Package ‘optionstrat’

December 3, 2019

Type Package
Title Utilizes the Black-Scholes Option Pricing Model to Perform Strategic Option Analysis and Plot Option Strategies
Version 1.4.1
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Description Utilizes the Black-Scholes-Merton option pricing model to calculate key option analytics and perform graphical analysis of various option strategies. Provides functions to calculate the option premium and option greeks of European-style options.
License GPL-3
Encoding UTF-8
LazyData true
RoxygenNote 6.1.1
Imports graphics, stats
Suggests knitr, rmarkdown
VignetteBuilder knitr
NeedsCompilation no
Repository CRAN
Date/Publication 2019-12-03 19:20:02 UTC

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### Description

Calculates the delta of the European-style call option.

### Usage

```r
calldelta(s, x, sigma, t, r, d = 0)
```

### Arguments

- `s`: Spot price of the underlying asset
- `x`: Strike price of the option
- `sigma`: Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns
- `t`: Time to maturity in years
- `r`: Annual continuously-compounded risk-free rate, use the function `r.cont`
- `d`: Annual continuously-compounded dividend yield, use the function `r.cont`
Details
The delta of an option can be defined as the rate of change of the option value given a $1 change in the underlying asset price.

Value
Returns the call delta

Examples
```r
calldelta(100, 100, 0.20, (45/365), 0.02, 0.02)
```

---

calleval Call Option Evaluation

Description
Creates a data.frame containing call option greeks; delta, gamma, vega, theta, rho and the call premium

Usage
calleval(s, x, sigma, t, r, d = 0)

Arguments
- `s` Spot price of the underlying asset
- `x` Strike price of the option
- `sigma` Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns
- `t` Time to maturity in years
- `r` Annual continuously-compounded risk-free rate, use the function r.cont
- `d` Annual continuously-compounded dividend yield, use the function r.cont

Value
Returns a data.frame containing the option premium and greeks:
- Premium
- Delta
- Gamma
- Vega
- Theta
- Rho
Author(s)

John T. Buynak

Examples

calleval(100, 100, 0.20, (45/365), 0.02, 0.02)

callgreek

Call Option Greek

Description

Computes the selected option greek, including premium

Usage

callgreek(greek = c("delta", "gamma", "theta", "vega", "rho", "premium"),
         s, x, sigma, t, r, d = 0)

Arguments

greek String value, desired option greek to return
s Spot price of the underlying asset
x Strike price of the option
sigma Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns
t Time to maturity in years
r Annual continuously-compounded risk-free rate, use the function r.cont
d Annual continuously-compounded dividend yield, use the function r.cont

Value

Returns the desired option greek, including premium

Examples

callgreek("delta", 100, 100, 0.20, (45/365), 0.02, 0.02)
callgreek("gamma", 100, 100, 0.20, (45/365), 0.02, 0.02)
**callpremium**

**Call Premium**

**Description**

Calculates the premium of a European-style call option using the Black-Scholes option pricing model.

**Usage**

```r
callpremium(s, x, sigma, t, r, d = 0)
```

**Arguments**

- `s`: Spot price of the underlying asset.
- `x`: Strike price of the option.
- `sigma`: Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns.
- `t`: Time to maturity in years.
- `r`: Annual continuously-compounded risk-free rate, use the function `r.cont`.
- `d`: Annual continuously-compounded dividend yield, use the function `r.cont`.

**Value**

Returns the value of the call option.

**Examples**

```r
callpremium(100, 100, 0.20, (45/365), 0.02, 0.02)
```

---

**callrho**

**Call Rho**

**Description**

Calculates the rho of the European-style call option.

**Usage**

```r
callrho(s, x, sigma, t, r, d = 0)
```
Arguments

\begin{itemize}
\item \textbf{s} \hspace{1em} Spot price of the underlying asset
\item \textbf{x} \hspace{1em} Strike price of the option
\item \textbf{sigma} \hspace{1em} Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns
\item \textbf{t} \hspace{1em} Time to maturity in years
\item \textbf{r} \hspace{1em} Annual continuously-compounded risk-free rate, use the function \texttt{r.cont}
\item \textbf{d} \hspace{1em} Annual continuously-compounded dividend yield, use the function \texttt{r.cont}
\end{itemize}

