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CHAPTER ONE

Economic Models

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Theoretical Models

- Economic models
  - Used by economists to describe economic activities
  - Most are abstractions from reality
  - Provide aid in understanding economic behavior

Verification of Economic Models

- Two general methods used to verify economic models:
  - Direct approach
    - Establishes the validity of the model's assumptions
  - Indirect approach
    - Shows that the model correctly predicts real-world events

Verification of Economic Models

- We can use the profit-maximization model to examine these approaches
  - Is the basic assumption valid? Do firms really seek to maximize profits?
  - Can the model predict the behavior of real-world firms?

General Features of Economic Models

1. Ceteris Paribus assumption

- "Other things the same"
- Economic models explain simple relationships
  - Focus on only a few forces at a time
  - Other variables are assumed to be unchanged

General Features of Economic Models

2. Optimization assumption

- Economic actors are rationally pursuing some goal
  - Consumers: maximize utility
  - Firms: maximize profits (or minimize costs)
  - Government regulators: maximize public welfare
- Generate precise, solvable models
- Optimization models appear to perform fairly well in explaining reality

EXAMPLE 1.1 Profit Maximization

- A firm can sell all the output that it wishes at a price of p per unit
  - Total costs of production, C, depend on the amount produced, q
- Profits = $\pi = pq - C(q)$
- The profit-maximization output level, q*
  - First-order condition
    - Output level for which price is equal to marginal cost, $C'(q)$
  - Second-order condition
    - Marginal cost must be increasing at q*

EXAMPLE 1.1 Profit Maximization

First-order condition:

$$\frac{d\pi}{dq} = p - C'(q) = 0 \quad \text{or} \quad p = C'(q)$$

Second-order condition:

