MBA in Food & Agribusiness

Financial Management

Cost – Volume – Profit Analysis

Questions

1.
'Where a business activity has both fixed and variable costs, as volume alters, the variable cost per unit of output stays the same, but the fixed cost per unit changes'. Comment on this statement.

2.
Could the marginal cost of some business activity ever be negative? Explain your answer.

3.
When there is a scarce resource, we undertake the activity that has the highest contribution per unit of the scarce resource. Explain, with a numerical example, why this is correct, and why it would be incorrect to select the activity with highest contribution per unit of output.

4.
For a particular business activity, labour is a variable cost (staff are paid by the unit of output). What factors could cause the (variable) labour cost not to be constant per unit of output?

Answers

1.
The statement is true. The variable cost of each unit is the same irrespective of the level of output. The effective fixed cost per unit reduces as the level of output expands and increases as it contracts.

This assumes that variable costs are strictly linear – for example, no economies of scale. It also assumes that fixed costs remain fixed over the entire range – there are no 'steps' in the fixed costs.

2.
Yes, it could. The marginal cost is the cost of producing one more unit of the service or product.

For example, a major variable cost could have bulk discount that only arises after a certain level of activity. Another example is where some item of inventories can be used in production and the alternative is to scrap it with a disposal cost. This could lead to an overall negative marginal cost.

Answers (cont.)

3.
Imagine that a business renders two services (both with very heavy demand), with the following profiles:

	Service A	Service B
	£	£
Selling price per unit	100	70
Variable costs	60	40
Contribution per unit	40	30

Both services require the input of a particular type of employee who has special skills. The business employs six of these, each working a 35-hour week (210 hours in total). Service A requires 30 minutes (0.5 hours) of the skilled staff and Service B 20 minutes (0.33 hours).

Contribution per hour 80 (€40/0.5) 90 (€30/0.33)

This means that the business should choose to render Service B in preference to Service A, despite the fact that the latter has the higher contribution per unit of the service provided.

To prove this point:

Possible contribution per week for
Service A = €40 × (210/0.5) = €16,800
Service B = €30 × (210/0.33) = €18,900

This shows that Service B more effectively uses the scarce employees' time than does Service A, despite Service A having a higher contribution per unit of service rendered.

Answers (cont.)

4.

Labour cost per unit could increase with volume if a shortage were created. At the level of the business itself, this might be caused by a need for employees to work beyond their normal commitment, giving rise to overtime rates of pay. Major expansion could cause a more general shortage of labour in the area, again leading to higher rates of pay.

Labour cost per unit could decrease as a result of economies of scale being available at higher levels of output. Staff may be able to work more efficiently where higher levels of output are involved.

Exercise 1

Bob's Textile Company sells shirts for men and boys. The average selling price and variable cost for each product are as follows:

Men's		**Boys'**	
Selling Price	28.80 €	Selling Price	24.00 €
Variable Cost	20.40 €	Variable Cost	16.80 €

Fixed costs are 38,400 €.

Required:

1. What is the operating income, assuming the sales are 6,000 men's shirts and 3,000 boys' shirts?
2. What is the breakeven point in units for each type of shirt, assuming the same sales mix?

Solution

1.

	Boys'	Men's	Total
Sales in units	3,000	6,000	9,000
Revenue	72,000	172,800	244,800
Variable costs	50,400	122,400	172,800
Contribution margin	21,600	$50,400	72,000
Fixed costs			38,400
Operating income			33,600

2.

N = breakeven in boys' shirts 2N = breakeven in men's shirts

$24N + $28.80(2N) – $16.80N – $20.40(2N) – $38,400 = 0
$81.6N – $57.6N – $38,400 = 0
$24N – $38,400 = 0
N = $38,400/$24 = 1,600 shirts

Therefore, to break even, 1,600 boys' shirts and 3,200 men's shirts need to be sold.

Or...

V* = 38,400 / 0.2941176 = 130,560 €

For the mix (29,4% ; 70,6%):
Boys' shirts = 38,400 € -> 1,600 boys' shirts
Men's shirts = 92,160 € -> 3,200 men's shirts

Exercise 2

Complete tables A & B below for the four scenarios. In table A Owen has a low cost (operating) gearing. In table B Owen has a high cost (operating) gearing.

Scenario	
Base Case	How much profit can Owen expect to make next year if it produces a single product which it sells for €100 per unit. In the forthcoming year it expects to sell 15,000 units.
Reduce Selling Price	Alternatively, how much profit will Owen make if it cuts the selling price of its product to €90 and sales increase to 20,000 units per annum.
Increase Selling Price	Alternatively, how much profit will Owen make if it increases the selling price of its product to €110 but sales reduce to 12,000 units per annum.
Increase Price and Advertise	Alternatively, how much profit will Owen make if it increases the unit selling price to €105 and if €25,000 per annum is spent on advertising to ensure that the price increase will not lead to any reduction in the sales volume of 15,000 units.

- What is operating gearing?
- What do you notice?