Details

Rho measures the change in the option’s value given a 1

Value

Returns the call rho

Examples

\begin{verbatim}
callrho(100, 100, 0.20, (45/365), 0.02, 0.02)
\end{verbatim}

Description

Calculates the theta of the European-style call option

Usage

\begin{verbatim}
calltheta(s, x, sigma, t, r, d = 0)
\end{verbatim}

Arguments

\begin{itemize}
\item \textbf{s} \hspace{1em} Spot price of the underlying asset
\item \textbf{x} \hspace{1em} Strike price of the option
\item \textbf{sigma} \hspace{1em} Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns
\item \textbf{t} \hspace{1em} Time to maturity in years
\item \textbf{r} \hspace{1em} Annual continuously-compounded risk-free rate, use the function \texttt{r.cont}
\item \textbf{d} \hspace{1em} Annual continuously-compounded dividend yield, use the function \texttt{r.cont}
\end{itemize}

Details

Theta is the "time-decay" of the option value measured as a daily value
Value

Returns the call theta

Examples

calltheta(100, 100, 0.20, (45/365), 0.02, 0.02)

dv

Double Vertical Spread Analytics

Description

Calculates the key analytics of a Double Vertical Credit Spread

Usage

dv(s, x1, x2, x3, x4, t, r, sigma, sigma2 = sigma, sigma3 = sigma, sigma4 = sigma, vol = sigma, d = 0)

Arguments

s
Spot price of the underlying asset
x1
Strike price of the lower strike (long) put option
x2
Strike price of the higher strike (short) put option
x3
Strike price of the lower strike (short) call option
x4
Strike price of the higher strike (long) call option
t
Time to expiration in years
r
Annual continuously compounded risk-free rate
sigma
Implied volatility of the lower strike (long) put option (annualized)
sigma2
Implied volatility of the higher strike (short) put option (annualized)
sigma3
Implied volatility of the lower strike (short) call option (annualized)
sigma4
Implied volatility of the higher strike (long) call option (annualized)
vol
Manual over-ride for the volatility of the underlying asset (annualized)
d
Annual continuously compounded dividend yield

Value

Returns a data.frame

Examples

dv(s = 100, x1 = 90, x2 = 95, x3 = 105, x4 = 110, t = 0.08, r = 0.02, sigma = 0.2, vol = 0.3)
iv.calc  

*Implied Volatility Calculation*

**Description**
Computes the implied volatility of an option, either a call or put, given the option premium and key parameters

**Usage**
iv.calc(type, price, s, x, t, r, d = 0)

**Arguments**
- **type**: String argument, either "call" or "put"
- **price**: Current price of the option
- **s**: Spot price of the underlying asset
- **x**: Strike Price of the underlying asset
- **t**: Time to expiration in years
- **r**: Annual continuously compounded risk-free rate
- **d**: Annual continuously compounded dividend yield

**Value**
Returns a single option’s implied volatility

**Examples**
iv.calc(type = "call", price = 2.93, s = 100, x = 100, t = (45/365), r = 0.02, d = 0)

---

lambda  

*Lambda*

**Description**
Calculates the Lambda of the call or put option

**Usage**
lambda(type = "call", s, x, sigma, t, r, d = 0)
Arguments

- **type**: Character string, either "call" or "put"
- **s**: Spot price of the underlying asset
- **x**: Strike price of the option
- **sigma**: Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns
- **t**: Time to maturity in years
- **r**: Annual continuously-compounded risk-free rate, use the function r.cont
- **d**: Annual continuously-compounded dividend yield, use the function r.cont

Details

Lambda, or elasticity is the percentage change in the option value per percentage change in the underlying price. It is a measure of leverage.

