Chapter 5 – Cost-Volume-Profit Relationships

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Exercise 5-2

Rejman Enterprises distributes a single product whose selling price is $25 per unit and whose variable expense is $15 per unit. The company's monthly fixed expense is $35,000.

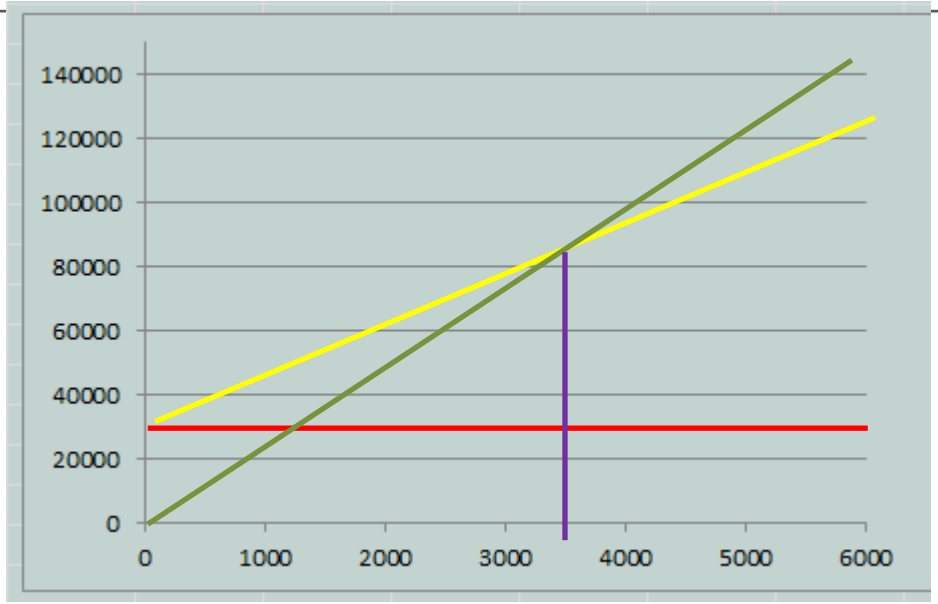
***Required**:*

1. Prepare a cost-volume-profit graph for the company up to a sales level of 6,000 units.
2. Estimate the company's break-even point in unit sales using your cost-volume-profit graph.

[LO2]

Requirement 1: Prepare a cost-volume- profit graph for the company up to a sales level of 6,000 units.

Requirement 2: Estimate the company's break-even point in unit sales using your cost-volume-profit graph.



Fixed expenses	$ 35,000
Variable expenses (6,000 units × $15 per unit)	90,000
Total expense	$ 125,000

$$Breakeven = \frac{Fixed\ costs}{CM/unit}$$

$$= \frac{\$35{,}000}{\$10}$$

$$= 3{,}500\ units$$

Exercise 5-6

Allwill Products distributes a single product, a decorative plate whose selling price is $10 and whose variable cost is $6 per unit. The company's monthly fixed expense is $7,500.

***Required**:*

1. Calculate the company's break-even point in unit sales.
2. Calculate the company's break-even point in dollar sales.
3. If the company's fixed expenses increase by $500, what would become the new breakeven point in unit sales? In dollar sales?

[LO5]

***Requirement 1**:* Compute the company's break-even point in unit sales.

***Requirement 2**:* Compute the company's break-even point in dollar sales.

Profit = Unit CM × Q − Fixed expenses

$0 = ($10 − $6) × Q − $7,500

$0 = $4 × Q − $7,500

$4 × Q = $7,500

Q = $7,500 ÷ $4

Q = 1,875 plates

Unit sales to break even 1,875

Selling price per unit $10

Dollar sales to break even $18,750

***Requirement 3**:* If the company's fixed expenses increase by $500, what would become the new breakeven point in unit sales? In dollar sales?

Profit = Unit CM × Q − Fixed expenses

$0 = ($10 − $6) × Q − $8,000

$0 = $4 × Q − $8,000

$4 × Q = $8,000

Q = $8,000 ÷ $4

Q = 2,000 plates

Unit sales to break even 2,000

Selling price per unit $10

Dollar sales to break even $20,000

Exercise 5-7

Stepman Corporation has a single product whose selling price is $200 and whose variable expense is $150 per unit. The company's monthly fixed expense is $75,000.

