Package 'JFE'

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Type Package

Title Tools for Analyzing Time Series Data of Just Finance and
Econometrics

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Description Offers procedures to support financial-economic time series modelling and enhanced procedures for computing the investment performance indices of Bacon (2004) <DOI:10.1002/9781119206309>.

License GPL (>= 2)

LazyData TRUE

LazyLoad yes

Depends R (>= 3.5.0), xts

Suggests car, dynlm, openxlsx, timeDate, timeSeries, zoo

NeedsCompilation no

Repository CRAN

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Contents

ActivePremium   *Active Premium or Active Return*

Description

The return on an investment's annualized return minus the benchmark's annualized return.

Usage

```
ActivePremium(Ra, Rb, scale = NA)
```

Arguments

Ra	return vector of the portfolio
Rb	return vector of the benchmark asset
scale	number of periods in a year (daily scale = 252, monthly scale = 12, quarterly scale = 4)

Details

Active Premium = Investment's annualized return - Benchmark's annualized return. With a view to speeding computation. I re-write the code of some ratios of the package PerformanceAnalytics, and use the same name for comparing the performance enhancing. Interested readers may compare speed improvement with the use of system.time().

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Sharpe, W.F. The Sharpe Ratio,*Journal of Portfolio Management*, Fall 1994, 49-58.
See aslo package PerformanceAnalytics.

See Also

Return.annualized,
InformationRatio,
TrackingError,

Examples

```
  data(assetReturns)
assetReturns=assetReturns["2015::2018"] #short sample for fast example
# Ra=assetReturns[, -29]
# Rb=assetReturns[,29] #DJI
#  ActivePremium(Ra, Rb)
```

AdjustedSharpeRatio   *Adjusted Sharpe ratio of the return distribution*

Description

Adjusted Sharpe ratio was introduced by Pezier and White (2006) to adjusts for skewness and kurtosis by incorporating a penalty factor for negative skewness and excess kurtosis.

Usage

```
AdjustedSharpeRatio(R, Rf = 0, FUN = "StdDev")
```

Arguments

R	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
Rf	the risk free rate
FUN	one of "StdDev" or "VaR" or "ES" to use as the denominator for unadjusted Sharpe ratio, default="StdDev"

Details

$$AdjustedSharpeRatio = SR * [1 + (\frac{S}{6}) * SR - (\frac{K-3}{24}) * SR^2]$$

where SR is the sharpe ratio with data annualized, S is the skewness and K is the kurtosis

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.99.

Pezier, Jaques and White, Anthony. 2006. The Relative Merits of Investable Hedge Fund Indices and of Funds of Hedge Funds in Optimal Passive Portfolios. Check https://econpapers.repec.org/paper/rdgicmadp/icma-dp2006-10.htm
See also package PerformanceAnalytics.

Examples

```
    data(assetReturns)

AdjustedSharpeRatio(assetReturns)
```

AppraisalRatio	*Appraisal ratio of the return distribution*

Description

Appraisal ratio is the Jensen's alpha adjusted for specific risk. The numerator is divided by specific risk instead of total risk.

Usage

```
AppraisalRatio(Ra, Rb, Rf = 0, method = c("appraisal", "modified",
  "alternative"))
```

Arguments

Ra	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
Rb	return vector of the benchmark asset
Rf	risk free rate, in same period as your returns
method	is one of "appraisal" to calculate appraisal ratio, "modified" to calculate modified Jensen's alpha or "alternative" to calculate alternative Jensen's alpha.

Details

Modified Jensen's alpha is Jensen's alpha divided by beta.

Alternative Jensen's alpha is Jensen's alpha divided by systematic risk.

$$Appraisalratio = \frac{\alpha}{\sigma_\epsilon}$$

$$ModifiedJensen'salpha = \frac{\alpha}{\beta}$$

$$AlternativeJensen'salpha = \frac{\alpha}{\sigma_S}$$

where $alpha$ is the Jensen's alpha, $\sigma_{epsilon}$ is the specific risk, σ_S is the systematic risk.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.77.
See also package PerformanceAnalytics.

Examples

```
    data(assetReturns)
Ra=assetReturns[, -29]
Rb=assetReturns[,29] #DJI
AppraisalRatio(Ra, Rb, method="appraisal")
```

BernardoLedoitRatio   *Bernardo and Ledoit ratio of the return distribution*

Description

To calculate Bernardo and Ledoit ratio we take the sum of the subset of returns that are above 0 and we divide it by the opposite of the sum of the subset of returns that are below 0

Usage

```
BernardoLedoitRatio(R)
```

Arguments

R   an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns

Details

$$BernardoLedoitRatio(R) = \frac{\frac{1}{n}\sum_{t=1}^{n}max(R_t,0)}{\frac{1}{n}\sum_{t=1}^{n}max(-R_t,0)}$$

where n is the number of observations of the entire series

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.95.
See also package PerformanceAnalytics.

Examples

```
    data(assetReturns)
BernardoLedoitRatio(R=assetReturns)
```

BurkeRatio	*Burke ratio of the return distribution*

Description

To calculate Burke ratio we take the difference between the portfolio return and the risk free rate and we divide it by the square root of the sum of the square of the drawdowns. To calculate the modified Burke ratio we just multiply the Burke ratio by the square root of the number of datas.

Usage

```
BurkeRatio(R, Rf = 0, modified = FALSE)
```

Arguments

R	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
Rf	the risk free rate
modified	a boolean to decide which ratio to calculate between Burke ratio and modified Burke ratio.

