

# Production and Producer's Equilibrium

*By*

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# OUTLINE



- 1) **Recall: The Law of Supply**
- 2) **What are Costs?**
- 3) **Production and Costs**
- 4) **Measures of Costs**
- 5) **Costs in the Short-run and Long-run**
- 6) **Profit Maximization: Production Decision Rule**

# 1. Recall: Supply and the Law of Supply



- An economy made up of thousands of firms that produce good and services
- Some firms employ thousands of workers and have thousands of stockholders
- Others are small, with few workers and largely owned by single person or family



## Law of Supply

- ... firms are willing to produce and sell a greater quantity of a good when the price of the good is higher
- ... this response leads to a supply curve that slopes upward



## Here

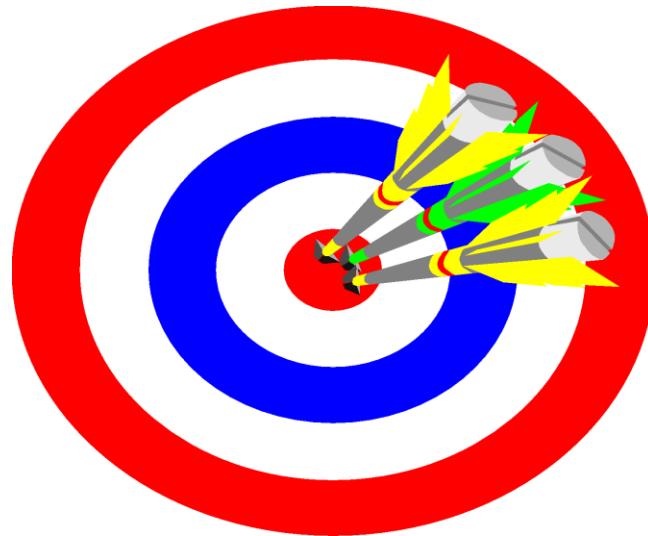
- ... will have a better understanding of the **decisions behind the supply curve**
- ... addresses a question – How does the **number of firms affect the prices in a market and the efficiency of the market outcome?**

## 2. What are Costs?



### The Firm's Objective

- ... The Economic Goal of the Firm is to **Maximize Profits**





## What is a Firm's Profit?

- **Profit = Total Revenue – Total Cost**
- **Total Revenue (TR)** is the amount that the firm receives from the sale of its output
- **Total Cost (TC)** is the amount that the firm pays to buy inputs



## How to measure Total Revenue and Total Cost ???

- Measurement of –
  - Total Revenue – *straightforward*
  - Total Cost – *very subtle*





## Costs as Opportunity Costs

- A firm's cost of production includes all the opportunity costs of making its output of goods and services



## Explicit and Implicit Costs

- A firm's cost of production include explicit costs and implicit costs
  - **Explicit** costs are input costs that require a direct outlay of money by the firm
  - **Implicit** costs are input costs that do not require an outlay of money by the firm



## Economic Profit versus Accounting Profit

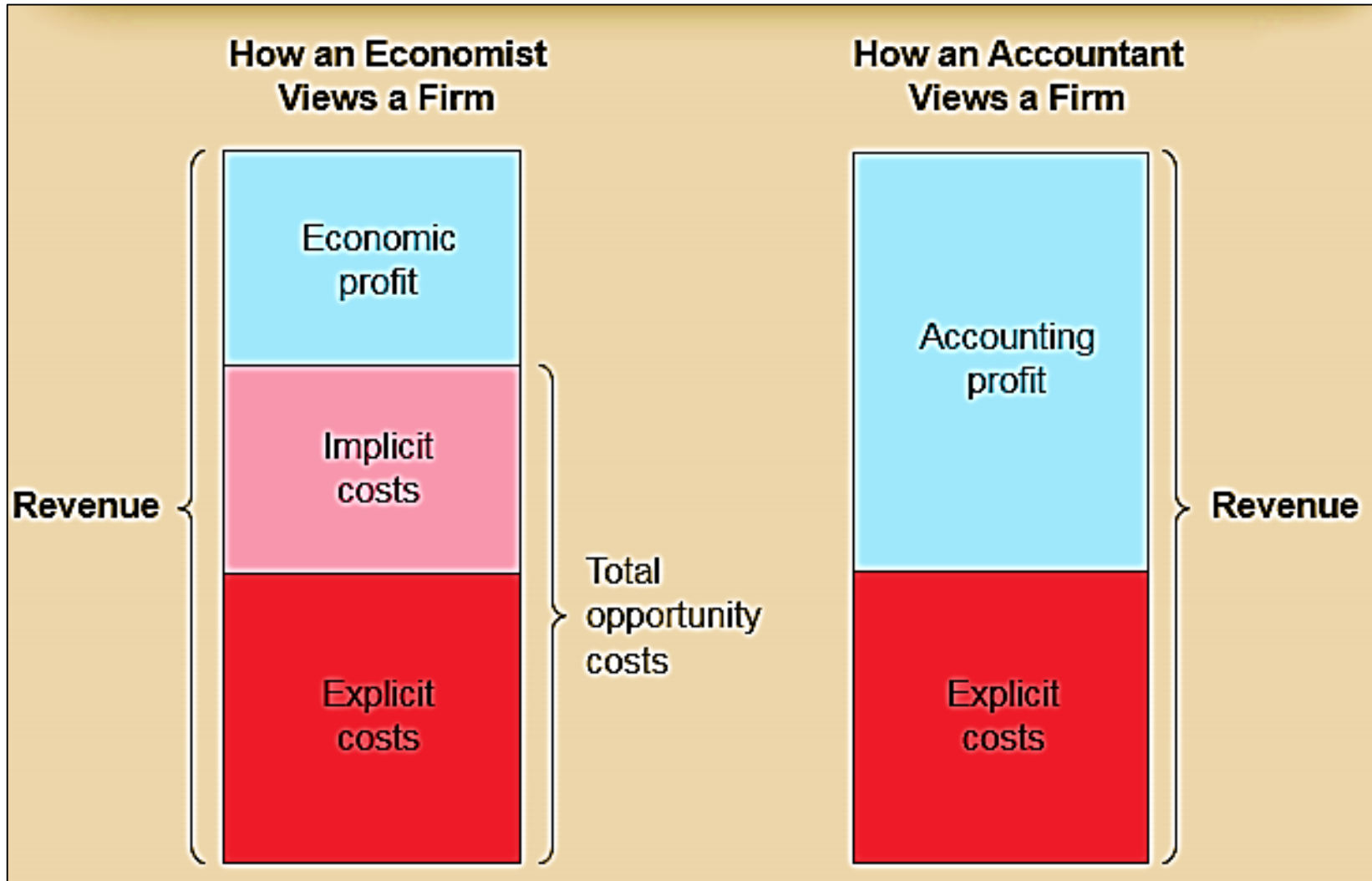
- Economists measure a firm's *economic profit* as total revenue minus total cost, including both explicit and implicit costs
- Accountants measure the *accounting profit* as the firm's total revenue minus only the firm's explicit costs



