MICROECONOMICS II
UNIT 5
Risk and Uncertainty

Individual behavior towards risk

•**Risk Aversion**: Individuals who are risk-averse prefer certain, predictable outcomes over risky ones, even if the risky option offers a higher reward. This behavior stems from a desire to avoid uncertainty and minimize potential losses, often leading people to choose safer alternatives like bonds over stocks.

•**Risk Seeking**: On the other hand, risk-seeking individuals are willing to take on greater uncertainty for the chance of higher returns. This can be seen in gamblers or investors willing to place their money in high-risk ventures, driven by the potential for substantial rewards despite the possibility of significant losses.

•**Risk Neutrality**: Risk-neutral individuals make decisions based solely on the expected outcome, without a preference for risk or safety. They assess choices rationally, balancing costs and benefits but are indifferent to whether the decision involves risk.

•**Expected Utility Theory**: This theory suggests that individuals make decisions by maximizing their expected utility, not just the monetary value. For risk-averse people, the perceived utility of a certain outcome is higher than the expected utility of a risky one, prompting them to avoid uncertain situations.

•**Prospect Theory**: This theory, which challenges traditional economic models, suggests that people value potential gains and losses differently. Losses tend to have a greater psychological impact than equivalent gains (loss aversion), leading individuals to avoid risks that could result in losses, even when the potential rewards are higher.

•**Overconfidence**: Overconfidence biases lead individuals to overestimate their ability to manage risk. This can lead them to take excessive risks, as they feel more capable of handling uncertain situations than they actually are.

•**Mental Accounting**: People tend to treat money differently based on its source or intended use. For example, they may take on more risk with a "windfall" gain (e.g., a bonus) than with their regular income, even if the financial consequences are the same.

•**Status Quo Bias**: Many individuals exhibit a preference for maintaining the current situation and avoiding change, even when it involves some risk. This can prevent them from making decisions that could lead to better outcomes, such as switching jobs or investing in new opportunities.

•**Insurance**: Risk-averse individuals often purchase insurance to protect themselves from uncertain events. The willingness to pay for insurance reflects a desire for financial security, despite the fact that the expected value of the insurance might be less than the premium paid.

•**Time Preference**: People tend to prioritize immediate rewards over future ones, influencing decisions that involve risk. This behavior is particularly relevant in areas like retirement savings or health-related behaviors, where the risks of future consequences may be discounted in favor of present satisfaction.

•**Discounting**: Discounting refers to the tendency to undervalue future outcomes. Individuals often take on risks today, ignoring or minimizing the potential negative effects in the future, because they place less weight on future consequences.

•**Behavioral Biases**: Behavioral biases, such as framing effects (where the way options are presented affects decisions) and herd behavior (following the crowd), significantly influence how individuals perceive and act on risk. These biases can lead to irrational decision-making, such as overestimating the likelihood of success based on group behavior.

•**Market Behavior**: In financial markets, individual behavior towards risk plays a significant role in market fluctuations. Risk-averse investors may contribute to price stability, while risk-seeking behavior can fuel speculative bubbles, leading to market volatility when expectations exceed reality.

Expected Utility Approach and Certainty Equivalence Approach

- **Expected Utility Approach**
- The **Expected Utility Approach** is based on the idea that individuals make decisions by maximizing the expected utility of different outcomes, rather than simply the expected monetary value. It is an extension of traditional utility theory and is used to explain how people behave under conditions of risk.
- **Application:**
- **Risk Aversion**: Individuals are risk-averse if they choose a certain outcome with a lower expected value over a risky one with a higher expected monetary value. Their utility function is concave, which implies that the marginal utility of wealth decreases as wealth increases.
- **Decision-Making Under Risk**: In the expected utility framework, people prefer certainty when the expected utility of a risky option is lower than the utility of a certain outcome. A risk-averse individual might choose a guaranteed $50 over a 50% chance of $100 and a 50% chance of $0, even though the expected monetary value of the gamble is $50.