$$\frac{d^2\pi}{dq^2} = -C''(q) < 0 \quad \text{or} \quad C''(q^*) > 0$$

$$\frac{d(p - C'(q^*) = 0)}{dp} = 1 - C''(q^*)\frac{dq^*}{dp} = 0$$

$$\Rightarrow \frac{dq^*}{dp} = \frac{1}{C''(q^*)} > 0$$

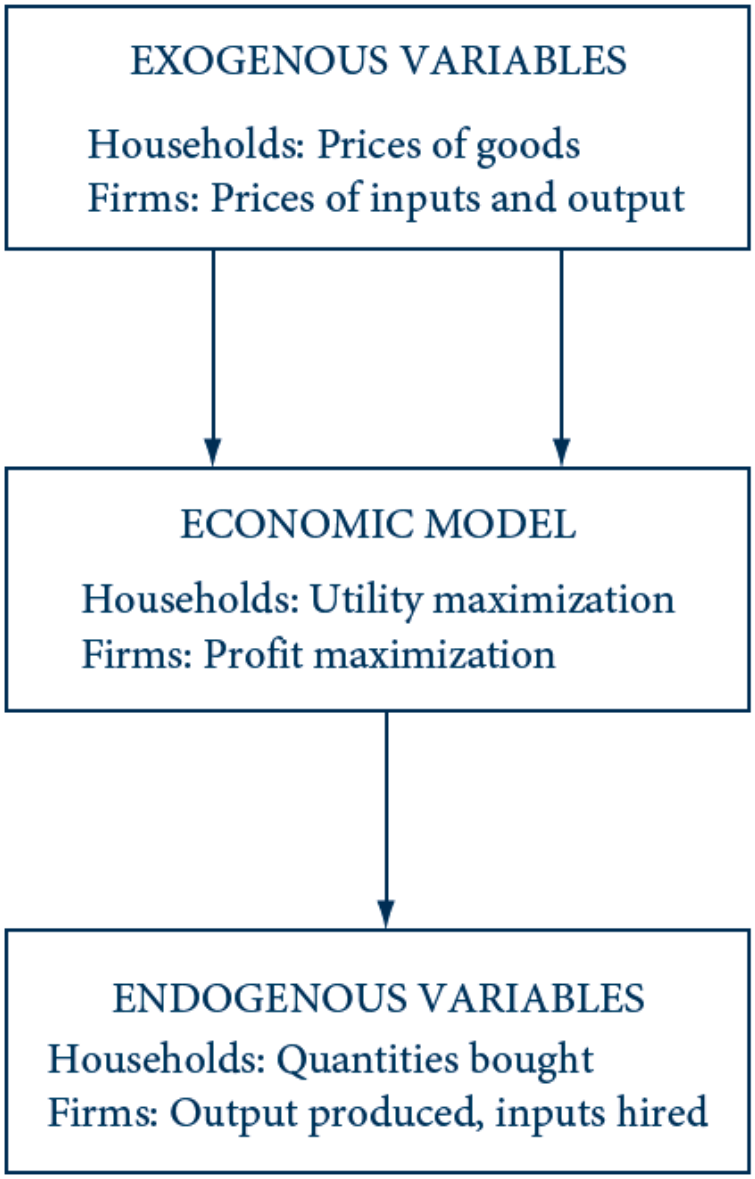
General Features of Economic Models

3. Positive-normative distinction

- Positive economic theories
  - Seek to explain the economic phenomena that are observed
- Normative economic theories
  - Focus on what "should" be done

FIGURE 1.1

Structure of a Typical Microeconomic Model



Values for exogenous variables are inputs into most economic models. Model outputs (results) are values for the endogenous variables.

The Economic Theory of Value

- Early economic thoughts on "value"
  - "Value" was considered to be synonymous with "importance"
  - The price of an item may differ from its value
  - Prices > value were judged to be "unjust"

The Economic Theory of Value

- The founding of modern economics
  - *The wealth of nations* by Adam Smith is considered the beginning of modern economics
  - Continuation of distinction between value and price
    - Value meant "value in use"
    - Price meant "value in exchange"

The Economic Theory of Value

- Labor theory of exchange value
  - The exchange values of goods are determined by the costs of producing them
    - Primarily affected by labor costs
  - Diamond-water paradox
    - Producing diamonds requires more labor than producing water

The Economic Theory of Value

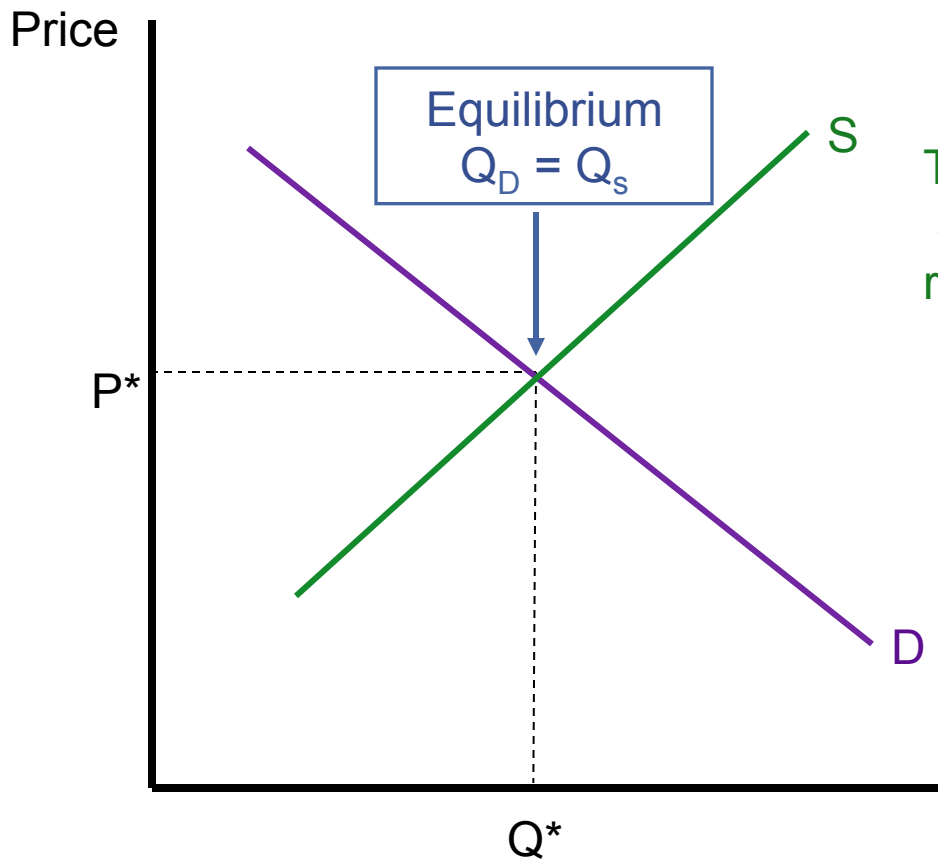
- The marginalist revolution
  - The exchange value of an item is determined by the usefulness of the *last unit consumed*
    - Since water is plentiful, consuming an additional unit has a relatively low value

The Economic Theory of Value

- Marshallian supply-demand synthesis
  - Supply and demand simultaneously operate to determine price
  - Prices reflect both the marginal valuation that consumers place on goods and the marginal costs of producing the goods

FIGURE 1.2

The Marshallian Supply–Demand Cross



The supply curve has a positive slope because marginal cost rises as quantity increases

The demand curve has a negative slope because the marginal value falls as quantity increases

Marshall theorized that demand and supply interact to determine the equilibrium price (p) and the quantity (q) that will be traded in the market. He concluded that it is not possible to say that either demand or supply alone determines price or therefore that either costs or usefulness to buyers alone determines exchange value.