## Economic Profit versus Accounting Profit

- When total revenue exceeds both explicit and implicit costs, the firm earns economic profit
- Economic profit is smaller than accounting profit

# Economists versus Accountants



# 3. Production and Costs



## The Production Function

- ... shows the relationship between quantity of inputs used to make a good and the quantity of output of that good



## Marginal Product

- The *marginal product* of any input in the production process is the increase in output that arises from an additional unit of that input



# A Production Function and Total Cost

Number of Workers	Output (quantity of cookies produced per hour)	Marginal Product of Labor	Cost of Factory	Cost of Workers	Total Cost of Inputs (cost of factory + cost of workers)
0	0		\$30	\$ 0	\$30
1	50	50	30	10	40
2	90	40	30	20	50
3	120	30	30	30	60
4	140	20	30	40	70
5	150	10	30	50	80

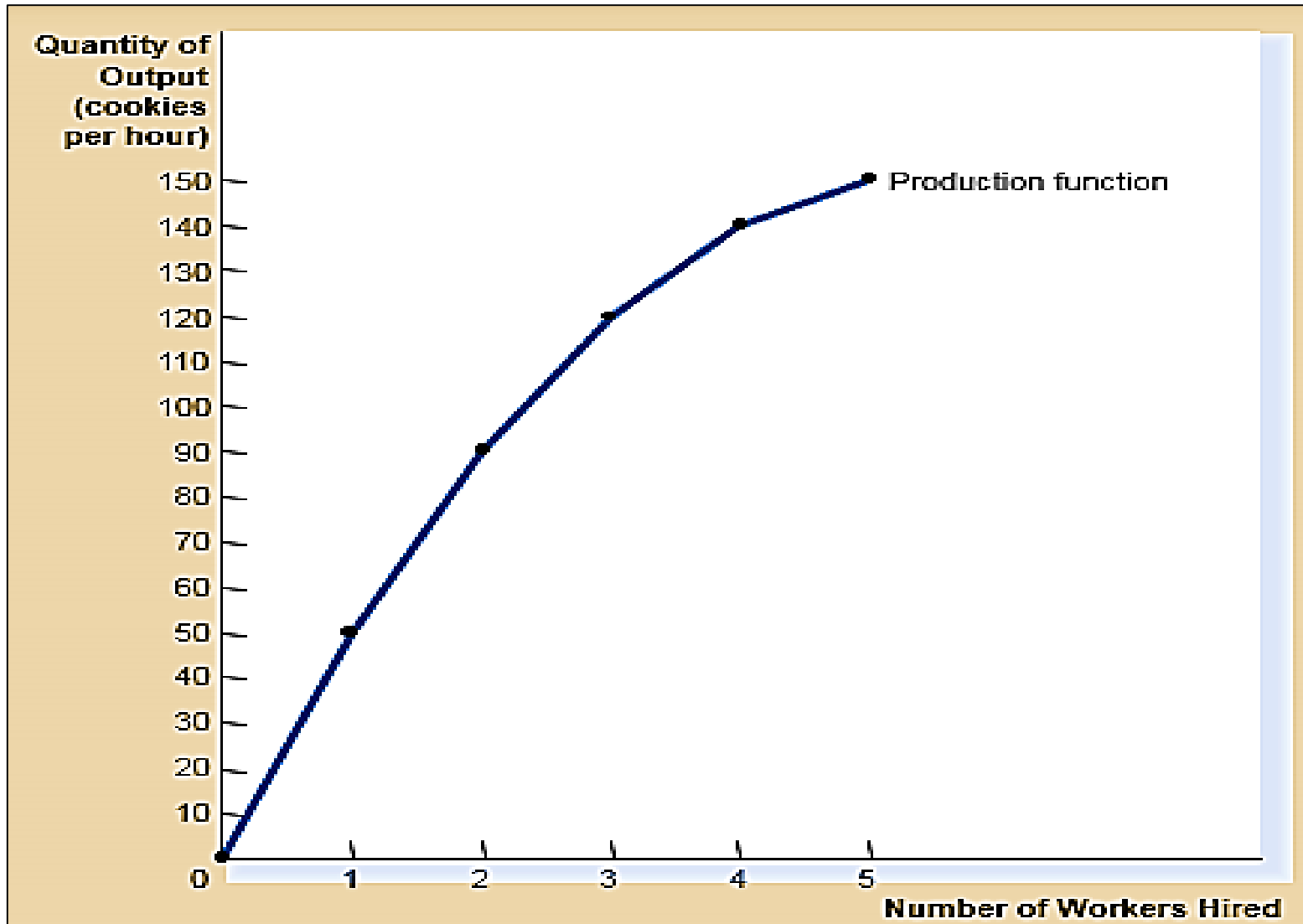




## Diminishing Marginal Product

- ... property whereby the marginal product of an input declines as the quantity of the input increases
  - Ex: As more and more workers are hired at a firm, each additional worker contributes less and less to production because the firm has a limited amount of equipment

# Production Function





## Diminishing Marginal Product

- The slope of the production function measures the marginal product of an input, such as a worker
- When the marginal product declines, the production function becomes flatter



