Package 'fUnitRoots'

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Suggests RUnit

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Description Environment for teaching ''Financial Engineering and Computational Finance''

NOTE SEVERAL PARTS ARE STILL PRELIMINARY AND MAY BE CHANGED IN THE FUTURE. THIS TYPICALLY INCLUDES FUNCTION AND ARGUMENT NAMES, AS WELL AS DEFAULTS FOR ARGUMENTS AND RETURN VALUES.

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R topics documented:

DickeyFullerPValues *Dickey-Fuller p Values*

Description

A collection and description of functions to compute the distribution and quantile function for the ADF unit root test statistics.

The functions are:

padf	the returns cumulative probability for the ADF test,
qadf	the returns quantiles for the ADF test,
adfTable	tables p values for ADF test.

Usage

```
padf(q, N = Inf, trend = c("nc", "c", "ct"), statistic = c("t", "n"))
qadf(p, N = Inf, trend = c("nc", "c", "ct"), statistic = c("t", "n"))

adfTable(trend = c("nc", "c", "ct"), statistic = c("t", "n"),
    includeInf = TRUE)
```

Arguments

includeInf	a logical flag. Should the asymptotic value included into the table?
N	the number of observations in the sample from which the quantiles are to be computed.
p	a numeric vector of probabilities. Missing values are allowed.
q	vector of quantiles or test statistics. Missing values are allowed.
statistic	a character string describing the type of test statistic. Valid choices are "t" for t-statistic, and "n" for normalized statistic, sometimes referred to as the rho-statistic. The default is "t".
trend	a character string describing the regression from which the quantiles are to be computed. Valid choices are: "nc" for a regression with no intercept (constant) nor time trend, and "c" for a regression with an intercept (constant) but no time trend, "ct" for a regression with an intercept (constant) and a time trend. The default is "c".

Value

The function padf returns the cumulative probability of the finite sample distribution of the unit root test statistics.

The function qadf returns the quantiles of the finite sample distribution of the unit root test statistics, given the probabilities.

Note

The functions padf and qadf use the tables from A. Banerjee et al. (1993).

Author(s)

Diethelm Wuertz for the Rmetrics R-port.

References

Banerjee A., Dolado J.J., Galbraith J.W., Hendry D.F. (1993); *Cointegration, Error Correction, and the Econometric Analysis of Non-Stationary Data*, Oxford University Press, Oxford.

Dickey, D.A., Fuller, W.A. (1979); *Distribution of the estimators for autoregressive time series with a unit root*, Journal of the American Statistical Association 74, 427–431.

Examples

```
## ADF dftesTable -
   adfTable()
```

MacKinnonPValues *MacKinnon's Unit Root p Values*

Description

A collection and description of functions to compute the distribution and and quantile function for MacKinnon's unit root test statistics.

The functions are:

punitroot	the returns cumulative probability,
qunitroot	the returns quantiles of the unit root test statistics,
unitrootTable	tables p values from MacKinnon's response surface.

Usage

```
punitroot(q, N = Inf, trend = c("c", "nc", "ct", "ctt"),
    statistic = c("t", "n"), na.rm = FALSE)
qunitroot(p, N = Inf, trend = c("c", "nc", "ct", "ctt"),
    statistic = c("t", "n"), na.rm = FALSE)

unitrootTable(trend = c("c", "nc", "ct", "ctt"), statistic = c("t", "n"))
```

Arguments

N	the number of observations in the sample from which the quantiles are to be computed.

na.rm	a logical value. If set to TRUE, missing values will be removed otherwise not, the default is FALSE.
p	a numeric vector of probabilities. Missing values are allowed.
q	vector of quantiles or test statistics. Missing values are allowed.
statistic	a character string describing the type of test statistic. Valid choices are "t" for t-statistic, and "n" for normalized statistic, sometimes referred to as the rho-statistic. The default is "t".
trend	a character string describing the regression from which the quantiles are to be computed. Valid choices are: "nc" for a regression with no intercept (constant) nor time trend, and "c" for a regression with an intercept (constant) but no time trend, "ct" for a regression with an intercept (constant) and a time trend. The default is "c".

Value

The function punitroot returns the cumulative probability of the asymptotic or finite sample distribution of the unit root test statistics.

