

**GLOBAL EDITION**

**Weygandt's**  
**MANAGERIAL**  
**ACCOUNTING**  
**TOOLS FOR BUSINESS DECISION MAKING**

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**WILEY**

# 5

## Cost-Volume-Profit

### Learning Objectives

5.1

Explain variable, fixed, and mixed costs and the relevant range.

5.2

Apply the high-low method to determine the components of mixed costs.

5.3

Prepare a CVP income statement to determine contribution margin.

5.4

Compute the break-even point using three approaches.

5.5

Determine the sales required to earn target net income and determine margin of safety.

**Cost Behavior Analysis** is the study of how specific costs respond to changes in the level of business activity.

- ◆ Some costs change; others remain the same.
- ◆ Helps management plan operations and decide between alternative courses of action.
- ◆ Applies to all types of businesses and entities.
- ◆ Starting point is measuring key business activities.

# Cost Behavior Analysis

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**Cost Behavior Analysis** is the study of how specific costs respond to changes in the level of business activity.

- ◆ Activity levels may be expressed in terms of:
  - ▶ Sales dollars (in a retail company)
  - ▶ Miles driven (in a trucking company)
  - ▶ Room occupancy (in a hotel)
  - ▶ Dance classes taught (by a dance studio)
- ◆ Many companies use more than one measurement base.

# Cost Behavior Analysis

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**Cost Behavior Analysis** is the study of how specific costs respond to changes in the level of business activity.

- ◆ Changes in the level or volume of activity should be correlated with changes in costs.
- ◆ Activity level selected is called activity or volume index.
- ◆ **Activity index:**
  - ▶ Identifies the activity that causes changes in the behavior of costs.
  - ▶ Allows costs to be classified as variable, fixed, or mixed.

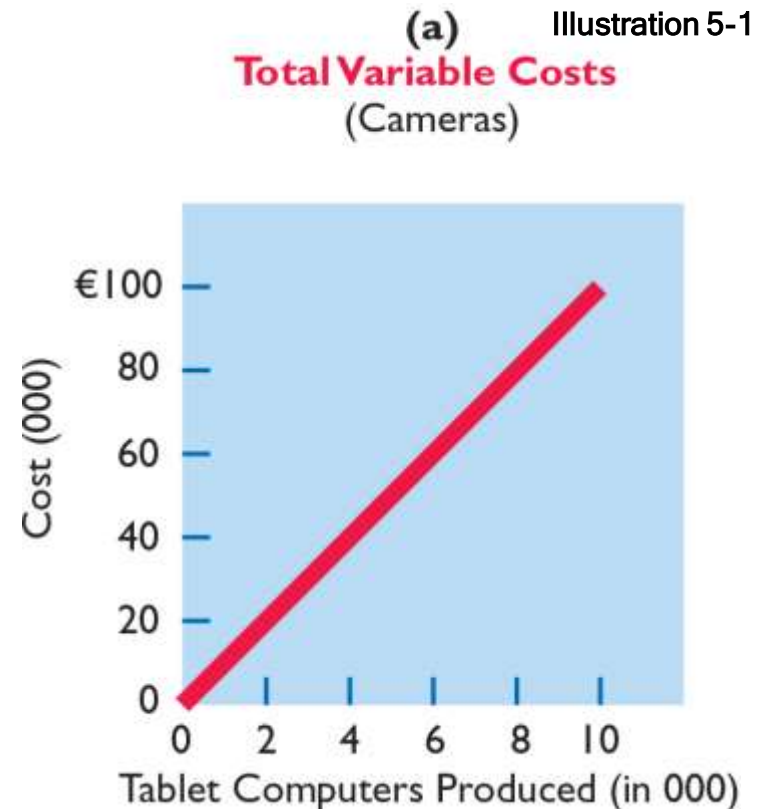
# Variable Costs

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- ◆ Costs that vary in total directly and proportionately with changes in the activity level.
  - ▶ **Example:** If the activity level increases 10 percent, total variable costs increase 10 percent.
  - ▶ **Example:** If the activity level decreases by 25 percent, total variable costs decrease by 25 percent.
- ◆ Variable costs **remain the same** per unit at every level of activity.

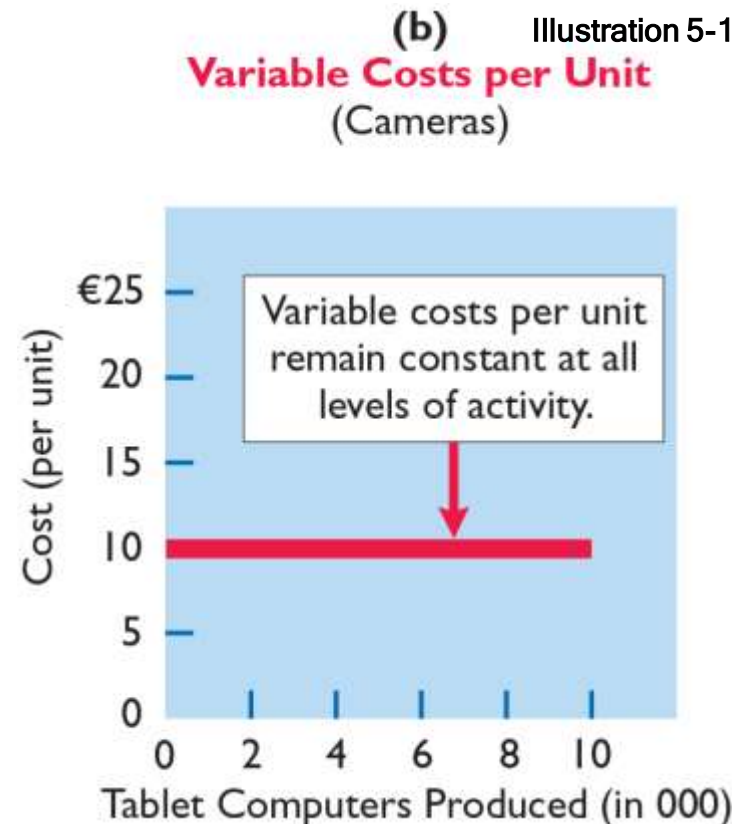
# Variable Costs

**Illustration:** Silva SpA manufactures tablet computers that contain a €10 camera. The activity index is the number of tablets produced. As Silva manufactures each tablet, the total cost of the cameras used increases by €10. **As part (a)** of Illustration 5-1 shows, total cost of the cameras will be €20,000 if Silva produces 2,000 tablets, and €100,000 when it produces 10,000 tablets. We also can see that a variable cost remains the same per unit as the level of activity changes.



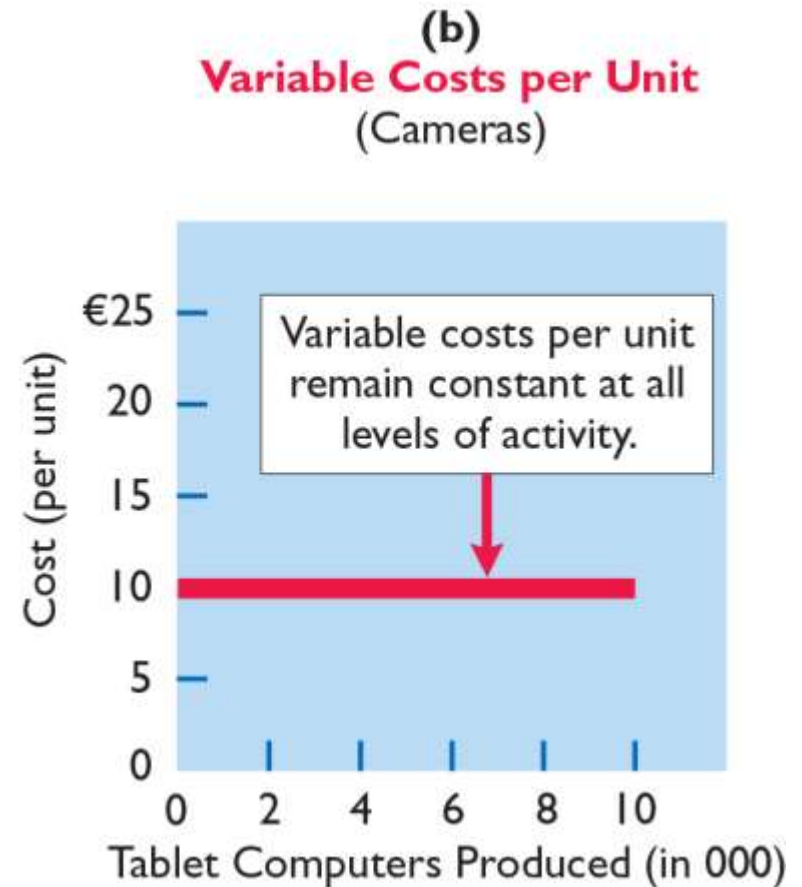
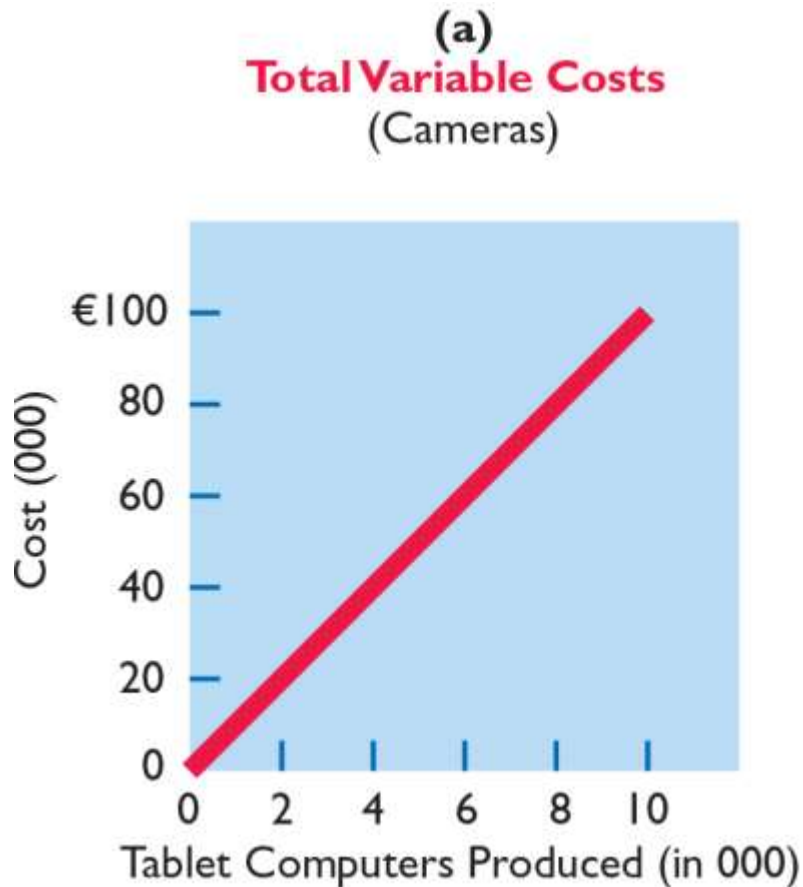
# Variable Costs