***Required**:*

1. Calculate the unit sales needed to attain a target profit of $9,000.
2. Calculate the dollar sales needed to attain a target profit of $10,000.

[LO6]

***Requirement 1**:* Calculate the unit sales needed to attain a target profit of $9,000.

$$\text{Profit} = \text{Unit CM} \times Q - \text{Fixed expenses}$$

$$\$9{,}000 = (\$200 - \$150) \times Q - \$75{,}000$$

$$\$9{,}000 = (\$50) \times Q - \$75{,}000$$

$$\$50 \times Q = \$9{,}000 + \$75{,}000$$

$$Q = \$84{,}000 \div \$50$$

$$Q = 1{,}680 \text{ units}$$

***Requirement 2**:* Calculate the dollar sales needed to attain a target profit of $10,000.

$$\text{Dollar sales to attain the target profit} = \frac{\text{Target profit} + \text{Fixed expenses}}{\text{Contribution margin ratio}}$$

$$= \frac{\$10{,}000 + \$75{,}000}{25\%}$$

$$= \frac{\$85{,}000}{25\%} = \$340{,}000$$

Exercise 5-10

Shamrock Products markets two video games: Running and Skiing. A contribution format income statement for a recent month for the two games appears below:

	Running	Skiing	Total
Sales	$120,000	$40,000	$160,000
Variable expenses	55,000	17,000	72,000
Contribution margin	$ 65,000	$23,000	88,000
Fixed expenses			41,250
Net operating income			$ 46,750

***Required**:*

1. Compute the overall contribution margin (CM) ratio for the company.
2. Compute the overall break-even point for the company in dollar sales .
3. Verify the overall break-even point for the company by constructing a contribution format income statement showing the appropriate levels of sales for the two products.

[LO9]

Requirement 1: Compute the overall contribution margin (CM) ratio for the company.

Requirement 2: Compute the overall break-even point for the company in sales dollars.

$$\text{Overall CM ratio} = \frac{\text{Total contribution margin}}{\text{Total sales}} = \frac{\$88{,}000}{\$160{,}000} = 55\%$$

$$\text{Overall break-even} = \frac{\text{Total fixed expenses}}{\text{Overall CM ratio}} = \frac{\$41{,}250}{55\%} = \$75{,}000$$

Requirement 3: Verify the overall break-even point for the company by constructing a contribution format income statement showing the appropriate levels of sales for the two products.

	Running	Skiing	Total
Original dollar sales	$120,000	$40,000	$160,000
Percent of total	75%	25%	100%
Sales at break-even	$ 56,250	$18,750	$ 75,000

	Running	Skiing	Total
Sales	$ 56,250	$18,750	$ 75,000
Variable expenses	25,781	7,969	33,750
Contribution margin	$ 30,469	$10,781	41,250
Fixed expenses			41,250
Net operating income			$ 0

Exercise 5-11

Fill in the missing amounts in each of the four case situations below. Each case is independent of the others. (*Hint:* One way to find the missing amounts would be to prepare a contribution format income statement for each case, enter the known data, and then compute the missing items.)

Case	Units Sold	Sales	Variable Expenses	Contribution Margin per Unit	Fixed Expenses	Net Operating Income
A	20,000	$300,000	$220,000	?	$45,000	?
B	12,000	?	$120,000	$15	?	$18,000

Case	Sales	Variable Expenses	Average Contribution Margin Ratio	Fixed Expenses	Net Operating Income
C	$900,000	?	40%	?	$125,000
D	?	?	45%	$120,000	$37,500

***Required**:*

1. Cases A and B assume that only one product is being sold.
2. Cases C and D assume that more than one product is being sold.

[LO1], [LO9]

Requirement 1: Cases A and B assume that only one product is being sold.

Case A		
Number of units sold	20,000	
Sales	$ 300,000	$ 15
Variable expenses	220,000	11
Contribution margin	80,000	$ 4
Fixed expenses	45,000	
Net operating income	$ 35,000	

Case B		
Number of units sold	12,000	
Sales	$ 300,000	$ 25
Variable expenses	120,000	10
Contribution margin	180,000	$ 15
Fixed expenses	162,000	
Net operating income	$ 18,000	

Requirement 2: Cases C and D assume that more than one product is being sold.