The function qunitroot returns the quantiles of the asymptotic or finite sample distribution of the unit root test statistics, given the probabilities.

Note

The function punitroot and qunitroot use Fortran routines and the response surface approach from J.G. MacKinnon (1988). Many thanks to J.G. MacKinnon putting his code and tables under the GPL license, which made this implementation possible.

Author(s)

J.G. MacKinnon for the underlying Fortran routine and the tables,
Diethelm Wuertz for the Rmetrics R-port.

References

Dickey, D.A., Fuller, W.A. (1979); *Distribution of the estimators for autoregressive time series with a unit root*, Journal of the American Statistical Association 74, 427–431.

MacKinnon, J.G. (1996); *Numerical distribution functions for unit root and cointegration tests*, Journal of Applied Econometrics 11, 601–618.

Phillips, P.C.B., Perron, P. (1988); *Testing for a unit root in time series regression*, Biometrika 75, 335–346.

Examples

```
## qunitroot -
   # Asymptotic quantile of t-statistic
   qunitroot(0.95, trend = "nc", statistic = "t")
```

```
## qunitroot -
   # Finite sample quantile of n-statistic
   qunitroot(0.95, N = 100, trend = "nc", statistic = "n")

## punitroot -
   # Asymptotic cumulative probability of t-statistic
   punitroot(1.2836, trend = "nc", statistic = "t")

## punitroot -
   # Finite sample cumulative probability of n-statistic
   punitroot(1.2836, N = 100, trend = "nc", statistic = "n")

## Mac Kinnon's unitrootTable -
   unitrootTable(trend = "nc")
```

`UnitrootTests` *Unit Root Time Series Tests*

Description

A collection and description of functions for unit root testing. The family of tests includes ADF tests based on Banerjee's et al. tables and on J.G. McKinnons' numerical distribution functions.

The functions are:

`adfTest`	Augmented Dickey–Fuller test for unit roots,
`unitrootTest`	the same based on McKinnons's test statistics.

Usage

```
unitrootTest(x, lags = 1, type = c("nc", "c", "ct"), title = NULL,
    description = NULL)

adfTest(x, lags = 1, type = c("nc", "c", "ct"), title = NULL,
    description = NULL)
```

Arguments

`description`	a character string which allows for a brief description.
`lags`	the maximum number of lags used for error term correction.
`title`	a character string which allows for a project title.
`type`	a character string describing the type of the unit root regression. Valid choices are `"nc"` for a regression with no intercept (constant) nor time trend, and `"c"` for a regression with an intercept (constant) but no time trend, `"ct"` for a regression with an intercept (constant) and a time trend. The default is `"c"`.
`x`	a numeric vector or time series object.

Details

The function `adfTest()` computes test statistics and p values along the implementation from Trapletti's augmented Dickey–Fuller test for unit roots. In contrast to Trapletti's function three kind of test types can be selected.

The function `unitrootTest()` computes test statistics and p values using McKinnon's response surface approach.

Value

The tests return an object of class `"fHTEST"` with the following slots:

`@call`	the function call.
`@data`	a data frame with the input data.
`@data.name`	a character string giving the name of the data frame.
`@test`	a list object which holds the output of the underlying test function.
`@title`	a character string with the name of the test.
`@description`	a character string with a brief description of the test.

The entries of the `@test` slot include the following components:

`$statistic`	the value of the test statistic.
`$parameter`	the lag order.
`$p.value`	the p-value of the test.
`$method`	a character string indicating what type of test was performed.
`$data.name`	a character string giving the name of the data.
`$alternative`	a character string describing the alternative hypothesis.
`$name`	the name of the underlying function, which may be wrapped.
`$output`	additional test results to be printed.

Author(s)

Adrian Trapletti for the tests adapted from R's "tseries" package,
Diethelm Wuertz for the Rmetrics R-port.

References

Banerjee A., Dolado J.J., Galbraith J.W., Hendry D.F. (1993); *Cointegration, Error Correction, and the Econometric Analysis of Non-Stationary Data*, Oxford University Press, Oxford.

Dickey, D.A., Fuller, W.A. (1979); *Distribution of the estimators for autoregressive time series with a unit root*, Journal of the American Statistical Association 74, 427–431.

