

# Cost-Volume-Profit Analysis

Adaptado del Libro:  
Contabilidad: Base de las  
Decisiones Gerenciales  
de Meigs, Cap. 19

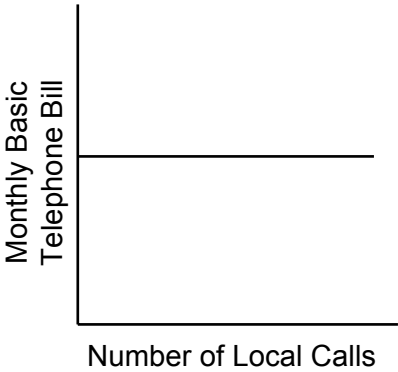
## Questions Addressed by Cost-Volume-Profit Analysis

CVP analysis is used to answer questions such as:

- | How much must I sell to earn my desired income?
- | How will income be affected if I reduce selling prices to increase sales volume?
- | What will happen to profitability if I expand capacity?

# Total Fixed Cost

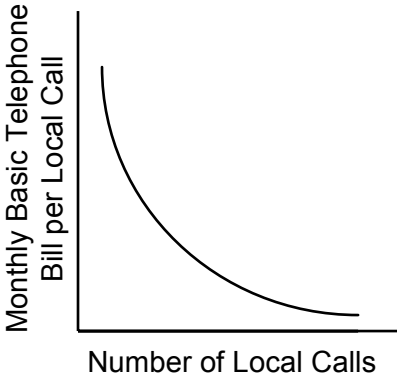
Total fixed costs remain unchanged when activity changes.



**Your monthly basic telephone bill probably does not change when you make more local calls.**

# Fixed Cost Per Unit

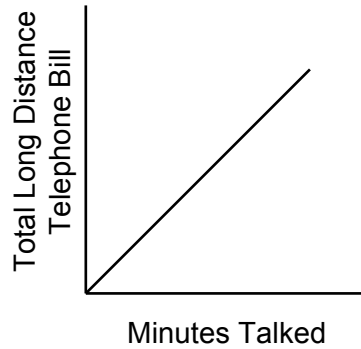
Fixed costs per unit decline as activity increases.



**Your average cost per local call decreases as more local calls are made.**

## Total Variable Cost

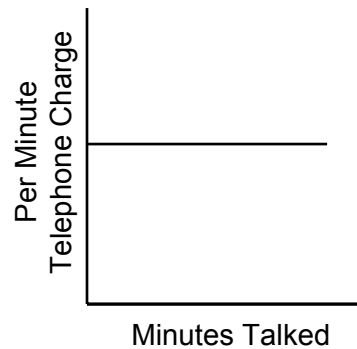
Total variable costs change when activity changes.



Your total long distance telephone bill is based on how many minutes you talk.

## Variable Cost Per Unit

Variable costs per unit do not change as activity increases.



The cost per long distance minute talked is constant.  
For example, 10 cents per minute.

## Cost Behavior Summary

### Summary of Variable and Fixed Cost Behavior

Cost	In Total	Per Unit
Variable	Changes as activity level changes.	Remains the same over wide ranges of activity.
Fixed	Remains the same even when activity level changes.	Decreases as activity level increases.

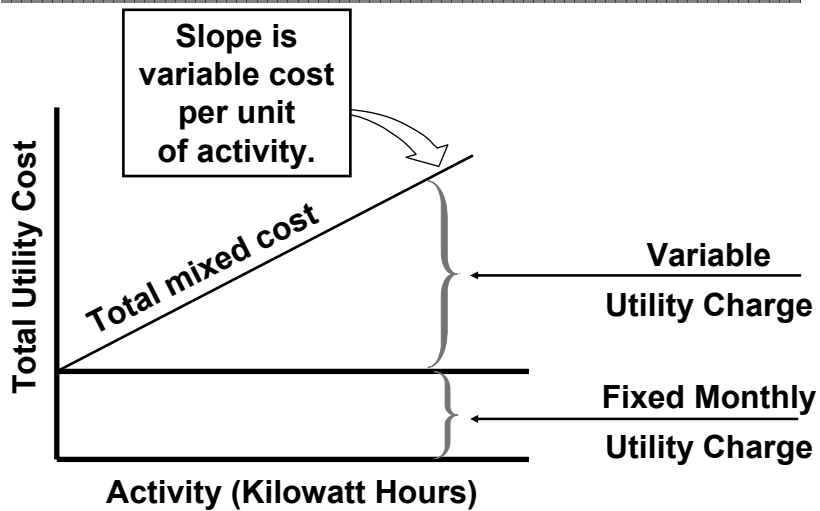
## Mixed Costs

Mixed costs contain a fixed portion that is incurred even when facility is unused, and a variable portion that increases with usage.