**Illustration:** Silva SpA manufactures tablet computers that contain a €10 camera. The activity index is the number of tablets produced. As Silva manufactures each tablet, the total cost of the cameras used increases by €10. **As part (b)** of Illustration 5-1 shows, the unit cost of €10 for the camera is the same whether Silva produces 2,000 or 10,000 tablets.





# Variable Costs



**Illustration 5-1**  
Behavior of total and  
unit variable costs

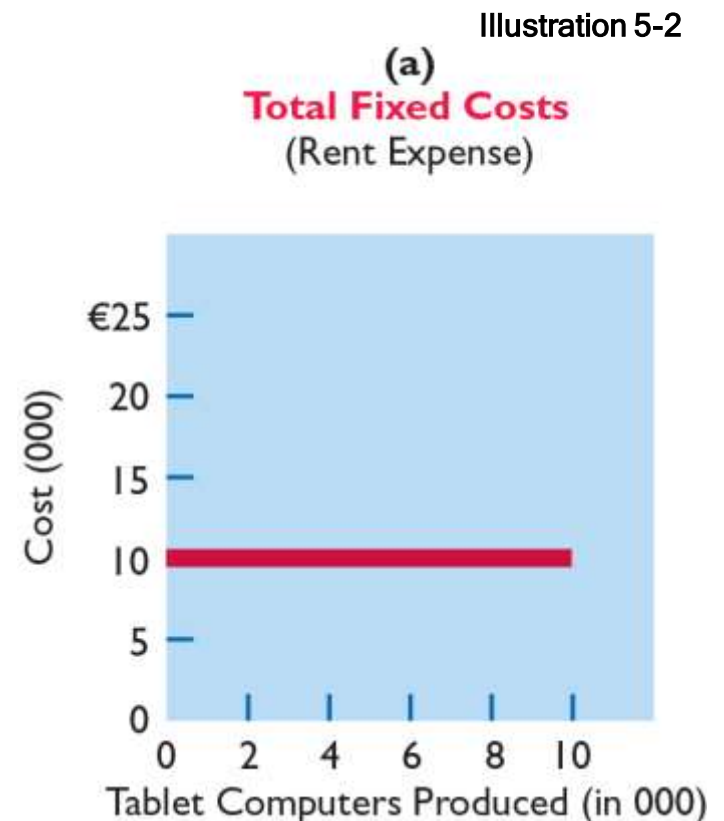
# Fixed Costs

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- ◆ **Costs that remain the same** in total regardless of changes in the activity level within a relevant range.
- ◆ **Fixed cost per unit cost varies inversely** with activity: As volume increases, unit cost declines, and vice versa
- ◆ **Examples:**
  - ▶ Property taxes
  - ▶ Insurance
  - ▶ Rent
  - ▶ Depreciation on buildings and equipment

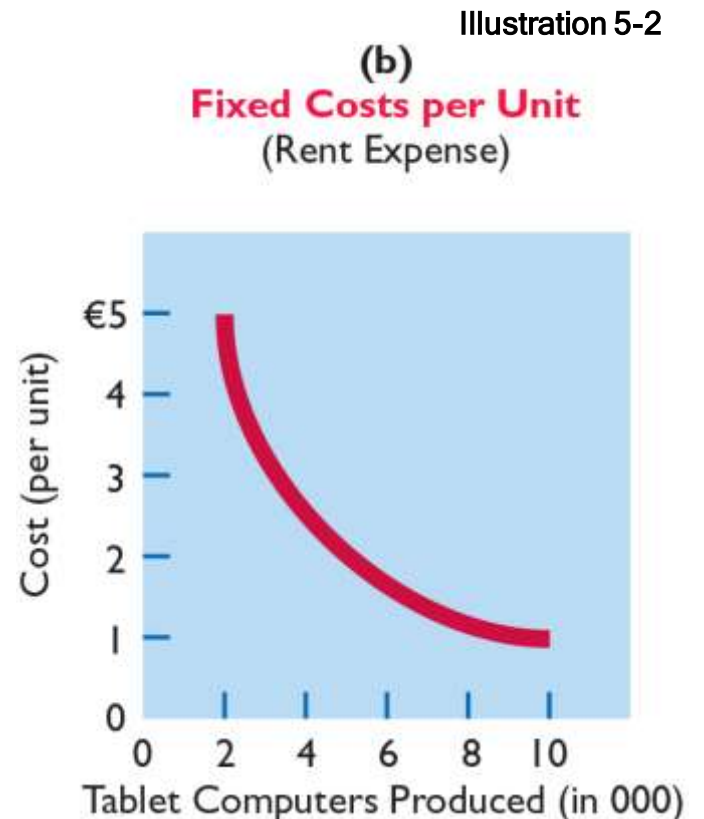
# Fixed Costs

**Illustration:** Silva Spa leases its productive facilities at a cost of €10,000 per month. Total fixed costs of the facilities will remain constant at every level of activity, as part (a) of Illustration 5-2 shows.

