MICROECONOMICS II

UNIT 4

General Equilibrium Analysis

Partial and General Equilibrium Analysis

- Partial equilibrium analysis examines the equilibrium condition in a **single market or sector** in isolation, assuming that all other markets remain constant. This approach focuses on the supply and demand of a particular good or service while holding other factors (such as the prices of other goods and income levels) constant. It is also referred to as the **ceteris paribus** (all else equal) approach.
- **Features**
- **Focus**: Studies the equilibrium in one specific market, ignoring its interdependence with other markets.
- **Assumptions**:
  - The effects of changes in this market do not spill over to other markets.
  - Prices of related goods, consumer income, and production costs remain constant.
- **Analysis**: Examines the impact of changes in factors such as price, production cost, or taxes on supply, demand, and equilibrium price/quantity in a single market.

- **Advantages**

1. **Simplicity**: Easier to analyze and understand since it deals with one market at a time.
2. **Practicality**: Useful for studying markets with minimal interactions or spillover effects with others.
3. **Policy Applications**: Frequently used in specific tax analysis, subsidy impacts, and price controls.

- **Limitations**

1. **Oversimplification**: Ignores the interconnectedness of markets in the real world.
2. **Limited Scope**: May lead to inaccurate conclusions when there are significant interdependencies with other markets.

General Equilibrium Analysis

- General equilibrium analysis examines how **all markets in an economy interact simultaneously** to determine the overall allocation of resources, prices, and quantities in multiple interconnected markets. This approach considers the interdependence of markets and studies the economy as a whole.
- **Key Features**
- **Scope**: Covers multiple or all markets in the economy simultaneously.
- **Assumptions**:
  - All agents (consumers and producers) are rational and maximize their utility or profit.
  - Markets are perfectly competitive.
  - There is no external intervention or market failure (in the classical model).
- **Equilibrium Condition**: Achieved when supply equals demand in all markets simultaneously, and no agent has an incentive to change their behavior.

- **Advantages**

1. **Realism**: Accounts for the interdependence of markets, making it more reflective of real-world conditions.
2. **Holistic Insight**: Provides a comprehensive view of how changes in one market affect others, capturing the ripple effects across the economy.
3. **Policy Analysis**: Useful for understanding the economy-wide impact of policies such as trade tariffs, tax reforms, or monetary policy.

- **Limitations**

1. **Complexity**: Much harder to model and analyze due to the simultaneous consideration of multiple markets.
2. **Data Requirements**: Requires extensive data and sophisticated mathematical models.
3. **Strong Assumptions**: Often relies on idealized conditions (e.g., perfect competition, absence of externalities), which may not hold in reality.

- **Applications in Policy Analysis**
- **Partial Equilibrium Applications**
  - **Tax Analysis**: Examining how a tax on a single good affects its price, supply, and demand.
  - **Subsidy Effects**: Studying the impact of subsidies on agricultural or industrial products.
  - **Price Controls**: Analyzing the effects of minimum wage laws or rent ceilings.
- **General Equilibrium Applications**
  - **Trade Policy**: Understanding the impact of tariffs and trade agreements on global markets and domestic industries.
  - **Economic Growth**: Analyzing how technological advancements or capital accumulation affect the overall economy.
  - **Macroeconomic Policy**: Assessing the effects of fiscal and monetary policies on output, employment, and inflation.

Walrasian Equilibrium in a Competitive Economy

- The **Walrasian equilibrium**, named after Léon Walras, is a cornerstone of general equilibrium theory in economics. It describes a state in a competitive economy where all markets simultaneously clear, meaning that the supply equals demand for every good and service at a set of equilibrium prices.

Features of Walrasian Equilibrium:

•**Market Clearing**:
•Each market in the economy clears, meaning that the quantity demanded equals the quantity supplied for every good, service, and factor of production.
•**Perfect Competition**:
•All agents (consumers and producers) are price takers, meaning no individual can influence the market price.
•Prices adjust to equilibrate supply and demand.
•**Rational Behavior**:
•Consumers maximize their utility subject to their budget constraints.
•Firms maximize their profits given their cost structures.
•**Complete Markets**:
•All goods and services are traded in markets, and there are no missing markets.
•Property rights are well-defined, allowing for the exchange of goods and services.
•**No Externalities**:
•The actions of one agent do not directly affect the utility or production of others, except through prices.
•**Convex Preferences and Technologies**:
•Consumers have convex preferences (e.g., diminishing marginal utility), and firms have convex production sets (e.g., diminishing marginal returns).