Value

Calculates the Lambda of the option contract

Examples

```r
lambda(type = "put", s = 100, x = 100, sigma = 0.15, t = 45/365, r = 0.02)
```

---

**opteval**

*Dual Option Evaluation*

Description

Creates a data.frame containing both call and put option greeks; delta, gamma, vega, theta, rho and the option premium

Usage

```r
opteval(s, x, sigma, t, r, d = 0)
```

Arguments

- **s**: Spot price of the underlying asset
- **x**: Strike price of the option
- **sigma**: Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns
- **t**: Time to maturity in years
- **r**: Annual continuously-compounded risk-free rate, use the function r.cont
- **d**: Annual continuously-compounded dividend yield, use the function r.cont
Value
Returns a data.frame containing the call and put option premium and greeks:

- Premium
- Delta
- Gamma
- Vega
- Theta
- Rho

Examples
```
opteval(100, 100, 0.20, (45/365), 0.02, 0.02)
```

---

**Description**
Calculates the gamma of a European-style call and put option

**Usage**
```
optiongamma(s, x, sigma, t, r, d = 0)
```

**Arguments**
- `s` Spot price of the underlying asset
- `x` Strike price of the option
- `sigma` Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns
- `t` Time to maturity in years
- `r` Annual continuously-compounded risk-free rate, use the function r.cont
- `d` Annual continuously-compounded dividend yield, use the function r.cont

**Details**
Gamma is the rate of change of the option’s delta given a $1 change in the underlying asset.

**Value**
Returns the option gamma

**Examples**
```
optiongamma(100, 100, 0.20, (45/365), 0.02, 0.02)
```
optionvega

Option Vega

Description
Calculates the vega of a European-style call and put option

Usage
optionvega(s, x, sigma, t, r, d = 0)

Arguments
- s: Spot price of the underlying asset
- x: Strike price of the option
- sigma: Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns
- t: Time to maturity in years
- r: Annual continuously-compounded risk-free rate, use r.cont
- d: Annual continuously-compounded dividend yield, use r.cont

Details
Vega measures the change in the option’s value given a 1

Value
Returns the option vega

Examples
optionvega(100, 100, 0.20, (45/365), 0.02, 0.02)

plotbearcall

Plot Bear Call Spread

Description
Plot a bear call spread (credit spread)

Usage
plotbearcall(s, x1, x2, t, r, sigma, sigma2 = sigma, d = 0, l1 = 0.75, ul = 1.25, xlab = "spot", ylab = "Profit/Loss", main = "Bear Call Spread", ...)
Arguments

- `s` Spot price of the underlying asset
- `x1` Lower-strike option price (short option)
- `x2` Higher-strike option price (long option)
- `t` Time to expiration in years
- `r` Annual continuously compounded risk-free rate
- `sigma` Annualized implied volatility of the lower-strike option
- `sigma2` Annualized implied volatility of the higher-strike option
- `d` Annual continuously compounded risk-free rate
- `ll` Lower-limit of the plot, set as (desired price/spot)
- `ul` Upper-limit of the plot, set as (desired price/spot)
- `xlab` X-Axis Label
- `ylab` Y-Axis Label
- `main` Title of the plot
- `...` Additional plot parameters

Value

Returns a plot of a vertical call spread (credit spread). Black line: The profit/loss at expiration. Red line: The profit/loss at (1/2) time "t" ~ half-way to expiration. Blue line: The profit/loss at inception.

Author(s)

John T. Buynak

Examples

```r
plotbearcall(s = 100, x1 = 95, x2 = 105, t = (45/365), r = 0.02, sigma = 0.20, sigma2 = 0.20, d = 0, ll = 0.75, ul = 1.25)
```

```
plotbearput

Plot Bear Put Spread
```

Description

Plot a bear put spread (debit spread)

Usage

```r
plotbearput(s, x1, x2, t, r, sigma, sigma2 = sigma, d = 0, ll = 0.75, ul = 1.25, xlab = "spot", ylab = "Profit/Loss", main = "Bear Put Spread", ...)
```
Arguments

s Spot price of the underlying asset
x1 Lower-strike option price (short option)
x2 Higher-strike option price (long option)
t Time to expiration in years
r Annual continuously compounded risk-free rate
sigma Annualized implied volatility of the lower-strike option
sigma2 Annualized implied volatility of the higher-strike option
d Annual continuously compounded risk-free rate
ll Lower-limit of the plot, set as (desired price/spot)
ul Upper-limit of the plot, set as (desired price/spot)
xlab X-Axis Label
ylab Y-Axis Label
main Title of the plot
... Additional plot parameters

Value

Returns a plot of a vertical put spread (debit spread). Black line: The profit(loss) at expiration. Red line: The profit(loss) at (1/2) time "t" ~ half-way to expiration. Blue line: The profit(loss) at inception.