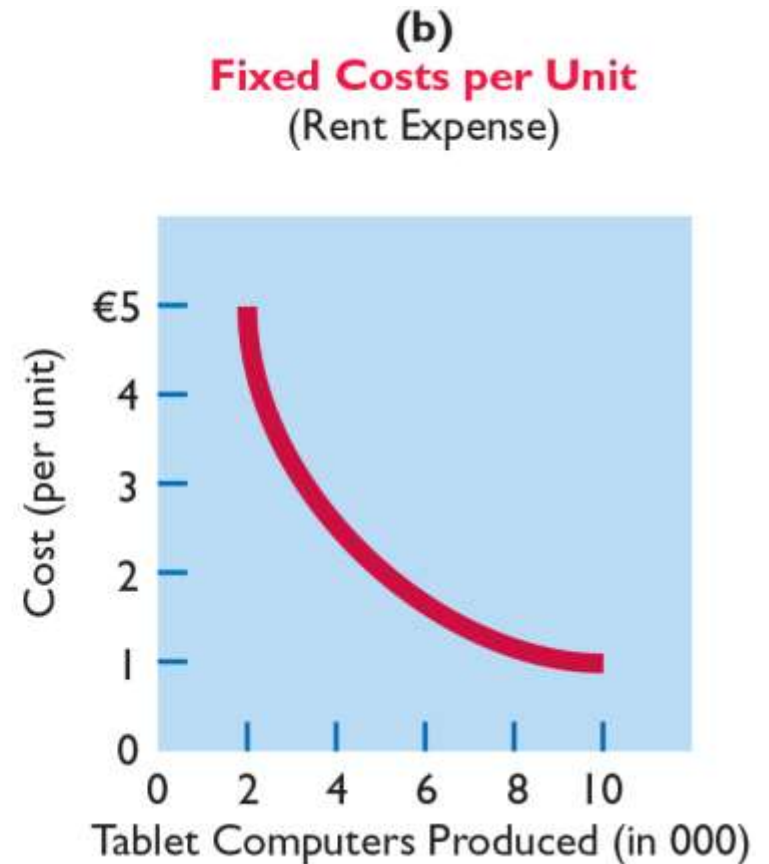
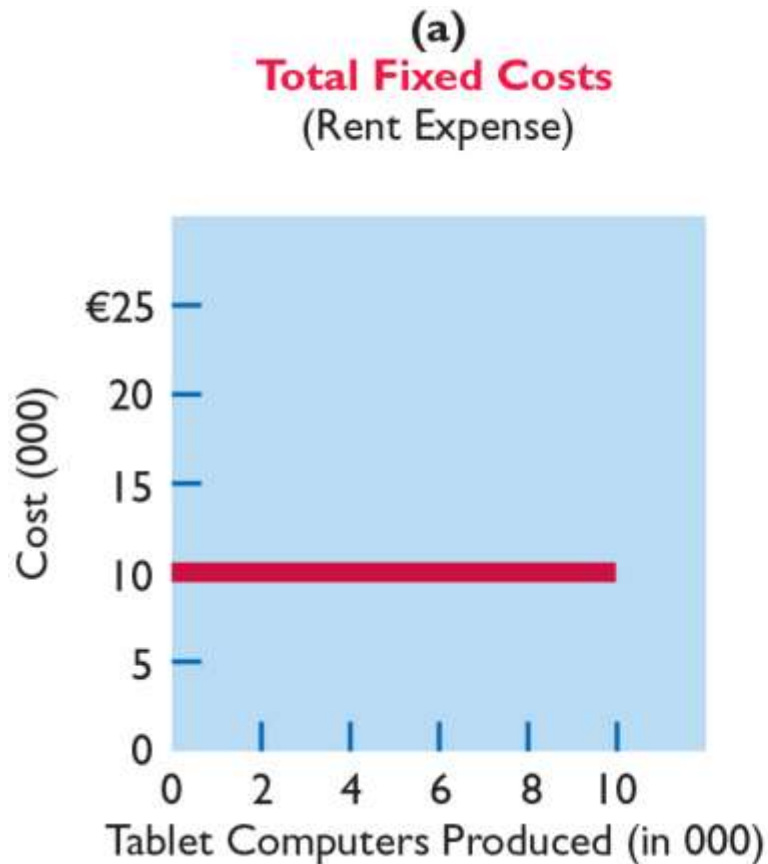


# Fixed Costs

**Illustration:** Silva Spa leases its productive facilities at a cost of €10,000 per month. Total fixed costs of the facilities will remain constant at every level of activity. But, **on a per unit basis, the cost of rent will decline as activity increases**, as part (b) of Illustration 5-2 shows. At 2,000 units, the unit cost per tablet computer is €5 ( $€10,000 \div 2,000$ ). When Silva produces 10,000 tablets, the unit cost of the rent is only €1 per tablet ( $€10,000 \div 10,000$ ).



# Fixed Costs



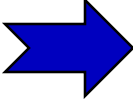
**Illustration 5-2**  
Behavior of total and  
unit fixed costs

# Fixed Costs

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## Question

Variable costs are costs that:

- a. Vary in total directly and proportionately with changes in the activity level.
- b. Remain the same per unit at every activity level.
- c. Neither of the above.
-  d. Both (a) and (b) above.



Alessandro2802/Getty Images

### Between a Rock and a Hard Place

Households in Western Australia that install solar panels sometimes generate several times the amount of energy that they use. For these surplus kilowatts generated that can be fed back into the grid, their electric company **Synergy** (AUS)

pays them a rebate (referred to as a feedback tariff). However, the amount recently paid by Synergy has been cut to a third of what imported electricity costs, so household users (and electricity producers) have to export a lot to break even. This rebate or feed-in tariff was reduced considerably because the surplus uptake due to renewables has been so great.

What this means is that when the initial customers that installed solar panels signed up for a 10-year contract under “The Premium Feed-In Tariff Scheme,” Synergy agreed to pay customers 40 cents

per unit of power they fed back into the grid. The tariff was then reduced to 20 cents, and now new customers are paid just 7.135 cents per unit under the Renewable Energy Buyback plan and have to buy electricity back at night for 26 cents per unit.

Customers, who wanted the greatest return on their investment, installed the maximum-size solar system (five-kilowatt equipment). These customers are now investigating the use of batteries to reduce the amount of power they purchase—their overnight costs—while looking to pay off their equipment investment.

**Source:** K. Diss, “Solar Panel Owners Caught Between a Rock and a Hard Place,” *ABC News* (October 22, 2016).

**If a five-kilowatt solar system costs \$24,000 to install, how many units of power were required to break-even under the original Premium Feed-In Tariff Scheme? How many units are currently required? (Go to the book’s companion website for this answer and additional questions.)**

# Relevant Range

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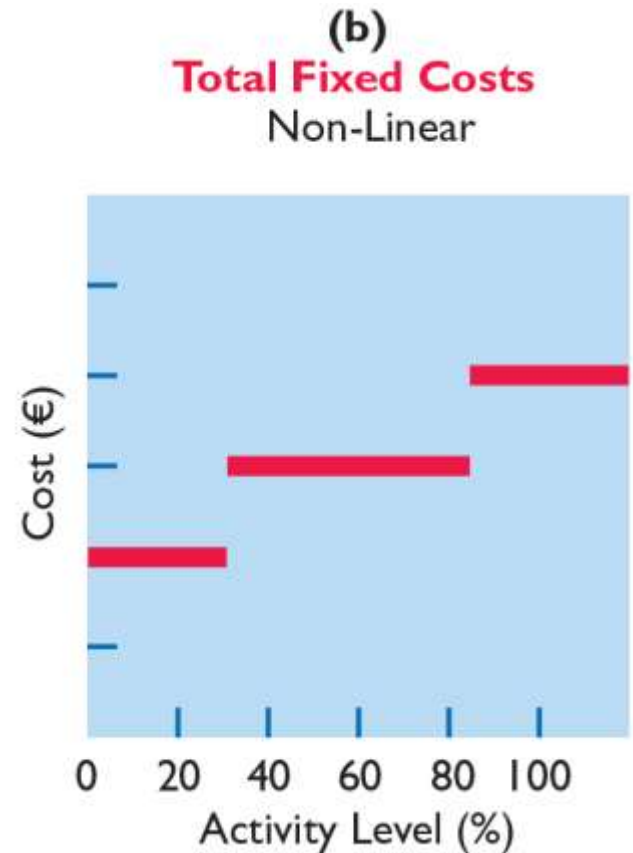
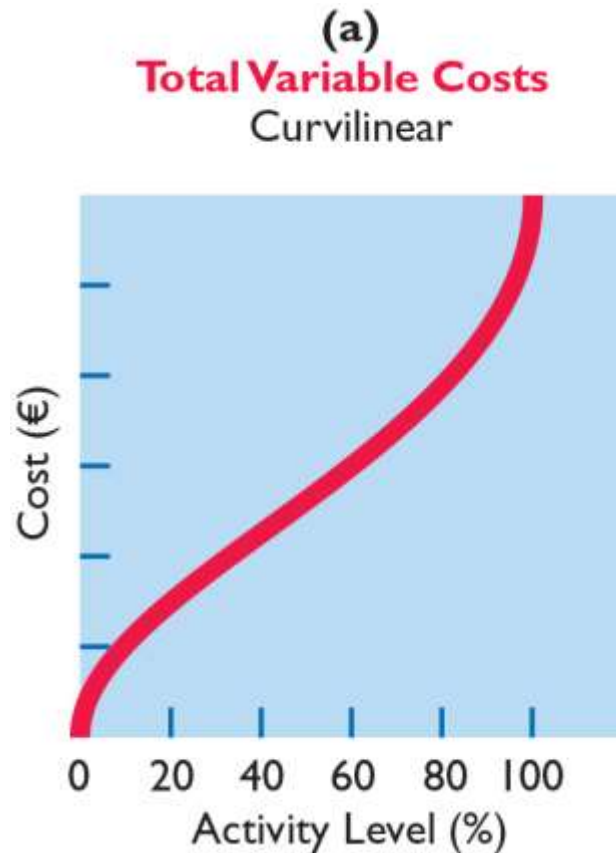
- ◆ Throughout the range of possible levels of activity, a straight-line relationship usually does not exist for either variable costs or fixed costs.
- ◆ Relationship between variable costs and changes in activity level is often **curvilinear**.
- ◆ For **fixed costs**, the **relationship is also nonlinear** - some fixed costs will not change over the entire range of activities, while other fixed costs may change.

## Helpful Hint

Fixed costs that may be changeable include research, such as new product development, and management training programs.