Properties of Walrasian Equilibrium

1. **Existence:**
    1. Walrasian equilibrium exists under certain conditions, such as convex preferences, continuous excess demand functions, and non-satiation of preferences.
2. **Uniqueness:**
    1. The equilibrium is generally unique if the excess demand function satisfies specific properties, such as the **gross substitutability** condition.
3. **Stability:**
    1. If prices adjust according to the law of supply and demand, the system will converge to the Walrasian equilibrium under certain conditions.
4. **Pareto Efficiency:**
    1. Every Walrasian equilibrium is Pareto efficient (First Theorem of Welfare Economics).
5. **Decentralization:**
    1. A Walrasian equilibrium decentralizes decision-making, with individuals and firms acting independently while still achieving efficient resource allocation.

Excess Demand and Input-Output Approaches to General Equilibrium

- The **general equilibrium theory** seeks to analyze how supply and demand across multiple interconnected markets achieve equilibrium simultaneously. Two major approaches to understanding general equilibrium are:

1. **Excess Demand Approach**: Focuses on the behavior of aggregate excess demand functions to determine equilibrium prices.
2. **Input-Output Approach**: Uses interdependencies in production and consumption to model equilibrium, often based on Leontief's input-output framework.

- The **excess demand approach** to general equilibrium focuses on how markets achieve equilibrium through the interaction of supply and demand. It examines the aggregate excess demand functions, defined as the difference between total demand and total supply for each good. Equilibrium occurs when excess demand is zero across all markets. The existence of equilibrium is proven under conditions such as convex preferences, continuity of demand and supply functions, and non-satiation. Using fixed-point theorems, such as those of Arrow and Debreu, it is demonstrated that a set of equilibrium prices exists. Stability in this approach depends on the price adjustment process (tâtonnement), where prices rise or fall in response to excess demand. If the conditions of gross substitutability are met, the tâtonnement process ensures that prices converge to equilibrium, resulting in a stable economic system.

- The **input-output approach**, developed by Wassily Leontief, models the interdependencies between industries in an economy. It represents these relationships through an input-output matrix, where each entry indicates how much of one industry's output is required as input by another. Equilibrium in this framework is determined when the total output of each industry matches the sum of intermediate and final demands. The existence of equilibrium is ensured by the Hawkins-Simon condition, which guarantees that the input-output matrix is productive and outputs are non-negative. Stability in the input-output model relies on the properties of the Leontief inverse, derived from the input-output matrix. For stability to hold, the spectral radius of the input-output matrix must be less than one, ensuring that the system converges to equilibrium.

The Edgeworth Box – Pure Exchange

- The **Edgeworth Box** is a graphical tool used in economics to analyze the allocation of resources in a **pure exchange economy**, where there is no production, and individuals trade existing endowments of goods to improve their utility.
- **Features of the Edgeworth Box**
  - **Two Consumers and Two Goods**
  - **Dimensions of the Box**
  - **Utility Levels**
  - **Initial Endowment Point**

- **Structure of the Edgeworth Box**
- **Dimensions**: Represent total quantities of the two goods in the economy.
- **Points Inside**: Indicate specific allocations of goods between two consumers.
- **Axes Origin**:
  - Consumer A's indifference curves originate from the bottom-left corner.
  - Consumer B's indifference curves originate from the top-right corner.
- **Key Concepts**
- **Initial Endowment Point**: Starting allocation of goods between the two consumers.
- **Mutually Beneficial Exchange**: Occurs within the lens-shaped region formed by intersecting indifference curves.
- **Pareto Efficiency**:
  - Allocation where no one can be made better off without making the other worse off.

One Consumer-One Producer Economy

- A **one consumer-one producer economy** is a simplified model used to analyze the interactions between consumption and production in an economy with a single producer and a single consumer. This setup provides insights into resource allocation, production, and consumption decisions under equilibrium conditions.

- **Key Features**

1. **Single Producer:**
    1. Produces one or more goods using available inputs (e.g., labor, capital).
    2. Operates under a production function, $Q=f(L,K)$ which describes how inputs are transformed into output.
2. **Single Consumer:**
    1. Owns the factors of production (e.g., labor, capital) and supplies them to the producer.
    2. Uses income from factor payments (e.g., wages, rents) to purchase goods from the producer.
3. **Circular Flow:**
    1. The producer pays the consumer for inputs, and the consumer spends this income on the goods produced.