Author(s)

John T. Buynak

Examples

```
plotbearput(s= 100, x1 = 95, x2 = 105, t = (45/365), r = 0.02,
sigma = 0.20, sigma2 = 0.20, d = 0, ll = 0.75, ul = 1.25)
```

Description

Plot a bull call spread (debit spread)

Usage

```
plotbullcall(s, x1, x2, t, r, sigma, sigma2 = sigma, d = 0,
ll = 0.75, ul = 1.25, xlab = "spot", ylab = "profit/loss",
main = "Bull Call Spread", ...)
```
Arguments

s     Spot price of the underlying asset
x1    Lower-strike option price (long option)
x2    Higher-strike option price (short option)
t    Time to expiration in years
r    Annual continuously compounded risk-free rate
sigma    Annualized implied volatility of the lower-strike option
sigma2    Annualized implied volatility of the higher-strike option
d    Annual continuously compounded risk-free rate
ll    Lower-limit of the plot, set as (desired price/spot)
ul    Upper-limit of the plot, set as (desired price/spot)
xlab    X-Axis Label
ylab    Y-Axis Label
main    Title of the plot
...    Additional plot parameters

Value

Returns a plot of a vertical call spread (debit spread). Black line: The profit(loss) at expiration. Red line: The profit(loss) at (1/2) time "t" ~ half-way to expiration. Blue line: The profit(loss) at inception.

Author(s)

John T. Buynak

Examples

plotbullcall(s= 100, x1 = 95, x2 = 105, t = (45/365), r = 0.02,
sigma = 0.20, sigma2 = 0.20, d = 0, ll = 0.75, ul = 1.25)

Description

Plot a bull put spread (credit spread)

Usage

plotbullput(s, x1, x2, t, r, d = 0, sigma, sigma2 = sigma, ll = 0.75,
ul = 1.25, xlab = "spot", ylab = "Profit/Loss",
main = "Bull Put Spread", ...)
### Arguments

- **s**: Spot price of the underlying asset
- **x1**: Lower-strike option price (long option)
- **x2**: Higher-strike option price (short option)
- **t**: Time to expiration in years
- **r**: Annual continuously compounded risk-free rate
- **d**: Annual continuously compounded risk-free rate
- **sigma**: Annualized implied volatility of the lower-strike option
- **sigma2**: Annualized implied volatility of the higher-strike option
- **ll**: Lower-limit of the plot, set as (desired price/spot)
- **ul**: Upper-limit of the plot, set as (desired price/spot)
- **xlab**: X-Axis Label
- **ylab**: Y-Axis Label
- **main**: Title of the plot
- **...**: Additional plot parameters

### Value

Returns a plot of a vertical put spread (credit spread). Black line: The profit(loss) at expiration. Red line: The profit(loss) at (1/2) time “t” ~ half-way to expiration. Blue line: The profit(loss) at inception.

### Author(s)

John T. Buynak

### Examples

```r
plotbullput(s= 100, x1 = 95, x2 = 105, t = (45/365), r = 0.02,
sigma = 0.20, sigma2 = 0.20, d = 0, ll = 0.75, ul = 1.25)
```

### Description

Plot a double vertical spread (credit spread)

### Usage

```r
plotdv(s, x1, x2, x3, x4, t, r, sigma, sigma2 = sigma, sigma3 = sigma,
sigma4 = sigma, d = 0, ll = 0.75, ul = 1.25, xlab = "spot",
ylab = "Profit/Loss", main = "Double Vertical Spread", ...)
```
Arguments

- **s**: Spot price of the underlying asset
- **x1**: Lower-strike put option price (long option)
- **x2**: Higher-strike put option price (short option)
- **x3**: Lower-strike call option price (short option)
- **x4**: Higher-strike call option price (long option)
- **t**: Time to expiration in years
- **r**: Annual continuously compounded risk-free rate
- **sigma**: Annualized implied volatility of the lower-strike put option
- **sigma2**: Annualized implied volatility of the higher-strike put option
- **sigma3**: Annualized implied volatility of the lower-strike call option
- **sigma4**: Annualized implied volatility of the higher-strike call option
- **d**: Annual continuously compounded risk-free rate
- **ll**: Lower-limit of the plot, set as (desired price/spot)
- **ul**: Upper-limit of the plot, set as (desired price/spot)
- **xlab**: X-Axis Label
- **ylab**: Y-Axis Label
- **main**: Title of the plot
- **...**: Additional plot parameters

Details

The double vertical spread consists of a credit put spread and a credit debit spread.