# Relevant Range

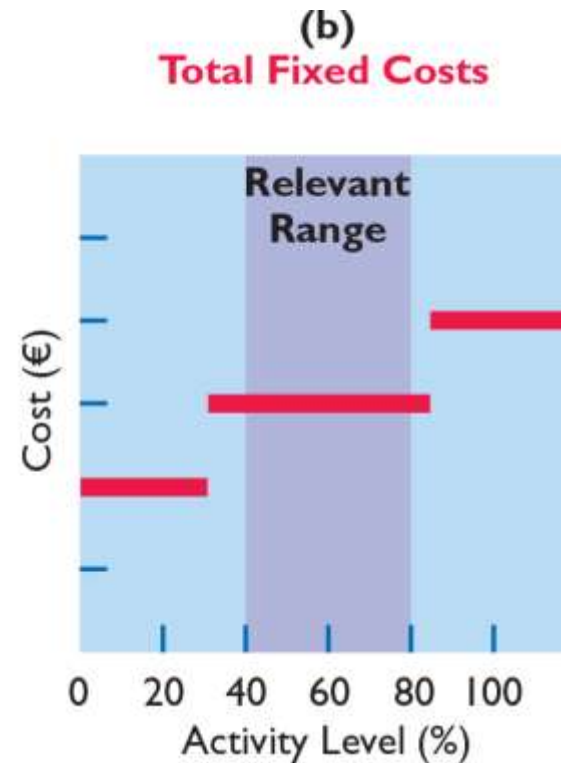
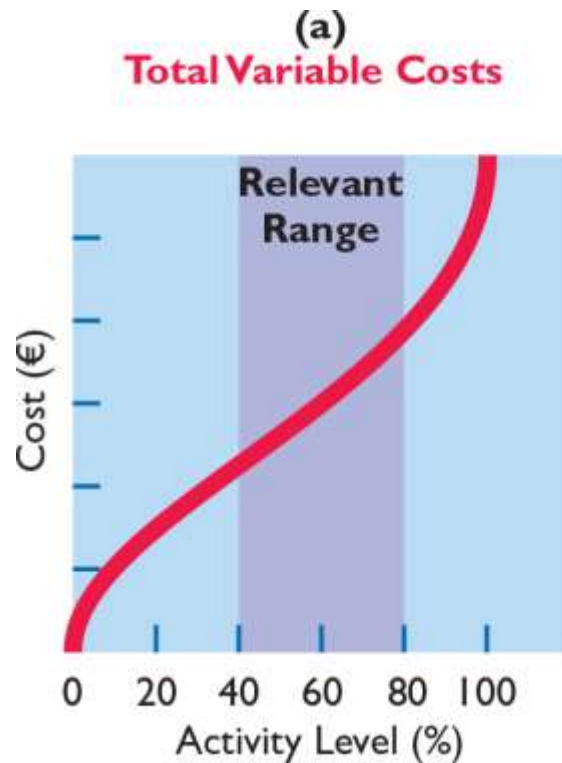


**Illustration 5-3**  
Non-linear behavior of  
variable and fixed costs

# Relevant Range

Range of activity over which a company expects to operate during a year.

Illustration 5-4  
Linear behavior within  
relevant range

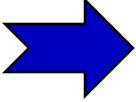


# Relevant Range

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## Question

The relevant range is:

- a. The range of activity in which variable costs will be curvilinear.
- b. The range of activity in which fixed costs will be curvilinear.
-  c. The range over which the company expects to operate during a year.
- d. Usually from zero to 100% of operating capacity.

# Mixed Costs

- ◆ Costs that have **both** a variable element **and** a fixed element.
- ◆ Change in total but not proportionately with changes in activity level.

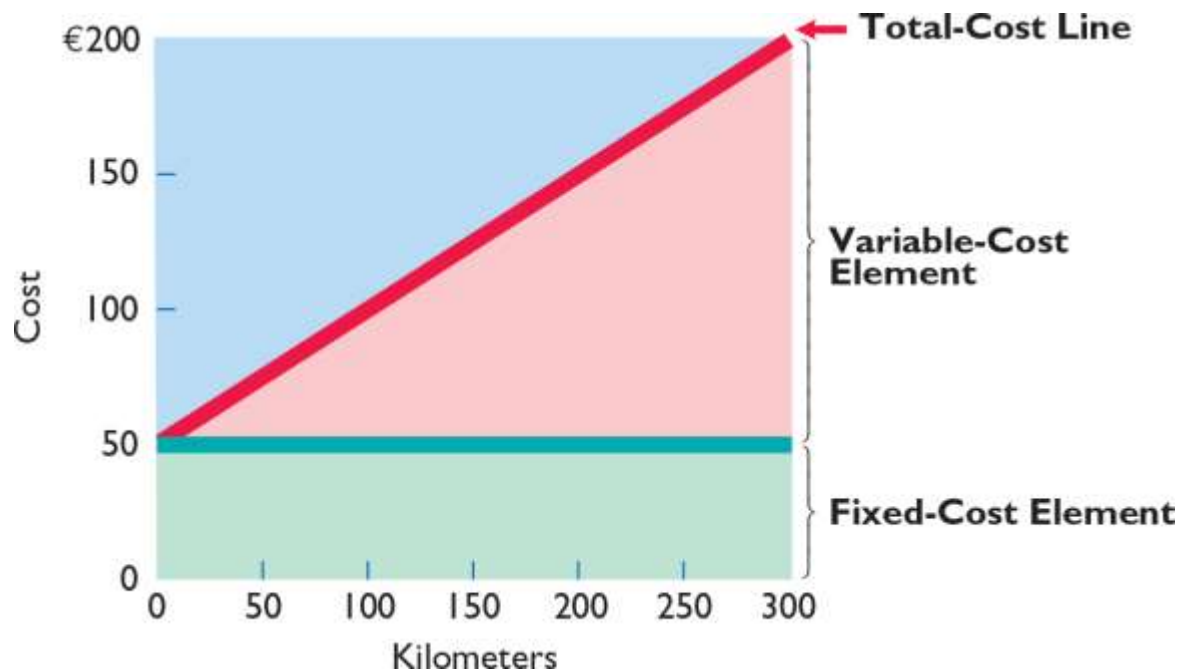


Illustration 5-5  
Behavior of a mixed cost

Yazici A.Ş, reports the following total costs at two levels of production.

Classify each cost as **variable**, **fixed**, or **mixed**.

	<u>10,000 Units</u>	<u>20,000 Units</u>	
<b>Variable</b>			
	Direct materials	₺20,000	₺40,000
	Maintenance	8,000	10,000
<b>Fixed</b>			
	Direct labor	17,000	34,000
	Indirect materials	1,000	2,000
<b>Mixed</b>			
	Depreciation	4,000	4,000
	Utilities	3,000	5,000
	Rent	6,000	6,000

## High-Low Method

- ◆ High-Low Method uses the total costs incurred at the high and the low levels of activity to classify mixed costs into fixed and variable components.
- ◆ The difference in costs between the high and low levels represents variable costs, since only variable-cost element can change as activity levels change.

# High-Low Method

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**STEP 1:** Determine **variable cost per unit** using the formula shown in Illustration 5-6.

$$\begin{array}{ccccc} \text{Change in} & & & & \\ \text{Total Costs} & \div & \text{High minus Low} & = & \text{Variable Cost} \\ & & \text{Activity Level} & & \text{per Unit} \end{array}$$

**Illustration 5-6**

Formula for variable cost per unit using high-low method

# High-Low Method

**Illustration:** Metro Transit has the maintenance costs and distance data shown in Illustration 5-7 for its fleet of buses over a 6-month period.

Illustration 5-7  
Assumed maintenance  
costs and distance data

<u>Month</u>	<u>Kilometers Driven</u>	<u>Total Cost</u>	<u>Month</u>	<u>Kilometers Driven</u>	<u>Total Cost</u>
January	<b>20,000</b>	<b>€30,000</b>	April	<b>50,000</b>	<b>€63,000</b>
February	40,000	48,000	May	30,000	42,000
March	35,000	49,000	June	43,000	61,000

Change in Costs	(€63,000 – €30,000)	€33,000	=	<b>€1.10</b> cost per unit
High minus Low	(50,000 – 20,000)	30,000		



# High-Low Method

**STEP 2:** Determine the **fixed cost** by subtracting the total variable cost at **either** the high or the low activity level from the total cost at that activity level.

