Package ‘portfolio.optimization’

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Type Package

Title Contemporary Portfolio Optimization

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Description Simplify your portfolio optimization process by applying a contemporary modeling way to model and solve your portfolio problems. While most approaches and packages are rather complicated this one tries to simplify things and is agnostic regarding risk measures as well as optimization solvers. Some of the methods implemented are described by Konno and Yamazaki (1991) <doi:10.1287/mnsc.37.5.519>, Rockafellar and Uryasev (2001) <doi:10.21314/JOR.2000.038> and Markowitz (1952) <doi:10.1111/j.1540-6261.1952.tb01525.x>.

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`portfolio.optimization-package`
Contemporary Portfolio Optimization

Description

Simplify your portfolio optimization process by applying a contemporary modeling way to model and solve your portfolio problems. While most approaches and packages are rather complicated this one tries to simplify things and is agnostic regarding risk measures as well as optimization solvers. Some of the methods implemented are described by Konno and Yamazaki (1991) <doi:10.1287/mnsc.37.5.519>, Rockafellar and Uryasev (2001) <doi:10.21314/JOR.2000.038> and Markowitz (1952) <doi:10.1111/j.1540-6261.1952.tb01525.x>.

Author(s)

Ronald Hochreiter, <`ronald@hochreiter.net`>

References

`http://www.finance-r.com/`

See Also

Useful links:

- `http://www.finance-r.com/`

`active.extension` *Enable active extension portfolios*

Description

`active.extension` adds corresponding long/short constraints for a diverse set of active extension portfolios (e.g. 130/30 portfolios)

Usage

```
active.extension(model, up = 130, down = 30)
```

Arguments

`model`	the portfolio.model to activate
`up`	percentage long (e.g. 130)
`down`	percentage short (e.g. 30)

Value

portfolio.model with active extension enabled

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`alpha` *Set new alpha of a portfolio.model*

Description

`alpha` sets a new alpha for VaR and Expected Shortfall

Usage

```
alpha(model, alpha)
```

Arguments

`model`	the portfolio.model to be changed
`alpha`	the value alpha (between 0 and 1)

Value

the adapted portfolio.model

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

Examples

```
data(sp100w17av30s)
model <- optimal.portfolio(scenario.set)
cvar95 <- optimal.portfolio(objective(model, "expected.shortfall"))
cvar90 <- optimal.portfolio(alpha(cvar95, 0.1))
```

`aux_portfolio.default` *Set portfolio.model default values*

Description

`aux_portfolio.default` sets portfolio.model default values

Usage

```
aux_portfolio.default(model)
```

Arguments

`model`	the portfolio.model to be reset

Value

a portfolio.model with all default values set

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`aux_risk.alias` *Convert risk alias names to internal names*

Description

`aux_risk.alias` converts risk alias names to internal names

Usage

```
aux_risk.alias(risk)
```

Arguments

`risk`	the risk name to be standardized

Value

the standardized risk name (if any)

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`aux_simulate.scenarios` *Simulate a multivariate-normal scenario.set*

Description

`aux_simulate.scenarios` simulates a scenario.set given a mean vector and a covariance matrix using mvrnorm of the MASS package

Usage

```
aux_simulate.scenarios(mu, Sigma, n = 1000, seed = 280277)
```

Arguments

`mu`	mean vector of asset returns
`Sigma`	covariance matrix of asset returns
`n`	number of scenarios to simulate (default 1000)
`seed`	random number seed (default 280277)

Value

A scenario set ‘simulation‘ with mean ‘mu‘ and covariance ‘Sigma‘

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`linear.constraint.eq` *Create or update a vector-based linear equality constraint set*

Description

`linear.constraint.eq` creates a vector-based linear equality constraint: Aeq(range) * factors == beq

Usage

```
linear.constraint.eq(constraints.linear, range, beq, factors = NULL)
```

Arguments

`constraints.linear`	the current set of equality constraints
`range`	the range of the variables to set (default 1 if factors is NULL)
`beq`	right-hand side scalar
`factors`	values to set for each variable in the given range

Value

the new (updated) set of equality constraints

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`linear.constraint.iq` *Create or update a vector-based linear inequality constraint set*

Description

`linear.constraint.iq` creates a vector-based linear inequality constraint: Aeq(range) * factors <= beq

Usage

```
linear.constraint.iq(constraints.linear, range, b, factors = NULL,
  leq = TRUE)
```

Arguments

`constraints.linear`	the current set of inequality constraints
`range`	the range of the variables to set (default 1 if factors is NULL)
`b`	right-hand side scalar
`factors`	values to set for each variable in the given range
`leq`	if false then the sign of the constraint will be inversed

Value

the new (updated) set of inequality constraints

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`long.only` *Disable active extension portfolios*