Details

$$BurkeRatio = \frac{r_P - r_F}{\sqrt{\sum_{t=1}^{d} D_t^2}}$$

$$ModifiedBurkeRatio = \frac{r_P - r_F}{\sqrt{\sum_{t=1}^{d} \frac{D_t^2}{n}}}$$

where n is the number of observations of the entire series, d is number of drawdowns, r_P is the portfolio return, r_F is the risk free rate and D_t the tth drawdown.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.90-91.
See aslo package PerformanceAnalytics.

Examples

```
   data(assetReturns)
assetReturns=assetReturns["2011::2018"] #short sample for fast example
  BurkeRatio(assetReturns,Rf=0)
```

CalmarRatio	*calculate a Calmar or Sterling reward/risk ratio Calmar and Sterling Ratios are yet another method of creating a risk-adjusted measure for ranking investments similar to the* [SharpeRatio]*.*

Description

Both the Calmar and the Sterling ratio are the ratio of annualized return over the absolute value of the maximum drawdown of an investment. The Sterling ratio adds an excess risk measure to the maximum drawdown, traditionally and defaulting to 10%.

Usage

```
CalmarRatio(R, scale = NA)

SterlingRatio(R, scale = NA, excess = 0.1)
```

Arguments

R	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
scale	number of periods in a year (daily scale = 252, monthly scale = 12, quarterly scale = 4)
excess	for Sterling Ratio, excess amount to add to the max drawdown, traditionally and default .1 (10%)

Details

It is also traditional to use a three year return series for these calculations, although the functions included here make no effort to determine the length of your series. If you want to use a subset of your series, you'll need to truncate or subset the input data to the desired length.

Many other measures have been proposed to do similar reward to risk ranking. It is the opinion of this author that newer measures such as Sortino's [SharpeRatio] are both "better" measures, and should be preferred to the Calmar or Sterling Ratio.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Bacon, Carl. *Practical Portfolio Performance Measurement and Attribution.* Wiley. 2004.
See also package PerformanceAnalytics.

See Also

Return.annualized,
maxDrawdown,

Examples

```
   data(assetReturns)
R=assetReturns[, -29]

#    SterlingRatio(R)
```

CAPM.jensenAlpha   *Jensen's alpha of the return distribution*

Description

The Jensen's alpha is the intercept of the regression equation in the Capital Asset Pricing Model
and is in effect the exess return adjusted for systematic risk.

Usage

```
CAPM.jensenAlpha(Ra, Rb, Rf = 0)
```

Arguments

Ra	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
Rb	return vector of the benchmark asset
Rf	risk free rate, in same period as your returns

Details

$$\alpha = r_p - r_f - \beta_p * (b - r_f)$$

where r_f is the risk free rate, β_r is the regression beta, r_p is the portfolio return and b is the
benchmark return

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.72
See also package `PerformanceAnalytics`.

Examples

```
  data(assetReturns)
assetReturns=assetReturns["2011::2018"] #short sample for fast example
Ra=assetReturns[, -29]
Rb=assetReturns[,29] #DJI

CAPM.jensenAlpha(Ra, Rb)
```

---

data-sets   *Data Sets*

Description

assetReturns contains DJ component stocks returns data. macrodata contains US unemployment(unrate) and year-to-year changes in three regional business cycle indices (OECD, NAFTA, and G7).

Usage

```
data(assetReturns)
data(macrodata)
```

Value

assetReturns is a time series object of package `xts`. macrodata is macroeconomic time series data.

DownsideDeviation   *downside risk (deviation, variance) of the return distribution*

Description

Downside deviation, semideviation, and semivariance are measures of downside risk.

Usage

```
DownsideDeviation(R, MAR = 0, method = c("full", "subset"),potential = FALSE)
```

Arguments

R	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
MAR	Minimum Acceptable Return, in the same periodicity as your returns
method	one of "full" or "subset", indicating whether to use the length of the full series or the length of the subset of the series below the MAR as the denominator, defaults to "full"
potential	if TRUE, calculate downside potential instead, default FALSE

Details

Downside deviation, similar to semi deviation, eliminates positive returns when calculating risk. Instead of using the mean return or zero, it uses the Minimum Acceptable Return as proposed by Sharpe (which may be the mean historical return or zero). It measures the variability of under-performance below a minimum targer rate. The downside variance is the square of the downside potential.

To calculate it, we take the subset of returns that are less than the target (or Minimum Acceptable Returns (MAR)) returns and take the differences of those to the target. We sum the squares and divide by the total number of returns to get a below-target semi-variance.

$$DownsideDeviation(R, MAR) = \delta_{MAR} = \sqrt{\sum_{t=1}^{n} \frac{min[(R_t - MAR), 0]^2}{n}}$$

$$DownsideVariance(R, MAR) = \sum_{t=1}^{n} \frac{min[(R_t - MAR), 0]^2}{n}$$

$$DownsidePotential(R, MAR) = \sum_{t=1}^{n} \frac{min[(R_t - MAR), 0]}{n}$$

where n is either the number of observations of the entire series or the number of observations in the subset of the series falling below the MAR.

SemiDeviation or SemiVariance is a popular alternative downside risk measure that may be used in place of standard deviation or variance. SemiDeviation and SemiVariance are implemented as a wrapper of DownsideDeviation with MAR=mean(R).

