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

R topics documented:

`CRSP` *monthly simple returns of the CRSP value-weighted index, 1926 to 1997*

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

```
data(CRSP)
```

Source

from Web resources of R.Tsay homepage.

References

Tsay, R.S. (2002). Analysis of Financial Time Series. Wiley.

Examples

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

`DEXCAUS` *Canada/US foreign exchanges rates, daily, Sept 6, 1996 to Sept. 5, 1996.*

Description

There are 2513 data values.

Usage

```
data(DEXCAUS)
```

Details

Title: Canada / U.S. Foreign Exchange Rate Series ID: DEXCAUS Source: Board of Governors of the Federal Reserve System Release: H.10 Foreign Exchange Rates Seasonal Adjustment: Not Applicable Frequency: Daily Units: Canadian Dollars to One U.S. Dollar Date Range: 1971-01-04 to 2006-09-05 Last Updated: 2006-09-06 10:42 AM CT Notes: Noon buying rates in New York City for cable transfers payable in foreign currencies.

Source

http://research.stlouisfed.org/fred2/series/DEXCAUS

References

Examples

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

`FitStable` *Fit parameters to stable distribution*

Description

The quantile method of McCullogh

Usage

```
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

J. H. McCulloch (1986), Simple consistent estimator of stable distribution parameters. Commun. Statist.–Simula., 15(4), 1109-1136.

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

Ljung, G.M. and Box, G.E.P. (1979). The Likelihood Function of Stationary Autoregressive-Moving Average Models. Biometrika 66, 265-270.

Li, W.K. (2004). Diagnostic Checks in Time Series. Chapman & Hall/CRC.

See Also

`LBNTest`, `PRTest`, `Box.Test`

Examples

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

LBTest *Ljung-Box portmanteau test*

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`	lags to be tested
`NREP`	number of bootstrap replications
`SquaredQ`	use squared residuals
`BoxPierceQ`	if TRUE, the Box-Pierce form of the portmanteau statistic is used

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 `PRTest`.

Author(s)

A.I. McLeod

References

Box, G.E.P. and Pierce, D.A. (1970). JASA.

Ljung, G.M. and Box, G.E.P. (1979). The Likelihood Function of Stationary Autoregressive-Moving Average Models. Biometrika 66, 265-270.

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

See Also

LBStat, PRTest, Box.Test

Examples

`MCPortmanteauTest` *Monte-Carlo portmanteau tests*

Description

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

Usage

```
MCPortmanteauTest(obj, lags = seq(5, 40, 5), NREP = 250, TestStatistic = "PR", S
```

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

Lin, J.W. and McLeod, A.I. (2006). Improved Pena-Rodriguez Portmanteau Test. Computational Statistics and Data Analysis, 51, 1731-1738.

Lin, J.W. and McLeod, A.I. (2007, accepted). Portmanteau Tests for ARMA Models with Infinite Variance. Journal of Time Series Analysis.

See Also

LjungBoxTest

Examples

```
#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=T
# tb[3,]<-MCPortmanteauTest(CRSP.AR5, lags=lags, NREP=NREP))[1]
# tb[4,]<-MCPortmanteauTest(CRSP.AR5, lags=lags, NREP=NREP, TestStatistic="LB"))[1]
# tb[5,]<-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.

MCTable7 *internal table for FitStable*

Description

Should not be used directly.

Mcalpha *internal function for FitStable*

Description

Should not be used directly.

Mcbeta *internal function for FitStable*

Description

Should not be used directly.

Mcmu *internal function for FitStable*

Description

Should not be used directly.

Mcsigma *internal function for FitStable*

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

Lin, J.W. and McLeod, A.I. (2006). Improved Pena-Rodriguez Portmanteau Test. Computational Statistics and Data Analysis, 51, 1731-1738.

Lin, J.W. and McLeod, A.I. (2007, accepted). Portmanteau Tests for ARMA Models with Infinite Variance. Journal of Time Series Analysis.

Peňa, D. and Rodriguez, J. (2002), A Powerful Portmanteau Test of Lack of Fit For Time Series. Journal of American Statistical Association 97, 601-610.

Peňa, D. and Rodriguez, J. (2006). The Log of the Autocorrelation Matrix for Testing Goodness of Fit in Time Series. Journal of Statistical Inference and Planning 136, 2706-2718.

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

Lin, J.W. and McLeod, A.I. (2006). Improved Pena-Rodriguez Portmanteau Test. Computational Statistics and Data Analysis, 51, 1731-1738.

Lin, J.W. and McLeod, A.I. (2007, accepted). Portmanteau Tests for ARMA Models with Infinite Variance. Journal of Time Series Analysis.

Examples

```
#
#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

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

Arguments

`x`	vector of time series prices
`AnnualizedQ`	should series be annualized, ie. 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

Tsay, R.S. (2002). Analysis of Financial Time Series. Wiley.

See Also

`diff`

Examples

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

`SimMA` *Compute MA using convolve*

Description

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

Usage

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

Arguments

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

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=length(a)-length(psi)

Author(s)

A.I. McLeod

See Also

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

Examples

```
#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<-length(psi)-1
a<-rt(n+Q,5)
z<-SimMA(psi,a)
z<-ts(z)
plot(z)
```

`SimulateARMA` *Simulate ARMA time series. Gaussian or Stable innovations.*

Description

Usage

```
SimulateARMA(n, phi, theta, InnovationVariance = 1, StableParameters = NULL, Use
```

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` *generate residuals from a fitted arma model*

Description

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

Usage

```
boot.residuals.arima(obj, StableQ = FALSE)
```

Arguments

`obj`	object of class Arima, that is the output from `Arima`
`StableQ`	True, use stable innovations. Otherwise Gaussian innovations.

Details

The fitted model is simulated using SimulateARMA. When 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 StableQ is false, Gaussian innovations are used.

Value

a time series or vector of length n is produced, where n is the length of the residuals in the original fitted model.

Author(s)

A.I. McLeod

References

J.-W. Lin and McLeod (2007, accepted). Portmanteau Tests for ARMA Models with Infinite Variance. Journal of Time Series Analysis.

See Also

`SimulateARMA`

Examples

```
data(CRSP)
CRSP.AR5<-arima(CRSP, c(5,0,0))
acf(boot.residuals.arima(CRSP.AR5, StableQ=TRUE)
```

`impARMA` *impulse coefficients for ARMA model*

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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