## From the Production Function to the Total-Cost Curve

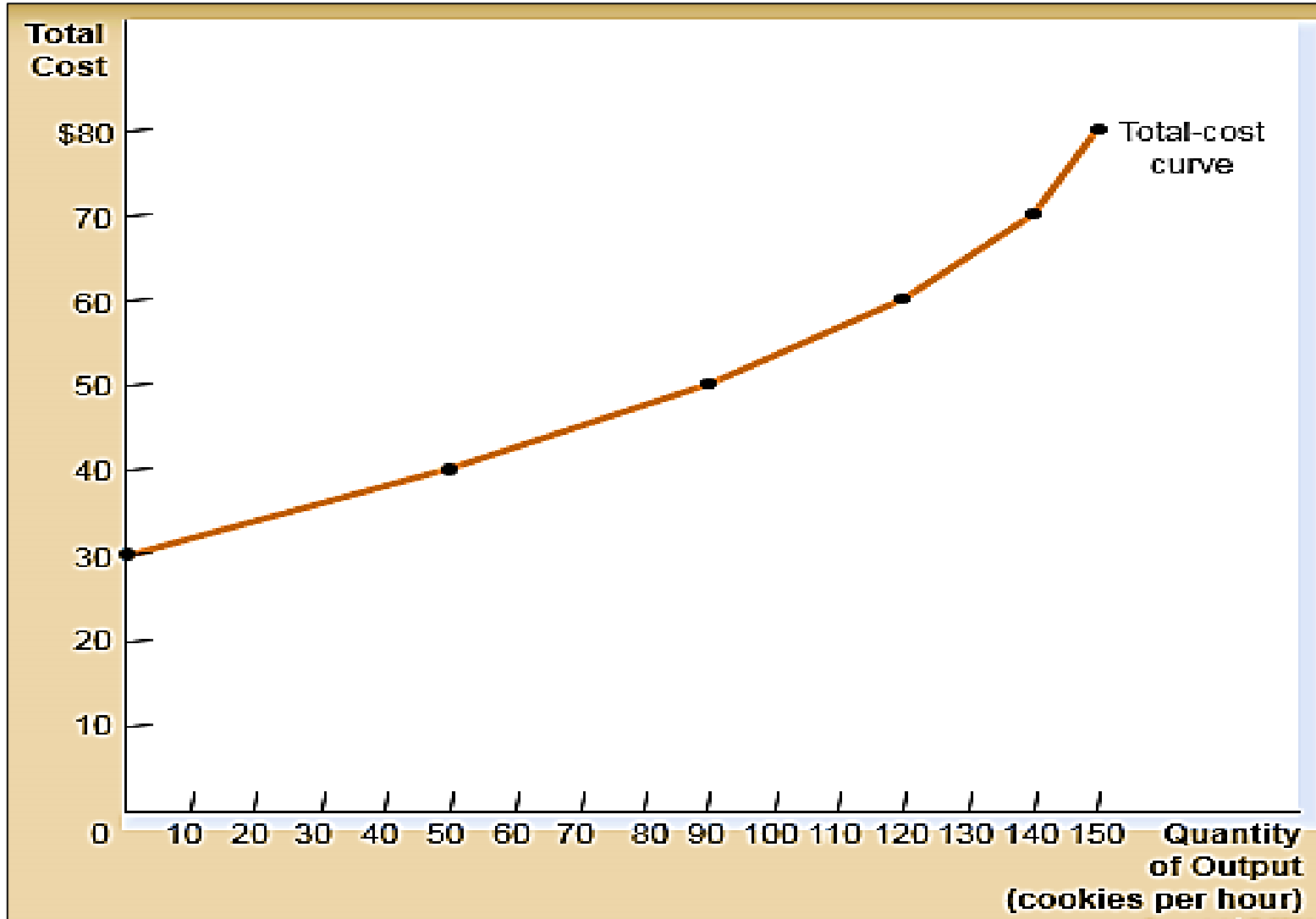
- The relationship between the quantity a firm can produce and its costs determines pricing decisions
- The total-cost curve shows this relationship graphically



# A Production Function and Total Cost

Number of Workers	Output (quantity of cookies produced per hour)	Marginal Product of Labor	Cost of Factory	Cost of Workers	Total Cost of Inputs (cost of factory + cost of workers)
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5	150	10	30	50	80

# Total Cost Curve



# 4. Various Measures of Costs



Costs of Production may be divided into Fixed Costs and Variable Costs

- **Fixed costs** are those costs that do not vary with the quantity of output produced
- **Variable costs** are those costs that do vary with the quantity of output produced

Cont.



## Total Costs

- Total Fixed Costs (TFC)
- Total Variable Costs (TVC)
- Total Costs (TC)

$$TC = TFC + TVC$$





# The Various Measures of Cost

Quantity of Lemonade (glasses per hour)	Total Cost	Fixed Cost	Variable Cost	Average Fixed Cost	Average Variable Cost	Average Total Cost	Marginal Cost
0	\$3.00	\$3.00	\$0.00	—	—	—	\$0.30
1	3.30	3.00	0.30	\$3.00	\$0.30	\$3.30	0.50
2	3.80	3.00	0.80	1.50	0.40	1.90	0.70
3	4.50	3.00	1.50	1.00	0.50	1.50	0.90
4	5.40	3.00	2.40	0.75	0.60	1.35	1.10
5	6.50	3.00	3.50	0.60	0.70	1.30	1.30
6	7.80	3.00	4.80	0.50	0.80	1.30	1.50
7	9.30	3.00	6.30	0.43	0.90	1.33	1.70
8	11.00	3.00	8.00	0.38	1.00	1.38	1.90
9	12.90	3.00	9.90	0.33	1.10	1.43	2.10
10	15.00	3.00	12.00	0.30	1.20	1.50	



**As an owner, you must decide how much to produce?**

- **How much does it cost to make the typical cup of coffee?**
- **How much does it cost to increase production of coffee by 1 cup?**



## Average Costs

- Average costs can be determined by dividing the firm's costs by the quantity of output it produces
- The average cost is the cost of each typical unit of product



## Average Costs

- **Average Fixed Costs (AFC)**
- **Average Variable Costs (AVC)**
- **Average Total Costs (ATC)**

$$\text{ATC} = \text{AFC} + \text{AVC}$$



# Average Costs

$$AFC = \frac{\text{Fixed cost}}{\text{Quantity}} = \frac{FC}{Q}$$

$$AVC = \frac{\text{Variable cost}}{\text{Quantity}} = \frac{VC}{Q}$$

$$ATC = \frac{\text{Total cost}}{\text{Quantity}} = \frac{TC}{Q}$$



# The Various Measures of Cost

Quantity of Lemonade (glasses per hour)	Total Cost	Fixed Cost	Variable Cost	Average Fixed Cost	Average Variable Cost	Average Total Cost	Marginal Cost
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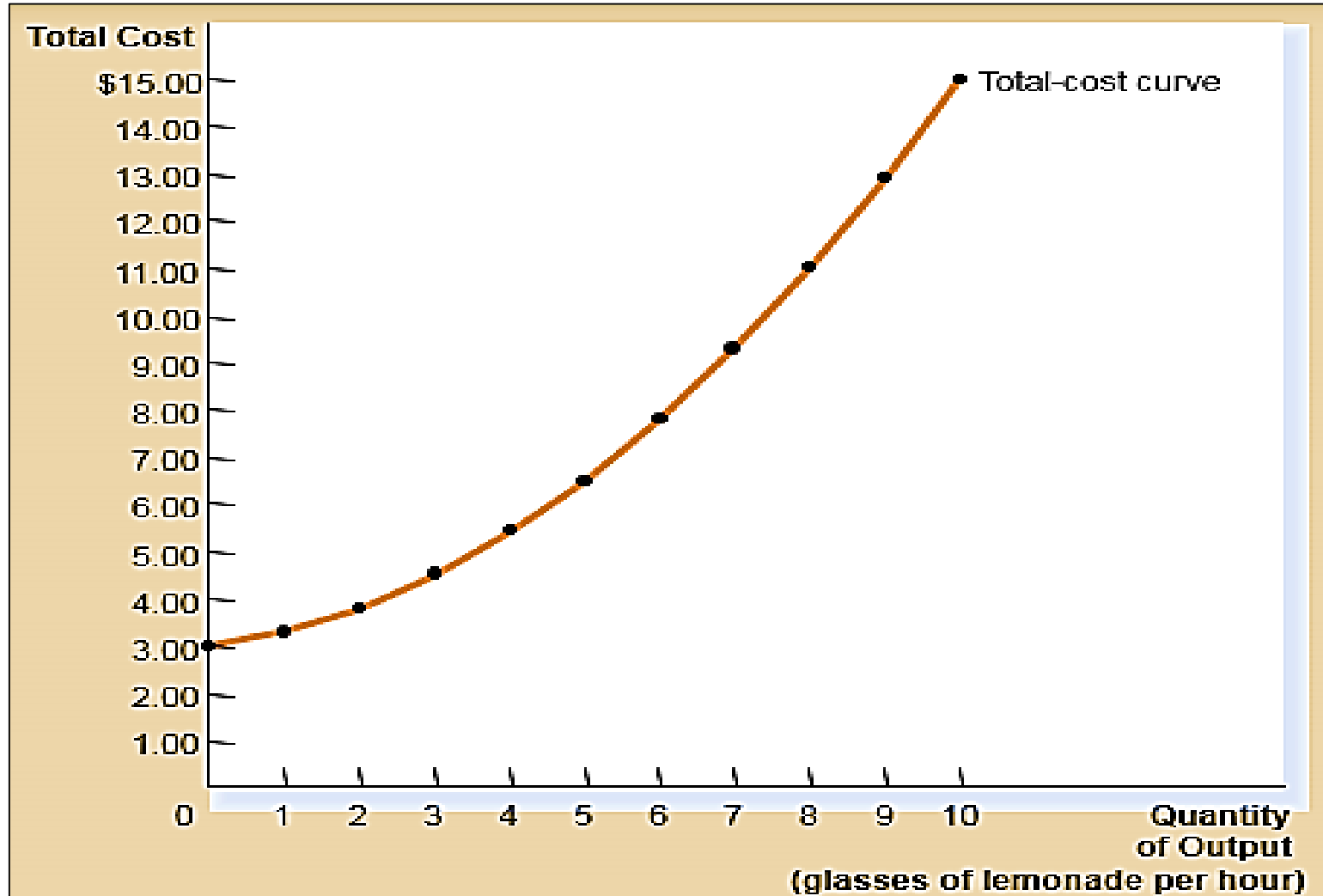