Illustration 5-8  
High-low method  
computation of  
fixed costs

Metro Transit				
P18      fx				
	A	B	C	D
1	<b>Metro Transit</b>			
2	Activity Level			
3			High	Low
4	Total cost		€63,000	€30,000
5	Less:	Variable costs		
6		$50,000 \times €1.10$	55,000	
7		$20,000 \times €1.10$		22,000
8	Total fixed costs		<b>€ 8,000</b>	<b>€ 8,000</b>
9				
10				

# High-Low Method

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Maintenance costs are therefore €8,000 per month of fixed costs plus €1.10 per mile of variable costs. This is represented by the following formula:

$$\text{Maintenance costs} = \text{€8,000} + (\text{€1.10} \times \text{Miles driven})$$

**Example:** At 45,000 miles, estimated maintenance costs would be:

Fixed		€ 8,000
Variable	(€1.10 x 45,000)	49,500
		<hr/>
		<b>€57,500</b>
		<hr/>

# High-Low Method

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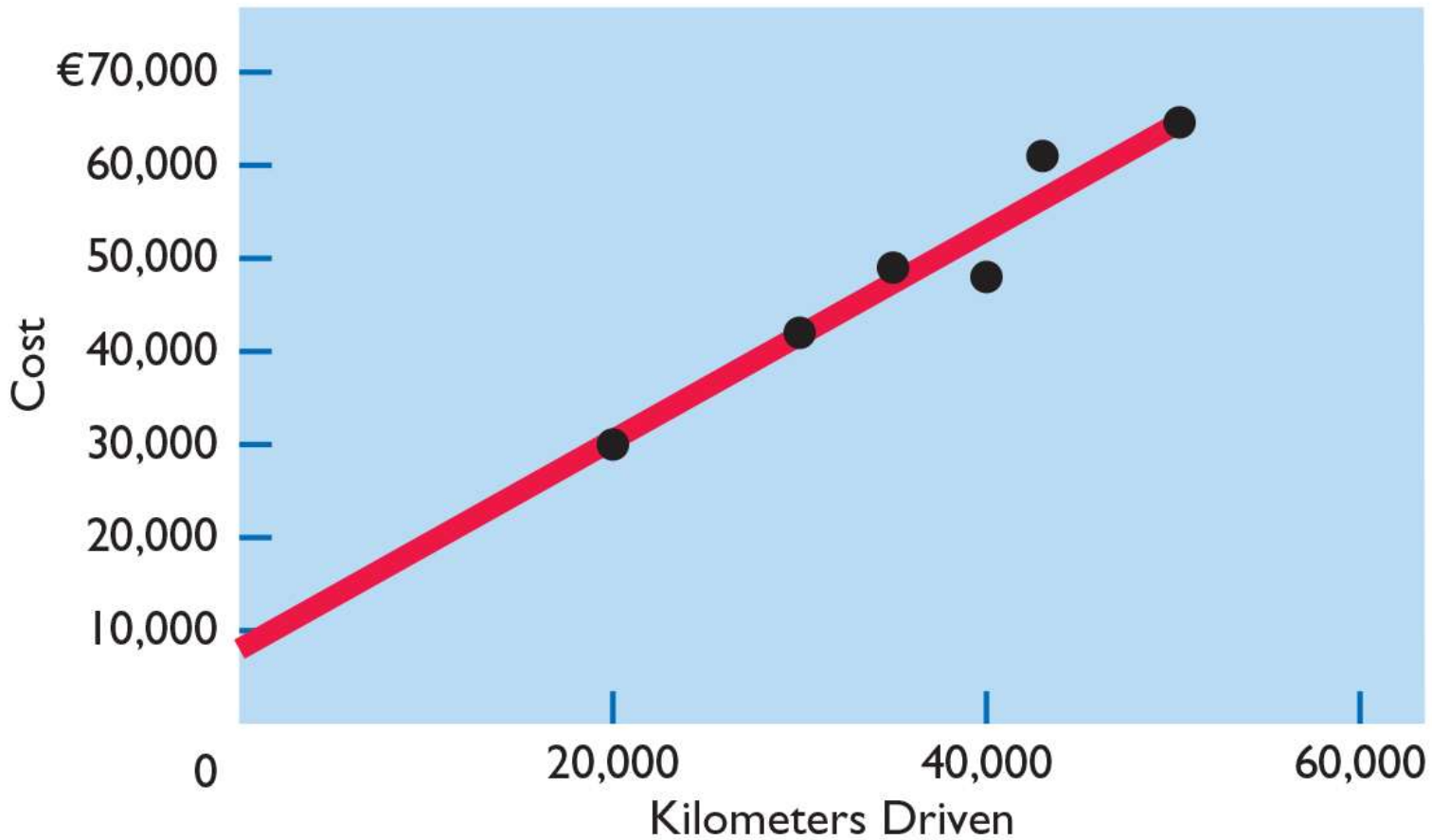


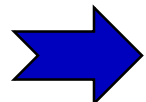
Illustration 5-9  
Scatter plot for Metro  
Transit Company

# High-Low Method

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## Question

Mixed costs consist of a:

- 
- a. Variable cost element and a fixed cost element.
  - b. Fixed cost element and a controllable cost element.
  - c. Relevant cost element and a controllable cost element.
  - d. Variable cost element and a relevant cost element.

## Management Insight Panasonic



Patrick T. Fallon/Bloomberg/Getty Images

### Cost per Unit Matters

As manufacturers face increased pressure to reduce cost per unit, many are moving out of China, where labor rates have been rising, to southeast and central Asia, most notably Vietnam and India. For example, **Panasonic Corporation**

(JPN) announced in August 2015 that it would close its lithium-ion battery factory in Beijing, cutting 1,300 jobs. The same month, **Foxconn** (TWN), the largest exporter out of China and the primary handset manufacturer for **Apple** (USA), also announced that it would invest \$5 billion in India to build assembly plants. This was followed by **Samsung's** (KOR) announcement that it would ramp up existing facilities in Vietnam with an additional investment of \$3 billion.

In the short-term, Vietnam will gain market share in apparel, footwear, and electronics, since low-end production cost is about 30% lower than in China. However, the long-term view is that China still has the edge over regional competitors regarding its robust supply chain, skilled labor base, and well-developed logistics infrastructure, which will continue to attract high-end manufacturers in the computer and airplane industries.

**Source:** S. Zhen, "Manufacturers Step Up Search for Low Cost Alternative to China," *South China Morning Post* (May 11, 2016).

**Although China is losing some jobs due to increased costs, what advantages does it still have over other countries? (Go to the book's companion website for this answer and additional questions.)**

Gim Ltd. accumulates the following data concerning a mixed cost, using units produced as the activity level.

	<u>Units Produced</u>	<u>Total Cost</u>
March	9,800	<del>W</del> 14,740,000
April	8,500	13,250,000
May	7,000	11,100,000
June	7,600	12,000,000
July	8,100	12,460,000

- (a) Compute the variable- and fixed-cost elements using the high-low method.
- (b) Estimate the total cost if the company produces 8,000 units.

	<u>Units Produced</u>	<u>Total Cost</u>
March	9,800	<del>₩</del> 14,740,000
April	8,500	13,250,000
May	7,000	11,100,000
June	7,600	12,000,000
July	8,100	12,460,000

- (a) Compute the variable and fixed cost elements using the high-low method.

**Variable cost:**  $(\cancel{₩}14,740,000 - \cancel{₩}11,100,000) \div (9,800 - 7,000) = \text{₩}1,300.00 \text{ per unit}$

**Fixed cost:**  $\cancel{₩}14,740,000 - \cancel{₩}12,740,000 = \text{₩}2,000,000$

or  $\cancel{₩}11,100,000 - \cancel{₩}9,100,000 = \text{₩}2,000,000$

**DO IT!**

**5.2**

## High-Low Method

	<u>Units Produced</u>	<u>Total Cost</u>
March	9,800	<del>¥</del> 14,740,000
April	8,500	13,250,000
May	7,000	11,100,000
June	7,600	12,000,000
July	8,100	12,460,000

(b) Estimate the total cost if the company produces 8,000 units.

**Total cost (8,000 units):** ~~¥~~2,000,000 + ~~¥~~10,400,000 (~~¥~~1,300.00 x 8,000 units) = **~~¥~~12,400,000**



**Cost-volume-profit (CVP) analysis** is the study of the effects of changes in costs and volume on a company's profits.

- ◆ Important in profit planning.
- ◆ Critical factor in management decisions as
  - ▶ Setting selling prices,
  - ▶ Determining product mix, and
  - ▶ Maximizing use of production facilities.

# Cost-Volume-Profit Analysis

## Basic Components

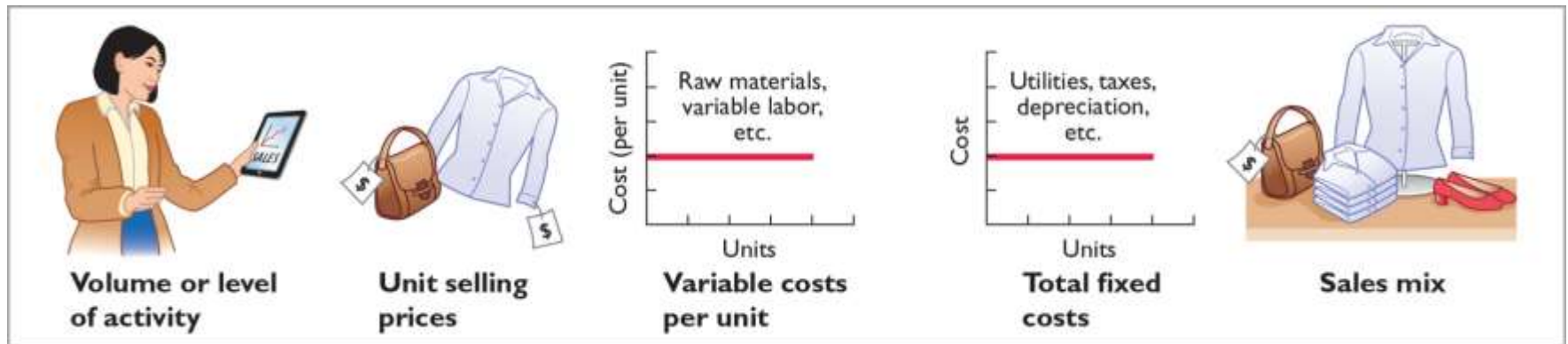


Illustration 5-10  
Components of CVP analysis

# Basic Components

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## Assumptions

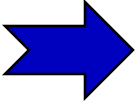
- ◆ Behavior of both costs and revenues is linear throughout the relevant range of the activity index.
- ◆ Costs can be classified accurately as either variable or fixed.
- ◆ Changes in activity are the only factors that affect costs.
- ◆ All units produced are sold.
- ◆ When more than one type of product is sold, the sales mix will remain constant.