In many functions like Markowitz optimization, semideviation may be substituted directly, and the covariance matrix may be constructed from semideviation or the vector of returns below the mean rather than from variance or the full vector of returns.

In semideviation, by convention, the value of n is set to the full number of observations. In semi-variance the the value of n is set to the subset of returns below the mean. It should be noted that while this is the correct mathematical definition of semivariance, this result doesn't make any sense if you are also going to be using the time series of returns below the mean or below a MAR to construct a semi-covariance matrix for portfolio optimization.

Sortino recommends calculating downside deviation utilizing a continuous fitted distribution rather than the discrete distribution of observations. This would have significant utility, especially in cases of a small number of observations. He recommends using a lognormal distribution, or a fitted

distribution based on a relevant style index, to construct the returns below the MAR to increase the confidence in the final result. Hopefully, in the future, we'll add a fitted option to this function, and would be happy to accept a contribution of this nature.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Sortino, F. and Price, L. Performance Measurement in a Downside Risk Framework. *Journal of Investing*. Fall 1994, 59-65.
Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008

Plantinga, A., van der Meer, R. and Sortino, F. The Impact of Downside Risk on Risk-Adjusted Performance of Mutual Funds in the Euronext Markets. July 19, 2001. Available at SSRN:https://papers.ssrn.com/sol3/papers.cfm?abstract_id=277352
see especially end note 10 https://en.wikipedia.org/wiki/Semivariance.

See also package PerformanceAnalytics.

Examples

```
  data(assetReturns)
assetReturns=assetReturns["2011::2018"] #short sample for fast example
R=assetReturns[, -29]
  DownsideDeviation(R, MAR = 0)
```

DRatio	*d ratio of the return distribution*

Description

The d ratio is similar to the Bernado Ledoit ratio but inverted and taking into account the frequency of positive and negative returns.

Usage

```
DRatio(R)
```

Arguments

R   an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns

Details

It has values between zero and infinity. It can be used to rank the performance of portfolios. The lower the d ratio the better the performance, a value of zero indicating there are no returns less than zero and a value of infinity indicating there are no returns greater than zero.

$$DRatio(R) = \frac{n_d * \sum_{t=1}^{n} max(-R_t, 0)}{n_u * \sum_{t=1}^{n} max(R_t, 0)}$$

where n is the number of observations of the entire series, n_d is the number of observations less than zero, n_u is the number of observations greater than zero

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.95
See also package `PerformanceAnalytics`.

Examples

```
   data(assetReturns)
R=assetReturns[, -29]

   DRatio(R)
```

DrawdownPeak	*Drawdawn peak of the return distribution*

Description

Drawdawn peak is for each return its drawdown since the previous peak

Usage

```
DrawdownPeak(R)
```

Arguments

R   an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

Examples

```
  data(assetReturns)
R=assetReturns[, -29]
# Not run
# DrawdownPeak(R)
```

---

durbinH   *calculate Sortino Ratio of performance over downside risk*

Description

durbinH test the serial correlation of a dynamic regression, namely, a time series regression with AR(1) terms. It modifies Durbin-Watson statictic.

Usage

```
durbinH(model,Ly.label="ar1")
```

Arguments

model	Estimation result object by, for example, dynlm or arima
Ly.label	Label of AR(1) dependent variable

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

Examples

```
  data(macrodata)
  y=ts(macrodata[,"OECD"],start=c(1961,1),freq=12) #OECD business cycle index

 out1=dynlm::dynlm(y~L(y,1)+season(y)+trend(y))
 durbinH(out1,Ly.label="L(y, 1)")
```

---

getBIS   *Download time series data from Bank of International Settlement*

Description

It downloads effective exchange rates from Bank of International Settlement.

Usage

```
getBIS(sheet="Real", type="broad")
```

Arguments

sheet	The name of spreedsheet of effective exchange rates (EER)of BIS, it has two options: "Real" and "Nominal", the default is "Real" for REER.
type	The type of EER, it has two types: "broad" and "narrow". The default is "broad".

Details

This function connects with <"https://www.bis.org/statistics/eer/"> and downloads the specified data. The rownames of downloaded data embeds the timestamp already, which can be directly transformed into time series via, as.timeSeries.

Value

data	The data object.
country.info	The country information with abbreviated symbol.
data.info	The information about effective exchange rates.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

Examples

```
#To save time, the example below is commented.
#output=getBIS(sheet=c("Nominal","Real")[1], type=c("broad","narrow")[1])
#output$data
#output$data.info
#output$country.info
```

getFed   *Download financial and economic time series data from the Fed*

Description

It downloads financial and economic time series data from the Fed.

Usage

```
getFed(var.name="UNRATE", freq="Monthly", do.plot=TRUE, plot.name=NULL)
```

Arguments

var.name	The name of variable as used by <"https://fred.stlouisfed.org">. For example, "UNRATE" denotes unemployment rate, "CPIAUCSL" is monthly consumer price index, "GDP" is Gross domestic product, and "ICSA" is the initial claim seasonally adjusted. User please check with the web for symbol.
freq	The time series frequency, match Fed label, for example,"Monthly","Quarterly".
do.plot	Whether to plot the retrieved data, the default is TRUE. Please set this value to be FALSE to avoid too many plotting, if you want to loop more downloads.
plot.name	if do.plot=TRUE, the main label appeared. Default is var.name.

Details

This function connects with <"https://fred.stlouisfed.org"> and downloads the specified market data. The rownames of downloaded data is embedded by the timestamp already.