# Marginal Costs (MC)

- ... measures the increase in total cost that arises from an extra unit of production
- ... helps answer the following question:
  - How much does it cost to produce an additional unit of output?

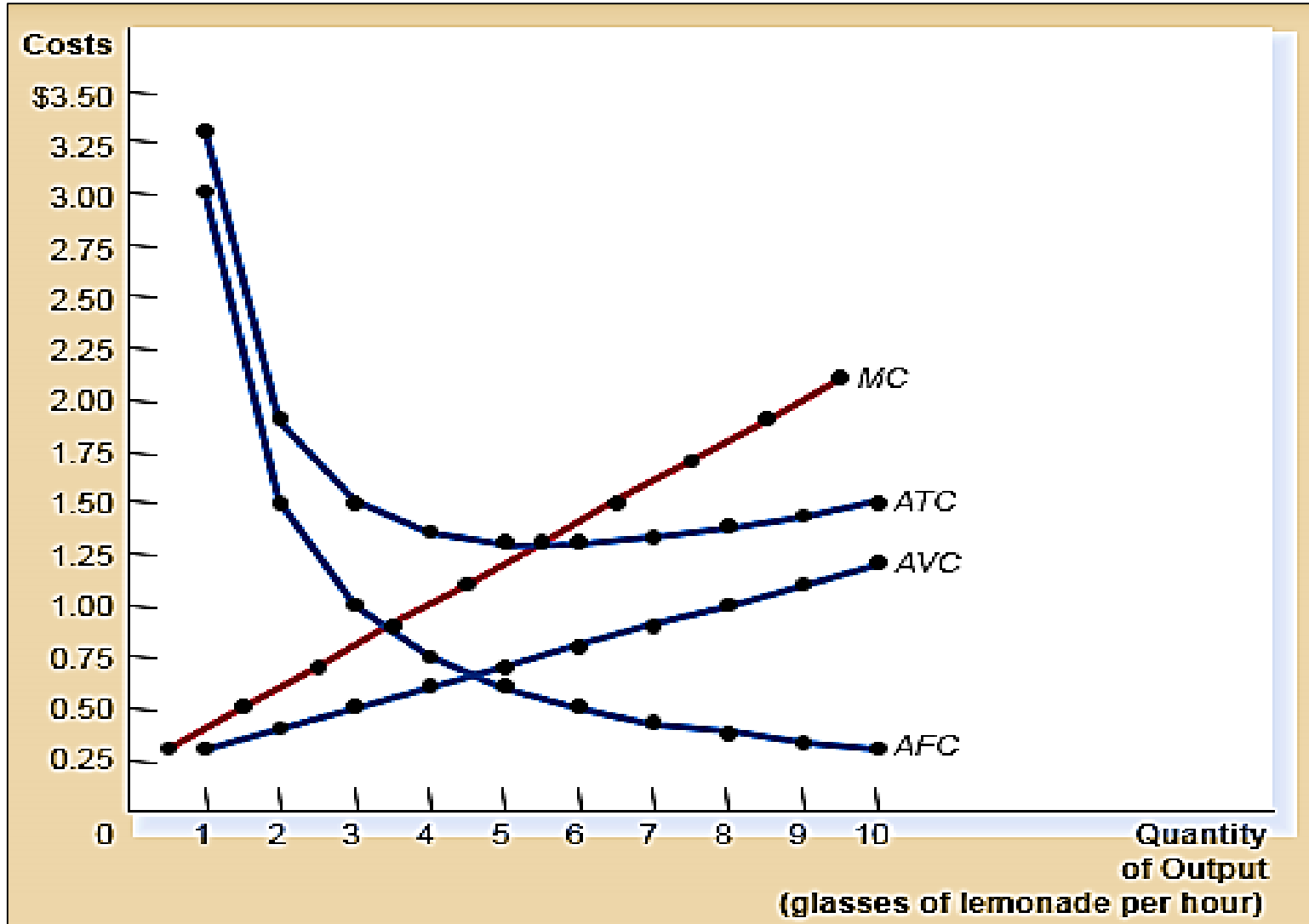
$$MC = \frac{\text{(change in total cost)}}{\text{(change in quantity)}} = \frac{\Delta TC}{\Delta Q}$$