- **Certainty Equivalence Approach**
- The **Certainty Equivalence Approach** simplifies the decision-making process by converting a risky prospect into a guaranteed (certain) outcome that makes the individual indifferent between the risky choice and the certain one.
- **Key Concepts:**
- **Certainty Equivalent (CE)**: The certainty equivalent is the amount of money that an individual would accept instead of taking on a risky prospect. It is the guaranteed amount that gives the individual the same utility as the expected utility of the risky choice.
- **Risk Aversion**: If an individual is risk-averse, their certainty equivalent will be lower than the expected monetary value of the risky choice. The greater the risk aversion, the larger the difference between the expected value of the gamble and the certainty equivalent.

- **Application:**

- **Risk Aversion**: For a risk-averse individual, the certainty equivalent of a risky gamble will always be less than the expected monetary value of the gamble. This reflects the individual's preference for avoiding uncertainty.
- **Risk Neutrality**: A risk-neutral individual will have a certainty equivalent equal to the expected monetary value of the risky choice, as they are indifferent to risk.

Risk and Risk Aversion

- **Risk** refers to the possibility of uncertain outcomes or events that may lead to both positive (gains) and negative (losses) consequences. In economic terms, risk is present when the probabilities of different outcomes are known or can be estimated. Individuals or organizations must make decisions while considering potential risks associated with their choices.
- **Risk Aversion** refers to the preference for certainty over uncertainty. A risk-averse individual prefers a guaranteed outcome over a gamble with the same expected value, due to the fear of potential loss. It is the tendency of individuals to avoid taking risks, especially when the potential negative outcomes are more impactful than the potential gains.

Economics of Insurance

- **Risk Pooling**
- Insurance operates on the principle of **risk pooling**, where the premiums collected from many policyholders are used to cover the losses of the few who experience adverse events. This helps reduce the financial burden on any single individual by spreading the risk across a larger group.
- **Risk Transfer**
- **Risk transfer** is the central function of insurance. Instead of bearing the full financial consequences of a risk (e.g., medical costs, house fire damage), individuals transfer the financial responsibility to an insurer in exchange for a premium.
- **Moral Hazard**
- **Moral hazard** arises when individuals or businesses take on more risk after purchasing insurance because they no longer bear the full financial consequences of their actions. For example, a person with car insurance may be less cautious about avoiding accidents because they know the insurance company will cover part of the costs.
- **Adverse Selection**
- **Adverse selection** occurs when individuals with higher-than-average risk are more likely to purchase insurance, while those with lower risk are less likely to buy it. This leads to an imbalance where insurers may face a higher-than-expected number of claims.
- **Premiums and Pricing**
- **Premiums** are the payments made by policyholders to the insurer in exchange for coverage. The amount paid depends on various factors, including the individual's risk level, the type of insurance, and the coverage amount.

- **Expected Utility and Risk Aversion**
- Insurance is closely tied to the **expected utility theory**. Risk-averse individuals are willing to pay a premium for insurance to avoid uncertain losses. They prefer the certainty of a known premium over the uncertainty of a potential large financial loss.
- **Insurance Markets and Competition**
- Insurance markets are subject to competition among insurance providers. This competition can lead to **lower premiums**, improved customer service, and innovation in insurance products. However, in some cases, competition can drive down the quality of coverage if insurers try to minimize costs.

Cost and Risk

Cost and Risk:

1. **Cost**: This refers to the price or expenditure involved in bearing a particular risk. For individuals or firms, cost often refers to the premiums they pay for insurance or the financial impact of a risk event (e.g., the cost of a car accident, medical bills, or property damage).
2. **Risk**: Refers to the uncertainty or possibility of a negative outcome from a given event. In economics, it is usually characterized by the potential for loss or damage that could occur due to a variety of factors such as accidents, natural disasters, or financial market fluctuations.