Value

data	The data retrieved.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

Examples

```
#To save time, the example below is commented.
#getFed(var.name="UNRATE", freq="Monthly",
#do.plot=TRUE,
#plot.name="Monthly US Unemployment Rate")$data
```

getFrench.Factors	*Download seven asset pricing factors data from the data library of Dr. French*

Description

It downloads seven factors data used for asset pricing analysis from the data library of Dr. Kenneth R. French at Dartmouth College.

Usage

```
#To save time, the example below is commented.
#getFrench.Factors(filename="F-F_Research_Data_5_Factors_2x3")
```

Arguments

filename   The name of data file as listed in <"http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.h
which is an important database for asset pricing literature, this function supports
seven factor files:
"F-F_Research_Data_Factors",# Fama/French 3 Factors
"F-F_Research_Data_5_Factors_2x3",# Fama/French 5 Factors
"F-F_Momentum_Factor", # Fama/French Momentum Factors
"F-F_Momentum_Factor_daily", # Fama/French Momentum Factors(daily)
"F-F_Research_Data_Factors_weekly",# Fama/French 3 Factors(weekly)
"F-F_Research_Data_Factors_daily", # Fama/French 3 Factors(daily)
"F-F_Research_Data_5_Factors_2x3_daily" # Fama/French 5 Factors (daily)

Details

This function connects with <"http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html">
and downloads the specified factors data. Sometimes, the datafile contains multiple data tables,
hence the code returns a list.

Value

ff.factor   The data retrieved and arranged.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

Examples

```
getFrench.Factors(filename="F-F_Research_Data_Factors")
```

---

getFrench.Portfolios   *Download 24 asset pricing factors data from the data library of Dr. French*

Description

It downloads 24 factors data used for asset pricing analysis from the data library of Dr. Kenneth R. French at Dartmouth College.

Usage

```
getFrench.Portfolios(filename="Portfolios_Formed_on_ME")
```

Arguments

filename   The name of portfolio data file as listed in (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_l
                 the default is "Portfolios_Formed_on_ME". So far, this function supports re-
                 trieving 24 portfolio data files:
                 "Portfolios_Formed_on_ME",#Portfolios Formed on Size
                 "Portfolios_Formed_on_BE-ME",#On Book-to-Market
                 "Portfolios_Formed_on_OP", #On Operating Profitability
                 "Portfolios_Formed_on_INV",#On Investment
                 "6_Portfolios_2x3", #6 Ports on Size and Book-to-Market
                 "25_Portfolios_5x5", #25 Ports on Size and Book-to-Market
                 "100_Portfolios_10x10", #100 Ports on Size and Book-to-Market
                 "6_Portfolios_ME_INV_2x3", #6 Ports on Size and Investment
                 "25_Portfolios_ME_INV_5x5",#25 Ports on Size and Investment
                 "100_Portfolios_ME_INV_10x10",#100 Ports on Size and Investment
                 "25_Portfolios_BEME_OP_5x5",#25 Ports on Book-to-Market and Operating
                 Profitability
                 "25_Portfolios_BEME_INV_5x5",#25 Ports on Book-to-Market and Investment
                 "25_Portfolios_OP_INV_5x5",#25 Ports on Operating Profitability and Invest-
                 ment
                 "32_Portfolios_ME_BEME_OP_2x4x4",#32 Ports on Size,Book-to-Market and
                 Operating Profitability
                 "32_Portfolios_ME_BEME_INV_2x4x4",#32 Ports on Size,Book-to-Market and
                 Investment
                 "32_Portfolios_ME_OP_INV_2x4x4",#32 Ports on Size,Operating Profitability
                 and Investment
                 "5_Industry_Portfolios", # Industry Portfolios by c(5,10,12,17,30,38,48,49)

Details

This function connects with <"http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html">
and downloads the specified portfolio data constructed by factors. Currently, we support on retriv-
ing and arranging 24 portfolio datasets. Sometimes, the datafile contains multiple data tables, hence
the code returns a list. Since the csv spreedsheet on the web is not structured data table, it does not

only contain irregular headings, but also 7, or more, data tablesr; and the trivial portfolio data tables labelled by "Portfolio Formed by ..." are omitted. Check the "table.names" of output object.

Value

data	The data retrieved and arranged.
table.names	The names of data table.
file.name	The file name of portfolio data.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

Examples

```
#To save time, the example below is commented.
#output=getFrench.Portfolios(filename="5_Industry_Portfolios")
#output$file.name
#dim(output$data[[1]])
#output$data
#output$table.names
```

InformationRatio   *InformationRatio = ActivePremium/TrackingError*

Description

The Active Premium divided by the Tracking Error.

Usage

```
InformationRatio(Ra, Rb, scale = NA)
```

Arguments

Ra	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
Rb	return vector of the benchmark asset
scale	number of periods in a year (daily scale = 252, monthly scale = 12, quarterly scale = 4)

Details

InformationRatio = ActivePremium/TrackingError

This relates the degree to which an investment has beaten the benchmark to the consistency with which the investment has beaten the benchmark.

Note

William Sharpe now recommends InformationRatio preferentially to the original [SharpeRatio](#).

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Sharpe, W.F. The Sharpe Ratio,*Journal of Portfolio Management*,Fall 1994, 49-58.
See also package PerformanceAnalytics.