Exercise 2 (cont)

Table A

In the base case the variable costs of producing the item are €70 and the company's fixed costs are €300,000 per annum. The other scenarios are variations on the base case.

	Base Case	Reduce Prices	Increase Prices	Increase Prices & Advertising
Selling price	100	90	110	105
Selling volume				
Revenue				
Variable cost/unit				
Fixed costs				
Total costs				
Profit				
Contribution/Selling price %				
BEP				

Exercise 2 (cont)

Table B

In the base case the variable costs of producing the item are €30 and the company's fixed costs are €900,000 per annum. The other scenarios are variations on the base case.

	Base Case	Reduce Prices	Increase Prices	Increase Prices & Advertising
Selling price	100	90	110	105
Selling volume				
Revenue				
Variable cost/unit				
Fixed costs				
Total costs				
Profit				
Contribution/Selling price %				
BEP				

Solution

Table A

	Base Case	Reduce Prices	Increase Prices	Increase Prices & Advertising
Selling price	100	90	110	105
Selling volume	15,000	20,000	12,000	15,000
Revenue	1,500,000	1,800,000	1,320,000	1,575,000
Variable cost/unit	70	70	70	70
Fixed costs	300,000	300,000	300,000	325,00
Total costs	1,350,000	1,700,000	1,140,000	1,375,000
Profit	150,000	100,000	180,000	200,000
Contribution/Selling price %	30%	22%	36%	33%
BEP	10,000	15,000	7,500	9,286

Solution (cont)

Table B

	Base Case	Reduce Prices	Increase Prices	Increase Prices & Advertising
Selling price	100	90	110	105
Selling volume	15,000	20,000	12,000	15,000
Revenue	1,500,000	1,800,000	1,320,000	1,575,000
Variable cost/unit	30	30	30	30
Fixed costs	900,000	900,000	900,000	925,00
Total costs	1,350,000	1,500,000	1,260,000	1,375,000
Profit	150,000	300,000	60,000	200,000
Contribution/Selling price %	70%	67%	73%	71%
BEP	12,857	15,000	11,250	12,333

Solution (cont)

- An operation with relatively high fixed costs compared with its variable costs is said to have high operating gearing. It causes an increase in fixed costs but at the same time it leads to reduction in variable costs per unit.
- Note that a low geared company has more scope to increase prices (if this does not produce a great reduction in volume) than a high geared company.
- Note that a highly geared company has more scope to reduce prices (if this produces an increase in volume) than low geared companies.

Exercise 3

The Cough Company produces and sells one type of over-the-counter cough bottle. Price and cost data relating to this medicine for the year 2003 are as follows:

	€	€
Sales price per unit		4.00
Variable costs per bottle:		
Direct materials	0.40	
Direct labour	0.90	
Variable overhead	0.30	
Selling expenses	0.30	1.90
Contribution per unit		2.10

Fixed costs for 2003:	€
Manufacturing overheads	20,000
Administrative expenses	75,000
Selling expenses	100,000
	195,000

Required:

- Calculate the break-even point in units and sales revenue for 2003.
- What is the projected net income for 2003, assuming annual sales revenue of €450,000?
- How many units must be sold in 2003 to earn a profit of €15,000?
- For 2004, the following changes are anticipated: (i) selling price will increase by 10 per cent; (ii) variable costs will increase by 20 per cent; and (iii) fixed costs will increase by €30,000. Calculate the break-even point for 2004.

Solution

(a)

Sales Price	4.00
Total Variable Cost	1.90
Contribution per unit	2.10

Total Fixed costs 195,000 = 92,857 units BEP
Contrib. per unit 2.10

Breakeven in terms of sales revenue = 92,857 units at price €4 = €371,429

(b)

Sales Revenue €450,000
Therefore number of units = €450,000 / €4 = 112,500

112,500 units with 2.10 contribution = total contribution	236,250
Less total fixed costs	(195,000)
Profit	41,250

Solution (cont)

(c)

Q = (Fixed Costs + TOI)/Unit Contribution = (€195,000 + €15,000)/ €2.1 = 100,000 units

(d)

Selling price	€4 increase to €4.40 (*€4x1.1*)
Variable Costs	€1.90 increase to €2.28 (*€1.9x1.2*)
Fixed Costs	€195,000 increase to €225,000 (*€195,000 + €30,000*)

New contribution per unit €4.40 - €2.28 = €2.12

BEP = €225,000 / €2.12 = 106,132 units or €466,981 (*106,132 x €4.4*) sales revenue

Exercise 4

The Chiropractic Clinic is split into a number of different departments. The 'realignment' department offers one particular service for sufferers of back pain. It performs 1,950 treatments annually.

