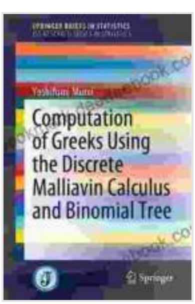
Computation of Greeks Using the Discrete Malliavin Calculus and Binomial Tree

Greeks are sensitivity measures that quantify the risk and exposure of financial instruments to underlying factors such as the price of the underlying asset, volatility, time, and interest rates. They are essential for pricing, hedging, and risk management of financial derivatives. The computation of Greeks can be a complex and computationally intensive task, especially for complex financial instruments.

The discrete Malliavin calculus and binomial tree are powerful mathematical tools that can be used to efficiently and accurately compute Greeks. The discrete Malliavin calculus is a powerful tool for the analysis of stochastic processes. It provides a framework for deriving explicit expressions for Greeks in terms of the underlying asset price and other relevant parameters. The binomial tree is a discrete-time model of the underlying asset price that can be used to approximate the continuous-time stochastic process.



Computation of Greeks Using the Discrete Malliavin Calculus and Binomial Tree (SpringerBriefs in Statistics) by Yoshifumi Muroi

4.5 out of 5

Language	: English
File size	: 2353 KB
Screen Reader	: Supported
Print length	: 114 pages

In this article, we will provide a comprehensive overview of the computation of Greeks using the discrete Malliavin calculus and binomial tree. We will first introduce the basic concepts of the discrete Malliavin calculus and binomial tree. We will then discuss how to use these tools to compute Greeks for various types of financial derivatives. Finally, we will provide some examples of how Greeks are used in practice.

The Discrete Malliavin Calculus

The discrete Malliavin calculus is a powerful tool for the analysis of stochastic processes. It provides a framework for deriving explicit expressions for Greeks in terms of the underlying asset price and other relevant parameters.

The discrete Malliavin calculus is based on the concept of Malliavin derivatives. A Malliavin derivative is a derivative of a random variable with respect to a Wiener process. Wiener processes are continuous-time stochastic processes that are used to model the evolution of asset prices and other financial variables.

The discrete Malliavin calculus provides a way to compute Malliavin derivatives in a discrete-time setting. This makes it possible to derive explicit expressions for Greeks in terms of the underlying asset price and other relevant parameters.

The Binomial Tree

The binomial tree is a discrete-time model of the underlying asset price that can be used to approximate the continuous-time stochastic process. The binomial tree is constructed by repeatedly dividing the time interval into smaller and smaller subintervals. At each subinterval, the asset price can either go up or down by a fixed amount.

The binomial tree provides a simple and efficient way to approximate the continuous-time stochastic process. This makes it possible to use the binomial tree to compute Greeks for various types of financial derivatives.

Computation of Greeks Using the Discrete Malliavin Calculus and Binomial Tree

The discrete Malliavin calculus and binomial tree can be used to compute Greeks for various types of financial derivatives. The following are some of the most common Greeks:

* Delta: The delta of a financial derivative measures the sensitivity of the derivative's price to changes in the underlying asset price. * Gamma: The gamma of a financial derivative measures the sensitivity of the derivative's delta to changes in the underlying asset price. * Vega: The vega of a financial derivative measures the sensitivity of the derivative's price to changes in the volatility of the underlying asset. * Theta: The theta of a financial derivative measures the sensitivity of the derivative's price to changes in time. * Rho: The rho of a financial derivative measures the sensitivity of the derivative's price to changes in interest rates.

The following are some examples of how to compute Greeks using the discrete Malliavin calculus and binomial tree:

* Delta: The delta of a call option can be computed as the expected value of the payoff at the expiration date, weighted by the probability of each path in the binomial tree. * Gamma: The gamma of a call option can be

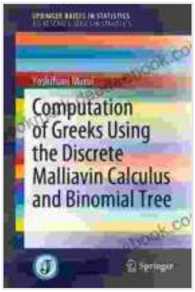
computed as the second derivative of the call option's price with respect to the underlying asset price. * Vega: The vega of a call option can be computed as the expected value of the payoff at the expiration date, weighted by the product of the probability of each path in the binomial tree and the volatility of the underlying asset. * Theta: The theta of a call option can be computed as the negative of the expected value of the payoff at the expiration date, weighted by the probability of each path in the binomial tree and the time to expiration. * Rho: The rho of a call option can be computed as the expected value of the payoff at the expiration date, weighted by the product of the probability of each path in the binomial tree and the interest rate.

Examples of the Use of Greeks in Practice

Greeks are used in a variety of applications in practice, including:

* Pricing financial derivatives: Greeks are used to price financial derivatives by computing the expected value of the payoff at the expiration date. * Hedging financial derivatives: Greeks are used to hedge financial derivatives by creating a portfolio of offsetting positions that have the same Greeks as the original derivative. * Risk management: Greeks are used to measure the risk and exposure of financial instruments to underlying factors such as the price of the underlying asset, volatility, time, and interest rates.

The discrete Malliavin calculus and binomial tree are powerful mathematical tools that can be used to efficiently and accurately compute Greeks for various types of financial derivatives. Greeks are essential for pricing, hedging, and risk management of financial derivatives.



Computation of Greeks Using the Discrete Malliavin Calculus and Binomial Tree (SpringerBriefs in Statistics) by Yoshifumi Muroi

4.5 out of 5

Language	: English
File size	: 2353 KB
Screen Reader	: Supported
Print length	: 114 pages

FREE DOWNLOAD E-BOOK

Don't Stop Thinking About the Music: Exploring the Power and Impact of Music in Our Lives

Music is an intrinsic part of our human experience, a universal language that transcends cultural boundaries and connects us all. It has the power...

Snowman Story Problems Math With Santa And Friends

It's a cold winter day, and the snowmen are having a snowball fight! But they need your help to solve these math problems to win. **Problem 1:** Santa has 10...