# Total Cost Curve





# Average Cost and Marginal Cost

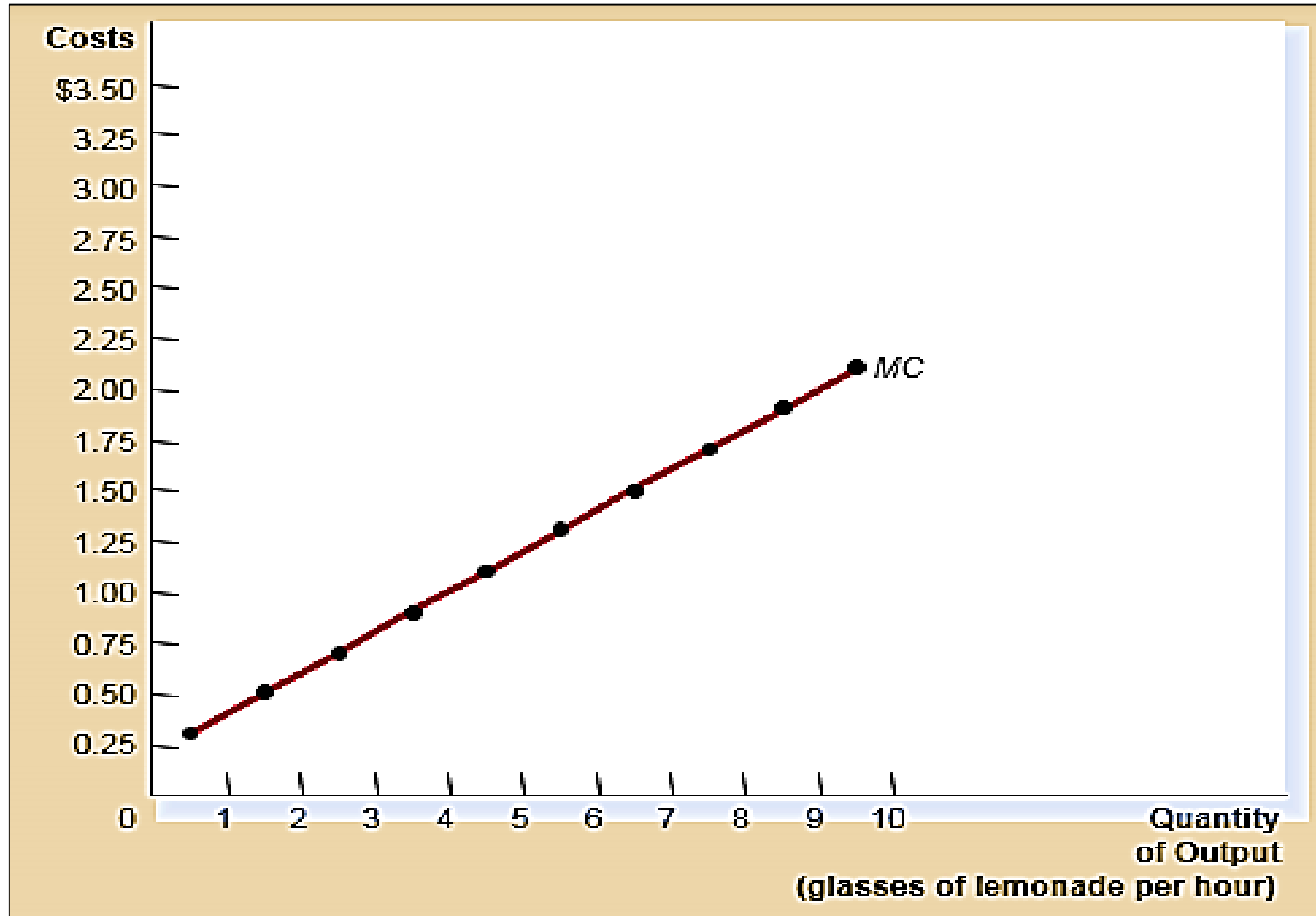




## Cost Curves and their Shapes

- Marginal cost rises with the amount of output produced
- This reflects the property of diminishing marginal product

# Marginal Cost (MC) Curve





## The Average Total-Cost (ATC) Curve is U-shaped

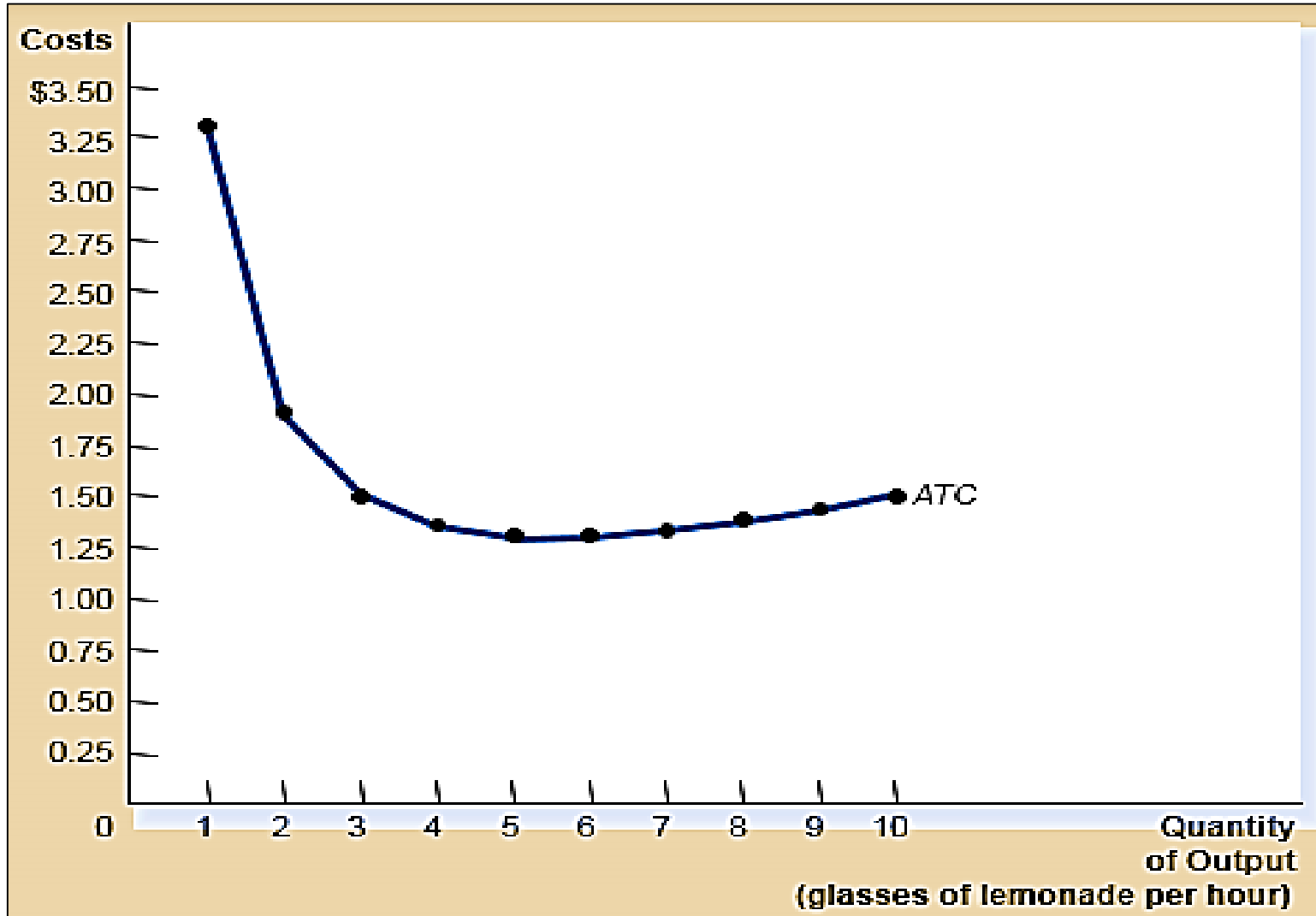
- At very low levels of output ATC is high because fixed cost is spread over only a few units
- ATC declines as output increases
- ATC starts rising because AVC rises substantially