Description

`long.only` switches a portfolio.model back to long-only by disabling the active extension

Usage

```
long.only(model)
```

Arguments

`model`	the portfolio.model to deactivate active extensions

Value

portfolio.model with active extension disabled

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`lower.bound` *Set lower bounds on assets*

Description

`lower.bound` sets lower bounds on assets within a portfolio.model

Usage

```
lower.bound(model, v1 = NULL, v2 = NULL)
```

Arguments

`model`	the portfolio.model to adapt the lower bounds
`v1`	either one lower bound or lower bounds for all assets
`v2`	if not empty then v1 contains the positions (or names) and v2 the bounds

Value

portfolio.model with new lower bounds

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`momentum` *Set momentum parameters for a portfolio.model*

Description

`momentum` sets a new alpha for VaR and Expected Shortfall

Usage

```
momentum(model, n_momentum, n_momentum.short = NULL)
```

Arguments

`model`	the portfolio.model to be changed
`n_momentum`	amount of momentum assets long
`n_momentum.short`	amount of momentum assets short

Value

the adapted portfolio.model

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`objective` *Set new objective of a portfolio.model*

Description

`objective` sets a new objective for VaR and Expected Shortfall

Usage

```
objective(model, objective = "markowitz")
```

Arguments

`model`	the portfolio.model to be changed
`objective`	the new objective

Value

the adapted portfolio.model

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

Examples

```
data(sp100w17av30s)
model <- portfolio.model(scenario.set)
mad <- optimal.portfolio(objective(model, "mad"))
```

`optimal.portfolio` *Meta-function to optimize portfolios given a portfolio.model instance*

Description

`optimal.portfolio` optimizes the portfolio of a model given the current specification

Usage

```
optimal.portfolio(input = NULL, ...)

p.opt(input = NULL, ...)

opt.p(input = NULL, ...)
```

Arguments

`input`	either a portfolio.model or something to convert to a new model
`...`	other parameters to be passed on to the optimization sub-functions.

Value

an S3 object of class portfolio.model with the optimized portfolio.

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

Examples

```
data(sp100w17av30s)
model <- optimal.portfolio(scenario.set)
```

`optimal.portfolio.1overN` *1 over N portfolio*

Description

`optimal.portfolio.1overN` adds a 1 over N portfolio to the portfolio.model

Usage

```
optimal.portfolio.1overN(model)
```

Arguments

`model`	the portfolio.model to compute the portfolio of

Value

the portfolio.model including the newly computed optimal portfolio

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`optimal.portfolio.expected.shortfall` *Portfolio Optimization minimizing Conditional Value at Risk (CVaR)*

Description

`optimal.portfolio.expected.shortfall` conducts a Portfolio Optimization minimizing Conditional Value at Risk (CVaR) based on Rockafellar and Uryasev (2001)

Usage

```
optimal.portfolio.expected.shortfall(model)
```

Arguments

`model`	the portfolio.model to compute the portfolio of

Value

the portfolio.model including the newly computed optimal portfolio

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`optimal.portfolio.expected.shortfall.long.short` *Portfolio Optimization minimizing Conditional Value at Risk (CVaR) with active extensions*

Description

`optimal.portfolio.expected.shortfall.long.short` conducts a Portfolio Optimization minimizing Conditional Value at Risk (CVaR) based on Rockafellar and Uryasev (2001) with active extensions

Usage

```
optimal.portfolio.expected.shortfall.long.short(model)
```

Arguments

`model`	the portfolio.model to compute the portfolio of

Value

the portfolio.model including the newly computed optimal portfolio

Author(s)

Ronald Hochreiter, <ronald@algorithmic.finance>

`optimal.portfolio.mad` *Portfolio Optimization minimizing MAD*

Description

`optimal.portfolio.mad` conducts a Portfolio Optimization minimizing Mean Absolute Deviation (MAD) based on Konno and Yamazaki (1991)

Usage

```
optimal.portfolio.mad(model)
```

Arguments

`model`	the portfolio.model to compute the portfolio of

Value

the portfolio.model including the newly computed optimal portfolio

Author(s)

Ronald Hochreiter, <ronald@algorithmic.finance>

`optimal.portfolio.mad.long.short` *Portfolio Optimization minimizing MAD (Active Extension)*

Description

`optimal.portfolio.mad.long.short` conducts a Portfolio Optimization minimizing Mean Absolute Deviation (MAD) based on Konno and Yamazaki (1991) including an active extension

Usage

```
optimal.portfolio.mad.long.short(model)
```

Arguments

`model`	the portfolio.model to compute the portfolio of

Value

the portfolio.model including the newly computed optimal portfolio

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`optimal.portfolio.markowitz`

Portfolio Optimization minimizing Standard Deviation

Description

`portfolio.weights` conducts a Portfolio Optimization minimizing Standard Deviation based on Markowitz (1952).

