Package ‘PRTest’

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Title Portmanteau Test for Normal and Stable innovations

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Depends R (>= 2.0.0), akima, fBasics

Description Generalized variance portmanteau test

License GPL (version 2 or later)

URL http://www.stats.uwo.ca/faculty/aim

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### CRSP

**Description**

This data is used in examples in Tsay (2002, Ch.2, p.38 and 39) and in Lin and McLeod (2007). There are 864 data values.

**Usage**

```r
data(CRSP)
```

**Source**

from Web resources of R.Tsay homepage.

**References**


**Examples**

```r
data(CRSP)
pacf(CRSP)
```

### DEXCAUS

**Description**


**Usage**

```r
data(DEXCAUS)
```

**Details**


**Source**

[http://research.stlouisfed.org/fred2/series/DEXCAUS](http://research.stlouisfed.org/fred2/series/DEXCAUS)
FitStable

References

Examples

```r
data(DEXCAUS)
acf(Returns(DEXCAUS))
```

FitStable

Fit parameters to stable distribution

Description

The quantile method of McCulloch

Usage

```r
FitStable(x)
```

Arguments

- `x` vector of data

Details

The quantile estimation method of McCulloch (1986) is used. It is highly reliable, fast and reasonably efficient especially bearing in mind that in most applications there is a lot of data.

Value

A vector with named components alpha, beta, scale and location corresponding to the parameters alpha, beta, gamma and delta used in the fBasics package.

Note

Uses internal functions Mcalpha, Mcbeta, Mcmu and Mcsigma as well as tables MCTable3, MCTable4, MCTable5 and MCTable7.

Author(s)

A.I. McLeod

References


See Also

There is also a function stableFit in the fBasics package for fitting stable distributions but it does not work very well. This is the reason for FitStable.
Examples

data(DEXCAUS)
FitStable(Returns(DEXCAUS))

LBStat

Evaluate Ljung-Box portmanteau statistic

Description

Usage

LBStat(a, lags = seq(5, 40, 5))

Arguments

a           time series
lags        lags at which the portmanteau statistic is evaluated

Details

The statistic

\[ Q_m = n(n + 2) \sum_{k=1}^{m} \frac{r_k^2}{n - k} \]

where \( r_k \) is the autocorrelation at lag \( k \) and \( n \) is the length of the time series. The use of squared residuals for detecting nonlinearity and ARCH-like effects is discussed in Li (2004).

Value

Author(s)

A.I. McLeod

References


See Also

LBNTest, PRTest, Box.Test

Examples

data(DEXCAUS)
r<-Returns(DEXCAUS)
LBStat(r, lags=c(10,25,50))
Description

This is an object oriented version which can be used to test an time series for randomness or to test the goodness-of-fit of a fitted time series model.

Usage

`LBTest(obj, lags = seq(5, 40, 5), SquaredQ = FALSE, BoxPierceQ=FALSE)`

Arguments

- `obj`  
- `lags`  
- `NREP`  
- `SquaredQ`  
- `BoxPierceQ`  

Details

As shown by Ljung and Box (1978) the statistic

\[ Q_m = n(n + 2) \sum_{k=1}^{m} \frac{r_k^2}{n-k} \]

where \( r_k \) is the autocorrelation at lag \( k \) and \( n \) is the length of the time series.

Value

the p-values at the corresponding lags

Note

The parametric bootstrap version of this test is implemented in our function `FRTTest`.

Author(s)

A.I. McLeod

References


The use of squared residuals for detecting nonlinearity and ARCH-like effects is discussed in Li (2004).
Description

Monte-Carlo portmanteau tests for Pena-Rodriguez and Ljung-Box tests.

Usage

`MCPortmanteauTest(obj, lags = seq(5, 40, 5), NREP = 250, TestStatistic = "PR", StableQ = FALSE, InitializeRandomSeedQ = TRUE, SquaredQ = FALSE)`

Arguments

- `obj`: If `obj` is a class Arima object, then a portmanteau goodness-of-fit test is done on the residuals. Otherwise if `obj` is class ts or numeric, a test of randomness is done.
- `lags`: lags used in test
- `NREP`: number of bootstrap replications
- `TestStatistic`: `PR` for generalized-variance test and `LB` for Ljung-Box type test and `BP` for Box-Pierce.
- `StableQ`: TRUE, assume stable distribution otherwise Gaussian
- `InitializeRandomSeedQ`: TRUE, use a fixed pre-set seed. Otherwise use a random seed.
- `SquaredQ`: TRUE, apply the test to the squared values. Otherwise the usual test.

Details

The tests discussed in Lin and McLeod (2006, 2007) are implemented.

