

Unit 3: Economic Models and Graphical Analysis

Learning Objectives

By the end of this unit, students will be able to:

- Explain the structure and assumptions of **demand** and **supply** models.
- Analyze **market equilibrium** and the effects of changes in demand and supply.
- Apply **comparative statics** to assess the impact of external shocks.
- Represent and interpret **economic relationships** graphically.

The demand and supply model is a fundamental tool in economics used to explain how prices and quantities of goods are determined in a market. Demand represents consumers' willingness and ability to purchase goods at different prices, while supply represents producers' willingness and ability to sell goods at various prices.

1. Demand and Supply Models

Economic models are **simplified representations** of reality that help us understand how markets function.

Among the **most fundamental models** are the **demand and supply models**, which describe the behavior of buyers and sellers in a market.

1.1 Demand

The **demand curve** shows the relationship between the price of a good and the quantity consumers are willing and able to buy, *holding other factors constant* (*ceteris paribus*).

Mathematically:

$$Q_d = a - bP$$

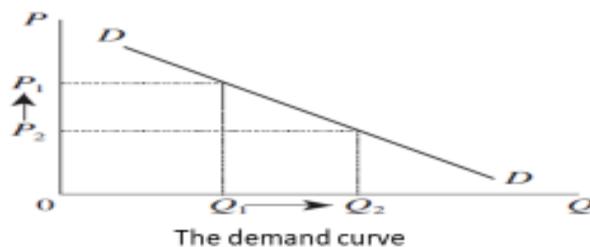
where:

- Q_d = Quantity demanded
- P = Price
- a = Intercept (maximum demand when price = 0)
- b = Slope coefficient (rate of change in demand as price changes)

Law of Demand:

As price increases, quantity demanded decreases, and vice versa — an inverse relationship.

The law of demand.....



Symbolically, the law of demand may be summarised as:

$$Q_D = f(P)$$

and

$$\frac{dQ_D}{dP} < 0$$

The above equation states that Q_D , the quantity demanded of a good or service, is functionally related to the selling price P . The inequality sign asserts that quantity demanded and price are inversely related.

This relationship is illustrated in the demand curve. The downward-sloping demand curve illustrates the inverse relationship between the quantity demanded of a good or service and its selling price.

1.2 Supply

The **supply curve** shows how much producers are willing to sell at various prices.

Mathematically:

$$Q_s = c + dP$$

where:

- Q_s = Quantity supplied
- P = Price
- c = Intercept (quantity supplied when price = 0)
- d = Slope coefficient (rate of change in supply as price changes)

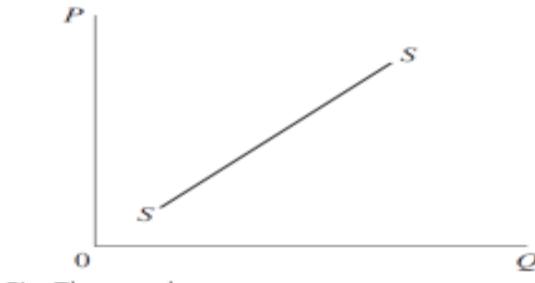
Law of Supply:

As price increases, quantity supplied increases — a direct relationship.

