

An Introduction to Probability

Random Variables

Martin Summer

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Random Variables

The Role of Random Variables in Finance

Random variables are the main mathematical tool that allows us to quantify and analyze uncertainty in Finance for complex portfolios and other financial contexts like risk management. In all of these contexts, random variables provide the foundation for probabilistic reasoning.

Context from Previous Lectures

- Concepts revisited:
 - **Conditional probabilities**
 - **Dependencies and independence**
- Purpose:
 - Build intuition for modeling uncertainty.
 - Lay the groundwork for advanced applications like portfolio risk modeling and asset price dynamics.

Importance of Random Variables

- **Core of probability theory:** Link real-world phenomena to mathematical models.
- **Key tools:**
 - **Expected value**
 - **Variance**
 - **Covariance**
- **Applications in Finance:**
 - **Portfolio Management:** Estimating expected return and risk.
 - **Risk Assessment:** Modeling extreme events like market crashes.
 - **Asset Pricing:** Evolving prices using models like the binomial tree.

Learning Objectives

By the end of this lecture, you will:

1. Understand the definition and properties of random variables.
2. Learn how to compute and interpret:
 - Expected value
 - Variance
 - Covariance
3. Apply R programming to:
 - Simulate random variables.
 - Construct a binomial tree to model asset price dynamics.