Value

vector of p-values

Author(s)

A.I. McLeod

References


See Also

LjungBoxTest

Examples

```r
# test DEXCAUS returns for randomness
r <- Returns(DEXCAUS)
MCPortmanteauTest(r)

# The following script generates Table 2 in Lin and McLeod (2007).
# It takes about 30 minutes on a Pentium 4, 3 GHZ PC
# To run, just uncomment the code
#
# data(CRSP)
# CRSP.AR5 <- arima(CRSP, c(5,0,0))
# NREP <- 1000
# lags <- c(10,20,30)
# tb <- matrix(numeric(5*length(lags)), nrow=5)
# tb[1,] <- MCPortmanteauTest(CRSP.AR5, lags=lags, NREP=NREP, StableQ=TRUE)[1]
# tb[2,] <- MCPortmanteauTest(CRSP.AR5, lags=lags, NREP=NREP, TestStatistic="LB", StableQ=TRUE)[1]
# tb[3,] <- MCPortmanteauTest(CRSP.AR5, lags=lags, NREP=NREP)[1]
# tb[4,] <- LBNTest(CRSP.AR5, lags=lags)
# rn <- c("PR-Stable","LB-Stable","PRN-MC","LBN-MC")
# dimnames(tb) <- list(c(rn,"LBN"), lags)
```

---

**MCTable3**

*internal table for FitStable*

**Description**

Should not be used directly.

---

**MCTable4**

*internal table for FitStable*

**Description**

Should not be used directly.

---

**MCTable5**

*internal table for FitStable*

**Description**

Should not be used directly.
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
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<td>MCTable7</td>
<td><em>internal table for FitStable</em></td>
</tr>
<tr>
<td>Mcalpha</td>
<td><em>internal function for FitStable</em></td>
</tr>
<tr>
<td>Mcbeta</td>
<td><em>internal function for FitStable</em></td>
</tr>
<tr>
<td>Mcmu</td>
<td><em>internal function for FitStable</em></td>
</tr>
<tr>
<td>Mcsigma</td>
<td><em>internal function for FitStable</em></td>
</tr>
</tbody>
</table>

**Description**

Should not be used directly.
**PRStat**

*Generalized variance test statistic*

**Description**

The negative of the log of the determinant of

**Usage**

```
PRStat(res, lags = seq(5, 20, 5))
```

**Arguments**

- `res`: residuals or series to be tested for randomness
- `lags`: vector of lags at which to evaluate the test statistic

**Details**

Pena-Rodriguez introduced a portmanteau goodness-of-fit test based on the generalized variance of the standardized residuals. The \((i,j)\)-entry of the corresponding covariance matrix is \( r[i-j] \), where \( r[k] \) denotes the residual autocorrelation at lag \( k \). Pena and Rodriguez (and 2006) and Lin and McLeod ( ) discuss various normalizations for obtaining the asymptotic distribution. Since Monte-Carlo simulations we can simply use the negative of the log of the determinant of the covariance matrix as our test statistic.

**Value**

negative of the log of the determinant

**Author(s)**

A.I. McLeod

**References**


**See Also**

`LBStat`

**Examples**

```
PRStat(rnorm(50))
```
PRTest-package

*Implements the Monte-Carlo testing methods discussed in the papers of Lin and McLeod (2006, 2007).*

Description

Details

- **Package:** PRTest
- **Type:** Package
- **Version:** 1.0
- **Date:** 2007-05-16
- **License:** GPL Version 2 or later

Author(s)

A.I. McLeod, aimcleod@uwo.ca

References


Examples

```r
# Gaussian Case, test AR(2) for adequacy
lynx.AR2 <- arima(log(lynx), c(2,0,0))
PRTest(lynx.AR2)
```

```
#testing for randomness
```

Returns

*Simple returns*

Description

Computes the simple returns of a time series of asset prices

Usage

```r
Returns(x, AnnualizedQ = FALSE, LoggedQ = FALSE, Period = 250)
```
Arguments

- `x`: vector of time series prices
- `AnnualizedQ`: should series be annualized, i.e., multiplied by `Period`
- `LoggedQ`: should logged form of returns be used
- `Period`: for daily set to 250; for monthly 12, etc.

Details

The simple returns or simple net returns are defined in eqn. (1.2) of Tsay (2002, p.2).

Value

- time series of length n-1, where n=length(x)

Author(s)

A.I. McLeod

References


See Also

diff

Examples

```r
data(DEXCAUS)
r<-Returns(DESCAUS)
qqnorm(r)
```

Description

Uses the R function `convolve` to compute the moving-average. Provides efficient algorithm for simulating a moving-average process given the innovations.

