The VaR Package

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Title Value at Risk estimation

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Depends R (>= 1.4.1)

Description A set of methods for calculation of Value at Risk (VaR)

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DJIA

Daily Closing Prices of Stocks in The Dow Jones 30 Industrial Index

Description


Usage

data(DJIA)
Format

A data frame with 2521 observations on the following 31 variables.

- **Date**: POSIXt object containing dates.
- **AA**: Quotes for ALCOA INC.
- **AXP**: Quotes for AMERICAN EXPRESS CO.
- **BA**: Quotes for BOEING CO.
- **C**: Quotes for CITIGROUP INC.
- **CAT**: Quotes for CATERPILLAR INC.
- **DD**: Quotes for DUPONT E I DE NEMOURS CO.
- **DIS**: Quotes for DISNEY CO WALT HLDG CO.
- **EK**: Quotes for EASTMAN KODAK CO.
- **GE**: Quotes for GENERAL ELECTRIC CO.
- **GM**: Quotes for GENERAL MOTORS CORP.
- **HD**: Quotes for HOME DEPOT INC.
- **HON**: Quotes for HONEYWELL INTERNATIONAL.
- **HPQ**: Quotes for HEWLETT-PACKARD CO.
- **IBM**: Quotes for INTERNATIONAL BUSINESS MACHINES CO.
- **INTC**: Quotes for INTEL CO.
- **IP**: Quotes for INTERNATIONAL PAPER CO.
- **JNJ**: Quotes for JOHNSON & JOHNSON.
- **JPM**: Quotes for JP MORGAN CHASE AND CO.
- **KO**: Quotes for COCA COLA CO.
- **MCD**: Quotes for MCDONALDS CORP.
- **MMM**: Quotes for 3M COMPANY.
- **MO**: Quotes for ALTRIA GROUP INC.
- **MRK**: Quotes for MERCK & CO INC.
- **MSFT**: Quotes for MICROSOFT CORPORATION.
- **PG**: Quotes for PROCTER & GAMBLE CO.
- **SBC**: Quotes for SBC COMMUNICATIONS INC.
- **T**: Quotes for AT & T CORP.
- **UTX**: Quotes for UNITED TECHNOLOGIES CORP.
- **WMT**: Quotes for WAL-MART STORES INC.
- **XOM**: Quotes for EXXON MOBIL CORP.

Details

The Dow Jones 30 Industrial Index (DJIA) is prepared and published by Dow Jones & Co. It is one of the oldest and most widely quoted of all the market indicators. The Dow Jones Industrial Average is comprised of 30 stocks that are major factors in their industries, and widely held by individuals and institutional investors. These 30 stocks represent about a fifth of the $8 trillion-plus market value of all U.S. stocks and about a fourth of the value of stocks listed on the New York Stock Exchange. Please refer for further information, for example, [www.nasdaq.com](http://www.nasdaq.com) or [www.dowjones.com](http://www.dowjones.com).
Examples

data(DJIA)
attach(DJIA)
plot(Date, IBM, xlab = "Time", ylab = "Close Price", main = "Stock Close Prices vs. Day", type = "l")
axis.POSIXct(1, Date)
detach(DJIA)

---

**VaR-internal**

**Internal Functions**

**Description**

Not to be called by the user.

**VaR.backtest**

**Backtest of VaR Estimation**

**Description**

Test for given proportions on input data respective a given VaR.

**Usage**

`VaR.backtest(x, VaR, p)`

**Arguments**

- `x` Numerical vector of observation.
- `VaR` Number or numerical vector of the same length as `x`.
- `p` Confidence level of VaR estimation.

**Details**

This function performs the test for equal or given proportion (prop.test) on input data. It calculates a part of observation exceeding a VaR and compares it with a confidence level of VaR estimation.

**Value**

Return value is a p.value of prop.test and can be interpreted in a usual manner.

**Author(s)**

T. Daniyarov
See Also

prop.test

Examples

data(exchange.rates)
attach(exchange.rates)
y <- USDJPY[!is.na(USDJPY)]
z <- VaR.norm(y)
VaR.backtest(z$cdata, z$VaR, p = 0.01)
detach(exchange.rates)

---

Description

Estimation of Value at Risk from log-likelihood fit of GPD.

Usage

VaR.gpd(ydat, p = 0.01, p.tr = 0.97, drift.appx = FALSE, init = c(1, 0.3), cflevel = 0.95)

Arguments

ydat Numeric vector of data for which VaR is to be calculated.
p Confidence level for VaR calculation.
p.tr Threshold for GPD fit.
drift.appx Logical; if TRUE VaR is calculated in non-zero drift approximation.
init Initial values for log-likelihood fit of GPD.
cflevel Confidence level for estimation of VaR and ES intervals.

Details

This function estimates Value at Risk and Expected Shortfall of a single risk factor with a
given confidence by using a fit of Generalized Pareto Distribution to the part of data exceed-
ing a given threshold (Peak over Threshold (POT) Method). The input data transformed
to procentual daily return. Then, transformed data is sorted and only part exceeding a
given threshold is hold. Threshold is calculated according an expression $p.tr \times std$. Log-
likelihood fit is then applied to get values of VaR and ES. After that, confidence intervals
for this values are calculated (see reference for details).