Case C		
Sales	$ 900,000	100%
Variable expenses	540,000	60%
Contribution margin	360,000	40%
Fixed expenses	235,000	
Net operating income	$ 125,000	

Case D		
Sales	$ 350,000	100%
Variable expenses	192,500	55%
Contribution margin	157,500	45%
Fixed expenses	120,000	
Net operating income	$ 37,500	

Exercise 5-12

Tralynna Products distributes two premium kid chairs—Hayden Recliner and Hadley Rocking. Monthly sales and the contribution margin ratios for the two products follow:

	Hayden Recliner	Hadley Rocking	Total
Sales	$600,000	$300,000	$900,000
CM ratio	75%	45%	?

Fixed expenses total $360,750 per month.

Required:

1. Prepare a contribution format income statement for the company as a whole. Carry computations to one decimal place.
2. What is the company's break-even point in dollar sales based on the current sales mix?
3. If sales increased by $120,000 a month, by how much would you expect the monthly net operating income to increase?

[LO9]

Requirement 1: Prepare a contribution format income statement for the company as a whole. Carry computations to one decimal place.

	Hayden Recliner	Hadley Rocking	Total
Sales	$600,000	$300,000	$900,000
Variable expenses	150,000	165,000	315,000
Contribution margin	$450,000	$135,000	585,000
Fixed expenses			360,750
Net operating income			$224,250

Requirement 2: What is the company's break-even in dollar sales based on the current sales mix?

$$\text{Overall CM ratio} = \frac{\text{Total contribution margin}}{\text{Total sales}}$$

$$= \frac{\$585{,}000}{\$900{,}000}$$

$$= 65.0\%$$

$$\text{Overall break-even} = \frac{\text{Total fixed expenses}}{\text{Overall CM ratio}}$$

$$= \frac{\$360{,}750}{65\%}$$

$$= \$555{,}000$$

Requirement 3: If sales increased by $120,000 a month, by how much would you expect the monthly net operating income to increase?

Increase to operating income $\$120{,}000 \times 65.0\% = \$78{,}000$

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Exercise 5-13

Miller Company's contribution format income statement for the most recent month is shown below:

	Total	Per Unit
Sales (25,000 units)	$450,000	$18.00
Variable expenses	250,000	10.00
Contribution margin	$200,000	$ 8.00
Fixed expenses	85,000	
Net operating income	$115,000	

***Required**:* (Consider each case independently):

1. What is the revised net operating income if unit sales increase by 20%?
2. What is the revised net operating income if the selling price decreases by $2.00 per unit and the number of units sold increases by 15%?
3. What is the revised net operating income if the selling price increases by $2.00 per unit, fixed expenses increase by $15,000, and the number of units sold decreases by 4%?
4. What is the revised net operating income if the selling price per unit increases by 10%, variable expenses increase by 80 cents per unit, and the number of units sold decreases by 8%?

[LO1], [LO4]

***Requirement 1**:* What is the revised net operating income if unit sales increase by 20%?

	Total	Per Unit
Sales (25,000 units × 1.2 = 30,000 units)	$540,000	$18.00
Variable expenses	300,000	10.00
Contribution margin	240,000	$ 8.00
Fixed expenses	85,000	
Net operating income	$155,000	

***Requirement 2**:* What is the revised net operating income if the selling price decreases by $2.00 per unit and the number of units sold increases by 15%?

	Total	Per Unit
Sales (25,000 units × 1.15 = 28,750 units)	$460,000	$16.00
Variable expenses	287,500	10.00
Contribution margin	172,500	$ 6.00
Fixed expenses	85,000	
Net operating income	$ 87,500	

***Requirement 3**:* What is the revised net operating income if the selling price increases by $2.00 per unit, fixed expenses increase by $15,000, and the number of units sold decreases by 4%?

	Total	Per Unit
Sales (25,000 units × 0.96 = 24,000 units)	$480,000	$20.00
Variable expenses	240,000	10.00
Contribution margin	240,000	$10.00
Fixed expenses	100,000	
Net operating income	$140,000	

***Requirement 4**:* What is the revised net operating income if the selling price per unit increases by 10%, variable expenses increase by 80 cents per unit, and the number of units sold decreases by 8%?

