Package 'greeks'

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Title Sensitivities of Prices of Financial Options

Version 0.2.1

Description Methods to calculate sensitivities of financial option prices for European and Asian options in the Black Scholes model. Classical formulas are implemented for European options in the Black Scholes Model, as is presented in Hull, J. C. (2017). Options, Futures, and Other Derivatives, Global Edition (9th Edition). Pearson. In the case of Asian options, Malliavin Monte Carlo Greeks are implemented, see Hudde, A. & Rüschendorf, L. (2016). European and Asian Malliavin Monte Carlo Greeks for general Jump Diffusions with nonvanishing Brownian motion part. <arXiv:1603.00920>.

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Imports magrittr, matrixStats

NeedsCompilation no

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R topics documented:

BS_European_Greeks *Calculates the greeks of an European call- or put-option in the Black Scholes model.*

Description

Calculates the greeks of an European call- or put-option in the Black Scholes model.

Usage

```
BS_European_Greeks(
  initial_price = 100,
  exercise_price = 100,
  r = 0,
  time_to_maturity = 1,
  volatility = 0.3,
  dividend_yield = 0,
  payoff = "call",
  greek = c("fair_value", "delta", "vega", "theta", "rho", "epsilon", "lambda",
    "gamma", "vanna")
)
```

Arguments

initial_price	• initial price of the underlying asset
exercise_price	• strike price of the option
r	• risk-free interest rate
time_to_maturity	• time to maturity
volatility	• volatility of the underlying asset
dividend_yield	• dividend yield
payoff	• in c("call", "put")
greek	• greeks to be calculated in c("fair_value", "delta", "vega", "theta", "rho", "epsilon", "lambda", "gamma", "vanna")

Value

Named vector containing the values of the greeks specified in the parameter greek.

Examples

```
BS_European_Greeks(initial_price = 120, exercise_price = 100,
r = 0.02, time_to_maturity = 4.5, dividend_yield = 0.015, volatility = 0.22,
greek = c("fair_value", "delta", "gamma"), payoff = "put")
```

`Malliavin_Asian_Greeks` *This function calculates the fair value of an European option by with the Malliavin Monte Carlo Method in the Black Scholes model.*

Description

This function calculates the fair value of an European option by with the Malliavin Monte Carlo Method in the Black Scholes model.

Usage

```
Malliavin_Asian_Greeks(
  initial_price = 100,
  exercise_price = 100,
  r = 0,
  time_to_maturity = 1,
  volatility = 0.3,
  dividend_yield = 0,
  payoff = "call",
  greek = c("fair_value", "delta", "rho", "vega", "theta", "gamma"),
  model = "black_scholes",
  lambda = 0.2,
  alpha = 0.3,
  jump_distribution = function(n) stats::rt(n, df = 3),
  steps = round(time_to_maturity * 252),
  paths = 10000,
  seed = 1,
  antithetic = FALSE
)
```

Arguments

`initial_price`	• initial price of the underlying asset.
`exercise_price`	• strike price of the option.
`r`	• risk-free interest rate.
`time_to_maturity`	• time to maturity.
`volatility`	• volatility of the underlying asset.
`dividend_yield`	• dividend yield.
`payoff`	• the payoff function, either a string in ("put", "call"), or a function.
`greek`	• the Greek to be calculated.
`model`	• the model to be chosen in ("black_scholes", "jump_diffusion")
`lambda`	• the lambda of the Poisson process in the jump-diffusion model
`alpha`	• the alpha in the jump-diffusion model influences the jump size
`jump_distribution`	• the distribution of the jumps, choose a function which generates random numbers with the desired distribution

steps	• the number of integration steps.
paths	• the number of simulated paths.
seed	• the seed of the random number generator
antithetic	• if TRUE, antithetic random numbers will be chosen to decrease variance

Value

Named vector containing the values of the Greeks specified in the parameter greek.

Examples

```
Malliavin_Asian_Greeks(initial_price = 110, exercise_price = 100,
r = 0.02, time_to_maturity = 4.5, dividend_yield = 0.015, volatility = 0.22,
greek = c("fair_value", "delta", "rho"), payoff = "put")
```

Malliavin_European_Greeks

This function calculates the fair value of an European option by with the Malliavin Monte Carlo Method in the Black Scholes model.

Description

This function calculates the fair value of an European option by with the Malliavin Monte Carlo Method in the Black Scholes model.

Usage

```
Malliavin_European_Greeks(
  initial_price = 100,
  exercise_price = 100,
  r = 0,
  time_to_maturity = 1,
  volatility = 0.3,
  dividend_yield = 0,
  payoff = "call",
  greek = c("fair_value", "delta", "vega", "theta", "rho", "gamma"),
  model = "Black Scholes",
  paths = 10000,
  seed = 1,
  antithetic = FALSE
)
```

Arguments

initial_price	• initial price of the underlying asset.
exercise_price	• strike price of the option.
r	• risk-free interest rate.
time_to_maturity	• time to maturity.

volatility	• volatility of the underlying asset.
dividend_yield	• dividend yield.
payoff	• the payoff function, either a string in ("put", "call"), or a function.
greek	• the greek to be calculated.
model	• the model to be chosen.
paths	• the number of simulated paths.
seed	• the seed of the random number generator
antithetic	• if TRUE, antithetic random numbers will be chosen to decrease variance

Value

Named vector containing the values of the Greeks specified in the parameter greek.

Examples

```
Malliavin_European_Greeks(initial_price = 110, exercise_price = 100,
r = 0.02, time_to_maturity = 4.5, dividend_yield = 0.015, volatility = 0.22,
greek = c("fair_value", "delta", "rho"), payoff = "put")
```

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