Risk Pooling and Risk Spreading

- **Risk pooling** and **risk spreading** are two fundamental concepts in insurance and risk management. These approaches are used to help reduce the financial impact of risk on individuals or firms by distributing it across a larger group.
- **1. Risk Pooling:**
- **Definition**: Risk pooling involves combining the risks of multiple individuals or entities into a single pool to share the financial burden of the risks. It is the process by which many individuals or entities contribute to a common pool of funds, which is then used to cover the losses that occur from uncertain events.
- **How It Works**: Insurance companies collect premiums from a large number of policyholders, creating a "pool" of funds. When one or more policyholders experience a loss (e.g., a car accident or medical emergency), the insurer uses the pooled funds to cover those losses.
- **Risk Pooling's Role in Insurance**: The main idea behind risk pooling is to **distribute risk** among a large group of individuals. While one person might face a significant loss, the cost of that loss can be shared by others who are unlikely to experience such a loss in the same period.

- **Risk Spreading:**
- **Definition**: Risk spreading refers to the process of distributing risk across multiple individuals, time periods, or geographic areas to reduce the likelihood of any single entity bearing the full burden of a loss. Unlike pooling, which focuses on combining risks within a group, **risk spreading** often focuses on spreading risk across different variables (e.g., across different investments, locations, or time).
  - **Geographical risk spreading** involves diversifying investments across different regions to reduce the impact of localized events, such as natural disasters or regional economic downturns.
  - **Time-based risk spreading** involves distributing risk over time, as with the use of **annuities** or **long-term insurance policies** that spread out risk events over many years.
  - **Portfolio diversification** is an example of risk spreading in financial markets, where investors hold a variety of assets (e.g., stocks, bonds, real estate) to avoid the risk that a downturn in one asset class will ruin their entire financial position.

Game Theory

- **Game Theory** is a branch of mathematics and economics that studies the strategic interaction between different decision-makers (called "players") in situations where the outcome of their choices depends on the choices of others.

Robert Aumann

Aumann's work primarily focused on **repeated games** and **the analysis of conflict** through strategic decision-making in scenarios involving multiple players. His research on **repeated games** helped explain how cooperation could emerge even in competitive environments where players interact multiple times, rather than in one-shot games.

Core Concepts:

Repeated Games: Aumann extended the analysis of **repeated games**, where players engage in the same game multiple times. This framework can explain the emergence of cooperation, as players may be motivated to cooperate in one round to encourage future cooperation from others.

The Folk Theorem: Aumann developed the **Folk Theorem**, which shows that in repeated games, players can sustain cooperation, even if defection is the best strategy in a single-round game, provided the future payoff of cooperation outweighs the immediate temptation to defect.

Information and Belief Systems: Aumann's work extended the study of **information** and **belief systems**, particularly in situations of **imperfect information**, which is a common real-world scenario in strategic decision-making.

- **Thomas Schelling:**

Schelling's work focused on **strategic behavior in situations of conflict**. His most famous contributions were in the areas of **bargaining** and **coordination games**, where players need to align their strategies to achieve mutually beneficial outcomes.

Core Concepts:

Focal Points: Schelling introduced the concept of **focal points**, or **Schelling points**, which are solutions to coordination problems that players tend to choose because they seem natural, special, or relevant in the given context. For example, if two people are trying to meet in a city without prior arrangements, they may both choose a famous landmark as the natural meeting point.

Deterrence and Strategic Commitment: Schelling made significant contributions to understanding the strategic use of **commitment** and **deterrence** in international conflicts, particularly in the context of the **Cold War** and the role of nuclear strategy.

Bargaining Models: Schelling's work also focused on how **bargaining** between players can lead to compromises and agreements in situations of conflict, with applications in international negotiations and diplomacy.

- **John Nash**

Nash is best known for his development of the **Nash equilibrium**, which revolutionized the understanding of strategic interactions in non-cooperative games.

Nash Equilibrium: Nash introduced the concept of a **Nash equilibrium**, which occurs when each player's strategy is optimal given the strategies of others. In this equilibrium, no player can improve their payoff by unilaterally changing their strategy.

Non-Cooperative Games: Nash's work provided the foundation for analyzing **non-cooperative games** (games where binding agreements are not possible), allowing economists to understand and predict behavior in markets, politics, and other social interactions.