2x2 Production Model

- A **2x2 production model** is a simplified framework used in economics to represent an economy with two goods and two factors of production. This model is often used to study the allocation of resources, trade, and production efficiency under different assumptions about technology, resource endowments, and preferences.

Key Components of the 2x2 Production Model

1. **Two Goods:**
    1. The economy produces two distinct goods, often labeled as Good 1 and Good 2.
    2. These goods may be produced using the same or different combinations of inputs (factors of production).
2. **Two Factors of Production:**
    1. The economy has two factors of production, commonly represented as **Labor (L)** and **Capital (K)**.
    2. These factors are used in varying amounts to produce the two goods.
3. **Production Functions:**
    1. Each good has its own production function, which describes how the factors of production are combined to produce the goods. The general form of a production function for each good iii is: $Q_i = f_i(L,K)$, where Q_i is the quantity of good i, and L and K are the amounts of labor and capital used to produce good i.

- **Assumptions**

1. **Constant Technology:**
    1. The production functions for both goods are assumed to be fixed, with no technological change over time.
2. **Factor Mobility:**
    1. Labor and capital are assumed to be mobile between the production of the two goods. This means that they can be reallocated between the goods without costs, subject to the constraint of available total amounts.
3. **Full Employment:**
    1. All available labor and capital are fully employed in the production process, i.e., there is no unemployment of resources.
4. **Closed Economy or Trade:**
    1. The model can be extended to a closed economy, where there is no trade, or an open economy, where goods can be traded with the outside world.

Arrow-Debreu Model (NP 1983: Gerard Debreu)

- The **Arrow-Debreu Model** is a fundamental framework in general equilibrium theory that provides a rigorous mathematical foundation for understanding how markets operate in an economy with complete markets and perfect competition. Developed by **Kenneth Arrow** and **Gerard Debreu** in the early 1950s, this model analyzes how a set of markets for goods and services clears through prices, ensuring an allocation of resources that maximizes societal welfare under certain conditions.

Key Features of the Arrow-Debreu Model

General Equilibrium Framework:

1. The model is designed to explain the determination of equilibrium in a general economy involving multiple agents (consumers and firms), multiple goods, and markets.
2. The equilibrium is determined by the interaction of supply and demand in all markets simultaneously, ensuring that the total demand equals total supply in each market.

Complete Markets:

1. The Arrow-Debreu model assumes **complete markets**, meaning that there is a separate market for every possible good in every possible state of the world. Consumers and firms can trade contingent claims (i.e., contracts) on goods for future states, making markets for all future contingencies.
2. Each good is available for trade at a given price, and consumers can choose to consume or trade based on their preferences and endowments.

Agents in the Economy:

1. There are two types of agents in the model: **consumers** and **firms**.
    1. **Consumers**: They have preferences over goods and services, and they receive endowments (e.g., labor, capital) which they use to buy goods in the market.
    2. **Firms**: They produce goods by utilizing factors of production (labor, capital) and sell them in the market to maximize profits.

Perfect Competition:

The model assumes perfect competition in all markets, meaning that there are many buyers and sellers, no individual agent can influence market prices, and all agents are price takers.

Consumer Preferences:

Consumers have complete, transitive preferences and maximize their utility subject to their budget constraints. They are assumed to have a well-defined utility function for every possible consumption bundle.

Production and Technology:

Firms produce goods using production functions, where output is a function of the input factors (e.g., labor, capital). The firms aim to maximize profits by choosing the optimal input-output combinations, given the production technology and market prices.

Equilibrium Condition:

The Arrow-Debreu model defines **equilibrium** as a set of prices and allocations such that:

1. **Demand equals supply** in all markets for every good and for every state of the world.
2. **Consumers maximize utility** given their budget constraints, and **firms maximize profit** given the prices of inputs and outputs.
3. No agent can improve their situation (no arbitrage opportunities or excess demand) once equilibrium is achieved.

- **Criticisms and Limitations**

1. **Assumptions of Perfect Competition:**
    1. The assumption of perfect competition may not hold in real-world economies, as many markets are characterized by monopoly or oligopoly power.
2. **Complete Markets:**
    1. The assumption of complete markets, where every possible contingent future event has a market for it, is unrealistic in many economies.
3. **Non-convexities:**
    1. The model assumes convex preferences and production functions, which may not hold in economies with non-convexities, such as increasing returns to scale or externalities.