See Also

[TrackingError](#)
[ActivePremium](#)
[SharpeRatio](#)

Examples

```
  data(assetReturns)
Ra=assetReturns[, -29]
Rb=assetReturns[,29] #DJI

  InformationRatio(Ra, Rb)
```

KellyRatio   *calculate Kelly criterion ratio (leverage or bet size) for a strategy*

Description

Kelly criterion ratio (leverage or bet size) for a strategy.

Usage

```
KellyRatio(R, Rf = 0)
```

Arguments

R	a vector of returns to perform a mean over
Rf	risk free rate, in same period as your returns

Details

The Kelly Criterion was identified by Bell Labs scientist John Kelly, and applied to blackjack and stock strategy sizing by Ed Thorpe.

The Kelly ratio can be simply stated as: "bet size is the ratio of edge over odds." Mathematically, you are maximizing log-utility. As such, the Kelly criterion is equal to the expected excess return of the strategy divided by the expected variance of the excess return, or

$$leverage = \frac{(\overline{R}_s - R_f)}{StdDev(R)^2}$$

As a performance metric, the Kelly Ratio is calculated retrospectively on a particular investment as a measure of the edge that investment has over the risk free rate. It may be use as a stack ranking method to compare investments in a manner similar to the various ratios related to the Sharpe ratio.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Thorp, Edward O. (1997; revised 1998). The Kelly Criterion in Blackjack, Sports Betting, and the Stock Market.
See also package `PerformanceAnalytics`.

Examples

```
  data(assetReturns)
R=assetReturns[, -29]

  KellyRatio(R, Rf=0)
```

M2Sortino   *M squared for Sortino of the return distribution*

Description

M squared for Sortino is a M^2 calculated for Downside risk instead of Total Risk

Usage

```
M2Sortino(Ra, Rb, MAR = 0)
```

Arguments

Ra	an xts, vector, matrix, data frame, timeSeries or zoo object of asset return
Rb	return vector of the benchmark asset
MAR	the minimum acceptable return

Details

$$M_S^2 = r_P + Sortinoratio * (\sigma_{DM} - \sigma_D)$$

where M_S^2 is MSquared for Sortino, r_P is the annualised portfolio return, σ_{DM} is the benchmark annualised downside risk and D is the portfolio annualised downside risk

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.102-103
See aslo package PerformanceAnalytics.

Examples

```
  data(assetReturns)
Ra=assetReturns[, -29]
Rb=assetReturns[,29] #DJI

M2Sortino(Ra, Rb, MAR=0)
```

MartinRatio   *Martin ratio of the return distribution*

Description

To calculate Martin ratio we divide the difference of the portfolio return and the risk free rate by the Ulcer index

Usage

```
MartinRatio(R, Rf = 0)
```

Arguments

R	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
Rf	risk free rate, in same period as your returns

Details

$$Martin\,ratio = \frac{r_P - r_F}{\sqrt{\sum_{i=1}^{n} \frac{{D_i'}^2}{n}}}$$

where r_P is the annualized portfolio return, r_F is the risk free rate, n is the number of observations of the entire series, D_i' is the drawdown since previous peak in period i

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.91
See also package `PerformanceAnalytics`.

Examples

```
   data(assetReturns)
R=assetReturns[, -29]

# Not run
# MartinRatio(R)
```

---

maxDrawdown	*caclulate the maximum drawdown from peak equity*

Description

To find the maximum drawdown in a return series, we need to first calculate the cumulative returns and the maximum cumulative return to that point. Any time the cumulative returns dips below the maximum cumulative returns, it's a drawdown. Drawdowns are measured as a percentage of that maximum cumulative return, in effect, measured from peak equity.

Usage

```
maxDrawdown(R, geometric = TRUE, invert = TRUE)
```

Arguments

R	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
geometric	utilize geometric chaining (TRUE) or simple/arithmetic chaining (FALSE) to aggregate returns, default TRUE
invert	TRUE/FALSE whether to invert the drawdown measure. see Details.

Details

The option to `invert` the measure should appease both academics and practitioners. The default option `invert=TRUE` will provide the drawdown as a positive number. This should be useful for optimization (which usually seeks to minimize a value), and for tables (where having negative signs in front of every number may be considered clutter). Practitioners will argue that drawdowns denote losses, and should be internally consistent with the quantile (a negative number), for which `invert=FALSE` will provide the value they expect. Individually, different preferences may apply for clarity and compactness. As such, we provide the option, but make no value judgment on which approach is preferable.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Bacon, C. *Practical Portfolio Performance Measurement and Attribution*. Wiley. 2004. p. 88
See also package `PerformanceAnalytics`.

Examples

```
  data(assetReturns)
R=assetReturns[, -29]

  maxDrawdown(R)
```

MeanAbsoluteDeviation   *Mean absolute deviation of the return distribution*

Description

To calculate Mean absolute deviation we take the sum of the absolute value of the difference between the returns and the mean of the returns and we divide it by the number of returns.

Usage

```
MeanAbsoluteDeviation(R)
```

Arguments

R   an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns

Details

$$MeanAbsoluteDeviation = \frac{\sum_{i=1}^{n} \mid r_i - \bar{r} \mid}{n}$$

where n is the number of observations of the entire series, r_i is the return in month i and $\bar{r}$ is the mean return

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.62.
See also package `PerformanceAnalytics`.