EXAMPLE 1.2 Supply-Demand Equilibrium

- Quantity demanded = $q_D = 1000 - 100p$
- Quantity supplied = $q_S = -125 + 125p$
- Equilibrium $\Rightarrow q_D = q_S$

$1000 - 100p = -125 + 125p$

$225p = 1125$

$p^* = 5$

$q^* = 500$

EXAMPLE 1.2 Supply-Demand Equilibrium

- A more general model is

$$q_D = a + bp$$

$$q_S = c + dp$$

- Equilibrium $\Rightarrow q_D = q_S$

$$a + bp = c + dp$$

$$p^* = \frac{a - c}{d - b}$$

- What happens to the equilibrium price if either demand or supply shift?
  - An increase in demand (an increase in a) increases equilibrium price
  - An increase in supply (an increase in c) reduces price

$$\frac{dp^*}{da} = \frac{1}{d-b} > 0$$

$$\frac{dp^*}{dc} = \frac{-1}{d-b} < 0$$

EXAMPLE 1.2 Supply-Demand Equilibrium

- A shift in demand will lead to a new equilibrium:

$q'_D = 1450 - 100p$

$q'_D = 1450 - 100p = q_S = -125 + 125p$

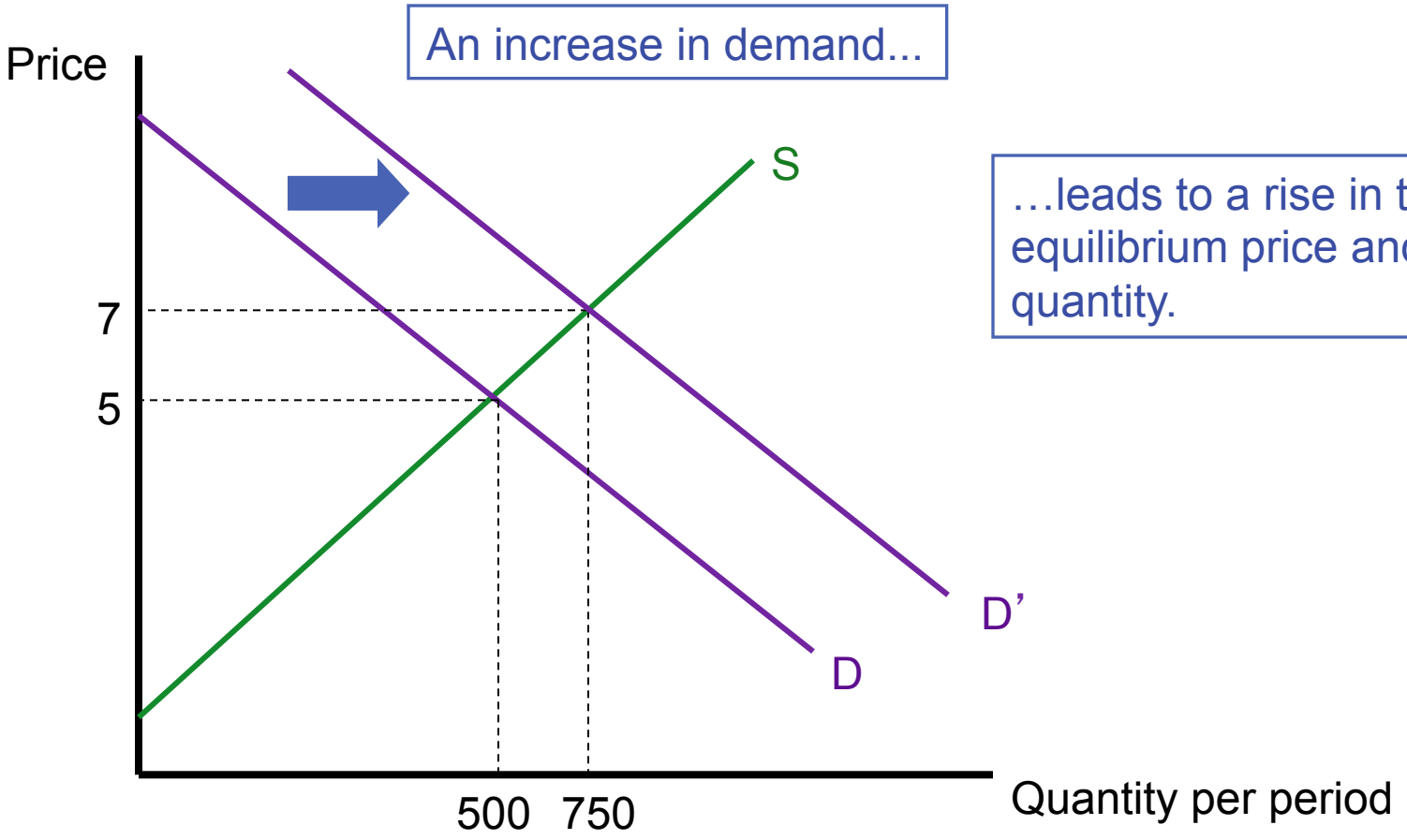