## The Average Total-Cost (ATC) Curve is U-shaped

- The bottom of the U-shaped ATC curve occurs at the quantity that minimizes average total cost
- This quantity is sometimes called the *efficient scale* of the firm

# Average Total Cost (ATC) Curve





## Relationship between Marginal Cost and Average Total Cost

- 1) Whenever marginal cost is less than average total cost, average total cost is falling
- 2) Whenever marginal cost is greater than average total cost, average total cost is rising

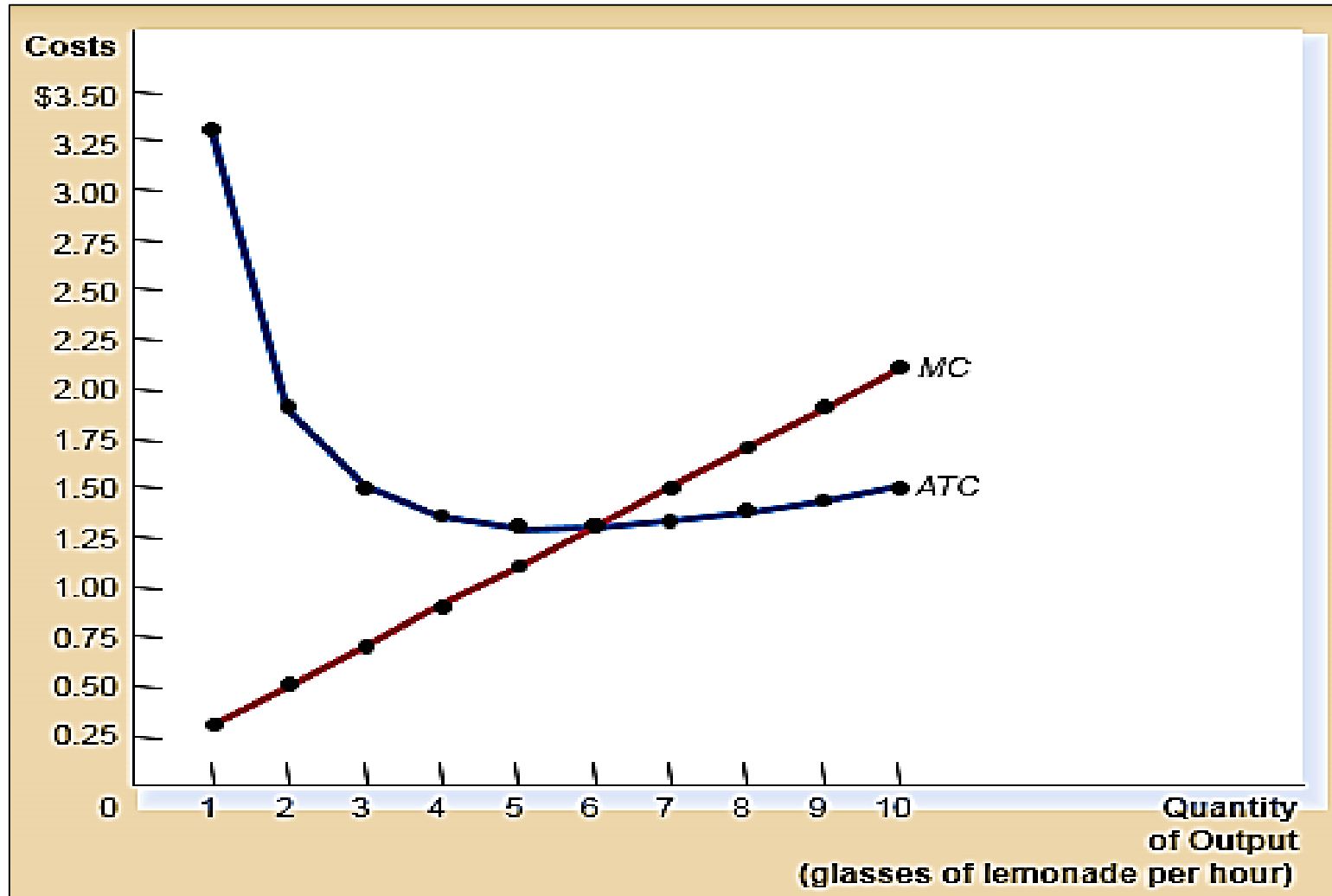


## Relationship between Marginal Cost and Average Total Cost

- 3) The marginal-cost curve crosses the average-total-cost curve at the efficient scale
  - Efficient scale is the quantity that minimizes average total cost