# Basic Components

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## Question

Which of the following is **not** involved in CVP analysis?

- a. Sales mix.
- b. Unit selling prices.
-  c. Fixed costs per unit.
- d. Volume or level of activity.

# Cost-Volume-Profit Analysis

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## CVP Income Statement

- ◆ A statement for **internal use**.
- ◆ Classifies costs and expenses as fixed or variable.
- ◆ Reports **contribution margin** in the body of the statement.
  - ▶ **Contribution margin** - amount of revenue remaining after deducting variable costs.
- ◆ Reports the **same net income** as a traditional income statement.

# CVP Income Statement

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**Illustration:** Fandi Electronics produces a cell phone that is quickly taking over the smartphone market. Relevant data for the cell phones sold by this company in June 2020 are shown in Illustration 5-11.

Unit selling price of cell phone	€500
Unit variable costs	€300
Total monthly fixed costs	€200,000
Units sold	1,600

**Illustration 5-11**  
Assumed selling and cost data  
for Fandi Electronics

# CVP Income Statement

**Illustration:** Illustration 5-12 shows CVP income statement for Fandi.

Fandi Electronics CVP Income Statement For the Month Ended June 30, 2020		
	Total	Per Unit
Sales (1,600 cell phones)	€800,000	€500
Variable costs	480,000	300
<b>Contribution margin</b>	<b>320,000</b>	<b>€200</b>
Fixed costs	200,000	
<b>Net income</b>	<b>€120,000</b>	

Illustration 5-12  
CPV income statement, with net income

# CVP Income Statement

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## UNIT CONTRIBUTION MARGIN

- ◆ Contribution margin is available to **cover fixed costs** and to **contribute to income**.
- ◆ Formula for **contribution margin per unit** and the computation for Fandi Electronics are:

Unit Selling Price	—	Unit Variable Costs	=	Unit Contribution Margin
€500	—	€300	=	€200

Illustration 5-13

Formula for unit contribution margin



# CVP Income Statement

## UNIT CONTRIBUTION MARGIN

Fandi's CVP income statement assuming a zero net income.

Fandi Electronics CVP Income Statement For the Month Ended June 30, 2020		
	Total	Per Unit
Sales (1,000 cell phones)	€500,000	€500
Variable costs	300,000	300
<b>Contribution margin</b>	<b>200,000</b>	<b>€200</b>
Fixed costs	200,000	
<b>Net income</b>	<b>€ -0-</b>	

Illustration 5-14

CVP income statement, with zero net income

# CVP Income Statement

## UNIT CONTRIBUTION MARGIN

Assume that Fandi sold one more cell phone, for a total of 1,001 cell phone sold.

Fandi Electronics CVP Income Statement For the Month Ended June 30, 2020		
	Total	Per Unit
Sales (1,001 cell phones)	€500,500	€500
Variable costs	300,300	300
<b>Contribution margin</b>	<b>200,200</b>	<b>€200</b>
Fixed costs	200,000	
<b>Net income</b>	<b>€ 200</b>	

Illustration 5-15

CPV income statement, with net income and per unit data

# CVP Income Statement

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## CONTRIBUTION MARGIN RATIO

- ◆ Shows the percentage of each sales euro available to apply toward fixed costs and profits.
- ◆ Formula for **contribution margin ratio** and the computation for Fandi Electronics are:

Unit Contribution Margin	÷	Unit Selling Price	=	Contribution Margin Ratio
€200	÷	€500	=	40%

Illustration 5-17  
Formula for contribution  
margin ratio

# CVP Income Statement

## CONTRIBUTION MARGIN RATIO

Fandi Electronics CVP Income Statement For the Month Ended June 30, 2020		
	<u>Total</u>	<u>Percent of Sales</u>
Sales (1,001 cell phones)	€500,500	100%
Variable costs	<u>300,300</u>	<u>60</u>
<b>Contribution margin</b>	<b>200,200</b>	<b>40%</b>
Fixed costs	<u>200,000</u>	<u></u>
<b>Net income</b>	<b>€ 200</b>	

### Illustration 5-16

CVP income statement, with  
net income and percent of sales data

# CVP Income Statement

## CONTRIBUTION MARGIN RATIO

Assume Fandi Electronics' current sales are €500,000 and it wants to know the effect of a €100,000 (200-unit) increase in sales.

Fandi Electronics CVP Income Statements For the Month Ended June 30, 2020						
	No Change			With Change		
	Total	Per Unit	Percent of Sales	Total	Per Unit	Percent of Sales
Sales	€500,000	€500	100%	€600,000	€500	100%
Variable costs	300,000	300	60	360,000	300	60
<b>Contribution margin</b>	<b>200,000</b>	<b>€200</b>	<b>40%</b>	<b>240,000</b>	<b>€200</b>	<b>40%</b>
Fixed costs	200,000			200,000		
<b>Net income</b>	<b>€ -0-</b>			<b>€ 40,000</b>		

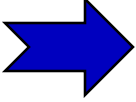
Illustration 5-18  
Comparative CVP income statement

# CVP Income Statement

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## Question

Contribution margin:

- a. Is revenue remaining after deducting variable costs.
- b. May be expressed as contribution margin per unit.
- c. Is selling price less cost of goods sold.
-  d. Both (a) and (b) above.

Khor Industries produces and sells a cell phone-operated thermostat. Information regarding the costs and sales of thermostats during September 2020 are provided below.

Unit selling price of thermostat	NT\$2,550
Unit variable costs	NT\$960
Total monthly fixed costs	NT\$5,700,000
Units sold	4,000

Prepare a CVP income statement for Khor Industries for the month of September. Provide per unit values and total values.

**DO IT!**

**5.3**

## **CVP Income Statement**

Prepare a CVP income statement for Khor Industries for the month of September. Provide per unit values and total values.

**Khor Industries**  
**CVP Income Statement**  
For the Month Ended September 30, 2020

	<u><b>Total</b></u>	<u><b>Per Unit</b></u>
Sales		
Variable costs		
Contribution margin		
Fixed costs		
Net income		



## Break-Even Analysis

- ◆ Process of finding the **break-even point** level of activity at which total revenues equal total costs (both fixed and variable).
- ◆ Can be computed or derived
  - ▶ from a **mathematical equation**,
  - ▶ by using **contribution margin**, or
  - ▶ from a **cost-volume profit (CVP) graph**.
- ◆ Expressed either in **units** or in **sales**.

# Mathematical Equation

Break-even occurs where total sales equal variable costs plus fixed costs; i.e., net income is zero.

Required Sales	–	Variable Costs	–	Fixed Costs	=	Net Income
€500Q	–	€300Q	–	€200,000	=	€0
€500Q	–	€300Q	=	€200,000	+	€0
€200Q	=	€200,000				
Q	=	$\frac{€200,000}{€200}$	=	$\frac{\text{Fixed Costs}}{\text{Unit Contribution Margin}}$		
Q	=	1,000 units				
where						
Q	=	sales volume in units				
€500	=	selling price				
€300	=	variable costs per unit				
€200,000	=	total fixed costs				

Illustration 5-20

Computation of break-even point in units.

# Contribution Margin Technique

---

- ◆ At the break-even point, contribution margin must equal total fixed costs

$$(\text{CM} = \text{total revenues} - \text{variable costs})$$

- ◆ Break-even point can be computed using either contribution margin per unit or contribution margin ratio.

# Break-Even Analysis

---

## CONTRIBUTION MARGIN IN UNITS

- ◆ When the break-even-point in **units** is desired, contribution margin per unit is used in the following formula which shows the computation for Fandi Electronics:

Fixed Costs	÷	Unit Contribution Margin	=	Break-Even Point in Units
€200,000	÷	€200	=	1,000 units

### Illustration 5-21

Formula for break-even point in units using unit contribution margin

# Break-Even Analysis

---

## CONTRIBUTION MARGIN RATIO

- ◆ When the break-even-point in **dollars** is desired, contribution margin ratio is used in the following formula which shows the computation for Fandi Electronics:

<b>Fixed Costs</b>	÷	<b>Contribution Margin Ratio</b>	=	<b>Break-Even Point in Sales</b>
€200,000	÷	40%	=	€500,000

### Illustration 5-22

Formula for break-even point in sales using contribution margin ratio



Lemberg Vector studio/Shutterstock

### Portal Advertising Bolstered by Social Media

The social media giant of **Sina** (CHN) has market penetration similar to Twitter and YouTube in the United States. On average, 100 million messages are posted each day on Sina Weibo.