Value

A list containing following components:

VaR Value at Risk for input data.
VaR.interval Lower and higher bounds of VaR estimation with confidence given by
parameter cflevel.
ES Expected shortfall.
ES.interval Lower and higher bounds of ES estimation with confidence given by parameter cflevel.
data Same as ydat.
cdata Vector of data used for GPD fit.
conf.level Same as p.
tr Same as p.tr.
mean Mean value of cdata.
std Standard deviation of cdata.
gfit Best fit values of GPD.
int.conf.level Same as cflevel.

Author(s)

T. Daniyarov

References


See Also

VaR.gpd.plots

Examples

data(exchange.rates)
attach(exchange.rates)
y <- USDJPY[!is.na(USDJPY)]
z <- VaR.gpd(y)
z$VaR
z$VaR.interval
z$ES
z$ES.interval
detach(exchange.rates)

---

**Description**

This function produces some diagnostic plots for VaR estimation using output of `VaR.gpd` function.

**Usage**

`VaR.gpd.plots(z)`
Arguments

z  Output of VaR.gpd function

Details

Returns plots of daily return (%), fit of sample distribution, quantile plot, loglikelihood functions for VaR and ES.

Author(s)

T. Daniyarov

See Also

VaR.gpd

Examples

data(exchange.rates)
attach(exchange.rates)
y <- USDJPY[!is.na(USDJPY)]
z <- VaR.gpd(y)
VaR.gpd.plots(z)
detach(exchange.rates)

---

**VaR.norm**  Value at Risk Calculation in Lognormal Approximation

Description

This function estimates Value of Risk (VaR) value in lognormal approximation.

Usage

```r
VaR.norm(ydat, p = 0.99, dt = 1, type = "long", drift.appx = FALSE, lin.appx = TRUE)
```

Arguments

<table>
<thead>
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<th>Argument</th>
<th>Description</th>
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<tr>
<td>ydat</td>
<td>Numeric vector of data for which VaR is to be calculated</td>
</tr>
<tr>
<td>p</td>
<td>Confidence level for VaR calculation</td>
</tr>
<tr>
<td>dt</td>
<td>Liquidation period</td>
</tr>
<tr>
<td>type</td>
<td>String describing type of VaR calculated: &quot;long&quot; or &quot;short&quot;</td>
</tr>
<tr>
<td>drift.appx</td>
<td>Logical; if TRUE VaR is calculated in non-zero drift approximation</td>
</tr>
<tr>
<td>lin.appx</td>
<td>Logical; if TRUE VaR is calculated in linear approximation</td>
</tr>
</tbody>
</table>
Details

This function estimates VaR for a single risk factor $S(t)$ in lognormal approximation. The final expression for VaR of long and short position is

$$
VaR_{\text{long}}(c) = S(t)[1 - \exp(\mu \delta t + Q_{1-c}^{N(0,1)} \sigma \sqrt{\delta t})]
$$

$$
VaR_{\text{short}}(c) = -S(t)[1 - \exp(\mu \delta t - Q_{1-c}^{N(0,1)} \sigma \sqrt{\delta t})]
$$

Here, $c$ is a desired confidence, $Q_{1-c}^{N(0,1)}$ is a $1 - c$ percentile of normal distribution, $\delta t$ is liquidation period, and parameters $\mu$ and $\sigma$ are mean value (or drift) and standard deviation of $\delta S(t)$. If $\text{drift.appx}=$FALSE, $\mu = 0$. If $\text{lin.appx}=$TRUE, the above functions are expanded according $\exp(x) = 1 + x$.

Value

Return value is a list containing following components:

- VaR: Value at Risk for input data
- data: Input data
- cdata: Log-transformed data
- liq.period: Same as dt
- type: Same as type
- conf.level: Same as p
- mean: Mean value of cdata
- std: Standard deviation of cdata

Author(s)

T. Daniyarov

References


See Also

VaR.norm.plots, VaR.backtest

Examples

```r
data(exchange.rates)
attach(exchange.rates)
y <- USDJPY[!is.na(USDJPY)]
z <- VaR.norm(y)
z$VaR
detach(exchange.rates)
```
Diagnostic Plots for VaR Calculation in Lognormal Approximation

This function produces some diagnostic plots for VaR calculation in lognormal approximation.

Usage

```r
VaR.norm.plots(z)
```

Arguments

- `z` An object returned by `VaR.norm()` function

Details

Returns plots of daily log return and of daily log return histogram with the best fit provided by `VaR.norm()`.

Author(s)

T. Daniyarov

See Also

- `VaR.norm`

Examples

```r
data(exchange.rates)
attach(exchange.rates)
y <- USDJPY[!is.na(USDJPY)]
z <- VaR.norm(y)
VaR.norm.plots(z)
detach(exchange.rates)
```

Data on the currencies exchange rates for USD, EUR, CHF, GPD. Data covers a period from 03-01-2000 till 22-08-2003.

Usage

```r
data(exchange.rates)
```
Format

A data frame with 950 observations on the following 5 variables.

date a POSIXt object containing dates.
EURUSD a numeric vector. EUR against USD exchange rate.
USDJPY a numeric vector. USD against JPY exchange rate.
USDCHF a numeric vector. USD against CHF exchange rate.
GPDUSD a numeric vector. GPD against USD exchange rate.

Source

http://www.federalreserve.gov/releases/

Examples

data(exchange.rates)
attach(exchange.rates)
plot(date, USDJPY, xlab = "Time", ylab = "Exchange Rate", main = "USD/JPY Exchange Rate", type = "l")
axis.POSIXct(1, date)
detach(exchange.rates)
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