THE LAW OF SUPPLY

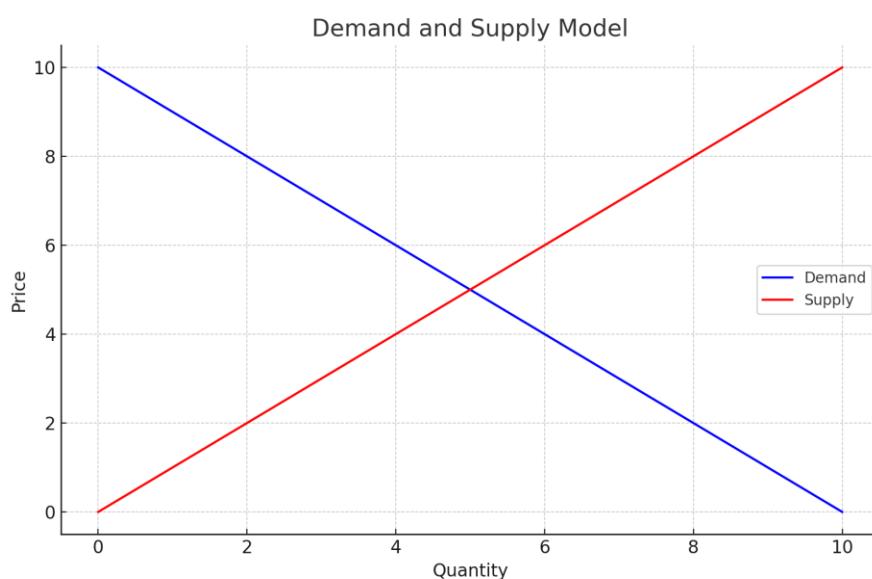
Definition: The law of supply asserts that quantity supplied of a good or service is directly (positively) related to the selling price, *ceteris paribus*.

Symbolically: $QS = g(P)$ *where:* $dQs/dP > 0$



Description:

- Draw two curves on a standard price–quantity (P–Q) axis.
- The **demand curve (D)** should slope downward.
- The **supply curve (S)** should slope upward.
- Label the intersection point as **E (Equilibrium)**, where $Qd = Qs$.
- Label the axes: *Price (vertical)* and *Quantity (horizontal)*.



2. Equilibrium Analysis

Equilibrium is the point where **quantity demanded equals quantity supplied**. At this point, the market price stabilizes — there is no **shortage** or **surplus**.

2.1 Determining Equilibrium

Let:

$$Q_d = 100 - 5P, Q_s = 20 + 3P$$

To find equilibrium:

$$Q_d = Q_s \Rightarrow 100 - 5P = 20 + 3P \Rightarrow P = 10$$

Substitute into either equation:

$$Q = 100 - 5(10) = 50$$

Equilibrium Price (P_e) = 10

Equilibrium Quantity (Q_e) = 50

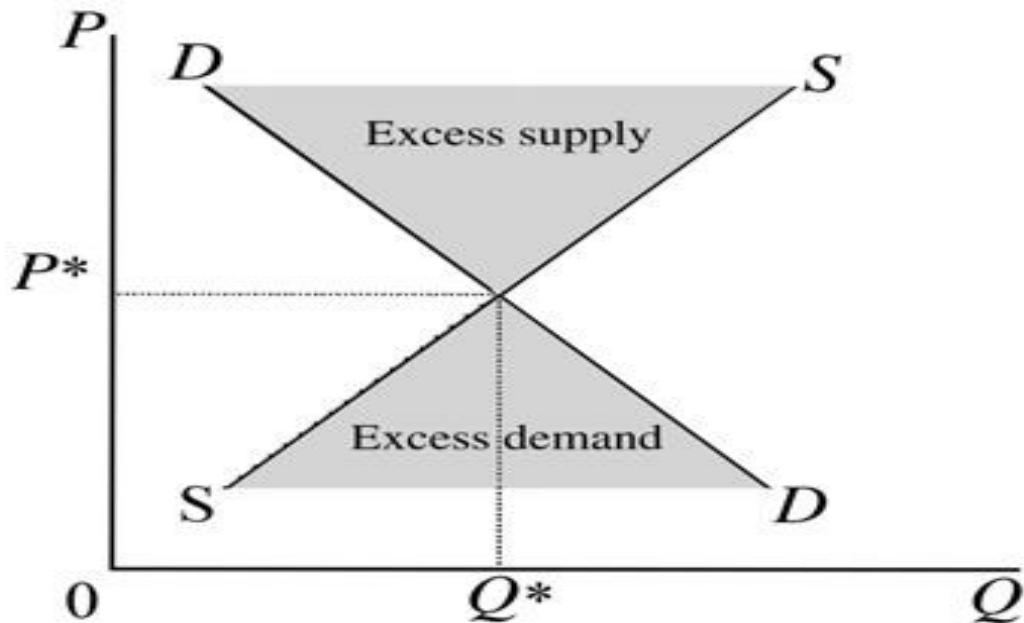
2.2 Market Adjustment

- If **price > P_e** , there is a **surplus**, and sellers lower prices.
- If **price < P_e** , there is a **shortage**, and buyers bid prices up.