Advertising revenues for Sina include portal advertising, or revenues generated from online brand advertising on Sina.com, mobile value-added services (MVAS), and fee-based services for data licensing, company accounts, and gaming-related services. Weibo earns advertising revenue generated by advertising and marketing on its microblogging and social media platform. Weibo has been instrumental in driving growth for the consolidated company while portal advertising revenues on Sina's platforms have struggled.

Over the last five years, Sina's advertising revenues have grown by a compounded annual growth rate of 20%. During the first three quarters of 2016, advertising revenues continued to

grow by 16% to \$602 million, while its MVAS revenues for the same period grew 11% to \$116 million. Weibo, on the other hand, saw advertising gross margins of just under 70% in 2015 which improved to 72.5% in 2016, when compared to non-advertising segments whose gross margins were less than 60%.

Despite the slowdown in portal advertising growth, Sina is hoping to turn things around with new projects like the National Football League (NFL) deal. The NFL is hoping to expand its presence in China by giving Sina's social media platform the rights to live stream select games, including the Super Bowl, on its network. The deal marks the first time a sports league will live stream games on the service, the NFL says. Additionally, Sina will gain the rights to non-game, video-on-demand clips, highlights, and other NFL content.

**Sources:** Trefis Team, "How Sina's Ad Revenues Are Primarily Dependent on Weibo as Portal Advertising Struggles," *Nasdaq.com* (December 13, 2016); and S. Perez, "NFL Games Are Now Live Streaming on China's Sina Weibo Network," *TechCrunch.com* (December 29, 2016).

**If the fixed costs associated with Sina's advertising segment are equal to those of its non-advertising segment, which segment has a higher break-even point in dollars? (Go to the book's companion website for this answer and additional questions.)**

# Graphic Presentation

Because this graph also shows costs, volume, and profits, it is referred to as a **cost-volume-profit (CVP) graph**.

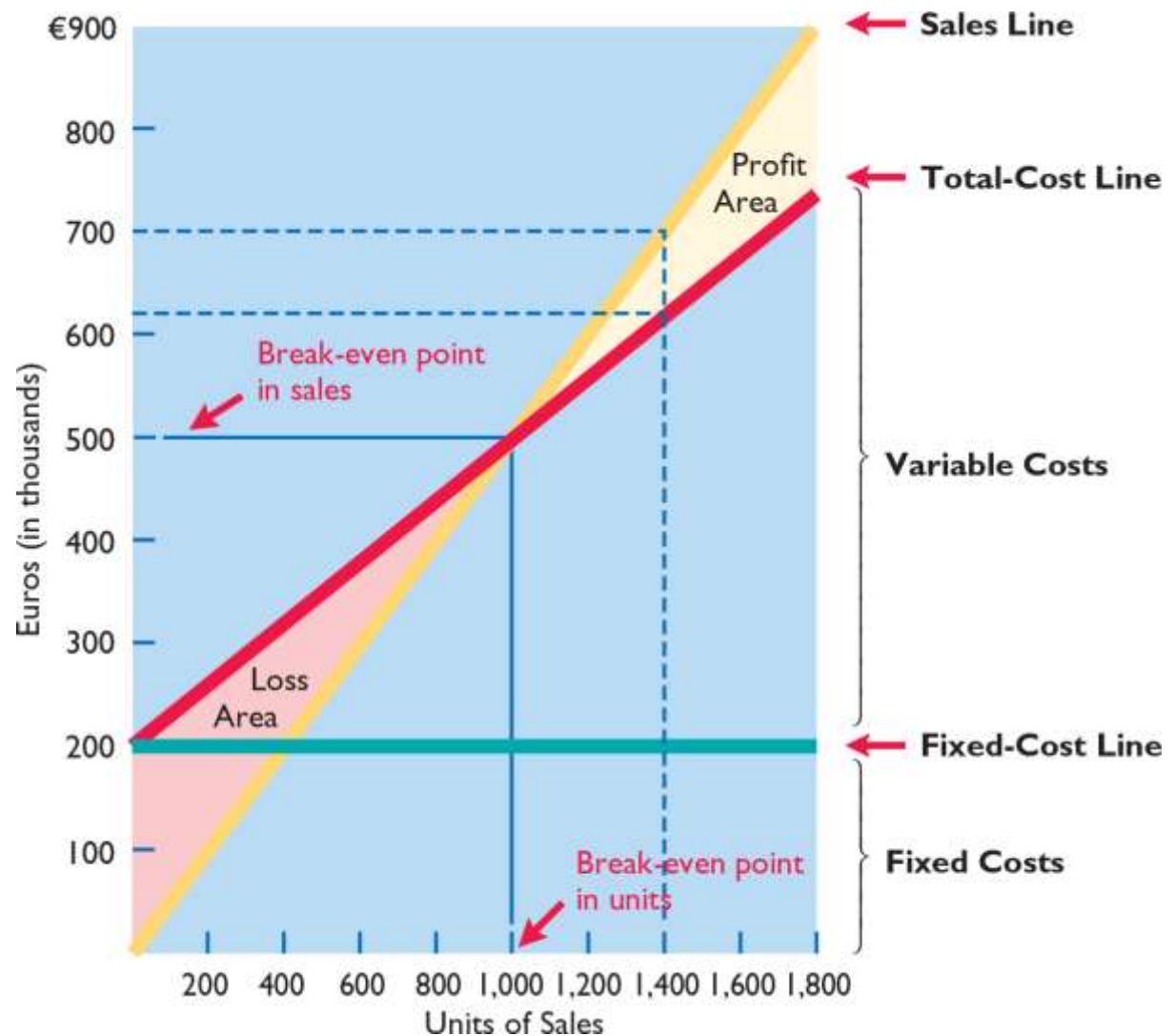


Illustration 5-23  
CVP graph

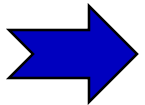
# Break-Even Analysis

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## Question

Gossen SA is planning to sell 200,000 pliers for €4 per unit. The contribution margin ratio is 25%. If Gossen will break even at this level of sales, what are the fixed costs?

- a. €100,000.
- b. €160,000.
- c. €200,000.
- d. €300,000.





Yunxuan Group has a unit selling price of HK\$400, variable costs per unit of HK\$240, and fixed costs of HK\$180,000.

Compute the **break-even point** in units using **(a) a mathematical equation** and (b) contribution margin per unit.

Illustration 5-19

Sales	-	Variable Costs	-	Fixed Costs	=	Net Income
<input type="text"/>	-	<input type="text"/>	-	<input type="text"/>	=	<input type="text"/>
<input type="text"/>	=	<input type="text"/>				
<input type="text"/>	=	<input type="text"/>				

**DO IT!**

**5.4**

## Break-Even Analysis

Yunxuan Group has a unit selling price of HK\$400, variable costs per unit of HK\$240, and fixed costs of HK\$180,000.

Compute the **break-even point** in units using (a) a mathematical equation and **(b) contribution margin per unit**.

Illustration 5-21

**Fixed  
Costs**

÷

**Contribution  
Margin per Unit**

=

**Break-Even  
Point in Units**

÷

=

## Target Net Income

- ◆ Level of sales necessary to achieve a specified income.
- ◆ Can be determined from each of the approaches used to determine break-even sales/units:
  - ▶ from a **mathematical equation**,
  - ▶ by using **contribution margin technique**, or
  - ▶ from a cost-volume profit (**CVP**) graph.
- ◆ Expressed either in **sales units** or in **sales dollars**.

# Target Net Income

---

## MATHEMATICAL EQUATION

Formula for required sales to meet target net income.

Illustration 5-24

$$\begin{array}{ccccccc} \text{Required} & & \text{Variable} & & \text{Fixed} & & \text{Target Net} \\ \text{Sales} & - & \text{Costs} & - & \text{Costs} & = & \text{Income} \end{array}$$

# Target Net Income

## MATHEMATICAL EQUATION

Using the formula for the break-even point, simply include the desired net income as a factor.