Data relating to these treatments are as follows:

	€
Price per treatment	165
Variable costs associated with each treatment	23
Disposable material needed for each treatment	3
Annual salaries of alignment department staff	113,500
Annual advertising costs	38,030
Other fixed costs (annual)	83,000

Required:

- Calculate the break-even point for the alignment department in number of treatments and in service revenue.
- Calculate the margin of safety in number of treatments carried out.
- Assume that the department carried out 1,850 treatments annually. Calculate the department's net income (or loss).
- If new health legislation introduced the compulsory use of a disposable table sheet costing €1 for each treatment, how many treatments would need to be carried out in a year in order to earn a net income of €53,500?
- Assume for next year an additional advertising campaign costing €23,000 is proposed; at the same time the selling price is to be increased by 20 per cent. What would then be the breakeven point in number of treatments?

Solution

(a) BEP = Fixed Costs / Unit Contribution (1)

Total Fixed Cost = €113,500 + €38,030 + €83,000 = €234,530
Total Variable Cost = €23 + €3 = €26/treatment
Unit Contribution = P – Total Variable Cost = €165 - €23 = €139/treatment

BEP = €234,530/€139 = 1,687 treatments x €165 = €278,399

(b) Expected number of treatments	1,950
BEP	1,687
Difference	263
Margin of safety (263/1950)	13.47%

(c) 1,850 treatments are 163 above the BEP (1,687) so profit is expected!

Profit = 163 treatments x €139/treatment = €22,657

Solution (cont)

(d) Variable Cost per treatment = €27

Q = (Fixed Costs + TOI) / Unit Contribution = (€234,530 + €53,500)/(€165-€27) = €288,030/€138 = 2,087 treatments

(e) Fixed Cost = €234,530 + €23,000 = €257,530

P per treatment = €165 x (1.2) = €198

Unit Contribution = €198 - €26 = €172

BEP = €257,530 /€172 = 1,497 treatments

Exercise 5

As a president of Walk Rite you are concerned that inflation may squeeze your profitability. Specifically you feel committed to the €30 selling price per pair and fear that decreasing the quality of the shoes in the face of rising costs would be an unwise move. You expect the cost of shoes to rise by 10% during the coming year. You are tempted to avoid the cost increase by placing a non-cancellable order with a large supplier that would provide 50,000 units of the specified quality for each store the chain owns at €19.5 (variable cost) per pair. These shoes could be acquired and paid for as delivered throughout the year. However all shoes must be delivered to the stores before the end of the year. Your fixed costs are €360,000.

However you foresee some risks. If sales were less than 50,000 units you feel that markdowns of the unsold merchandise would be necessary to sell the goods. You predict that the average selling price of the leftover units would be €18. The regular commission of 5% of revenues would be paid to salespeople

Required

a) Suppose that actual sales for the year are 48,000 units (pair of shoes) at €30 per unit and that you contracted for 50,000 units. What is the operating income of the store?
b) If you had perfect forecasting ability, you would have contracted for 48,000 units rather than 50,000 units. What would the operating income have been if you had ordered 48,000 units?
c) Given actual sales of 48,000 units, by how much would the variable cost per unit have had to rise before you would have been indifferent to having the contract for 50,000 or not having the contract?

For questions (b) and (c) assume that there is a sales commission of €1.50 per shoe pair paid to individual sales people.

Solution

a) Revenues	€30 x 48,000	€1,440,000
	€18 x 2,000	€36,000
		€1,476,000
Variable costs:		
Goods sold	€19.5 x 50,000	€975,000
Commission	0.05 x €1,476,000	€73,800
		€1,048,800
Contribution margin		€427,000
Fixed costs		€360,000
Operating income		€67,200

Solution (cont)

b) Optimal operating income, given perfect knowledge would be:

Unit Contribution x 48,000 units – Fixed costs =
(€30 – €19.5 – €1.5) x 48,000 - €360,000 = €72,000

c) The point of indifference is where the operating incomes of (a) and (b) are equal. Assuming that the respective variable costs is X we have:

48,000x(€30.00 – (X+€1.5) – €360,000 = €67,200
X = €19.6

Therefore any rise in purchase cost in excess of €19.6 per pair increases the operating income benefit of signing the long term contract.

Exercise 6

Need the Dough, a small village bakery, makes only two types of loaf, small and large. There is unlimited demand for this bread and both products use the same skilled labour of bakers, which is in short supply. The product data are as follows:

	Small	Large
Sales price per loaf	€0.71	€0.85
Variable cost per loaf	€0.51	€0.61
Contribution per loaf	€0.20	€0.24
Minutes of skilled labour per loaf	20	30

Required:

Determine the contribution-maximising strategy for Need the Dough.

Solution

If we consider the contribution per unit of scarce resource, one hour of skilled labour, we can see that the contribution for each loaf per hour is:

Small loaves earn €0.60 per labour hour [60/20 x 20c]
Large loaves earn €0.48 per labour hour [60/30 x 24c]

So even though large loaves generate a larger unit contribution of 24c compared to 20c earned by small loaves, the contribution-maximising strategy for Need the Dough is to bake and sell as many small loaves as possible which generate a contribution of 60c compared with 48c for large loaves, per each hour of scarce labour.