Usage

```
optimal.portfolio.markowitz(model)
```

Arguments

`model`	the portfolio.model to compute the portfolio of

Value

the portfolio.model including the newly computed optimal portfolio

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`optimal.portfolio.momentum`

Momentum portfolio including momentum for active extensions

Description

`optimal.portfolio.momentum` adds a momentum portfolio to the portfolio.model

Usage

```
optimal.portfolio.momentum(model)
```

Arguments

`model`	the portfolio.model to compute the portfolio of

Value

the portfolio.model including the newly computed optimal portfolio

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`optimal.portfolio.reward` *Compute maximum/minimum return portfolio given the constraints*

Description

`optimal.portfolio.reward` computes a maximum/minimum return portfolio given the constraints

Usage

```
optimal.portfolio.reward(model)
```

Arguments

`model`	the portfolio.model to compute the portfolio of

Value

the portfolio.model including the newly computed optimal portfolio

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`po.tutorial` *Open a specific portfolio.optimization package tutorial*

Description

`po.tutorial` returns the filename of a specific portfolio.optimization package tutorial. If no tutorial is given or the tutorial is missspelled, a list of available tutorials is printed.

Usage

```
po.tutorial(tutorial = "")
```

Arguments

`tutorial`	name of the tutorial to open

Value

Nothing if no tutorial specified, otherwise the path to the tutorial.

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

Examples

```
## Not run:
file.edit(po.tutorial("101"))
file.edit(po.tutorial("compare"))

## End(Not run)
```

`portfolio.loss` *Return the loss distribution of the portfolio.model*

Description

`portfolio.loss` return the loss distribution of the portfolio.model

Usage

```
portfolio.loss(model)

l(model)
```

Arguments

`model`	the portfolio.model to display

Value

nothing

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`portfolio.model` *Create a portfolio.model instance (or fix an existing one)*

Description

`portfolio.model` creates a new S3 portfolio.model instance or fixes an existing one.

Usage

```
portfolio.model(input = NULL)

p.mo(input = NULL)
```

Arguments

`input`	model, scenario.set or mean.covariance list

Value

an S3 object of class portfolio.model

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`portfolio.weights` *Return the portfolio weights of a portfolio.model*

Description

`portfolio.weights` return the portfolio weights of a portfolio.model

Usage

```
portfolio.weights(model)

portfolio(model)

w(model)

weights(model)

x(model)
```

Arguments

`model`	the portfolio.model to return the portfolio weights from

Value

a vector of portfolio weights or NULL if no weights are available yet.

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

Examples

```
data(sp100w17av30s)
portfolio.weights(optimal.portfolio(scenario.set))
```

`print.portfolio.model` *Overload print() for portfolio.model*

Description

`print.portfolio.model` overloads print() and outputs some information about the portfolio.model object

Usage

```
## S3 method for class 'portfolio.model'
print(x, ...)
```

Arguments

`x`	the portfolio.model to display
`...`	further parameters

Value

nothing

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

`sp100w17` *S&P 100 weekly stock returns 2017*

Description

A dataset sp100w17 containing the (crude) weekly returns of (almost) all S&P 100 stocks of 2017, daily basis (101 stocks, 251 returns).

Usage

```
data(sp100w17)
```

Format

One xts time series object with 251 rows and 101 columns.

Details

Furthermore contains a vector sp100w17av with the average trading volume of all stocks in 2017 - to be used for a subselection.

`sp100w17av` *S&P 100 average trading volume over the whole year 2017*

Description

A vector sp100w17av with the average trading volume of all stocks in 2017 - to be used e.g. for a subselection.

Usage

```
data(sp100w17)
```

Format

One named numeric vector of length 101.

`sp100w17av30s` *S&P 100 weekly stock returns 2017 of 30 stocks with the highest average trading volume over the whole year*

Description

A sceario sp100w17 containing the (crude) weekly returns of (almost) all S&P 100 stocks of 2017, daily basis (101 stocks, 251 returns).

Usage

```
data(sp100w17av30s)
```

Format

A named matrix scenario.set with 251 rows and 30 columns.

`upper.bound` *Set upper bounds on assets*

Description

`upper.bound` sets lower bounds on assets within a portfolio.model

Usage

```
upper.bound(model, v1 = NULL, v2 = NULL)
```

Arguments

`model`	the portfolio.model to adapt the upper bounds
`v1`	either one upper bound or lower bounds for all assets
`v2`	if not empty then v1 contains the positions (or names) and v2 the bounds

Value

portfolio.model with new upper bounds

Author(s)

Ronald Hochreiter, `<ronald@algorithmic.finance>`

Index