MacKinnon, J.G. (1996); *Numerical distribution functions for unit root and cointegration tests*, Journal of Applied Econometrics 11, 601–618.

Said S.E., Dickey D.A. (1984); *Testing for Unit Roots in Autoregressive-Moving Average Models of Unknown Order*, Biometrika 71, 599–607.

Examples

```
## Time Series
   # A time series which contains no unit-root:
   x = rnorm(1000)
   # A time series which contains a unit-root:
   y = cumsum(c(0, x))

## adfTest -
   adfTest(x)
   adfTest(y)

## unitrootTest -
   unitrootTest(x)
   unitrootTest(y)
```

UnitrootUrcaInterface *Unit Root Time Series Tests*

Description

A collection and description of functions for unit root testing. This is a Rmetrics conform interface to the unitroot tests implemented by B. Pfaff available through the contributed package "urca".

Added functions based on the 'urca' package include:

`urdfTest`	Augmented Dickey–Fuller test for unit roots,
`urersTest`	Elliott–Rothenberg–Stock test for unit roots,
`urkpssTest`	KPSS unit root test for stationarity,
`urppTest`	Phillips–Perron test for unit roots,
`urspTest`	Schmidt–Phillips test for unit roots,
`urzaTest`	Zivot–Andrews test for unit roots.

Note, that the contributed R package `urca` is required!

Usage

```
urdfTest(x, lags = 1, type = c("nc", "c", "ct"), doplot = TRUE)
urersTest(x, type = c("DF-GLS", "P-test"), model = c("constant", "trend"),
    lag.max = 4, doplot = TRUE)
urkpssTest(x, type = c("mu", "tau"), lags = c("short", "long", "nil"),
    use.lag = NULL, doplot = TRUE)
urppTest(x, type = c("Z-alpha", "Z-tau"), model = c("constant", "trend"),
    lags = c("short", "long"), use.lag = NULL, doplot = TRUE)
urspTest(x, type = c("tau", "rho"), pol.deg = c(1, 2, 3, 4),
    signif = c(0.01, 0.05, 0.1), doplot = TRUE)
urzaTest(x, model = c("intercept", "trend", "both"), lag, doplot = TRUE)
```

Arguments

doplot	[ur*Test] - a logical flag, by default TRUE. Should a diagnostical plot be displayed?
lag.max	[urersTest] - the maximum numbers of lags used for testing of a decent lag truncation for the "P-test", BIC used, or the maximum number of lagged differences to be included in the test regression for "DF-GLS".
lag	[urzaTest] - the highest number of lagged endogenous differenced variables to be included in the test regression.
lags	[urkpssTest][urppTest] - the maximum number of lags used for error term correction.
model	[urersTest] - a character string dennoting the deterministic model used for detrending, either "constant", the default, or "trend". [urppTest] - a character string which determines the deterministic part in the test regression, either "constant", the default, or "trend". [urzaTest] - a character string specifying if the potential break occured in either the "intercept", the linear "trend" or in "both".
pol.deg	[urspTest] - the polynomial degree in the test regression.
signif	[urspTest] - the significance level for the critical value of the test statistic.
type	[urkpssTest] - a character string which denotes the type of deterministic part, either "mu", the default, or "tau". [urppTest] - a character string which specifies the test type, either "Z-alpha", the default, or "Z-tau". [urspTest] - a character string which specifies the test type, either "tau", the default, or "rho".
use.lag	[urkpssTest] - a character string specifying the number of lags. Allowed arguments are lags=c("short", "long", "nil"), for more information see the details section. [urppTest] - Use of a different lag number, specified by the user.
x	a numeric vector or time series object.