# ATC and MC Curves



# 5. Costs in the Short Run and in the Long Run

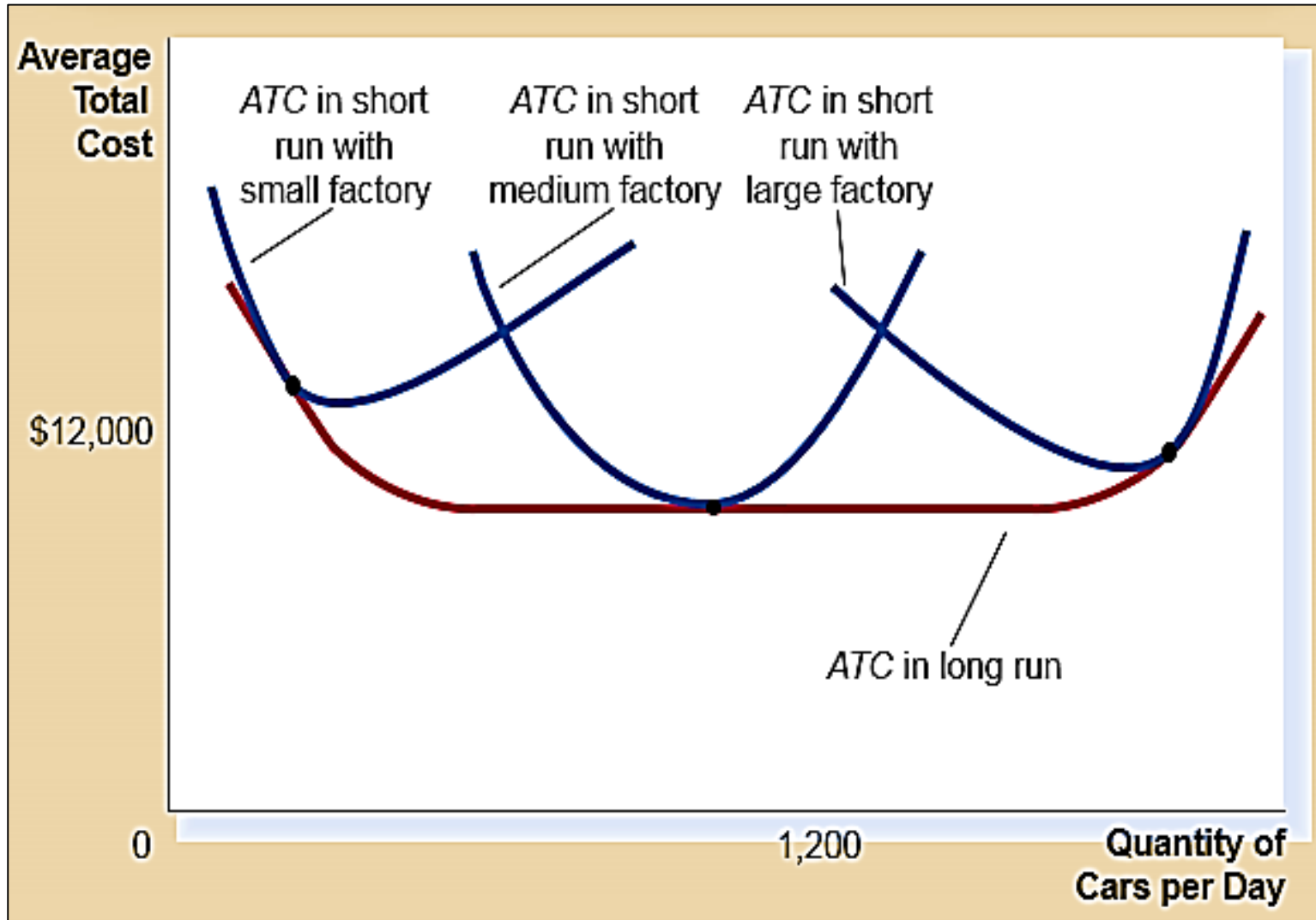


- For many firms, the division of total costs between fixed and variable costs depends on the time horizon being considered
  - In the short run, some costs are fixed
  - In the long run, fixed costs become variable costs

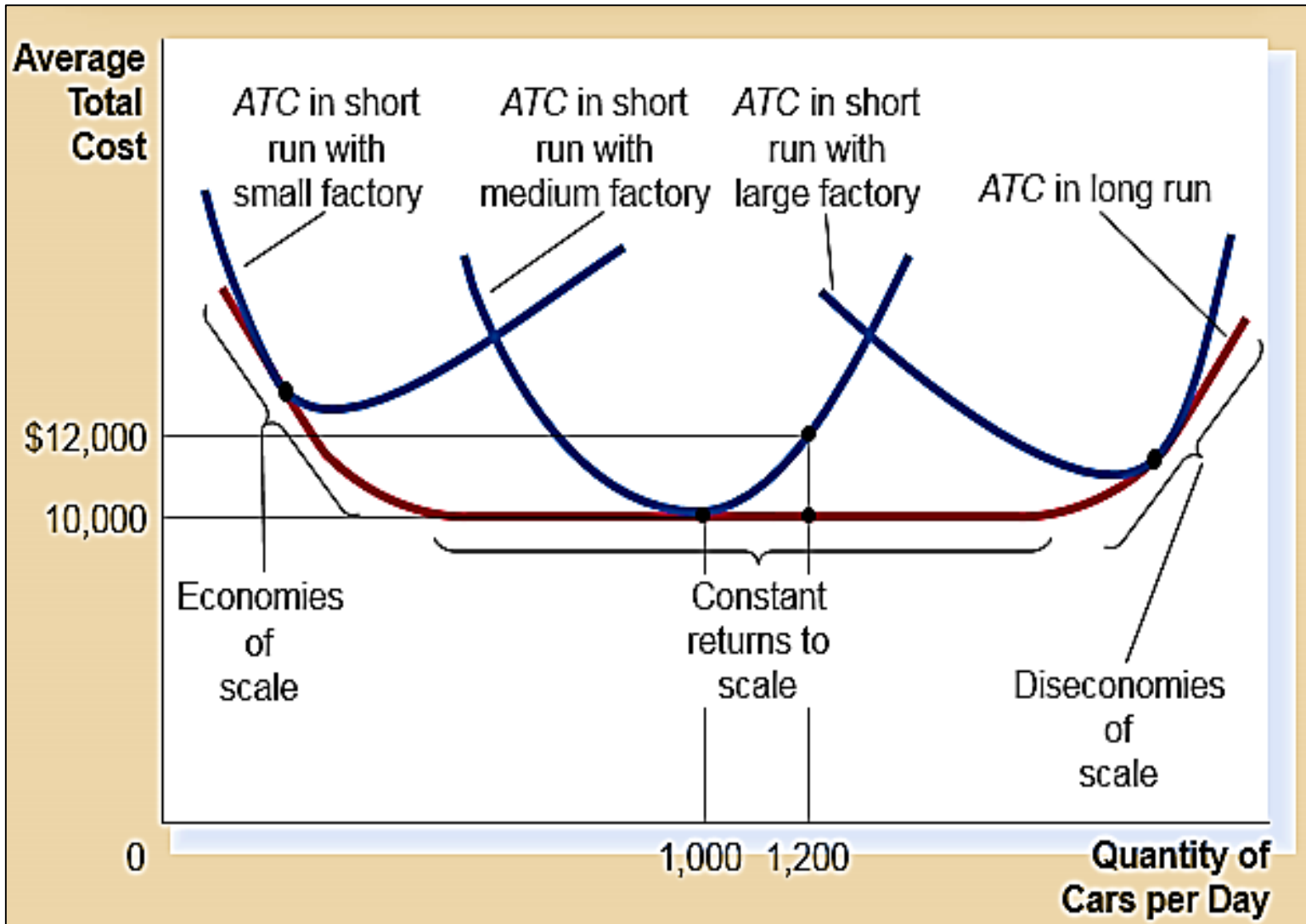


- Because many costs are fixed in the short run but variable in the long run, a firm's long-run cost curves differ from its short-run cost curves