Usage

```r
SimMA(psi, a)
```

Arguments

- `psi`: vector of MA coefficients starting with 1.
- `a`: innovations
SimulateARMA

Details

\[ z_t = \sum_{k=0}^{Q} \psi_k a_{t-k} \]

where \( t = 1, \ldots, n \) and the innovations \( a_t, t = 1 - Q, \ldots, 0, 1, \ldots, n \) are given in the input vector \( a \).

Since `convolve` uses the FFT this is faster than direct computation.

Value

vector of length \( n \), where \( n = \text{length}(a) - \text{length}(\psi) \)

Author(s)

A.I. McLeod

See Also

`convolve`, `SimulateARMA`, `arima.sim`

Examples

```r
# Simulate an AR(1) process with parameter \( \phi = 0.8 \) of length \( n = 100 \) with
# innovations from a t-distribution with 5 df and plot it.
#
psi <- \phi^{0:127}
n <- 100
Q <- \text{length}(psi) - 1
a <- rt(n + Q, 5)
z <- SimMA(psi, a)
z <- \text{ts}(z)
plot(z)
```

SimulateARMA  

Simulate ARMA time series. Gaussian or Stable innovations.

Description

Usage

SimulateARMA(\( n, \phi, \theta, \text{InnovationVariance} = 1, \text{StableParameters} = \text{NULL}, \text{UseC} = \text{TRUE}, \text{Q} = 128 \)
SimulateARMA

Arguments

n length of series
phi AR parameters
theta MA parameters
InnovationVariance
If Gaussian, this is the innovation variance
StableParameters
If Stable, this is the vector of 4 parameters described in FitStable
UseC If True, call compiled C code for extra speed
Q MA approximation used to compute initial values

Details

The ARMA(p,q) is approximated by a MA(Q) model by using the impulse response coefficients from lags 0 to lag Q-1 and then the r=max(p,q) initial time series values are computed. The remaining n-r values are computed directly from the model equation using the compiled C code when UseC=TRUE. Otherwise when UseC=FALSE, a for loop in R is used.

Value

a time series of length n is generated

Note

requires rstable from the fBasics package for simulating the Stable innovation sequence.

Author(s)

A.I. McLeod

See Also

SimMA, arima.sim

Examples

# obtain timing comparison for simulation methods
#
# n<-1000  # length of series
NREP<-25  # number of replications
phi<-c(0.8,0.1)
theta<-c(-0.8, 0.1)
start<-proc.time()[1]
for (i in 1:NREP)
  x<-SimulateARMA(n,phi,theta,c(1.7,0.1,1,0),UseC=T)
T1<-proc.time()[1]-start
start<-proc.time()[1]
for (i in 1:NREP)
  x<-SimulateARMA(n,phi,theta,c(1.7,0.1,1,0),UseC=F)
T2<-proc.time()[1]-start
Tot<-c(T1,T2,T2/T1)
names(Tot)<-c("With C","Without C","Tot")
boot.residuals.arima

\textit{generate residuals from a fitted arma model}

\textbf{Description}

This function takes a fitted model, generates a simulated time series from that model and then fits the model using \texttt{arima} and returns the residuals.

\textbf{Usage}

\begin{verbatim}
boot.residuals.arima(obj, StableQ = FALSE)
\end{verbatim}

\textbf{Arguments}

- \texttt{obj} \hspace{1cm} object of class \texttt{Arima}, that is the output from \texttt{Arima}
- \texttt{StableQ} \hspace{1cm} True, use stable innovations. Otherwise Gaussian innovations.

\textbf{Details}

The fitted model is simulated using \texttt{SimulateARMA}. When \texttt{StableQ} is true, the parameters of the stable distribution are estimated in the original fitted model using the residuals. These parameters are then used to generate innovations for the ARMA model. When \texttt{StableQ} is false, Gaussian innovations are used.

\textbf{Value}

A time series or vector of length \( n \) is produced, where \( n \) is the length of the residuals in the original fitted model.

\textbf{Author(s)}

A.I. McLeod

\textbf{References}


\textbf{See Also}

\texttt{SimulateARMA}

\textbf{Examples}

\begin{verbatim}
data(CRSP)
CRSP.AR5<-arima(CRSP, c(5,0,0))
acf(boot.residuals.arima(CRSP.AR5, StableQ=TRUE))
\end{verbatim}
Description
The impulse coefficients are computed.

Usage
impARMA(phi, theta, MaxLag)

Arguments
phi    AR parameters
theta  MA parameters
MaxLag number of lags

Details
The impulse coefficients are the coefficients in the infinite moving-average form of the model.

Value
vector of length maxlag+1 containing the coefficients starting with 1.

Author(s)
A.I. McLeod

References
Hipel and McLeod (1994)

See Also
ARMAtoMA

Examples
impARMA(0.8, NULL, 10)
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