	Total	Per Unit
Sales (25,000 units × 0.92 = 23,000 units)	$455,400	$19.80
Variable expenses	248,400	10.80
Contribution margin	207,000	$ 9.00
Fixed expenses	85,000	
Net operating income	$122,000	

Exercise 5A-1

The Empire Hotel in Vail, Colorado has accumulated records of the total electrical costs of the hotel and the number of occupancy-days over the last year. An occupancy-day represents a room rented out for one day. The Hotel's business is highly seasonal, with peaks occurring during the ski season and in the summer.

Month	Occupancy-Days	Electrical Costs
January	2,890	$6,945
February	3,170	$7,271
March	3,794	$8,864
April	1,598	$4,464
May	599	$2,541
June	1,239	$3,986
July	3,892	$9,003
August	3,510	$8,063
September	384	$1,952
October	1,399	$4,115
November	1,199	$3,686
December	2,271	$5,768

Required:

Using the high-low method, estimate the fixed cost of electricity per month and the variable cost of electricity per occupancy-day. Round off the fixed cost to the nearest whole dollar and the variable cost to the nearest whole cent.

[LO10]

Requirement 1:

Using the high-low method, estimate the fixed cost of electricity per month and the variable cost of electricity per occupancy-day. Round off the fixed cost to the nearest whole dollar and the variable cost to the nearest whole cent.

Month	Occupancy-Days	Electrical Costs
January	2,890	$6,945
February	3,170	$7,271
March	3,794	$8,864
April	1,598	$4,464
May	599	$2,541
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August	3,510	$8,063
September	384	$1,952
October	1,399	$4,115
November	1,199	$3,686
December	2,271	$5,768

July	3,892	$9,003
September	384	$1,952
Difference	3,508	$7,051

/

$2.01 X

$7,823	Variable
$1,180	Fixed

Total

Variable: $2.01 per occupancy-day
Fixed: $1,180 per month

Exercise 5A-3

Expedited Delivery operates a fleet of delivery trucks in a large metropolitan area. A careful study by the company's cost analyst has determined that if a truck is driven 200,000 miles during a year, the average operating cost is 9.6 cents per mile. If a truck is driven only 130,000 miles during a year, the average operating cost increases to 11.6 cents per mile.

***Required**:*

1. Using the high-low method, estimate the variable and fixed cost elements of the annual cost of truck operation.
2. Express the variable and fixed costs in the form $Y = a + bX$.
3. If a truck were driven 150,000 miles during a year, what total cost would you expect to be incurred?

[LO10]

Requirement 1

Using the high-low method, estimate the variable and fixed cost elements of the annual cost of truck operation.

	Miles Driven	Cost Per Mile	Total Annual Cost	Variable Portion
High level of activity	200,000	$0.096	$19,200	
Low level of activity	130,000	0.116	15,080	
Change	70,000		$ 4,120	$0.06

Total cost at 200,000 miles	$19,200
Less variable cost element:	
200,000 miles × $0.06 per mile	12,000
Fixed cost per year	$7,200

Requirement 2

Express the variable and fixed costs in the form $Y = a + bX$.

$$Y = \$7,200 + .06X$$

Requirement 3

If a truck were driven 150,000 miles during a year, what total cost would you expect to be incurred?

$$Y = \$7,200 + .06X$$

$$Y = \$7,200 + .06(150,000)$$

$$Y = \$16,200$$

Exercise 5A-5

Solène & Soeurs, located in Toulouse, France, makes high-tech stopwatches in small batches. The company has observed electricity costs in the table at the right over the last six weeks.

For planning purposes, management would like to know the amount of variable electricity cost per unit and the total fixed electricity cost per week.

