Package ‘optionval’

January 15, 2021

Type Package

Title Option Valuation Package

Version 0.1.1

Imports `pip install git+https://github.com/kyustorm7/option-valuation`

Description Calculate and visualize option valuation process

URL https://github.com/kyustorm/option-valuation

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Date/Publication 2021-01-15 15:52:26 (GMT+9)

`Python` topics documented:

optionval-package *Option Valuation Framework*

Description

Option Value Calculating and Visualizing Package for Python

Download

`Optionval` can be installed by pip

```
! pip install git+https://github.com/kyustorm7/option-valuation
```

Modules

optionval.values Calculate values that are useful for option valuation

```
from optionval.values import black_scholes
```

black_scholes	call_gamma	put_gamma
volatility	call_vega	put_vega
d1	call_theta	put_theta
d2	call_rho	put_rho
call_delta	put_delta	

optionval.trees Caculate and Visualize Binomial tree mode

```
from optionval.trees import BinomialAmerican_tree
```

BinomialAmerican	BinomialEuropean
BinomialAmerican_graph	BinomialEuropean_graph
BinomialAmerican_tree	BinomialEuropean_tree

blackscholes *Calculate option value with blackscholes model*

Description

Calculate option value through blackscholes model with the arguments

Usage

```
blackscholes(S=50, E=50, T=5/12, r=0.1, sigma=0.4, PutCall='C')
blackscholes(S=50, E=50, T=5/12, r=0.1, sigma=0.4, PutCall='P')
```

Arguments

S	Current value of underlying asset
E	Exercise Price
T	Time to expiration date (in years) ex) 5 months = 5/12
r	Annual risk-free interest rate over the period from now to expiration date
sigma	Standard deviation (per year) of continuous stock returns
PutCall	Whether the option is call or put *default: 'C' -Call option: PutCall = 'C' -Put option: PutCall = 'P'

volatility *Calculate a volatility of the firm's asset*

Description

Calculate a volatility of the firm's asset with the arguments assuming that there are only one type of common stock and one type of bond.

Usage

```
volatility(stock_sd=0.3, bond_sd=0.2, stock_weight=0.6,
bond_weight=0.4, corr=0.5)
```

Arguments

stock_sd	Standard deviation of stock	
bond_sd	Standard deviation of bond	
stock_weight	Weight on stock	
bond_weight	Weight on bond	
	*stock_weight + bond_weight = 1	
	(if either one is not given, the other is automatically calculated)	
corr	Correlation between stock and bond	*default: 0

d1 *Calculate d1 value used in blackscholes model*

Description

Calculate d1 value used in blackscholes model with the arguments

Usage

```
d1(S=50, E=50, T=5/12, r=0.1, sigma=0.4)
```

Arguments

S	Current value of underlying asset
E	Exercise Price
T	Time to expiration date (in years) ex) 5 months = 5/12
r	Annual risk-free interest rate over the period from now to expiration date
sigma	Standard deviation (per year) of continuous stock returns

Details

$$d_1 = \frac{ln\left(\frac{S}{E}\right) + (r + \frac{\sigma^2}{2})T}{\sigma\sqrt{T}}$$

d2 *Calculate d2 value used in blackscholes model*

Description

Calculate d2 value used in blackscholes model with the arguments

Usage

```
d2(S=50, E=50, T=5/12, r=0.1, sigma=0.4)
```

Arguments

S	Current value of underlying asset
E	Exercise Price
T	Time to expiration date (in years) ex) 5 months = 5/12
r	Annual risk-free interest rate over the period from now to expiration date
sigma	Standard deviation (per year) of continuous stock returns

Details

$$\boldsymbol{d_2 = d_1 - \sigma\sqrt{T}}$$

call_delta *Calculate delta in call option*

Description

Calculate delta in call option with the arguments

Usage

```
call_delta(S=50, E=50, T=5/12, r=0.1, sigma=0.4)
```

Arguments

S	Current value of underlying asset
E	Exercise Price
T	Time to expiration date (in years) ex) 5 months = 5/12
r	Annual risk-free interest rate over the period from now to expiration date
sigma	Standard deviation (per year) of continuous stock returns

Details

Delta measures the rate of change of the theoretical option value with respect to changes in the underlying asset's price.

$\Delta = \frac{\partial V}{\partial S}$ (V: value of call option, S: value of underlying asset)

call_gamma Calculate gamma in call option

Description

Calculate gamma in call option with the arguments

Usage

```
call_gamma(S=50, E=50, T=5/12, r=0.1, sigma=0.4)
```

Arguments

S	Current value of underlying asset
E	Exercise Price
T	Time to expiration date (in years) ex) 5 months = 5/12
r	Annual risk-free interest rate over the period from now to expiration date
sigma	Standard deviation (per year) of continuous stock returns

Details

Gamma measures the rate of change in delta with respect to changes in the underlying asset's price.