Over time, these forces push the market back to equilibrium.

Description:

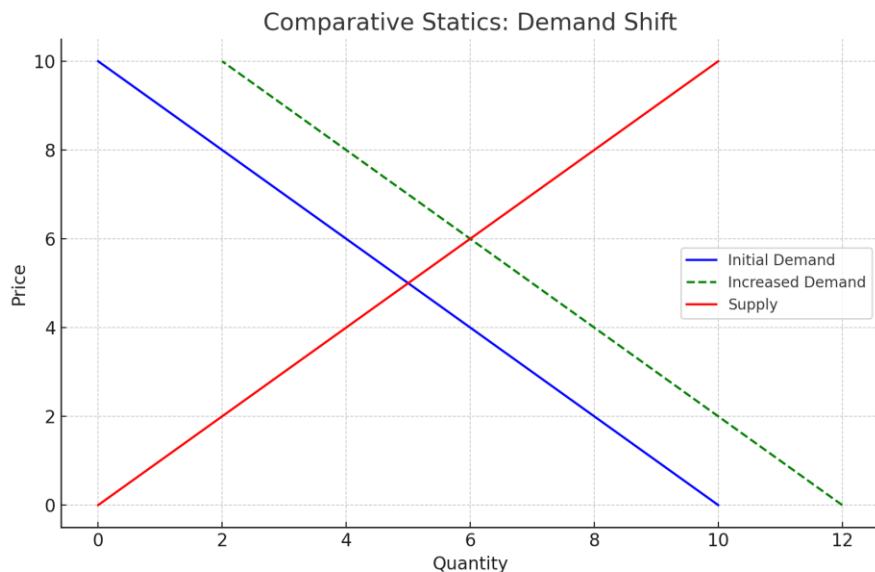
- Use the same D and S curves.
- Mark **E (P_e, Q_e)** where they intersect.
- Shade the area above equilibrium as “Surplus” and below as “Shortage.”
- Add arrows showing how prices adjust back to equilibrium.



3. Comparative Statics

Comparative statics involves analyzing the **effect of a change in one variable** (like demand or supply) on equilibrium. For instance, if consumer income increases, demand for normal goods will rise, shifting the demand curve to the right.

Comparative statics studies how **changes in external factors** (like income, tastes, technology, or policy) shift demand or supply, and how these shifts affect the new equilibrium.

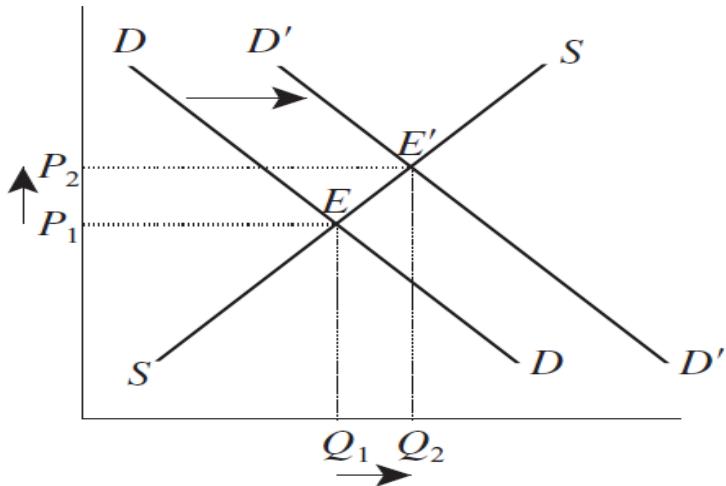


3.1 Shift in Demand

Suppose consumers' income increases (for a normal good).
The demand curve shifts **rightward** ($D \rightarrow D_1$).

