Package ‘mleur’

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Type Package

Title Maximum likelihood unit root test

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Depends R (>= 2.0.0), urca, stabledist, fGarch, lattice

Description Provides functions for unit root testing using MLE method

License GPL (>= 2)

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LazyData yes

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mleur-package	*Maximum likelihood unit root test*

Description

Support for mle unit root tests

Details

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Version:	1.0-6
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License: GPL (>= 2)	
LazyLoad:	yes

Author(s)

A. I. McLeod, Hao Yu and Ying Zhang

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Examples

```
#Example 1. Analysis of money velocity
library(lattice)
xyplot(vel, lwd=1.5, type="b", cex=0.7, pch=16, aspect=0.8,
 xlab="year", ylab="money velocity")
mleurDiag(vel)
mleur(vel)
dftest(vel)
ar1est(vel)
ar1est(vel, method="LSE")
#
#Example 2.
#Difference in BAA and AAA corporate bonds
library(lattice)
xyplot(DiffBA, lwd=1.5, type="b", cex=0.7, pch=16, aspect=0.8,
 xlab="year", ylab="money velocity")
mleurDiag(DiffBA)
mleur(DiffBA)
dftest(DiffBA)
ar1est(DiffBA)
ar1est(DiffBA, method="LSE")
```

`ar1est` *MLE or LSE for AR(1) parameter. Sample mean correction used in MLE case. Intercept term estimated in LSE case.*

Description

Fast exact computation of the MLE for AR(1) by solving the likelihood equation. The sample mean correction is used, so the method is not strickly speaking exact but the name derives from the fact that if the mean is known and was used instead of the sample mean the estimate would be an exact MLE estimate of the parameter in the AR(1) model. It has been shown that effect of estimating the sample mean is negligible.

Usage

```
ar1est(z, method = c("MLE", "LSE"))
```

Arguments

`z`	time series or vector
`method`	must be "MLE" or "LSE"

Details

The exact MLE for mean-zero an AR(1) time series satisfies a cubic equation. The solution of this equation for the MLE given by Zhang (2002) is used. This approach is more reliable as well as faster than the usual approach to the exact MLE using a numerical optimization technique which can occasionally have convergence problems.

Value

MLE for the parameter

Author(s)

A.I. McLeod and Ying Zhang

References

Zhang, Y. (2002). Topics in Autoregression, Ph.D. Thesis, University of Western Ontario.

Examples

```
#Example 1
#compare MLE and LSE for vel series
ar1est(vel)
ar1est(vel, method="MLE")
ar1est(vel, method="LSE")
#
```

```
#Example 2
ar1est(DiffBA)
ar1est(DiffBA, method="LSE")
```

---

dftest *Dickey-Fuller test*

Description

Computes the Dickey-Fuller test using the pivotal test statistic and returns critical points for tests at levels 0.1, 0.05, 0.01.

Usage

```
dftest(y)
```

Arguments

`y`	time series or vector

Details

The function ur.df() in the package ur.ca is used.

Value

The output is a list with components:

`DFStat`	value of Dickey-Fuller pivotal statistic
`criticalValues`	critical values corresponding to 1

Author(s)

A.I. McLeod and Hao Yu

See Also

`ur.df`, `mleur`

Examples

```
dftest(vel)
mleur(vel)
```

DiffBA — *Bond yield differences, annual*

Description

The difference in Moody's BAA and AAA corporate bond yields annually

Usage

```
data(DiffBA)
```

Format

The format is: Time-Series [1:35] from 1976 to 2010: 1.32 0.95 0.76 1.06 1.73 ...

Details

The data set includes the annual Moody's Baa and Aaa corporate bond yields from 1976 to 2010, and the difference between Baa and Aaa.

Source

The annual data of BAA and AAA are downloaded from the Board of Governors of the Federal Reserve System (http://www.federalreserve.gov/releases/h15/data.htm)

Examples

```
mleurDiag(DiffBA)
mleur(DiffBA)
dftest(DiffBA)
```

GetPower — *Simulation function to compute power for AR(1) alternative*

Description

Compares the empirical power of unit-root tests using simulation. Various non-normal distributions may be selected.

Usage

```
GetPower(phi, n, NSIM = 1000, tests = c("DF", "MLEp", "MLEn", "MCT"),
noiseDist = c("normal", "t", "stable", "GARCH11"), df = 5,
ALPHA = 1.5, BETA = 0, alpha = 0.2, beta = 0.7)
```

Arguments

phi	AR(1) parameter or phi=1 if null is true
n	length of series
NSIM	Number of simulations
tests	available tests include: DF for Dickey-Fuller, MLEp for exact MLE using pivotal, MLEn - exact MLEn using normalized, MCT using Monte-Carlo test
noiseDist	distribution of innovations: "normal" for Gaussian; "t" for t-distribution; "stable" for stable distribution; "GARCH11" for GARCH
df	df for t-distribution
ALPHA	shape parameter of stable distribution in (0,2]
BETA	skewness parameter of stable in [-1,1]
alpha	GARCH(1,1) first parameter
beta	GARCH(1,1) second parameter

Value

List with the following components:

power	vector with estimated power for selected tests
phi	AR(1) parameter value
NSIM	Number of simulations used
MOE	margin of error for level 0.95 c.i.