$\boldsymbol{\Gamma = \frac{\partial \Delta}{\partial S}}$ (Δ: delta in call option, S: value of underlying asset)

call_vega	Calculate vega in call option

Description

Calculate vega in call option with the arguments

Usage

```
call_vega(S=50, E=50, T=5/12, r=0.1, sigma=0.4)
```

Arguments

S	Current value of underlying asset
E	Exercise Price
T	Time to expiration date (in years) ex) 5 months = 5/12
r	Annual risk-free interest rate over the period from now to expiration date
sigma	Standard deviation (per year) of continuous stock returns

Details

Vega measures the sensitivity to volatility

$\boldsymbol{\nu} = \frac{\partial \mathbf{V}}{\partial \boldsymbol{\sigma}}$ (V: value of call option, σ: volatility of underlying asset)

call_theta	Calculate theta in call option

Description

Calculate theta in call option with the arguments

Usage

```
call_theta(S=50, E=50, T=5/12, r=0.1, sigma=0.4)
```

Arguments

S	Current value of underlying asset
E	Exercise Price
T	Time to expiration date (in years) ex) 5 months = 5/12
r	Annual risk-free interest rate over the period from now to expiration date
sigma	Standard deviation (per year) of continuous stock returns

Details

Theta measures the sensitivity of the option price with respect to the option's time to maturity

$$\boldsymbol{\theta = \frac{\partial V}{\partial \tau} = -\frac{S\emptyset(d_1)\sigma}{2\sqrt{t}} - rKe^{-rt}N(d_2)}$$

call_rho	Calculate rho in call option

Description

Calculate rho in call option with the arguments

Usage

```
call_rho(S=50, E=50, T=5/12, r=0.1, sigma=0.4)
```

Arguments

S	Current value of underlying asset
E	Exercise Price
T	Time to expiration date (in years) ex) 5 months = 5/12
r	Annual risk-free interest rate over the period from now to expiration date
sigma	Standard deviation (per year) of continuous stock returns

Details

Rho measures the sensitivity to the interest rate

$\boldsymbol{\rho} = \frac{\partial \mathbf{V}}{\partial r}$ (V: value of call option, r: annual risk-free interest rate)

put_delta *Calculate delta in put option*

Description

Calculate delta in put option with the arguments

Usage

```
put_delta(S=50, E=50, T=5/12, r=0.1, sigma=0.4)
```

Arguments

S	Current value of underlying asset
E	Exercise Price
T	Time to expiration date (in years) ex) 5 months = 5/12
r	Annual risk-free interest rate over the period from now to expiration date
sigma	Standard deviation (per year) of continuous stock returns

Details

Delta measures the rate of change of the theoretical option value with respect to changes in the underlying asset's price.

$\Delta = \frac{\partial V}{\partial S}$ (V: value of put option, S: value of underlying asset)

put_gamma	Calculate gamma in put option

Description

Calculate gamma in put option with the arguments

Usage

```
put_gamma(S=50, E=50, T=5/12, r=0.1, sigma=0.4)
```

Arguments

S	Current value of underlying asset
E	Exercise Price
T	Time to expiration date (in years) ex) 5 months = 5/12
r	Annual risk-free interest rate over the period from now to expiration date
sigma	Standard deviation (per year) of continuous stock returns

Details

Gamma measures the rate of change in delta with respect to changes in the underlying asset's price.

$\boldsymbol{\Gamma = \frac{\partial \Delta}{\partial S}}$ (Δ: delta in put option, S: value of underlying asset)

put_vega	Calculate vega in put option

Description

Calculate vega in put option with the arguments

Usage

```
put_vega(S=50, E=50, T=5/12, r=0.1, sigma=0.4)
```

Arguments

S	Current value of underlying asset
E	Exercise Price
T	Time to expiration date (in years) ex) 5 months = 5/12
r	Annual risk-free interest rate over the period from now to expiration date
sigma	Standard deviation (per year) of continuous stock returns

Details

Vega measures the sensitivity to volatility

$\boldsymbol{\nu} = \frac{\partial \mathbf{V}}{\partial \boldsymbol{\sigma}}$ (V: value of put option, σ: volatility of underlying asset)

put_theta	Calculate theta in put option

Description

Calculate theta in put option with the arguments

Usage

```
put_theta(S=50, E=50, T=5/12, r=0.1, sigma=0.4)
```

Arguments

S	Current value of underlying asset
E	Exercise Price
T	Time to expiration date (in years) ex) 5 months = 5/12
r	Annual risk-free interest rate over the period from now to expiration date
sigma	Standard deviation (per year) of continuous stock returns