Value

Returns a plot of a double vertical spread (credit spread). Black line: The profit(loss) at expiration. Red line: The profit(loss) at (1/2) time “t” ~ half-way to expiration. Blue line: The profit(loss) at inception.

Author(s)

John T. Buynak

Examples

```r
plotdv(s = 100, x1 = 90, x2 = 95, x3 = 105, x4 = 110, t = (45/365), r = 0.02, sigma = 0.20)
```
**plotvertical**

**Plot Custom Vertical Spread**

**Description**

Plot Custom Vertical Spread

**Usage**

```r
plotvertical(options = c("call", "put"), s, x1, x2, t, r, sigma,
            sigma2 = sigma, d = 0, ll = 0.75, ul = 1.25, xlab = "spot",
            ylab = "profit/loss", main = "Vertical Spread", ...)
```

**Arguments**

- `options`: String argument, either "call" or "put"
- `s`: Spot price of the underlying asset
- `x1`: Short strike (either higher or lower)
- `x2`: Long strike (either higher or lower)
- `t`: Time to expiration in years
- `r`: Annual continuously compounded risk-free rate
- `sigma`: Annualized implied volatility of the short option
- `sigma2`: Annualized implied volatility of the long option
- `d`: Annual continuously compounded dividend yield
- `ll`: Lower-limit of the plot, set as (desired price/spot)
- `ul`: Upper-limit of the plot, set as (desired price/spot)
- `xlab`: X-Axis Label
- `ylab`: Y-Axis Label
- `main`: Title of the plot
- `...`: Additional plot parameters

**Value**

Returns a plot of a custom vertical spread. Black line: The profit(loss) at expiration. Red line: The profit(loss) at (1/2) time "t" ~ half-way to expiration. Blue line: The profit(loss) at inception.

**Author(s)**

John T. Buynak

**Examples**

```r
plotvertical("call", 100, 90, 110, (45/365), 0.02, 0.20)
```
**Description**

Calculates the probability of the underlying asset value remaining above a price level in a designated time frame, given the daily standard deviation of the underlying returns.

**Usage**

```r
prob.above(spot, lower, mean = 0, asd = 0, dsd = 0, dte = 0, p,
quantile = FALSE, tradedays = 262)
```

**Arguments**

- `spot`: Current price of the underlying asset
- `lower`: Lower price of the range
- `mean`: The average daily price movement, default = 0
- `asd`: Annualized standard deviation of the underlying returns
- `dsd`: Daily standard deviation of the underlying returns (Annual vol/sqrt(256)), used as an alternative to the asd parameter in conjunction with the dte parameter
- `dte`: Days until expiration, designated time frame
- `p`: Designated probability
- `quantile`: Logical. If True, calculates the price the asset will remain above, given the designated probability
- `tradedays`: Number of trade days in a year, default = 262

**Details**

This function has two separate possible operations: 1. Calculates the probability of the underlying asset value remaining above a price level in a designated time frame, given the daily standard deviation of the underlying returns. 2. Calculates the price the asset will remain above, given the designated probability

**Value**

Returns a probability (if quantile = FALSE), Returns a data.frame (if quantile = TRUE)

**Examples**

```r
prob.above(spot = 100, lower = 110, mean = 0, dsd = 0.01, dte = 45)
prob.above(spot = 100, mean = 0, dsd = 0.01, dte = 45, p = 0.75, quantile = TRUE)
```
**prob.below**

**Probability Below**

**Description**

Calculates the probability of the underlying asset value remaining below a price level in a designated time frame, given the daily standard deviation of the underlying returns.

**Usage**

```r
prob.below(spot, upper, mean = 0, asd = 0, dsd = 0, dte = 0, p, quantile = FALSE, tradedays = 262)
```

**Arguments**

- `spot`: Current price of the underlying asset
- `upper`: Upper price of the range
- `mean`: The average daily price movement, default = 0
- `asd`: Annualized standard deviation of the underlying returns
- `dsd`: Daily standard deviation of the underlying returns (Annual vol/sqrt(256)), used as an alternative to the `asd` parameter in conjunction with the `dte` parameter
- `dte`: Days until expiration, designated time frame
- `p`: Designated probability
- `quantile`: Logical. If True, calculates the price the asset will remain below, given the designated probability
- `tradedays`: Number of trade days in a year, default = 262

**Details**

This function has two separate possible operations: 1. Calculates the probability of the underlying asset value remaining below a price level in a designated time frame, given the daily standard deviation of the underlying returns. 2. Calculates the price the asset will remain below, given the designated probability.