Author(s)

A.I. McLeod

See Also

mleur, dftest

Examples

```
GetPower(phi=0.8, n=50, NSIM=100, tests=c("DF", "MLEp"))
```

`mctest` *Monte-Carlo unit root test*

Description

The Monte-Carlo unit root test using the exact MLE. This provides a check for the function `mleur()` as well as a more robust approach using bootstrap residuals.

Usage

```
mctest(y, type = c("p", "n"), NumRep = 1000, bootQ = FALSE)
```

Arguments

`y`	the time series to be tested
`type`	default "p" for pivotal statistic, otherwise the normalized statistic is used
`NumRep`	Number of iterations for Monte-Carlo
`bootQ`	if FALSE, use NID innovations, otherwise if TRUE a bootstrap sample of the residuals

Value

p-value

Author(s)

A.I. McLeod and Hao Yu

See Also

`mleur`

Examples

```
mctest(DiffBA, NumRep=100, type="n")
```

mleur — *Fast exact MLE unit root test*

Description

Implements fast unit root test using response surface

Usage

```
mleur(y, type = c("p", "n"))
```

Arguments

`y`	time series
`type`	default "p" for pivotal statistic, otherwise the normalized statistic is used

Details

In paper.

Value

a vector of length 4 with named elements: c("test statistic", "1

Author(s)

A.I. McLeod and Hao Yu

Examples

```
mleur(vel)
```

mleurDiag — *Diagnostic checks for mleur test*

Description

Test for autocorrelation for mleur test

Usage

```
mleurDiag(y, lag.max = "default")
```

Arguments

`y`	time series
`lag.max`	maximum lag for test. Default setting is "default".

Details

Box-and-Whisker plot of residuals from fitted AR(1) plotted along with the p-value for the Wilk-Shairo test. The test in the package fBasics is used. The p-values of the Box-Ljung portmanteau test are plotted as well as the residual autocorrelations.

Value

The residuals are returned invisibly.

Author(s)

A. I. McLeod

See Also

mleur

Examples

```
z <- rnorm(100)
mleurDiag(z)
```

---

simar1 *Simulate AR(1)*

Description

Exact simulation for AR(1) with normal and non-normal innovations

Usage

```
simar1(phi = 0.5, n = 100, InnovationVariance = 1, noiseDist = c("normal", "t",
 "stable", "GARCH11"), df = 5, ALPHA = 1.5, BETA = 0, GAMMA = 1, DELTA = 0,
 alpha = 0.2, beta = 0.7)
```

Arguments

phi	AR(1) parameter
n	length of series
InnovationVariance	innovation variance, if applicable
noiseDist	distribution of innovations: "normal" for Gaussian; "t" for t-distribution; "stable" for stable distribution; "GARCH11" for GARCH
df	df for t-distribution
ALPHA	shape parameter of stable distribution in (0,2]
BETA	skewness parameter of stable in [-1,1]

`GAMMA`	scale parameter of stable
`DELTA`	shift parameter of stable
`alpha`	GARCH(1,1) first parameter
`beta`	GARCH(1,1) second parameter

Details

More details later.

Value

a vector of length n containing the simulated series

Author(s)

A.I. McLeod

Examples

```
simar1()
```

---

testStatUM *unit root MLE test statistic*

Description

Computes the MLE unit root test statistic.

Usage

```
testStatUM(y, type = c("p", "n"))
```

Arguments

`y`	time series
`type`	default "p" for pivotal statistic, otherwise the normalized statistic is used

Details

See paper.

Value

the test statistic

Author(s)

A.I. McLeod

See Also

mleur

Examples

```
testStatUM(vel)
```

---

vel *Velocity of money, 1869-1970, Nelson*

Description

Component in the famous dataset of Nelson and Plosser. Available in the urca package.

Usage

```
data(vel)
```

Format

The format is: Time-Series [1:102] from 1869 to 1970: 5.61 5.16 4.63 5.05 4.95 4.71 4.46 4.65 ...

Source

See example 1 below.

Examples

```
#Example 1: Data source:
data(nporg, package="urca")
testdata <- na.omit(nporg[, c("year", "vel")])
vel <- ts(testdata[,"vel"], start=testdata[1,1], freq=1)
#
mleurDiag(vel)
dftest(vel)
mleur(vel)
```

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