Examples

```
   data(assetReturns)
assetReturns=assetReturns["2011::2018"] #short sample for fast example
R=assetReturns[, -29]

MeanAbsoluteDeviation(R)
```

OmegaSharpeRatio   *Omega-Sharpe ratio of the return distribution*

Description

The Omega-Sharpe ratio is a conversion of the omega ratio to a ranking statistic in familiar form to the Sharpe ratio.

Usage

```
OmegaSharpeRatio(R, MAR = 0)
```

Arguments

R   an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns

MAR   Minimum Acceptable Return, in the same periodicity as your returns

Details

To calculate the Omega-Sharpe ration we subtract the target (or Minimum Acceptable Returns (MAR)) return from the portfolio return and we divide it by the opposite of the Downside Deviation.

$$OmegaSharpeRatio(R, MAR) = \frac{r_p - r_t}{\sum_{t=1}^{n} \frac{max(r_t - r_i, 0)}{n}}$$

where n is the number of observations of the entire series

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008, p.95
See also package `PerformanceAnalytics`.

Examples

```
   data(assetReturns)
R=assetReturns[, -29]
   OmegaSharpeRatio(R)
```

PainIndex   *Pain index of the return distribution*

Description

The pain index is the mean value of the drawdowns over the entire analysis period. The measure is similar to the Ulcer index except that the drawdowns are not squared. Also, it's different than the average drawdown, in that the numerator is the total number of observations rather than the number of drawdowns.

Usage

```
   PainIndex(R)
```

Arguments

R   an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns

Details

Visually, the pain index is the area of the region that is enclosed by the horizontal line at zero percent and the drawdown line in the Drawdown chart.

$$Painindex = \sum_{i=1}^{n} \frac{\mid D'_i \mid}{n}$$

where n is the number of observations of the entire series, D'_i is the drawdown since previous peak in period i

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.89, Becker, Thomas (2006) Zephyr Associates
See also package `PerformanceAnalytics`.

Examples

```
   data(assetReturns)
R=assetReturns[, -29]
# Not run
# PainIndex(R)
```

PainRatio   *Pain ratio of the return distribution*

Description

To calculate Pain ratio we divide the difference of the portfolio return and the risk free rate by the Pain index

Usage

```
PainRatio(R, Rf = 0)
```

Arguments

R	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
Rf	risk free rate, in same period as your returns

Details

$$Painratio = \frac{r_P - r_F}{\sum_{i=1}^{n} \frac{|D_i'|}{n}}$$

where r_P is the annualized portfolio return, r_F is the risk free rate, n is the number of observations of the entire series, D_i' is the drawdown since previous peak in period i

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.91
See also package `PerformanceAnalytics`.

Examples

```
  data(assetReturns)
assetReturns=assetReturns["2011::2018"] #short sample for fast example
R=assetReturns[, -29]
  PainRatio(R)
```

ProspectRatio   *Prospect ratio of the return distribution*

Description

Prospect ratio is a ratio used to penalise loss since most people feel loss greater than gain

Usage

```
ProspectRatio(R, MAR)
```

Arguments

R	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
MAR	the minimum acceptable return

Details

$$PropsectRatio(R) = \frac{\frac{1}{n} * \sum_{i=1}^{n}(Max(r_i, 0) + 2.25 * Min(r_i, 0) - MAR)}{\sigma_D}$$

where n is the number of observations of the entire series, MAR is the minimum acceptable return and σ_D is the downside risk

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.100
See also package `PerformanceAnalytics`.

Examples

```
   data(assetReturns)
R=assetReturns[, -29]

   ProspectRatio(R, MAR=0)
```

Return.annualized	*calculate an annualized return for comparing instruments with different length history*

Description

An average annualized return is convenient for comparing returns.

Usage

```
Return.annualized(R, scale = NA, geometric = TRUE)
```

Arguments

R	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
scale	number of periods in a year (daily scale = 252, monthly scale = 12, quarterly scale = 4)
geometric	utilize geometric chaining (TRUE) or simple/arithmetic chaining (FALSE) to aggregate returns, default TRUE

Details

Annualized returns are useful for comparing two assets. To do so, you must scale your observations to an annual scale by raising the compound return to the number of periods in a year, and taking the root to the number of total observations:

$$prod(1 + R_a)^{\frac{scale}{n}} - 1 = \sqrt[n]{prod(1 + R_a)^{scale}} - 1$$

where scale is the number of periods in a year, and n is the total number of periods for which you have observations.

For simple returns (geometric=FALSE), the formula is:

$$\overline{R_a} \cdot scale$$

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Bacon, Carl. *Practical Portfolio Performance Measurement and Attribution*. Wiley. 2004. p. 6
See also package PerformanceAnalytics.

Examples

```
  data(assetReturns)
R=assetReturns[, -29]

  Return.annualized(R)
```

SharpeRatio	*calculate a traditional or modified Sharpe Ratio of Return over StdDev or VaR or ES*

Description

The Sharpe ratio is simply the return per unit of risk (represented by variability). In the classic case, the unit of risk is the standard deviation of the returns.

Usage

```
SharpeRatio(R, Rf = 0, alpha = 0.05, FUN="StdDev",annualize=FALSE)
```

Arguments

R	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
Rf	risk free rate, in same period as your returns
alpha	Tail probability for VaR or ES, default alpha=.05
FUN	one of "StdDev" or "VaR" or "ES" to use as the denominator
annualize	if TRUE, annualize the measure, default FALSE

Details

$$\frac{\overline{(R_a - R_f)}}{\sqrt{\sigma_{(R_a - R_f)}}}$$

William Sharpe now recommends `InformationRatio` preferentially to the original Sharpe Ratio.