Description:

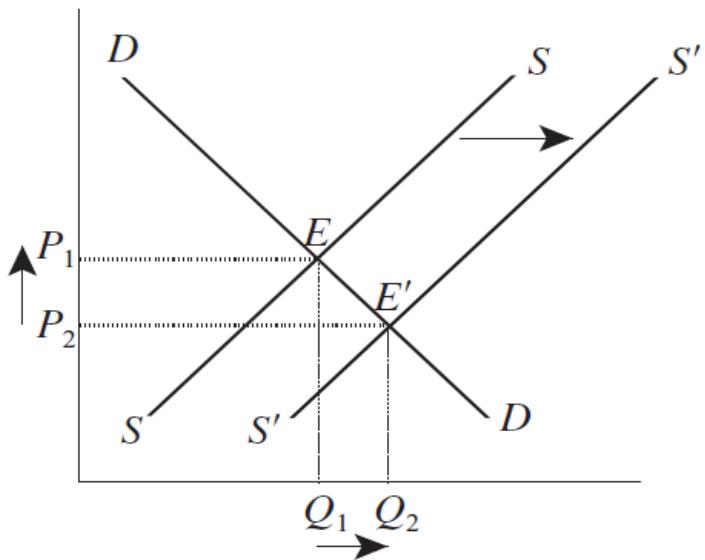
- Show a rightward shift in demand (D to D_1).
- Label initial equilibrium E_0 and new equilibrium E_1 .
- Indicate the increase in both price and quantity.
- New equilibrium: higher price and higher quantity.



3.2 Shift in Supply

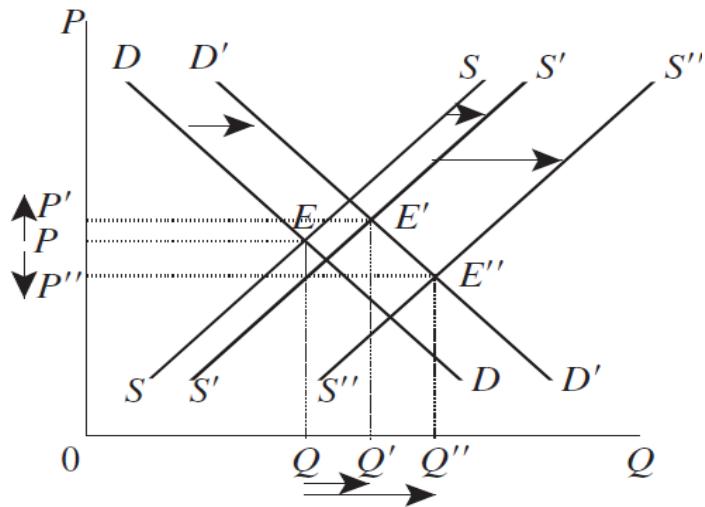
If technology improves, producers can make goods more efficiently.
The supply curve shifts **rightward** ($S \rightarrow S_1$).

- New equilibrium: lower price and higher quantity.