Example: monthly electric utility charge

- | Fixed service fee
- | Variable charge per kilowatt hour used

## Mixed Costs



## What is our Margin of Safety?

Margin of safety is the amount by which sales may decline before reaching break-even sales:

$$\text{Margin of safety} = \text{Actual sales} - \text{Break-even sales}$$

Margin of safety provides a quick means of estimating operating income at any level of sales:

$$\text{Operating Income} = \text{Margin of safety} \times \text{Contribution margin ratio}$$

## What is our Margin of Safety?

Oxco's contribution margin ratio is 40 percent. If sales are \$100,000 and break-even sales are \$80,000, what is operating income?

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$$\text{Operating Income} = \text{Margin of safety} \times \text{Contribution margin ratio}$$

$$\text{Operating Income} = \$20,000 \times .40 = \$8,000$$

## What Change in Operating Income Do We Anticipate?

Once break-even is reached, every additional dollar of contribution margin becomes operating income:

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Oxco expects sales to increase by \$15,000. How much will operating income increase?

$$\text{Change in operating income} = \$15,000 \times .40 = \$6,000$$

## Business Applications of CVP

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Consider the following information developed by the accountant at CyclCo, a bicycle retailer:

	Total	Per Unit	Percent
Sales (500 bikes)	\$ 250,000	\$ 500	100%
Less: variable expenses	150,000	300	60%
Contribution margin	\$ 100,000	<u>\$ 200</u>	<u>40%</u>
Less: fixed expenses	80,000		
Operating income	<u>\$ 20,000</u>		



## Business Applications of CVP

Should CyclCo spend \$12,000 on advertising to increase sales by 10 percent?

	Total	Per Unit	Percent
Sales (500 bikes)	\$ 250,000	\$ 500	100%
Less: variable expenses	150,000	300	60%
Contribution margin	\$ 100,000	<u>\$ 200</u>	<u>40%</u>
Less: fixed expenses	80,000		
Operating income	<u>\$ 20,000</u>		



## Business Applications of CVP

Should CyclCo spend \$12,000 on advertising to increase sales by 10 percent?

	500 Bikes	$550 \times \$500$	550 Bikes
Sales	\$ 250,000		\$ 275,000
Less: variable expenses	150,000	$550 \times \$300$	165,000
Contribution margin	\$ 100,000		\$ 110,000
Less: fixed expenses	80,000		92,000
Operating income	\$ 20,000	$\$80K + \$12K$	\$ 18,000

No, income is decreased.



## Business Applications of CVP

Now, in combination with the advertising, CyclCo is considering a 10 percent price reduction that will increase sales by 25 percent. What is the income effect?

	500 Bikes	
Sales	\$ 250,000	_____
Less: variable expenses	150,000	_____
Contribution margin	\$ 100,000	_____
Less: fixed expenses	80,000	_____
Operating income	\$ 20,000	_____



## Business Applications of CVP

Now, in combination with the advertising, CyclCo is considering a 10 percent price reduction that will increase sales by 25 percent. What is the income effect?

	500 Bikes	$1.25 \times 500$	→ 625 Bikes
Sales	\$ 250,000	$625 \times \$450$	\$ 281,250
Less: variable expenses	150,000		187,500
Contribution margin	\$ 100,000	$625 \times \$300$	\$ 93,750
Less: fixed expenses	80,000		92,000
Operating income	<u>\$ 20,000</u>	$\$80K + \$12K$	<u>\$ 1,750</u>

Income is decreased even more.



## Business Applications of CVP

Now, in combination with advertising and a price cut, CyclCo will replace \$50,000 in sales salaries with a \$25 per bike commission, increasing sales by 50 percent above the original 500 bikes. What is the effect on income?

	500 Bikes		
Sales	\$ 250,000		_____
Less: variable expenses	150,000		_____
Contribution margin	\$ 100,000		_____
Less: fixed expenses	80,000		_____
Operating income	<u>\$ 20,000</u>		<u>_____</u>



## Business Applications of CVP

Now, in combination with advertising and a price cut, CyclCo will replace \$50,000 in sales salaries with a \$25 per bike commission, increasing sales by 50 percent above the original 500 bikes. What is the effect on income?

	500 Bikes	1.5 × 500 → 750 Bikes
Sales	\$ 250,000	750 × \$450 \$ 337,500
Less: variable expenses	150,000	→ 243,750
Contribution margin	\$ 100,000	750 × \$325 \$ 93,750
Less: fixed expenses	80,000	→ 42,000
Operating income	<u>\$ 20,000</u>	<u>\$ 51,750</u> \$92K - \$50K

**The combination of advertising, a price cut, and change in compensation increases income.**



## CVP Analysis When a Company Sells Many Products

Sales mix is the relative combination in which a company's different products are sold.

Different products have different selling prices, costs, and contribution margins.

If CyclCo sells bikes and carts and how will we deal with break-even analysis?