The higher the Sharpe ratio, the better the combined performance of "risk" and return.

As noted, the traditional Sharpe Ratio is a risk-adjusted measure of return that uses standard deviation to represent risk.

A number of papers now recommend using a "modified Sharpe" ratio using a Modified Cornish-Fisher VaR or CVaR/Expected Shortfall as the measure of Risk.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Sharpe, W.F. The Sharpe Ratio,*Journal of Portfolio Management*,Fall 1994, 49-58.

Laurent Favre and Jose-Antonio Galeano. Mean-Modified Value-at-Risk Optimization with Hedge Funds. Journal of Alternative Investment, Fall 2002, v 5.
See also package PerformanceAnalytics.

See Also

SharpeRatio.annualized
InformationRatio
TrackingError
ActivePremium
SortinoRatio

Examples

```
   data(assetReturns)
R=assetReturns[, -29]

SharpeRatio(R)
```

SharpeRatio.annualized

calculate annualized Sharpe Ratio

Description

The Sharpe Ratio is a risk-adjusted measure of return that uses standard deviation to represent risk.

Usage

```
SharpeRatio.annualized(R, Rf = 0, alpha=0.05,scale = NA, geometric = TRUE, FUN = "StdDev")
```

Arguments

R	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
Rf	risk free rate, in same period as your returns
alpha	Tail probability for VaR or ES, default alpha=.05
scale	number of periods in a year (daily scale = 252, monthly scale = 12, quarterly scale = 4)
geometric	utilize geometric chaining (TRUE) or simple/arithmetic chaining (FALSE) to aggregate returns,default TRUE
FUN	one of "StdDev" or "VaR" or "ES" to use as the denominator, default="StdDev"

Details

The Sharpe ratio is simply the return per unit of risk (represented by variance). The higher the Sharpe ratio, the better the combined performance of "risk" and return.

This function annualizes the number based on the scale parameter.

$$\frac{\sqrt[n]{prod(1 + R_a)^{scale}} - 1}{\sqrt{scale} \cdot \sqrt{\sigma}}$$

Using an annualized Sharpe Ratio is useful for comparison of multiple return streams. The annualized Sharpe ratio is computed by dividing the annualized mean monthly excess return by the annualized monthly standard deviation of excess return.

William Sharpe now recommends Information Ratio preferentially to the original Sharpe Ratio.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Sharpe, W.F. The Sharpe Ratio,*Journal of Portfolio Management*,Fall 1994, 49-58.
See also package PerformanceAnalytics.

See Also

[SharpeRatio](#)
[InformationRatio](#)
[TrackingError](#)
[ActivePremium](#)
[SortinoRatio](#)

Examples

```
   data(assetReturns)
R=assetReturns[, -29]
  SharpeRatio.annualized(R)
```

SkewnessKurtosisRatio   *Skewness-Kurtosis ratio of the return distribution*

Description

Skewness-Kurtosis ratio is the division of Skewness by Kurtosis.

Usage

```
SkewnessKurtosisRatio(R)
```

Arguments

R   an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns

Details

It is used in conjunction with the Sharpe ratio to rank portfolios. The higher the rate the better.

$$SkewnessKurtosisRatio(R, MAR) = \frac{S}{K}$$

where S is the skewness and K is the Kurtosis

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.100
See also package `PerformanceAnalytics`.

Examples

```
  data(assetReturns)
R=assetReturns[, -29]
  SkewnessKurtosisRatio(R)
```

SortinoRatio   *calculate Sortino Ratio of performance over downside risk*

Description

Sortino proposed an improvement on the Sharpe Ratio to better account for skill and excess performance by using only downside semivariance as the measure of risk.

Usage

```
SortinoRatio(R, MAR = 0)
```

Arguments

R   an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns

MAR   Minimum Acceptable Return, in the same periodicity as your returns

Details

Sortino contends that risk should be measured in terms of not meeting the investment goal. This gives rise to the notion of "Minimum Acceptable Return" or MAR. All of Sortino's proposed measures include the MAR, and are more sensitive to downside or extreme risks than measures that use volatility(standard deviation of returns) as the measure of risk.

Choosing the MAR carefully is very important, especially when comparing disparate investment choices. If the MAR is too low, it will not adequately capture the risks that concern the investor, and if the MAR is too high, it will unfavorably portray what may otherwise be a sound investment. When comparing multiple investments, some papers recommend using the risk free rate as the MAR. Practitioners may wish to choose one MAR for consistency, several standardized MAR values for reporting a range of scenarios, or a MAR customized to the objective of the investor.

$$SortinoRatio = \frac{(\overline{R_a - MAR})}{\delta_{MAR}}$$

where δ_{MAR} is the DownsideDeviation.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Sortino, F. and Price, L. Performance Measurement in a Downside Risk Framework. *Journal of Investing*. Fall 1994, 59-65.
See also package PerformanceAnalytics.

