

# Unit 3

## Production & Cost Analyses

### PRODUCTION ANALYSIS

#### PRODUCTION FUNCTION

The production function represents the relationship between the inputs (factors of production) and the resulting output. It shows how different combinations of inputs result in different levels of output.

##### Mathematical Representation

$$Q = f(L, K)$$

Where:

- Q = Output
- L = Labour
- K = Capital

Assumes technology is constant and resources are used efficiently.

#### TIME PERIOD IN PRODUCTION

##### Short Run

- Some inputs (like capital) are fixed.
- Only labour or raw material can be changed.
- Relevant for Law of Variable Proportion.

##### Long Run

- All inputs are variable.
- Firms can change the scale of production.
- Relevant for Returns to Scale.

#### FIXED AND VARIABLE INPUTS

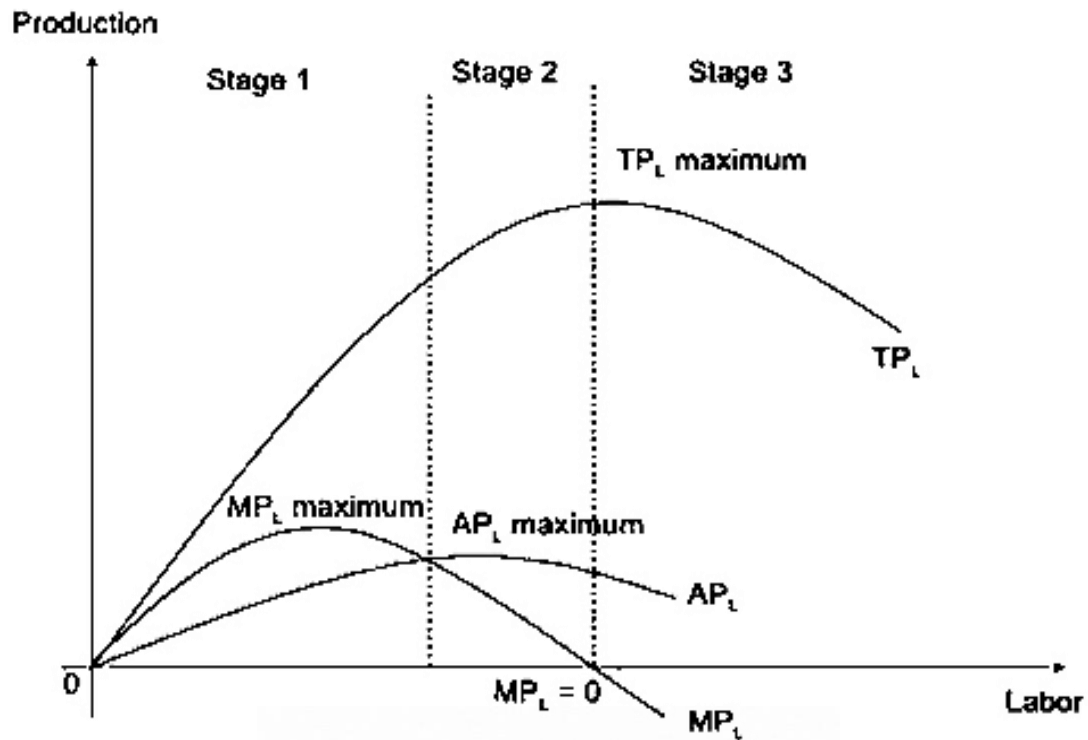
Factor Type	Description	Examples
Fixed Inputs	Do not change with output in short run	Plant, Building, Machinery
Variable Inputs	Change with output level	Labour, Raw Materials, Fuel

#### TOTAL, MARGINAL, AND AVERAGE PRODUCT

Term	Definition	Formula
Total Product (TP)	Total output from given inputs	Sum of all output
Marginal Product (MP)	Additional output from one more unit of input	$\Delta TP / \Delta \text{Input}$
Average Product (AP)	Output per unit of input	$TP / \text{Input}$

#### SHAPES OF TP, MP, AND AP CURVES

- **TP Curve:** Rises, flattens, and then falls.
- **MP Curve:** Increases, peaks, falls, and becomes negative.
- **AP Curve:** Rises, peaks when  $MP = AP$ , and then declines.



## LAW OF VARIABLE PROPORTIONS

As more units of a variable input are added to fixed inputs, total output increases initially at an increasing rate, then at a decreasing rate, and finally starts declining.

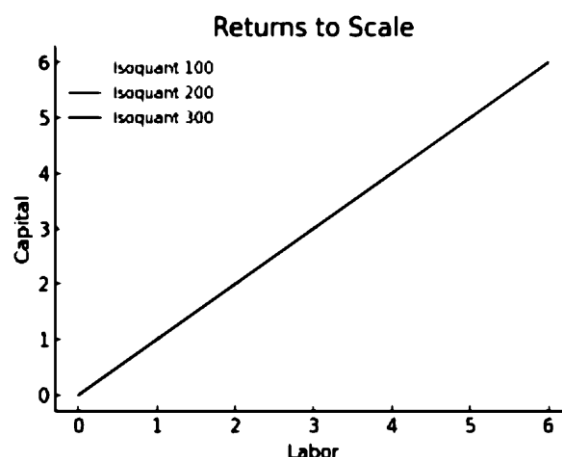
### Three Stages

1. Stage I – Increasing Returns: MP increases.
2. Stage II – Diminishing Returns: MP decreases, but positive. (Most efficient stage)
3. Stage III – Negative Returns: MP becomes negative, TP falls.

## RETURNS TO SCALE (LONG RUN CONCEPT)

Refers to changes in output when all inputs are changed by the same proportion.

Type	Description
Increasing Returns	Output increases more than inputs
Constant Returns	Output increases in the same proportion
Decreasing Returns	Output increases less than inputs



Returns to scale are shown through isoquants where distance between isoquants changes based on the type of return.

# **COST ANALYSIS**

## **COST**

Economies of scale are cost advantages that businesses experience when they increase production. This happens because fixed costs are spread out over more units, and because businesses can negotiate lower prices for materials when they buy in bulk.

## **TYPES OF COSTS**

Type	Description	Formula
<b>Fixed Cost (FC)</b>	Constant in short run	Rent, salaries
<b>Variable Cost (VC)</b>	Changes with output	Wages, raw materials
<b>Total Cost (TC)</b>	Sum of FC and VC	$TC = FC + VC$
<b>Average Cost (AC)</b>	Cost per unit	$AC = TC / Q$
<b>Average Fixed Cost (AFC)</b>	FC per unit	$AFC = FC / Q$
<b>Average Variable Cost (AVC)</b>	VC per unit	$AVC = VC / Q$
<b>Marginal Cost (MC)</b>	Cost of one more unit	$MC = \Delta TC / \Delta Q$

## **ECONOMIES OF SCALE**

A cost reduction that occurs when a business increases production. It happens when Fixed costs are spread out over more units.

### **Internal Economies (within firm):**

- Technical, Managerial, Financial, Marketing, Risk-bearing

### **External Economies (industry-level):**

- Infrastructure, skilled labour, R&D clusters

## **HOW ECONOMIES OF SCALE WORK**

As a business grows, it can spread fixed costs over more units. Businesses can negotiate lower prices for materials when they buy in bulk. Businesses can employ specialist managers who are more efficient at certain tasks. Businesses can invest in newer and better technology. Economies of scale can boost economic growth by creating more jobs and increasing prosperity. However, economies of scale can also have negative consequences, such as workers earning less money.