Details

Theta measures the sensitivity of the option price with respect to the option's time to maturity

$$\boldsymbol{\theta = \frac{\partial V}{\partial \tau} = -\frac{S\emptyset(d_1)\sigma}{2\sqrt{t}} - rKe^{-rt}N(d_2)}$$

put_rho	Calculate rho in put option

Description

Calculate rho in call option with the arguments

Usage

```
put_rho(S=50, E=50, T=5/12, r=0.1, sigma=0.4)
```

Arguments

S	Current value of underlying asset
E	Exercise Price
T	Time to expiration date (in years) ex) 5 months = 5/12
r	Annual risk-free interest rate over the period from now to expiration date
sigma	Standard deviation (per year) of continuous stock returns

Details

Rho measures the sensitivity to the interest rate

$\boldsymbol{\rho} = \frac{\partial \mathrm{V}}{\partial r}$ (V: value of put option, r: annual risk-free interest rate)

BinomialAmerican *Calculate American option value with binomial tree model*

Description

Calculate American option value through binomial tree model with the arguments

Usage

```
BinomialAmerican(n=5, S=50, K=50, r=0.1, v=0.4, t=5/12, PutCall ="P")

BinomialAmerican(n=5, S=50, K=50, r=0.1, v=0.4, t=5/12, PutCall "C")
```

Arguments

n	number of binomial steps	
S	initial stock price	
K	Strike Price	
r	Annual risk-free interest rate over the period from now to expiration date	
v	Volatility factor	
t	Time to expiration date (in years)	ex) 5 months = 5/12
PutCall	Whether the option is call or put	*default: ‘C’
	-Call option: PutCall = ‘C’	
	-Put option: PutCall = ‘P’	

BinomialEuropean *Calculate European option value with binomial tree model*

Description

Calculate European option value through binomial tree model with the arguments

Usage

```
BinomialEuropean(n=5, S=50, K=50, r=0.1, v=0.4, t=5/12, PutCall="P")
BinomialEuropean(n=5, S=50, K=50, r=0.1, v=0.4, t=5/12, PutCall="C")
```

Arguments

n	number of binomial steps	
S	initial stock price	
K	Strike Price	
r	Annual risk-free interest rate over the period from now to expiration date	
v	Volatility factor	
t	Time to expiration date (in years)	ex) 5 months = 5/12
PutCall	Whether the option is call or put	*default: 'C'
	-Call option: PutCall = 'C'	
	-Put option: PutCall = 'P'	

BinomialAmerican_graph *Visualize American option payoff with binomial tree model*

Description

Visualize American option payoff diagram (Payoff – Value of Underlying asset) through binomial tree model with the given arguments

Usage

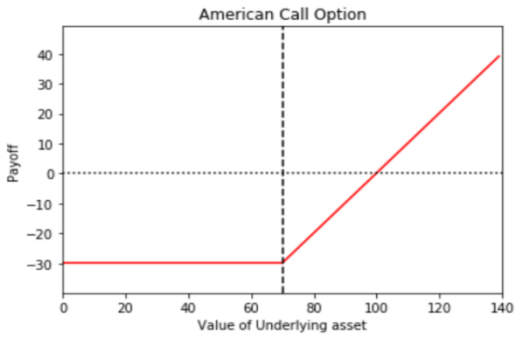
```
BinomialAmerican_graph(n=5,S=50,K=50,r=0.1,v=0.4,t=5/12,PutCall="C")

BinomialAmerican_graph(n=5,S=50,K=50,r=0.1,v=0.4,t=5/12,PutCall="P")
```

Arguments

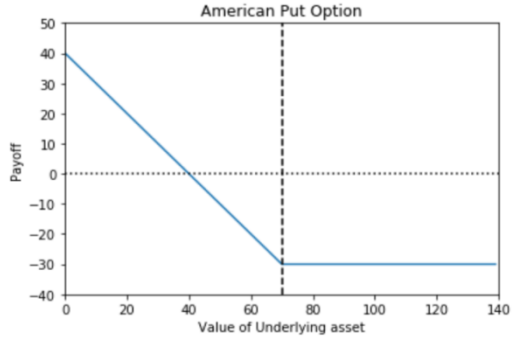
n	number of binomial steps	
S	initial stock price	
K	Strike Price	
r	Annual risk-free interest rate over the period from now to expiration date	
v	Volatility factor	
t	Time to expiration date (in years)	ex) 5 months = 5/12
PutCall	Whether the option is call or put	*default: 'C'