See Also

SharpeRatio
DownsideDeviation
InformationRatio

Examples

```
   data(assetReturns)
R=assetReturns[, -29]

   SortinoRatio(R)
```

---

table.AnnualizedReturns

Annualized Returns Summary: Statistics and Stylized Facts

Description

Table of Annualized Return, Annualized Std Dev, and Annualized Sharpe

Usage

```
table.AnnualizedReturns(R, scale = NA, Rf = 0, geometric = TRUE,
  digits = 4)
```

Arguments

R	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
scale	number of periods in a year (daily scale = 252, monthly scale = 12, quarterly scale = 4)
Rf	risk free rate, in same period as your returns
geometric	utilize geometric chaining (TRUE) or simple/arithmetic chaining (FALSE) to aggregate returns, default TRUE
digits	number of digits to round results to

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

See Also

[Return.annualized](#)
[SharpeRatio.annualized](#)

Examples

```
  data(assetReturns)
Ra=assetReturns[, -29]
  table.AnnualizedReturns(R=Ra)
```

TrackingError	*Calculate Tracking Error of returns against a benchmark*

Description

A measure of the unexplained portion of performance relative to a benchmark.

Usage

```
TrackingError(Ra, Rb, scale = NA)
```

Arguments

Ra	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
Rb	return vector of the benchmark asset
scale	number of periods in a year (daily scale = 252, monthly scale = 12, quarterly scale = 4)

Details

Tracking error is calculated by taking the square root of the average of the squared deviations between the investment's returns and the benchmark's returns, then multiplying the result by the square root of the scale of the returns.

$$TrackingError = \sqrt{\sum \frac{(R_a - R_b)^2}{len(R_a)\sqrt{scale}}}$$

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Sharpe, W.F. The Sharpe Ratio,*Journal of Portfolio Management*,Fall 1994, 49-58.
See also package PerformanceAnalytics.

See Also

InformationRatio TrackingError

Examples

```
   data(assetReturns)
assetReturns=assetReturns["2011::2018"] #short sample for fast example
Ra=assetReturns[, -29]
Rb=assetReturns[,29] #DJI

   TrackingError(Ra, Rb)
```

TreynorRatio	*calculate Treynor Ratio or modified Treynor Ratio of excess return over CAPM beta*

Description

The Treynor ratio is similar to the Sharpe Ratio, except it uses beta as the volatility measure (to divide the investment's excess return over the beta).

Usage

```
TreynorRatio(Ra, Rb, Rf = 0, scale = NA, modified = FALSE)
```

Arguments

Ra	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
Rb	return vector of the benchmark asset
Rf	risk free rate, in same period as your returns
scale	number of periods in a year (daily scale = 252, monthly scale = 12, quarterly scale = 4)
modified	a boolean to decide whether to return the Treynor ratio or Modified Treynor ratio

Details

To calculate modified Treynor ratio, we divide the numerator by the systematic risk instead of the beta.

Equation:

$$TreynorRatio = \frac{\overline{(R_a - R_f)}}{\beta_{a,b}}$$

$$ModifiedTreynorRatio = \frac{r_p - r_f}{\sigma_s}$$

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

<https://en.wikipedia.org/wiki/Treynor_ratio>, Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.77
See also package PerformanceAnalytics.

See Also

SharpeRatio SortinoRatio

Examples

```
  data(assetReturns)
assetReturns=assetReturns["2011::2018"] #short sample for fast example
Ra=assetReturns[, -29]
Rb=assetReturns[,29] #DJI

  TreynorRatio(Ra, Rb)
```

UlcerIndex   *calculate the Ulcer Index*

Description

Developed by Peter G. Martin in 1987 (Martin and McCann, 1987) and named for the worry caused
to the portfolio manager or investor. This is similar to drawdown deviation except that the impact
of the duration of drawdowns is incorporated by selecting the negative return for each period below
the previous peak or high water mark. The impact of long, deep drawdowns will have significant
impact because the underperformance since the last peak is squared.

Usage

```
UlcerIndex(R)
```

Arguments

R   a vector, matrix, data frame, timeSeries or zoo object of asset returns

Details

$UI = sqrt(sum[i=1,2,...,n](D'\_i^2/n))$ where D'_i = drawdown since previous peak in period i

DETAILS: This approach is sensitive to the frequency of the time periods involved and penalizes
managers that take time to recover to previous highs.

REFERENCES: Martin, P. and McCann, B. (1989) The investor's Guide to Fidelity Funds: Winning
Strategies for Mutual Fund Investors. John Wiley & Sons, Inc.

See also package `PerformanceAnalytics`.

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

Examples

```
  data(assetReturns)
R=assetReturns[, -29]
  maxDrawdown(R)
```

VolatilitySkewness   *Volatility and variability of the return distribution*

Description

Volatility skewness is a similar measure to omega but using the second partial moment. It's the ratio of the upside variance compared to the downside variance. Variability skewness is the ratio of the upside risk compared to the downside risk.

Usage

```
VolatilitySkewness(R, MAR = 0, stat = c("volatility", "variability"))
```

Arguments

R	an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns
MAR	Minimum Acceptable Return, in the same periodicity as your returns
stat	one of "volatility", "variability" indicating whether to return the volatility skewness or the variability skweness

Details

$$VolatilitySkewness(R, MAR) = \frac{\sigma_U^2}{\sigma_D^2}$$

$$VariabilitySkewness(R, MAR) = \frac{\sigma_U}{\sigma_D}$$

where σ_U is the Upside risk and σ_D is the Downside Risk

Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

References

Carl Bacon, *Practical portfolio performance measurement and attribution*, second edition 2008 p.97-98.
See also package PerformanceAnalytics.

Examples

```
  data(assetReturns)
R=assetReturns[, -29]
  VolatilitySkewness(R, MAR=0, stat="volatility")
```

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