**Value**

Returns a probability (if `quantile` = `FALSE`), Returns a data.frame (if `quantile` = `TRUE`)

**Examples**

```r
prob.below(spot = 100, upper = 110, mean = 0, dsd = 0.01, dte = 45)
prob.below(spot = 100, mean = 0, dsd = 0.01, dte = 45, p = 0.75, quantile = TRUE)
```
Description

Calculates the probability of the underlying asset value falling between two prices in a designated time frame, given the daily standard deviation of the underlying returns.

Usage

```r
prob.btwn(spot, lower, upper, asd = 0, dsd = 0, dte = 0, mean = 0, p, quantile = FALSE, tradedays = 262)
```

Arguments

- **spot**: Current price of the underlying asset
- **lower**: Lower price of the range
- **upper**: Upper price of the range
- **asd**: Annualized standard deviation of the underlying returns
- **dsd**: Daily standard deviation of the underlying returns (Annual vol/sqrt(256)), used as an alternative to the asd parameter in conjunction with the dte parameter
- **dte**: Days until expiration, designated time frame
- **mean**: The average daily price movement, default = 0
- **p**: Designated probability
- **quantile**: Logical. If True, calculates the probable price range
- **tradedays**: Number of trade days in a year, default = 262

Details

This function has two separate possible operations: 1. Calculates the probability of the underlying asset value falling between two prices in a designated time frame, given the daily standard deviation of the underlying returns. 2. Calculates the probable price range, given a set probability

Value

Returns a probability (if quantile = FALSE), Returns a data.frame (if quantile = TRUE)

Examples

```r
prob.btwn(spot = 100, lower = 90, upper = 110, mean = 0, dsd = 0.01, dte = 45)
prob.btwn(spot = 100, mean = 0, dsd = 0.01, dte = 45, p = 0.75, quantile = TRUE)
```
**putdelta**

### Description
Calculates the delta of the European-style put option

### Usage
`putdelta(s, x, sigma, t, r, d = 0)`

### Arguments
- **s**: Spot price of the underlying asset
- **x**: Strike price of the option
- **sigma**: Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns
- **t**: Time to maturity in years
- **r**: Annual continuously-compounded risk-free rate, use the function `r.cont`
- **d**: Annual continuously-compounded dividend yield, use the function `r.cont`

### Details
The delta of an option can be defined as the rate of change of the option value given a $1 change in the underlying asset price.

### Value
Returns the put delta

### Examples
`putdelta(100, 0.20, (45/365), 0.02, 0.02)`

---

**puteval**

### Description
Creates a data.frame containing put option greeks; delta, gamma, vega, theta, rho and the put-premium

### Usage
`puteval(s, x, sigma, t, r, d = 0)`
Arguments

s  Spot price of the underlying asset
x  Strike price of the option
sigma  Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns
t  Time to maturity in years
r  Annual continuously-compounded risk-free rate, use the function r.cont
d  Annual continuously-compounded dividend yield, use the function r.cont

Value

Returns a data.frame containing the option premium and greeks:

• Premium
• Delta
• Gamma
• Vega
• Theta
• Rho

Author(s)

John T. Buynak

Examples

puteval(100, 100, 0.20, (45/365), 0.02, 0.02)

tugreek

<table>
<thead>
<tr>
<th>putgreek</th>
<th>Put Option Greek</th>
</tr>
</thead>
</table>

Description

Computes the selected option greek, including premium

Usage

putgreek(greek = c("delta", "gamma", "theta", "vega", "rho", "premium"),
s, x, sigma, t, r, d = 0)
**Arguments**

- `greek` (String value, desired option greek to return)
- `s` (Spot price of the underlying asset)
- `x` (Strike price of the option)
- `sigma` (Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns)
- `t` (Time to maturity in years)
- `r` (Annual continuously-compounded risk-free rate, use the function `r.cont`)
- `d` (Annual continuously-compounded dividend yield, use the function `r.cont`)

**Value**

Returns the directed option greek, including premium

**Examples**

```r
putgreek("vega", 100, 100, 0.20, (45/365), 0.02, 0.02)
```

---

**Description**

Calculates the premium of a European-style put option using the Black-Scholes option pricing model.