# ATC in the Short and Long Run



# Economies and Diseconomies of Scale



# 6. Profit Maximization: Production Decision Rule



**Average Revenue (AR)** = revenue earned per unit of output

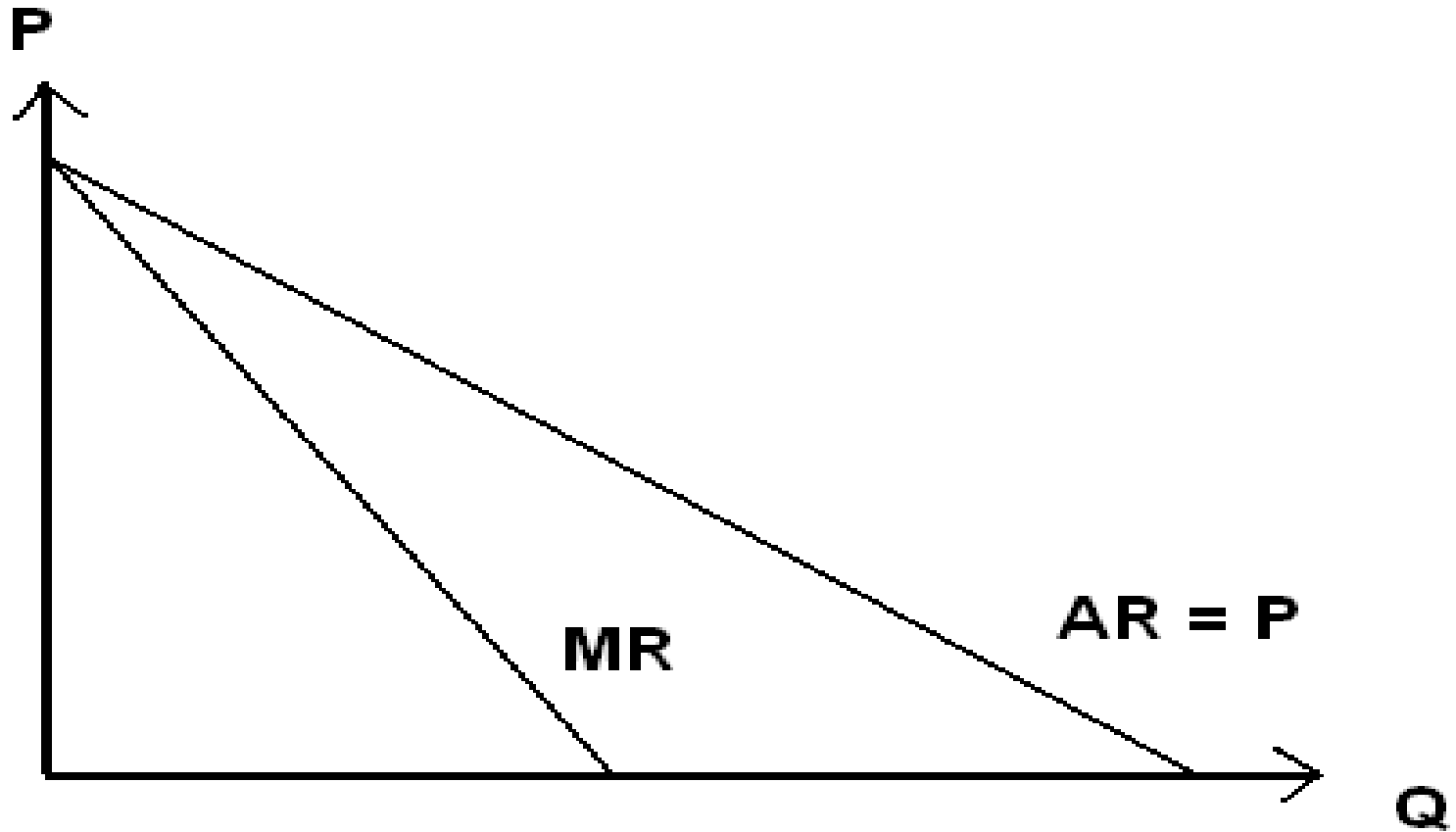
$\Rightarrow AR = TR/Q = P =$  price per unit of output = demand

$\Rightarrow$  AR curve is the demand curve

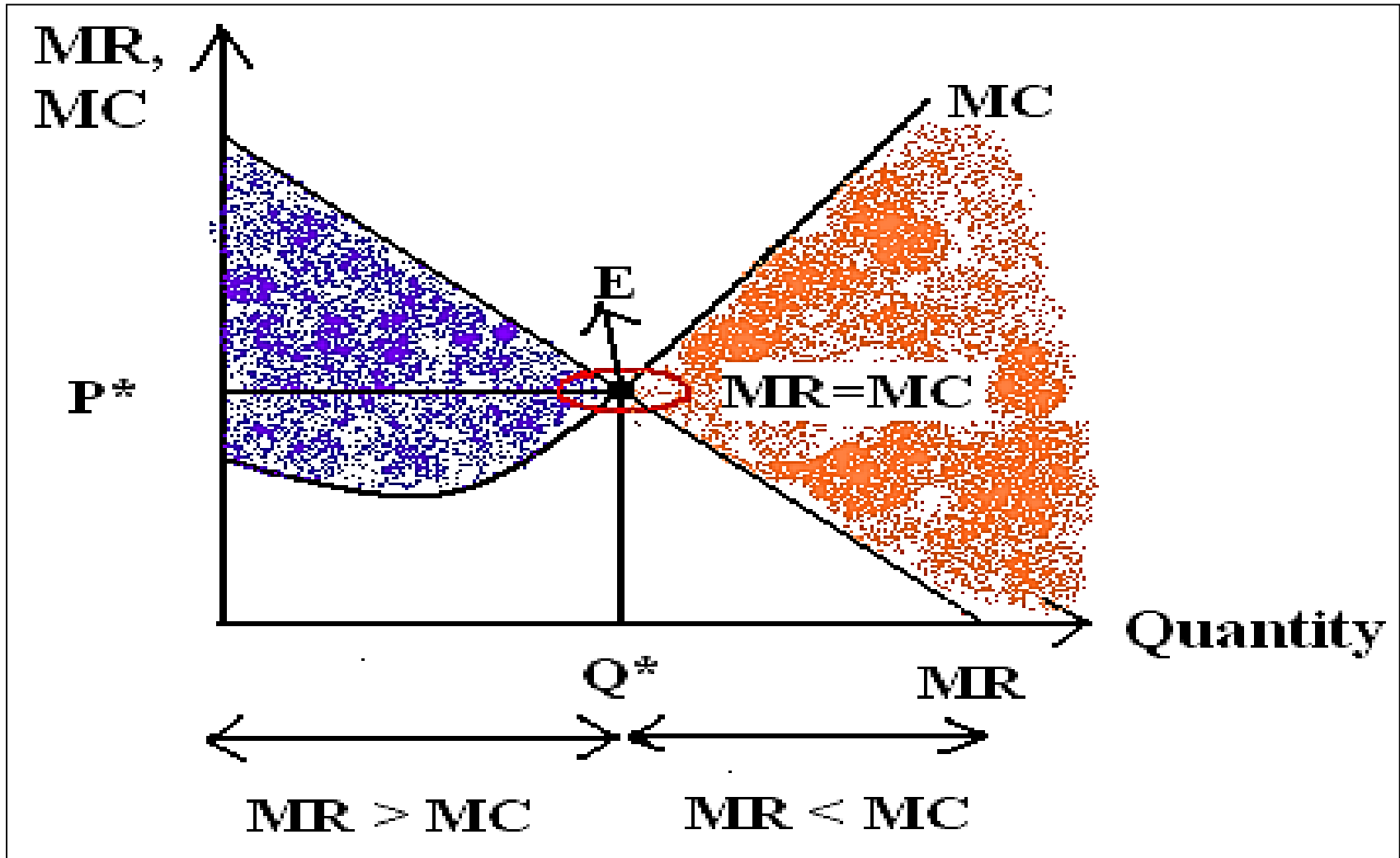
**Marginal Revenue (MR)** =  $\Delta TR / \Delta Q$

= change in TR due to a unit change in output

# Cont.



# Profit maximization occurs when $MR = MC$





THANK  
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