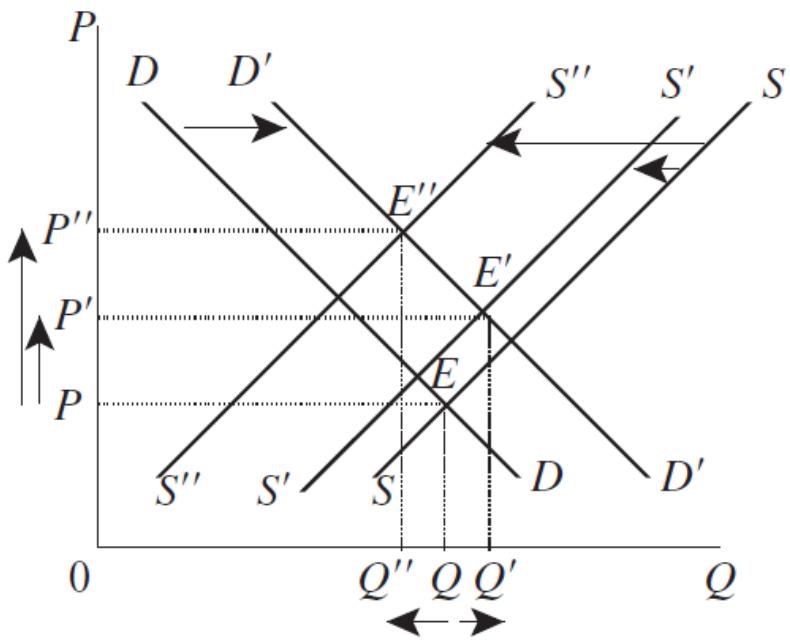


3.3 A shift in both demand and supply

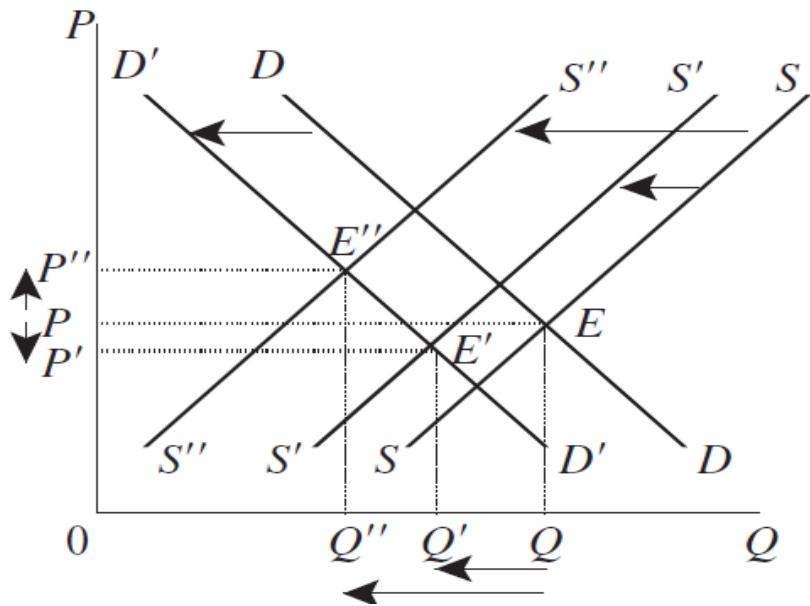
An Increase in Demand and an Increase in Supply



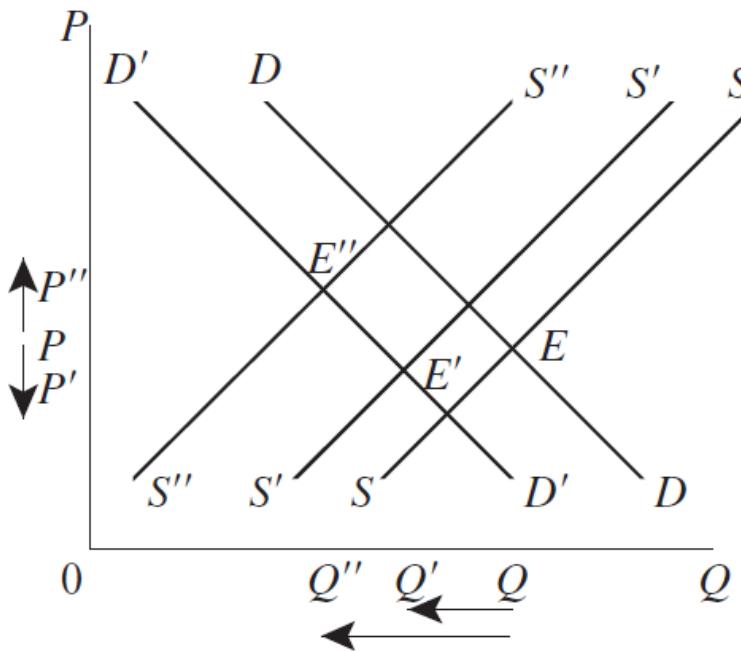
An Increase in Demand and a Decrease in Supply