## CVP Analysis When a Company Sells Many Products

CyclCo provides us with the following information:

	Bikes		Carts		Total	
Sales	\$ 250,000	100%	\$ 300,000	100%	\$ 550,000	100%
Var. exp.	150,000	60%	135,000	45%	285,000	52%
Contrib. margin	\$ 100,000	40%	\$ 165,000	55%	\$ 265,000	48%
Fixed exp.					170,000	
Net income					\$ 95,000	



## CVP Analysis When a Company Sells Many Products

The overall contribution margin ratio is:

	Bikes		Carts		Total	
Sales	\$ 250,000	100%	\$ 300,000	100%	\$ 550,000	100%
Var. exp.	150,000	60%	135,000	45%	285,000	52%
Contrib. margin	\$ 100,000	40%	\$ 165,000	55%	\$ 265,000	48%
Fixed exp.					170,000	
Net income					\$ 95,000	

$$\frac{\$265,000}{\$550,000} = 48\% \text{ (rounded)}$$



## CVP Analysis When a Company Sells Many Products

**Break-even in sales dollars is:**

	Bikes		Carts		Total	
Sales	\$ 250,000	100%	\$ 300,000	100%	\$ 550,000	100%
Var. exp.	150,000	60%	135,000	45%	285,000	52%
Contrib. margin	<u>\$ 100,000</u>	<u>40%</u>	<u>\$ 165,000</u>	<u>55%</u>	<u>\$ 265,000</u>	<u>48%</u>
Fixed exp.					170,000	
Operating income					<u>\$ 95,000</u>	

$$\frac{\$170,000}{.48} = \$354,167 \text{ (rounded)}$$



## The High-Low Method

OwlCo recorded the following production activity and maintenance costs for two months:

	Units	Cost
High activity level	9,000	\$9,700
Low activity level	<u>5,000</u>	<u>6,100</u>
Change	<u>4,000</u>	<u>\$3,600</u>

Using these two levels of activity, compute:

- ① the variable cost per unit.
- ② the total fixed cost.
- ③ total cost formula.



## The High-Low Method

	Units	Cost
High activity level	9,000	\$9,700
Low activity level	5,000	6,100
Change	<u>4,000</u>	<u>\$3,600</u>

① Unit variable cost =  $\frac{\Delta \text{ in cost}}{\Delta \text{ in units}} = \frac{\$3,600}{4,000} = \$0.90$  per unit



## The High-Low Method

	Units	Cost
High activity level	9,000	\$9,700
Low activity level	5,000	6,100
Change	<u>4,000</u>	<u>\$3,600</u>

① Unit variable cost =  $\frac{\Delta \text{ in cost}}{\Delta \text{ in units}} = \frac{\$3,600}{4,000} = \$0.90$  per unit

② Fixed cost = Total cost – Total variable cost



## The High-Low Method

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① Unit variable cost =  $\frac{\Delta \text{ in cost}}{\Delta \text{ in units}} = \frac{\$3,600}{4,000} = \$0.90$  per unit

② Fixed cost = Total cost – Total variable cost

Fixed cost = \$9,700 – (\$0.90 per unit × 9,000 units)

Fixed cost = \$9,700 – \$8,100 = \$1,600



## The High-Low Method

	Units	Cost
High activity level	9,000	\$9,700
Low activity level	<u>5,000</u>	<u>6,100</u>
Change	<u>4,000</u>	<u>\$3,600</u>

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② Fixed cost = Total cost – Total variable cost

Fixed cost = \$9,700 – (\$0.90 per unit × 9,000 units)

Fixed cost = \$9,700 – \$8,100 = \$1,600

③ Total cost = \$1,600 + \$0.90 per unit



## The High-Low Method Question 1

If sales commissions are \$10,000 when 80,000 units are sold and \$14,000 when 120,000 units are sold, what is the variable portion of sales commission per unit sold?

- a. \$.08 per unit
- b. \$.10 per unit
- c. \$.12 per unit
- d. \$.125 per unit

## The High-Low Method Question 1

If sales commissions are \$10,000 when 80,000 units are sold and \$14,000 when 120,000 units are sold, what is the variable portion of sales commission per unit sold?

- a. \$.08 per unit
- b. \$.10 per unit
- c. \$.12 per unit
- d. \$.125 per unit

	Units	Cost
High level	120,000	\$ 14,000
Low level	<u>80,000</u>	<u>10,000</u>
Change	<u>40,000</u>	<u>\$ 4,000</u>

$$\begin{aligned} & \$4,000 \div 40,000 \text{ units} \\ & = \$ .10 \text{ per unit} \end{aligned}$$

## The High-Low Method Question 2

If sales commissions are \$10,000 when 80,000 units are sold and \$14,000 when 120,000 units are sold, what is the fixed portion of the sales commission?

- a. \$ 2,000
- b. \$ 4,000
- c. \$10,000
- d. \$12,000

## The High-Low Method Question 2

If sales commissions are \$10,000 when 80,000 units are sold and \$14,000 when 120,000 units are sold, what is the fixed portion of the sales commission?

- a. \$ 2,000
- b. \$ 4,000
- c. \$10,000
- d. \$12,000

$$\begin{aligned} \text{Total cost} &= \text{Total fixed cost} + \text{Total variable cost} \\ \$14,000 &= \text{Total fixed cost} + (\$.10 \times 120,000 \text{ units}) \\ \text{Total fixed cost} &= \$14,000 - \$12,000 \\ \text{Total fixed cost} &= \$2,000 \end{aligned}$$