Example

```
BinomialAmerican_graph(10, 40, 70, 0.3, 0.7, 5, "C")
```




```
BinomialAmerican_graph(10, 40, 70, 0.3, 0.7, 5, "P")
```



BinomialEuropean_graph *Visualize European option payoff with binomial tree model*

Description

Visualize European option payoff diagram (Payoff – Value of Underlying asset) through binomial tree model with the given arguments

Usage

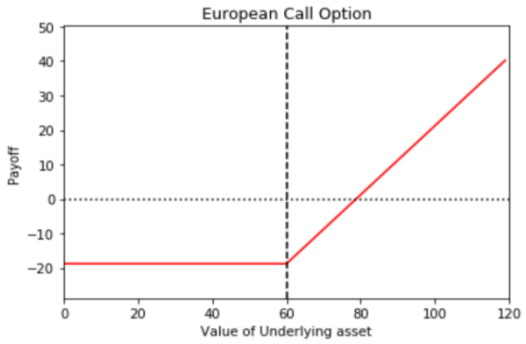
```
BinomialEuropean_graph(n=5,S=50,K=50,r=0.1,v=0.4,t=5/12,PutCall="C")

BinomialEuropean_graph(n=5,S=50,K=50,r=0.1,v=0.4,t=5/12,PutCall="P")
```

Arguments

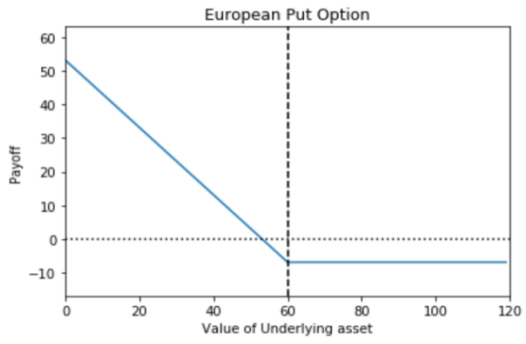
n	number of binomial steps	
S	initial stock price	
K	Strike Price	
r	Annual risk-free interest rate over the period from now to expiration date	
v	Volatility factor	
t	Time to expiration date (in years)	ex) 5 months = 5/12
PutCall	Whether the option is call or put	*default: 'C'

Example

```
BinomialEuropean_graph(10, 30, 60, 0.3, 0.7, 4, "C")
```




```
BinomialEuropean_graph(10, 30, 60, 0.3, 0.7, 4, "P")
```



BinomialAmerican_tree *Visualize American option value with binomial tree model*

Description

Visualize American option valuation process through binomial tree model with the given arguments

Usage

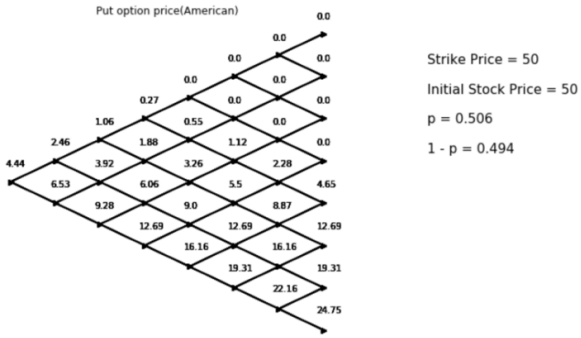
```
BinomialAmerican_tree(n=5,S=50,K=50,r=0.1,v=0.4,t=5/12,PutCall="C")

BinomialAmerican_tree(n=5,S=50,K=50,r=0.1,v=0.4,t=5/12,PutCall="P")
```

Arguments

n	number of binomial steps	
S	initial stock price	
K	Strike Price	
r	Annual risk-free interest rate over the period from now to expiration date	
v	Volatility factor	
t	Time to expiration date (in years)	ex) 5 months = 5/12
PutCall	Whether the option is call or put	*default: ‘C’

Example

```
BinomialAmerican_tree(7, 50, 50, 0.1, 0.4, 5/12, "P")
```



BinomialEuropean_tree *Visualize European option value with binomial tree model*

Description

Visualize European option valuation process through binomial tree model with the given arguments

Usage

```
BinomialEuropean_tree(n=5,S=50,K=50,r=0.1,v=0.4,t=5/12,PutCall="C")

BinomialEuropean_tree(n=5,S=50,K=50,r=0.1,v=0.4,t=5/12,PutCall="P")
```

Arguments

n	number of binomial steps	
S	initial stock price	
K	Strike Price	
r	Annual risk-free interest rate over the period from now to expiration date	
v	Volatility factor	
t	Time to expiration date (in years)	ex) 5 months = 5/12
PutCall	Whether the option is call or put	*default: 'C'

Example

```
BinomialEuropean_tree(5, 50, 50, 0.1, 0.4, 5/12, "P")
```