Global Impact: Nash’s equilibrium concept has been widely applied in economics, political science, biology (in evolutionary theory), and even evolutionary game theory, where it helps explain how certain behaviors or strategies can evolve over time.

Reinhard Selten

Selten's work expanded on Nash's equilibrium and provided insights into the stability and **refinement** of Nash equilibria, particularly in **games with more complex strategies**.

Subgame Perfect Equilibrium: Selten introduced the concept of **subgame perfect equilibrium**, which refines Nash's equilibrium by requiring players' strategies to be optimal not only in the overall game but also in every possible subgame (i.e., in every decision node of the game). This refinement ensures that strategies are credible and rational at every stage of a game.

Evolutionary Games: Selten applied game theory to **evolutionary biology**, helping explain how cooperation can evolve in species and how evolutionary stable strategies (ESS) emerge in populations

- **John Harsanyi**

Harsanyi's work focused on the role of **information** in games and the development of **Bayesian game theory**.

Bayesian Games: Harsanyi developed the concept of **Bayesian games**, which analyze situations where players have incomplete information about each other (e.g., about their preferences or strategies). This framework uses **Bayesian probability** to model uncertainty and strategic behavior.

Incomplete Information: Harsanyi's Bayesian approach allowed for the study of **games with incomplete information**, where players do not have perfect knowledge about the game or the other players' preferences, leading to more realistic models of human behavior in economics and political science.

Utility Theory and Social Choice: Harsanyi also made contributions to **social choice theory** and **utilitarianism**, applying game theory to issues of fairness, resource allocation, and collective decision-making.

Competitive Firm Under Uncertainty

- **Sources of Uncertainty for Competitive Firms:**

1. **Demand Uncertainty**:

   The firm cannot predict with certainty the level of demand for its product in the future. Factors such as consumer preferences, income levels, and prices of substitute goods may fluctuate.

   For example, an unexpected economic downturn may reduce consumer demand for luxury goods, affecting the firm's sales.

2. **Price Uncertainty**:

   In a competitive market, firms are price takers, meaning they cannot influence the price of the good they sell. However, the price itself is uncertain due to factors such as changes in market conditions, raw material prices, and government regulations.

3. **Supply Uncertainty**:

   Supply-side uncertainty arises from factors like changes in the cost of raw materials, labor, and technology, as well as disruptions like natural disasters, strikes, or logistical challenges.

4. **Technological Uncertainty**:

   New technologies can disrupt existing production processes, affecting cost structures, productivity, and competitive advantage. Firms may face risks related to the adoption of new technologies or the obsolescence of their existing production methods.

5. **Regulatory Uncertainty**:

   Changes in government policy, such as new taxes, subsidies, or environmental regulations, can affect the costs of production or the overall profitability of firms in a particular industry.

Adverse Selection Under Uncertainty

- **Adverse selection** refers to a situation where one party in a transaction has more information than the other party, leading to an inefficient or suboptimal outcome. This concept is especially relevant in markets involving uncertainty, where the presence of **asymmetric information** can exacerbate the problems of adverse selection.
- In the context of **uncertainty**, adverse selection can manifest in various situations, particularly when individuals or firms cannot perfectly observe the characteristics or behaviors of others involved in the transaction. This leads to market failures, particularly in insurance markets, credit markets, and labor markets.

•**Asymmetric Information**: One party (the seller or provider) knows more about the product or service than the other party (the buyer or customer). This creates **moral hazard** or **adverse selection**, as the informed party may take advantage of this imbalance in information.

•**Adverse Selection in the Context of Uncertainty**:
•**Uncertainty** complicates the decision-making process, as individuals or firms must act without complete knowledge of the future or the exact characteristics of the parties they are dealing with.
•In such conditions, individuals might make **suboptimal decisions** due to incomplete or uncertain information, often leading to the selection of high-risk participants or entities in transactions.

