the choice of a particular action requires that an alternative action be given up

- Opportunity cost = lost contribution to profits arising from the best alternative given up

- These costs arise only when the resources are scarce and have alternative uses

1. Special pricing decisions (encomendas especiais)

- *Example 1 (A short-term order)*

Company X has offered to buy 120 seats at a ticket price of 250€ per passenger to an airline company in a flight to Macau, where normal ticket price is 450€ and total cost per passenger is 300€. Should the airline company accept this special order?

The aim is to maximize profit in the short-term, without affecting long term profits

- As such, and when there is unutilized capacity, we must compare the price of the special order with the unit variable cost (40€, which refers to meals and beverage)*
- If there is not excess capacity, we need to take also into account the opportunity costs

* As only variable costs and the extra sales revenues differ between alternatives (are relevant costs/revenues)

• Since relevant revenues (120 x 250€) exceed relevant costs (120 x 40€) the order is acceptable subject to the following assumptions:

1. Normal selling price of *450€* will not be affected
2. No better opportunities will be available during the period
3. The resources have no alternative uses
4. The fixed costs are unavoidable for the period under consideration

2. Product mix decisions with capacity constraints

(decisões sobre recursos limitados)

• Scarce resources are factors that restrict output; therefore the objective is to concentrate on those products/ services that yield the largest contribution per scarce resource

Example

2.1) A law firm is in a very busy moment, and needs to prioritize its work for next month. As capacity for the period is restricted to 280 days, which cases much be accepted?

Types of cases	Civil	Criminal	Family
Contribution per case	1.000€	1.500€	2.000€
Days per case in average	4	8	10
Estimated sales demand	25 cases	15 cases	14 cases
Required days	100	120	140

.

2. Product mix decisions with capacity constraints

(decisões sobre recursos limitados)

2.2) What will be the profit of the law firm if fixed costs = 35.500 €?

3. Decisions on replacement of equipment

• The original purchase cost of the old machine,its written down value and depreciation are irrelevant for decision-making

Example

- WDV of existing machine (remaining life of 3 years) 90 000€
- Cost of new machine 70 000€
  (expected life of 3 years and zero scrap value)
- Variable operating costs (3€ per unit old machine)
  (2€ per unit new machine)
- Output of both machines 20 000 units per annum
- Disposal value of old machine now 40 000€
-Disposal value of new and old machines in 3 years time Zero

Should the existing (old) machine be replaced?

4. **Outsourcing** (make or buy decisions)

• Involves obtaining goods or services from outside suppliers instead of from within the organization

Example

A company manufactures currently component Alpha. The cost for 400 units is as follows:

	Total (€)
Direct materials (4 € per unit)	1.600
Variable conversion costs (16 € per unit)	6.400
Fixed conversion costs	4.800
Total costs	12.800

There is the possibility of purchasing the 400 units from an outside supplier at the total cost of 10.000 €. What is the best decision if:

a) There is no alternative use for the capacity required to produce component Alpha

4. **Outsourcing** (make or buy decisions)

Example (cont.)

A company manufactures currently component Alpha. The cost for 400 units is as follows:

	Total (€)
Direct materials (4 € per unit)	1.600
Variable conversion costs (16 € per unit)	6.400
Fixed conversion costs	4.800
Total costs	12.800

There is the possibility of purchasing the 400 units from an outside supplier at the total cost of 10.000 €. What is the best decision if:

b) Instead of producing the 400 units of Alpha, the company buys them from the outside supplier and produces 200 units of component Beta which generates a contribution of 30 € per unit?

5. Discontinuation decisions

• Routine periodic profitability analysis by cost objects provides attention-directing information that highlights those potential unprofitable activities that require more detailed (special studies).

• Assume the periodic profitability analysis of sales territories reports the following:

	Southern	Northern	Central	Total
	£000	£000	£000	£000
Sales	900	1 000	900	2 800
Variable costs	(466)	(528)	(598)	(1 592)
Fixed costs	(266)	(318)	(358)	(942)
Profit/(Loss)	168	154	(56)	266

• Assume that special study indicates that £250 000 of Central fixed costs and all variable costs are avoidable and £108 000 fixed costs are unavoidable if the territory is discontinued.

(Drury, 2008)

• The relevant financial information is as follows:

	Keep Central open	Discontinue Central	Difference
	£000	£000	£000
Variable costs	1 592	994	598
Fixed costs	942	692	250
Total costs to be assigned	2 534	1 686	848
Reported profit	266	214	52
Sales	2 800	1 900	900

• Columns 1 and 2 can be presented or just column 3 which shows that the relevant revenues arising from keeping the territory open are £900 000 and the relevant (incremental) costs are £848 000.Therefore Central provides a contribution of £52 000 towards fixed costs and profits.

5. Discontinuation decisions

2nd example

A supermarket show the following profit in each line of products:

	Fresh Products	Packaged Food	Soft Drinks	Total
Sales	100.000	80.000	10.000	190.000
Variable costs	80.000	56.000	6.000	142.000
Contribution Margin	20.000	24.000	4.000	48.000
Fixed Costs				
Avoidable	15.000	10.000	1.500	26.500
Unavoidable	10.000	7.000	2.000	19.000
Profit	(5.000)	7.000	500	2.500

Shoul the company stop selling fresh products?

Determining the relevant costs of direct materials

- If direct materials required to produce a product are bought
  - ✓ Relevant cost = purchase price

- If direct materials required are taken from existing stock and are being used regularly on other activities
  - ✓ Relevant cost = replacement cost

- If direct materials required are taken from existing stock and have no use
  - ✓ Relevant cost = opportunity cost (i.e. the realizable value)

Example

A company has received an order which requires the following materials:

Direct Materials	Units required	Units in stock	Original purchase price	Realizable value (if sold)	Current purchase price
A	2.000				6
B	2.000	1.200	3	3,50	5
C	1.000	700	2	1,50	3
D	500	500	4	5	8

- ✓ Material B is used regularly and the stock must be replaced
- ✓ Materials C and D in stock are from past purchase excesses
- ✓ Material C has no further alternative use
- ✓ Material D can be used to replace material X, which is used regularly in other activities at a current cost of 7,50€

What is the cost of direct materials if the order is accepted?

Determining the relevant costs of direct labour

- If company has temporary spare (excess) capacity

  ✓ Relevant cost = 0 (irrelevant direct labour cost for short-term decision-making purposes)

- If company uses casual labour (workers hired on a daily basis or overtime working)

  ✓ Relevant cost = cost of casual labour

- If company works at full capacity and there is reduction of existing production if a specific order is accepted

  ✓ Relevant cost = hourly labour rate + opportunity cost

  (i.e contribution lost by accepting the order)