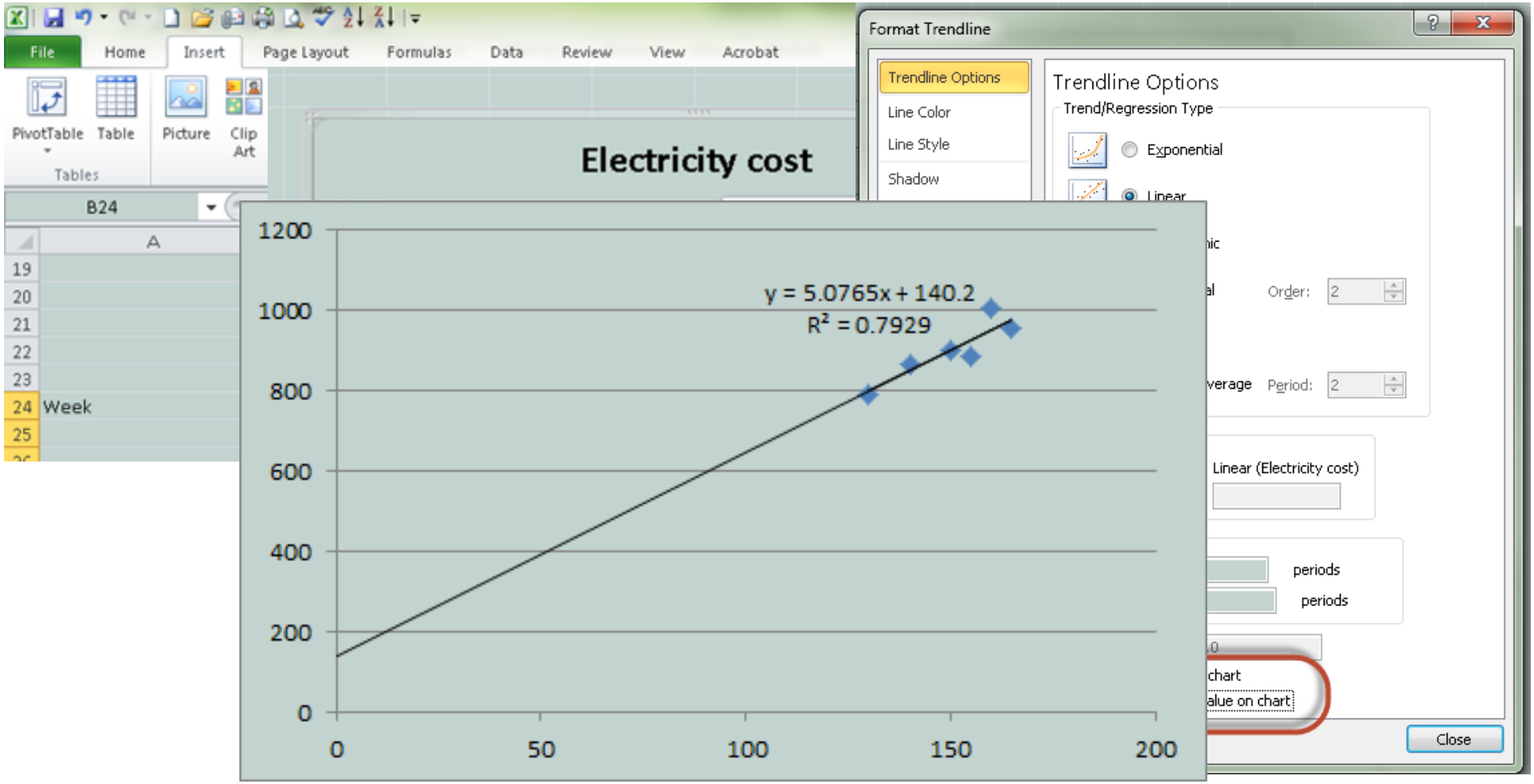
Week	Units	Electricity Cost
1	150	$ 900
2	130	793
3	165	957
4	155	884
5	160	1,008
6	140	868
	900	$5,410

Required:

1. Prepare a scattergraph plot. (Place electricity costs on the vertical axis and units on the horizontal axis.)
2. Using the least-squares regression method, estimate the variable and fixed elements of electricity cost. Express these estimates in the form $Y = a + bX$.
3. If the company processes 145 units next week, what would be the expected total electricity cost?

[LO11]

Requirement 1: Prepare a scattergraph plot. (Place electricity costs on the vertical axis and units on the horizontal axis.)



Requirement 2: Using the least-squares regression method, estimate the variable and fixed elements of etching cost. Express these estimates in the form $Y = a + bX$.

R-squared	79%
Intercept	$140.20
Slope	$ 5.08

$$Total\ cost = \$140.20 + \$5.08 \times units$$

Requirement 3: If the company processes 145 units next week, what would be the expected total electricity cost?

Variable cost: 145 units × $5.08 per unit	$ 736.60
Fixed cost	140.20
Total expected cost	$ 876.80