Details

Unit Root Tests from Berhard Pfaff's "urca" Package:

Elliott–Rothenberg–Stock Test for Unit Roots:
To improve the power of the unit root test, Elliot, Rothenberg and Stock proposed a local to unity detrending of the time series. ERS developed a feasible point optimal test, `"P-test"`, which takes serial correlation of the error term into account. The second test type is the `"DF-GLS"` test, which is an ADF-type test applied to the detrended data without intercept. Critical values for this test are taken from MacKinnon in case of `model="constant"` and else from Table 1 of Elliot, Rothenberg and Stock.
`[urca:ur.ers]`

KPSS Test for Unit Roots:
Performs the KPSS unit root test, where the Null hypothesis is stationarity. The test types specify as deterministic component either a constant `"mu"` or a constant with linear trend `"tau"`. `lags="short"` sets the number of lags to *root 4 of [4 times (n/100)*, whereas `lags="long"` sets the number of lags to *root 4 of [12 times (n/100)]*. If `lags="nil"` is choosen, then no error correction is made. Furthermore, one can specify a different number of maximum lags by setting use.lag accordingly.
`[urca:ur.kpss]`

Phillips–Perron Test for Unit Roots:
Performs the Phillips and Perron unit root test. Beside the Z statistics Z-alpha and Z-tau, the Z statistics for the deterministic part of the test regression are computed, too. For correction of the error term a Bartlett window is used.
`[urca:ur.pp]`

Schmidt–Phillips Test for Unit Roots:
Performs the Schmidt and Phillips unit root test, where under the Null and Alternative Hypothesis the coefficients of the deterministic variables are included. Two test types are available: the `"rho-test"` and the `"tau-test"`. Both tests are extracted from the LM principle.
`[urca:ur.sp]`

Zivot–Andrews Test for Unit Roots:
Performs the Zivot and Andrews unit root test, which allows a break at an unknown point in either the intercept, the linear trend or in both. This test is based upon the recursive estimation of a test regression. The test statistic is defined as the minimum t-statistic of the coeffcient of the lagged endogenous variable.
`[urca:ur.za]`

Value

All tests return an object of class `"fHTEST"` with the following slots:

`@call`	the function call.
`@data`	a data frame with the input data.
`@data.name`	a character string giving the name of the data frame.
`@test`	a list object which holds the output of the underlying test function.
`@title`	a character string with the name of the test.
`@description`	a character string with a brief description of the test.

The entries of the `@test` slot include the following components:

`$statistic`	the value of the test statistic.
`$parameter`	the lag order.
`$p.value`	the p-value of the test.
`$method`	a character string indicating what type of test was performed.
`$data.name`	a character string giving the name of the data.
`$alternative`	a character string describing the alternative hypothesis.
`$name`	the name of the underlying function, which may be wrapped.
`$output`	additional test results to be printed.

Note

The functions `ur*Test()` fullfill the naming conventions of Rmetrics, return an S4 object named `fHTEST` as any other hypothesis test from Rmetrics, and allow for `timeSeries` objects as input. These are the only differences to the original implementation of the functions.

Fur further details we refer to the manual pages of the `"urca"` package.

Author(s)

Bernhard Pfaff for the tests implemented in R's "urca" package,
Diethelm Wuertz for the Rmetrics R-port.

References

Banerjee A., Dolado J.J., Galbraith J.W., Hendry D.F. (1993); *Cointegration, Error Correction, and the Econometric Analysis of Non-Stationary Data*, Oxford University Press, Oxford.

Dickey, D.A., Fuller, W.A. (1979); *Distribution of the estimators for autoregressive time series with a unit root*, Journal of the American Statistical Association 74, 427–431.

Kwiatkowski D., Phillips P.C.B, Schmidt P., Shin Y. (1992); *Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root*, Journal of Econometrics 54, 159–178.

Perron P. (1988); *Trends and Random Walks in Macroeconomic Time Series*, Journal of Economic Dynamics and Control 12, 297–332.

Phillips P.C.B., Perron P. (1988); *Testing for a unit root in time series regression*, Biometrika 75, 335–346.

Said S.E., Dickey D.A. (1984); *Testing for Unit Roots in Autoregressive-Moving Average Models of Unknown Order*, Biometrika 71, 599–607.

Schwert G.W. (1989); *Tests for Unit Roots: A Monte Carlo Investigation*, Journal of Business and Economic Statistics 2, 147–159.

Examples

```
## Time Series
   # A time series which contains no unit-root:
   x = rnorm(1000)
   # A time series which contains a unit-root:
   y = cumsum(c(0, x))

## ERS Test:
   if (require(urca)) {
   urersTest(x)
   urersTest(y)
   }
```

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