The Five Forces Model of Competition

- The Threat of New Entrants
- The Bargaining Power of Suppliers
- The Bargaining Power of Buyers
- The Threat of Substitutes
- Industry Rivalry

Decision Making Under Uncertainty (Daniel Kahneman, 2002)

- Daniel Kahneman, a psychologist and Nobel laureate in economics, has made significant contributions to the study of decision-making, particularly under uncertainty. His work, including the influential book **"Thinking, Fast and Slow"** (2011), explores how people make decisions in situations of uncertainty, often revealing biases and cognitive errors that lead to suboptimal outcomes.
- In 2002, Kahneman, along with his collaborator Amos Tversky, developed key concepts in the area of **behavioral economics**, focusing on how real-world decision-making deviates from the ideal of rational choice theory. Kahneman's work challenges the traditional economic model, which assumes that individuals make decisions rationally based on all available information.

- **Key Concepts from Kahneman's Work on Decision Making Under Uncertainty:**

1. Prospect Theory:

Prospect Theory is one of Kahneman and Tversky's most important contributions, explaining how people make decisions involving risk and uncertainty.

- **Key Components:**
  - **Loss Aversion**: People tend to weigh losses more heavily than gains of the same size. For example, the pain of losing $100 is psychologically greater than the pleasure of gaining $100. This leads to a bias where individuals are more likely to avoid risks that could result in a loss, even if the expected outcome is favorable.
  - **Reference Points**: Individuals evaluate outcomes relative to a reference point, such as their current situation or past experiences, rather than absolute outcomes. This explains why people may be more upset by a smaller loss if they were expecting a larger gain.
  - **Diminishing Sensitivity**: The impact of a given amount of gain or loss decreases as the size of the gain or loss increases. For example, the difference between $100 and $200 is more impactful than the difference between $1,100 and $1,200.
  - **Risk Seeking in Losses and Risk Aversion in Gains**: Kahneman and Tversky found that people are risk-averse when they are dealing with potential gains but become risk-seeking when they are trying to avoid losses. This behavior is contrary to what traditional economic theory would predict.

- **Heuristics and Biases:**
- Kahneman and Tversky also discovered that humans rely on **heuristics** (mental shortcuts) to make decisions under uncertainty. While these shortcuts can be helpful, they often lead to **systematic biases**.

- **Availability Heuristic**: People tend to judge the likelihood of an event based on how easily they can recall examples from memory. For instance, after hearing about a plane crash, people may overestimate the risk of flying.
- **Anchoring Heuristic**: People often rely too heavily on the first piece of information (the "anchor") when making decisions, even if that information is irrelevant. For example, if a car is originally priced at $30,000 and is then marked down to $25,000, people may perceive it as a better deal than if it were originally priced at $20,000, even though the actual value hasn't changed.
- **Representativeness Heuristic**: People tend to judge the probability of an event by how similar it is to a prototype. For example, people might assume someone who looks like a "typical" lawyer is more likely to be a lawyer, even if the statistical likelihood of them being a lawyer is low.

- **Framing Effect:**
- The way information is presented (or **framed**) can significantly affect decision-making.
- **Positive Framing**: When outcomes are framed in terms of potential gains (e.g., "you will save $100 if you buy this now"), people tend to be more risk-averse and prefer sure gains.
- **Negative Framing**: When outcomes are framed in terms of potential losses (e.g., "you will lose $100 if you don’t buy this now"), people are more likely to take risks to avoid losses, even if the expected outcome is the same.
- This phenomenon shows that people's decisions can be **manipulated** based on how options are framed, rather than the intrinsic value of the options themselves.

- **Endowment Effect:**
- People tend to assign more value to things simply because they own them, known as the **endowment effect**. This bias leads to overvaluing owned items and making people reluctant to trade or sell them, even if the market price is lower than their perceived value.
- **Overconfidence Bias:**
- People often have an **overconfident** view of their abilities and knowledge, which leads to poor decision-making under uncertainty. For example, individuals may underestimate the likelihood of failure or overestimate their ability to predict future events. This bias can be particularly problematic in situations that involve complex decision-making and long-term outcomes.