Lecture 1. Introduction

1. Cash Flows

Definition 1. An *investment* is defined as the "current" commitment of resources (or money) in order to achieve "later" benefits which are often "uncertain", aiming to tailor the pattern of future cash flows over time to be as desirable as possible.

Remark 2. When expenditures by and receipts from an investment are denominated in cash, the net receipts at any time period are termed *cash flow*, and the series of flows over several periods is termed a *cash flow stream*.

2. Investments and Markets

Investment analysis is a process of examining alternatives and deciding which alternative is most preferable. Key concepts include:

- Comparison principle: In evaluating the investment, you compare it with other investment opportunities available in the financial market. If the investment offers a rate above normal, you accept; otherwise, you decline.
- Arbitrage: Arbitrage means earning money without investing anything. It is assumed that no arbitrage opportunity exists in a well-functioning market. No arbitrage assumption is a powerful vehicle deriving a modern theory of investments.
- Dynamics: Financial instruments are traded on a continuing basis, meaning that the future price of a financial asset is not regarded as a single number, but as a probabilistic or stochastic process moving in time and subject to uncertainty. This dynamic price process is often represented in terms of *binomial lattice models*, *difference equation models*, and *differential equation models*.
- Risk aversion: The risk aversion principle implies that a rational, risk-averse investor accepts more risk only if she expects to get greater expected return. In a framework of mean-variance analysis, the risk-aversion principle predicts that given several assets that have the same mean, an investor shall choose the one with the smallest variance. This is a core idea for *portfolio analysis*.

3. Typical Investment Problems

- Pricing: Given an investment with known payoff characteristics (which are likely to be random), what should be the reasonable price?
- Hedging: Hedging is the process of reducing the financial risks that either arise in the course of normal business operations or are associated with investments. Hedging can be carried out mainly through *insurance*, *futures,* and *options*.
- Pure investment: Pure investment refers to the objective of obtaining increased future return for present allocation of capital, which is the motivation underlying individual investments in the stock market. Most approaches to the pure investment problem rely on the risk aversion principle, in that an investor assess her preference when deciding how to balance *risk* and *expected reward*.