Required Sales	–	Variable Costs	–	Fixed Costs	=	Target Net Income
€500Q	–	€300Q	–	€200,000	=	€120,000
€500Q	–	€300Q	=	€200,000	+	€120,000
$€200Q = €200,000 + €120,000$						
$Q = \frac{€200,000 + €120,000}{€200} = \frac{\text{Fixed Costs} + \text{Target Net Income}}{\text{Unit Contribution Margin}}$						
$Q = 1,600$						
where						
Q = sales volume						
€500 = selling price						
€300 = variable costs per unit						
€200,000 = total fixed costs						
€120,000 = target net income						

Illustration 5-25

Computation of required sales

# Target Net Income

---

## CONTRIBUTION MARGIN TECHNIQUE

To determine the required **units** for Fandi Electronics:

$\left( \begin{array}{c} \text{Fixed Costs +} \\ \text{Target Net Income} \end{array} \right)$	$\div$	$\begin{array}{c} \text{Unit Contribution} \\ \text{Margin} \end{array}$	$=$	$\begin{array}{c} \text{Required} \\ \text{Units} \end{array}$
$(\text{€}200,000 + \text{€}120,000)$	$\div$	$\text{€}200$	$=$	$1,600 \text{ units}$

### Illustration 5-26

Formula for required units  
using unit contribution  
margin

# Target Net Income

---

## CONTRIBUTION MARGIN TECHNIQUE

To determine the required **sales** for Fandi Electronics:

$\left( \begin{array}{c} \text{Fixed Costs +} \\ \text{Target Net Income} \end{array} \right)$	$\div$	<b>Contribution Margin Ratio</b>	$=$	<b>Required Sales</b>
$(\text{€}200,000 + \text{€}120,000)$	$\div$	40%	$=$	<b>€800,000</b>

### Illustration 5-27

Formula for required sales  
using contribution margin ratio

# Target Net Income

## GRAPHIC PRESENTATION

Suppose Fandi Electronics sells 1,400 cell phones. Illustration 5-23 shows that a vertical line drawn at 1,400 units intersects the sales line at €700,000 and the total cost line at €620,000. The difference between the two amounts represents the net income (profit) of €80,000.

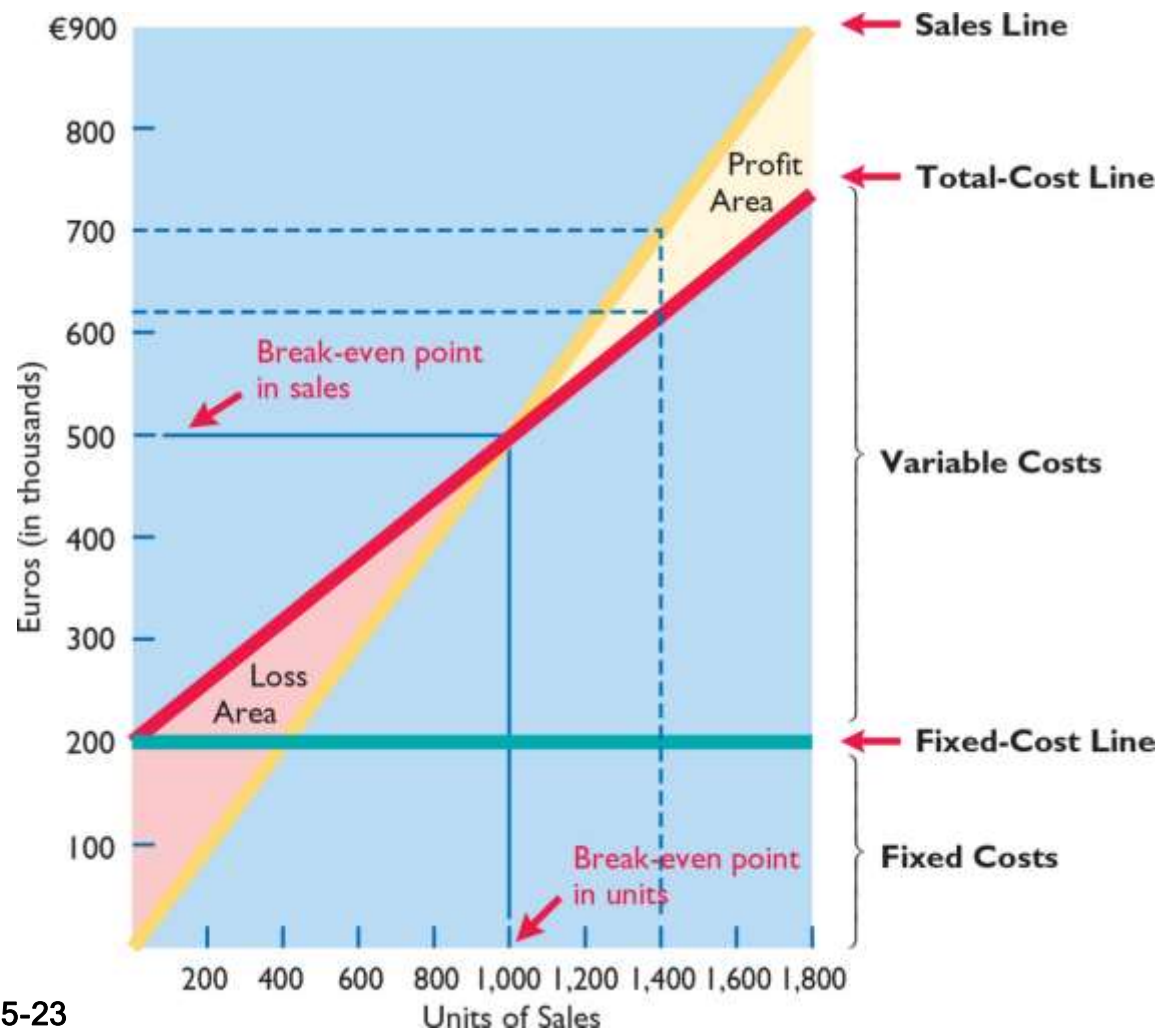


Illustration 5-23



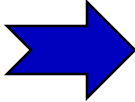
# Target Net Income

---

## Question

The mathematical equation for computing required sales to obtain target net income is:

Required sales =

- a. Variable costs + Target net income.
-  b. Variable costs + Fixed costs + Target net income.
- c. Fixed costs + Target net income.
- d. No correct answer is given.

# Margin of Safety

---

- ◆ Difference between **actual or expected sales** and sales at the **break-even point**.
- ◆ Measures the “cushion” that a particular level of sales provides.
- ◆ May be expressed in **sales** or as a **ratio**.
- ◆ Assuming actual/expected sales are €750,000:

Actual (Expected) Sales	–	Break-Even Sales	=	Margin of Safety
€750,000	–	€500,000	=	€250,000

Illustration 5-28  
Formula for margin of safety

# Margin of Safety Ratio

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- ◆ Computed by dividing the margin of safety by the actual (or expected) sales.
- ◆ Assuming actual/expected sales are €750,000:

Margin of Safety	÷	Actual (Expected) Sales	=	Margin of Safety Ratio
€250,000	÷	€750,000	=	33%

**Illustration 5-29**  
Formula for margin of safety ratio

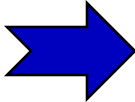
- ◆ The higher the sales or percentage, the greater the margin of safety.

# Margin of Safety

---

## Question

Lanza SA had actual sales of R\$600,000 when break-even sales were R\$420,000. What is the margin of safety ratio?

- a. 25%.
-  b. 30%.
- c. 33 1/3%.
- d. 45%.



Yael/Retna

### How a Rolling Stones' Tour Makes Money

Computations of break-even and margin of safety are important for service companies. Consider how the promoter for the **Rolling Stones'** tour used the break-even point and margin of safety. For example, say one outdoor show should bring 70,000 individuals for a gross of \$2.45 million.

The promoter guarantees \$1.2 million to the Rolling Stones. In addition, 20% of gross goes to the stadium in which the performance is staged. Add another \$400,000 for other expenses such as ticket takers, parking attendants, advertising, and so on. The promoter also shares in sales of T-shirts and memorabilia for which the promoter will net over \$7 million during the tour. From a successful Rolling Stones' tour, the promoter could make \$35 million!

**What amount of sales are required for the promoter to break even? (Go to the book's companion website for this answer and additional questions.)**

Praveen Ltd. makes travel bags that sell for Rs3,920 each. For the coming year, management expects fixed costs to total Rs22,400,000 and variable costs to be Rs2,940 per unit.

Compute the following:

- a) break-even point in sales using the contribution margin (CM) ratio;
- b) the margin of safety and margin of safety ratio assuming actual sales are Rs96,768,000; and
- c) the sales required to earn net income of Rs28,700,000.

Praveen Ltd. makes travel bags that sell for Rs3,920 each. For the coming year, management expects fixed costs to total Rs22,400,000 and variable costs to be Rs2,940 per unit.

**Compute break-even point in sales using the contribution margin (CM) ratio.**

Contribution margin ratio =

Break-even point in sales =

Praveen Ltd. makes travel bags that sell for Rs3,920 each. For the coming year, management expects fixed costs to total Rs22,400,000 and variable costs to be Rs2,940 per unit. **Compute the margin of safety and margin of safety ratio assuming actual sales are Rs96,768,000.**

Margin of safety =

Margin of safety ratio =



Praveen Ltd. makes travel bags that sell for Rs3,920 each. For the coming year, management expects fixed costs to total Rs22,400,000 and variable costs to be Rs2,940 per unit.

**Compute the sales required to earn net income of Rs28,700,000.**

Required sales =

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