A Decrease in Demand and a Decrease in Supply



A Decrease in Demand and an Increase in Supply

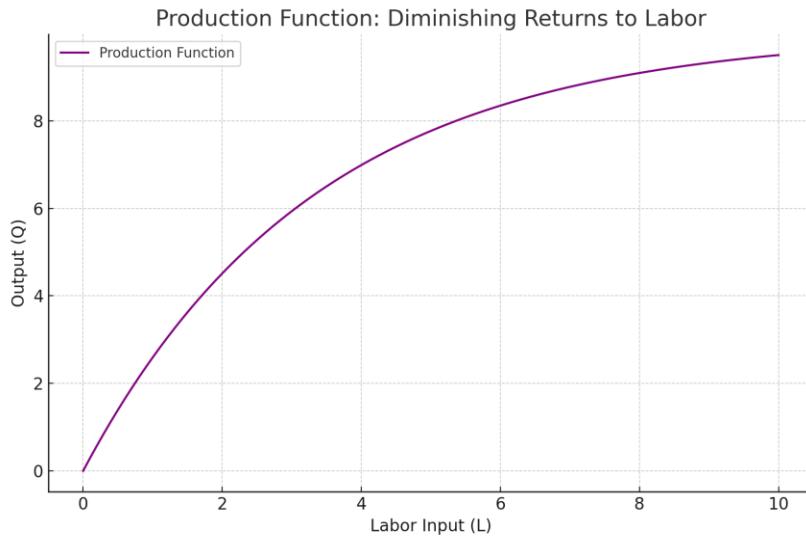


4. Graphical Representation of Economic Relationships

Graphs are visual tools that allow economists to demonstrate relationships among variables quickly and clearly.

4.1 Types of Economic Relationships

1. **Positive (Direct) Relationship** – As one variable increases, the other increases (e.g., supply curve).
2. **Negative (Inverse) Relationship** – As one variable increases, the other decreases (e.g., demand curve).
3. **Nonlinear Relationship** – The relationship changes at different rates (e.g., production with diminishing returns).