$225p = 1575$

$p^* = 7$

$q^* = 750$

FIGURE 1.3

Changing Supply–Demand Equilibria



The initial supply–demand equilibrium is illustrated by the intersection of D and S (p* = 5, q* = 500). When demand shifts to $q_{D'}$ =1; 450 - 100p (denoted as D'), the equilibrium shifts to p*= 7, q*=750.

The Economic Theory of Value

- Paradox resolved
  - Water
    - Low marginal value
    - Low marginal cost of production
    - Low price
  - Diamonds
    - High marginal value
    - A high marginal cost of production
    - High price

The Economic Theory of Value

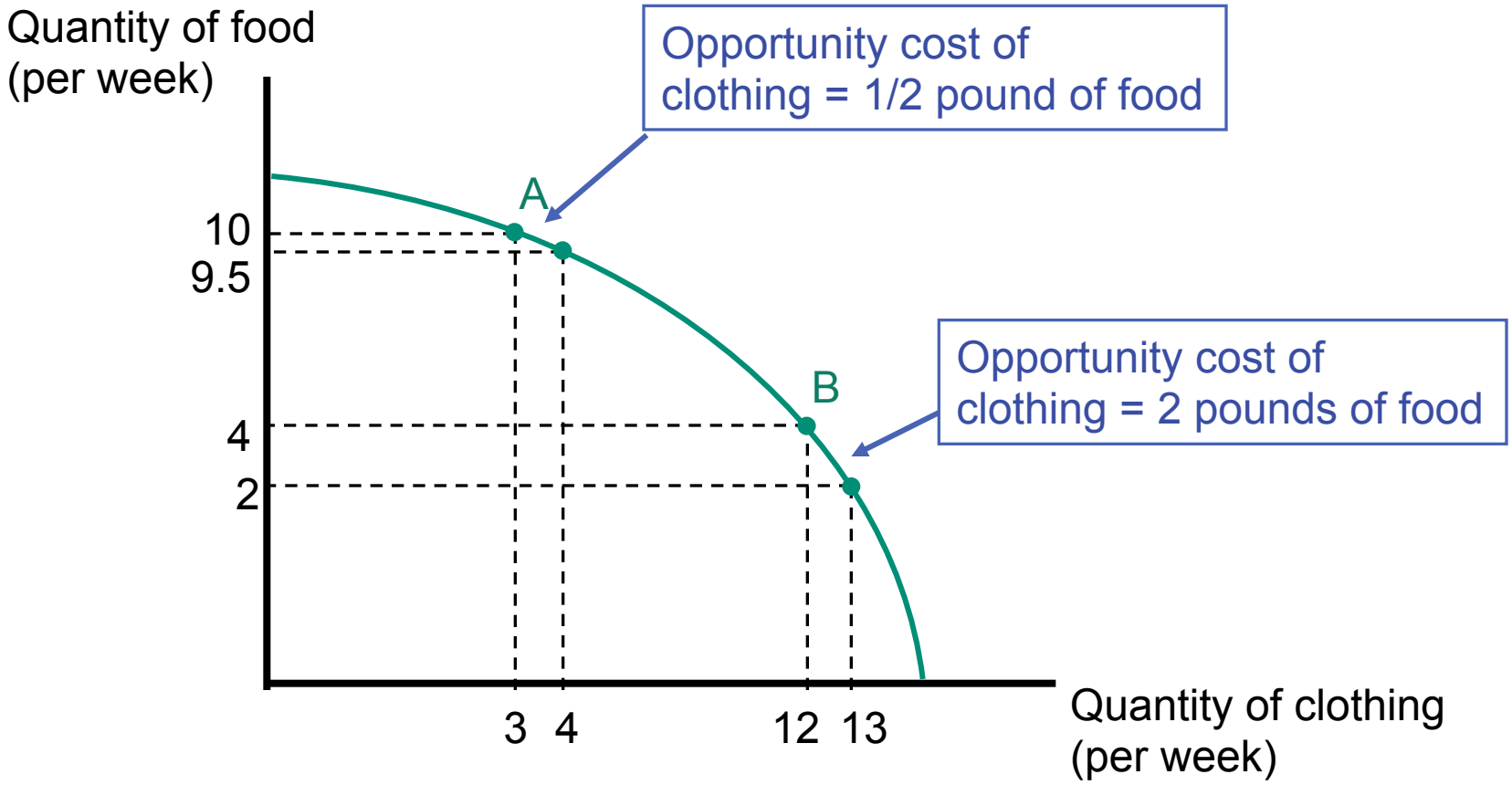
- General equilibrium models
  - The Marshallian model is a partial equilibrium model
    - Focuses only on one market at a time
  - For more general questions, we need a model of the entire economy
    - Must include the interrelationships between markets and economic agents