**Usage**

```r
putpremium(s, x, sigma, t, r, d = 0)
```

**Arguments**

- `s` (Spot price of the underlying asset)
- `x` (Strike price of the option)
- `sigma` (Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns)
- `t` (Time to maturity in years)
- `r` (Annual continuously-compounded risk-free rate, use the function `r.cont`)
- `d` (Annual continuously-compounded dividend yield, use the function `r.cont`)

**Value**

Returns the value of the put option

**Examples**

```r
putpremium(100, 100, 0.20, (45/365), 0.02, 0.02)
```
Description

Calculates the rho of the European-style put option

Usage

\texttt{putrho(s, x, \sigma, t, r, d = 0)}

Arguments

\begin{itemize}
\item \texttt{s} \quad \text{Spot price of the underlying asset}
\item \texttt{x} \quad \text{Strike price of the option}
\item \texttt{\sigma} \quad \text{Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns}
\item \texttt{t} \quad \text{Time to maturity in years}
\item \texttt{r} \quad \text{Annual continuously-compounded risk-free rate, use the function \texttt{r.cont}}
\item \texttt{d} \quad \text{Annual continuously-compounded dividend yield, use the function \texttt{r.cont}}
\end{itemize}

Details

Rho measures the change in the option's value given a 1

Value

Returns the put rho

Examples

\texttt{putrho(100, 100, 0.20, (45/365), 0.02, 0.02)}

Description

Calculates the theta of the European-style put option

Usage

\texttt{puttheta(s, x, \sigma, t, r, d = 0)}
Arguments

- **s**: Spot price of the underlying asset
- **x**: Strike price of the option
- **sigma**: Implied volatility of the underlying asset price, defined as the annualized standard deviation of the asset returns
- **t**: Time to maturity in years
- **r**: Annual continuously-compounded risk-free rate, use the function `r.cont`
- **d**: Annual continuously-compounded dividend yield, use the function `r.cont`

Details

Theta is the "time-decay" of the option value measured as a daily value.

Value

Returns the put theta

Examples

```r
puttheta(100, 100, 0.20, (45/365), 0.02, 0.02)
```

---

### `r.cont`

**Continuously Compounded Rate**

**Description**

Convert a given nominal rate to a continuously compounded rate

**Usage**

```r
r.cont(r, n)
```

**Arguments**

- **r**: nominal rate
- **n**: number of times compounded each year

**Value**

Returns a continuously compounded rate

**Examples**

```r
r.cont(0.12, 2)
```
### tdiff

**Time Difference**

**Description**

Computes the difference in time between two dates

**Usage**

```r
tdiff(date1, date2, period = c("days", "years"))
```

**Arguments**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>date1</td>
<td>Earlier date</td>
</tr>
<tr>
<td>date2</td>
<td>Later date</td>
</tr>
<tr>
<td>period</td>
<td>String value, either &quot;days&quot;, or &quot;years&quot;</td>
</tr>
</tbody>
</table>

**Value**

Returns a numeric value

**Examples**

```r
tdiff("2018-01-01", "2018-06-30", "days")
```

---

### vertical

**Vertical Spread Analytics**

**Description**

Calculates the key analytics of a vertical spread

**Usage**

```r
vertical(options = c("call", "put"), s, x1, x2, t, r, sigma, sigma2 = sigma, vol = sigma, d = 0)
```
Arguments

options Character string. Either "call", or "put"
s Spot price of the underlying asset
x1 Strike price of the short option
x2 Strike price of the long option
t Time to expiration in years
r Annual continuously compounded risk-free rate
sigma Implied volatility of the short option (annualized)
sigma2 Implied volatility of the long option (annualized)
vol Manual over-ride for the volatility of the underlying asset (annualized)
d Annual continuously compounded dividend yield

Value

Returns a data.frame

Examples

vertical("call", s = 100, x1 = 90, x2 = 110, t = (45/365), r = 0.025, sigma = 0.20, vol = 0.25)
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