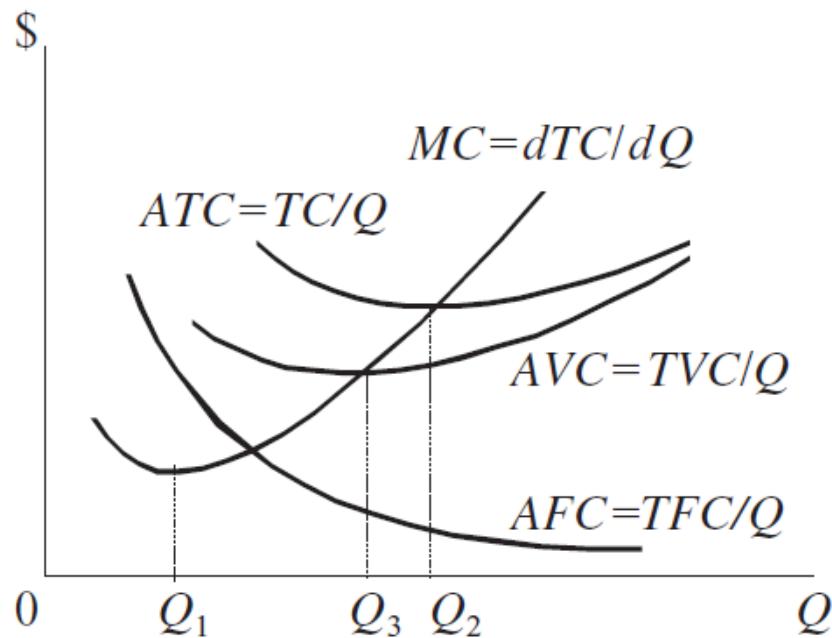


4.2 Applications

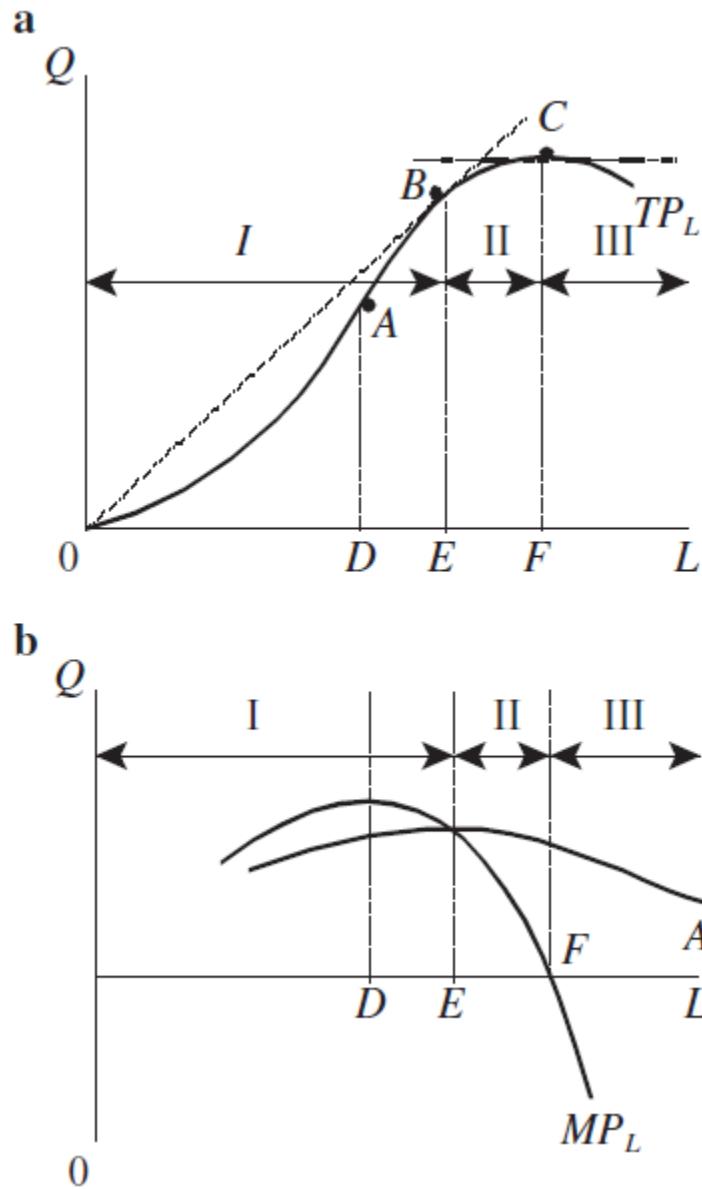
- **Total Revenue and Price:** Often form an inverted U-shape due to elasticity.
- **Production Function:** Initially increasing returns, then diminishing returns.
- **Cost Curves:** U-shaped, due to economies and diseconomies of scale.

Description:

- Option 1: Draw a **U-shaped cost curve** (Average Cost).



- Option 2: Draw a **product curve** with an Inverted-U shape.



- Label key points (minimum cost, maximum).

Summary

This unit presented the **core analytical tools** used in economics to model and interpret market behavior.

Through **demand and supply models**, we understand how prices and quantities are determined.

Equilibrium analysis shows how markets self-adjust, while **comparative statics** explains the impact of external shocks and policy changes.

Finally, **graphical representations** help translate abstract models into intuitive visuals, making economic reasoning clearer and more effective.

Students who master these tools will be able to:

- Interpret real-world market outcomes.
- Predict how changes in policy or environment affect equilibrium.
- Communicate economic ideas effectively using both equations and diagrams.

Conclusion

Economic models and graphical analysis are vital tools for understanding how markets operate, predicting outcomes, and formulating policy. Through the use of demand and supply models, equilibrium analysis, comparative statics, and graphical tools, economists can represent and interpret complex relationships between variables.