The Economic Theory of Value

- Production possibilities frontier
  - Can be used as a basic building block for general equilibrium models
  - Shows the combinations of two outputs that can be produced with an economy's resources

FIGURE 1.4

Production Possibility Frontier



The production possibility frontier shows the different combinations of two goods that can be produced from a certain amount of scarce resources. It also shows the opportunity cost of producing more of one good as the amount of the other good that cannot then be produced. The opportunity cost at two different levels of clothing production can be seen by comparing points A and B.

The Economic Theory of Value

- Resources are scarce
- Scarcity ⇒ we must make choices
  - Each choice has opportunity costs
  - Opportunity costs depend on how much of each good is produced
- Welfare economics
  - Concerns the desirability of various economic outcomes

EXAMPLE 1.3 A Production Possibility Frontier

- An economy produces two goods, x and y
  - Labor - the only input
  - Production function for good x: $x=l_x^{0.5}$
    - l_x is the quantity of labor used in x production
  - Production function for good y: $y=2l_y^{0.5}$
    - l_y is the quantity of labor used in y production
  - Total labor available: $l_x + l_y \leq 200$
- Production possibilities frontier:

$$l_x + l_y = x^2 + 0.25y^2 \leq 200$$

EXAMPLE 1.3 A Production Possibility Frontier

- Opportunity cost of good y in terms of good x
  - $x^2 + 0.25y^2 = 200$, or $y^2 = 800 - 4x^2$, or

$$y = \sqrt{800 - 4x^2}$$

- If we differentiate, we get

$$\frac{dy}{dx} = 0.5(800 - 4x^2)^{-0.5}(-8x) = \frac{-4x}{y}$$

  - When $x = 10$, $y = 20$, $dy/dx = -4(10)/20 = -2$

EXAMPLE 1.3 A Production Possibility Frontier

- Concavity
  - The slope of the frontier becomes steeper (more negative) as x output increases and y output decreases
  - When $x = 12$, $y \approx 15$, $dy/dx = -4(12)/15 = -3.2$
- Inefficiency
  - Economy operating inside its production possibility frontier
    - 20 workers are permanently unemployed
  - $x^2 + 0.25y^2 = 180$
    - When $x = 10$, then $y \approx 17.9$

The Economic Theory of Value

- Welfare economics
  - ‘‘Economic efficiency’’
  - Conditions under which markets will be able to achieve it
  - Clarifying the relationship between the allocation pricing of resources
    - Properly functioning markets provide an ‘‘invisible hand’’ that helps allocate resources efficiently

Modern Developments

- The mathematical foundations of economic models
  - Clarification and formalization of the basic assumptions that are made about individuals and firms
- New tools for studying markets
  - Creation of new tools to study markets

Modern Developments

- The economics of uncertainty and information
  - Incorporation of uncertainty and imperfect information into economic models
- Computers and empirical analysis
  - Increasing use of computers to analyze economic data and build economic models