Package: unitrootests (via r-universe)

May 28, 2026

Type Package

Title Comprehensive Unit Root and Stationarity Tests

Version 1.1.0

Description A unified framework for unit root and stationarity testing including quantile ADF tests (Koenker and Xiao, 2004) <doi:10.1198/016214504000001114>, GARCH-based unit root tests with endogenous structural breaks (Narayan and Liu, 2015) <doi:10.1016/j.eneco.2014.11.021>, and comprehensive Dickey-Fuller, Phillips-Perron, KPSS, ERS/DF-GLS, Zivot-Andrews, and Kobayashi-McAleer tests with an Elder-Kennedy decision strategy (Elder and Kennedy, 2001) <doi:10.1080/00220480109595179>.

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Encoding UTF-8

RoxygenNote 7.3.3

Depends R (>= 3.5.0)

Imports stats, quantreg, tseries, urca, strucchange

Suggests testthat (>= 3.0.0), zoo

Config/testthat/edition 3

Config/pak/sysreqs libssl-dev

Repository https://muhammedalkhalaf.r-universe.dev

Date/Publication 2026-04-27 20:57:05 UTC

RemoteUrl https://github.com/muhammedalkhalaf/unitrootests

RemoteRef HEAD

RemoteSha 4d1dbb045e7c58e14f7880ccb567c4ec7b714973

Contents

`garchur` *GARCH Unit Root Test with Endogenous Structural Breaks*

Description

Implements the trend-GARCH(1,1) unit root test with up to three endogenous structural breaks proposed by Narayan and Liu (2015).

Usage

```
garchur(y, breaks = 2L, model = c("ct", "c"), trim = 0.15)
```

Arguments

`y`	Numeric vector. The time-series variable to be tested.
`breaks`	Integer. Number of structural breaks (1, 2, or 3). Default is 2.
`model`	Character. Deterministic specification: `"ct"` (constant plus linear trend, default) or `"c"` (constant only).
`trim`	Numeric. Trimming proportion for the break-date grid search, between 0.05 and 0.30. Default is `0.15`.

Details

The mean equation is:

$$y_t = a_0 + a_1 t + \rho y_{t-1} + \sum_j \gamma_j DU_{jt} + \varepsilon_t$$

The null hypothesis is $H_0 : \rho = 1$ (unit root). Break dates are selected by sequential maximum $|t|$ search. GARCH parameters are estimated by approximate maximum likelihood via Nelder-Mead optimisation. Critical values are interpolated from Table III of Narayan and Liu (2015).

Value

A list of class `"garchur"` containing: `stat` (t-statistic), `rho`, `kappa`, `alpha`, `beta`, `ab`, `halflife`, `loglik`, `break_dates`, `nobs`, `cv1`, `cv5`, `cv10`, `model`, `breaks`, and `decision`.

References

Narayan, P. K., & Liu, R. (2015). A unit root model for trending time-series energy variables. *Energy Economics*, 46, 1–9. doi:10.1016/j.eneco.2014.11.021

Examples

```
set.seed(42)
y <- cumsum(rnorm(80))
res <- garchur(y, breaks = 2, model = "ct")
print(res)
```

---

print.garchur — *Print Method for garchur Objects*

Description

Prints a formatted summary of GARCH unit root test results.

Usage

```
## S3 method for class 'garchur'
print(x, ...)
```

Arguments

`x`	An object of class `"garchur"`.
`...`	Further arguments passed to or from other methods (unused).

Value

Invisibly returns `x`.

Examples

```
set.seed(1)
y <- cumsum(rnorm(60))
res <- garchur(y, breaks = 2)
print(res)
```

---

print.qadf — *Print and Summary Methods for qadf Objects*

Description

Print and summary methods for objects of class `"qadf"` returned by `qadf`.

Usage

```
## S3 method for class 'qadf'
print(x, digits = 4L, ...)

## S3 method for class 'qadf'
summary(object, ...)
```

Arguments

`x`	An object of class `"qadf"`.
`digits`	Integer. Number of significant digits for display.
`...`	Further arguments (ignored).
`object`	An object of class `"qadf"`.

Value

Invisibly returns the input object.

Examples

```
set.seed(1)
y <- cumsum(rnorm(80))
res <- qadf(y, tau = 0.5)
print(res)
summary(res)
```

---

qadf — *Quantile ADF Unit Root Test*

Description

Implements the Quantile Autoregressive Distributed Lag (QADF) unit root test of Koenker and Xiao (2004). The test examines unit root behaviour across quantiles of the conditional distribution of a time series using quantile regression.

Usage

```
qadf(x, tau = 0.5, model = "c", max_lags = 8, ic = "aic")
```

Arguments

`x`	A numeric vector or univariate time series object.
`tau`	A numeric scalar specifying the quantile at which to estimate the model. Must satisfy `0` < `tau` < `1`. Default is `0.5`.
`model`	A character string specifying the deterministic component. `"c"` (default) includes a constant; `"ct"` includes a constant and a linear trend.
`max_lags`	A non-negative integer specifying the maximum number of augmentation lags to consider. Default is `8`.
`ic`	A character string for the information criterion used to select the optimal lag length. One of `"aic"` (default), `"bic"`, or `"tstat"` (sequential t-test at the 10% level).

Details

The QADF test estimates the autoregressive parameter $\hat{\rho}(\tau)$ at quantile τ via quantile regression on the ADF regression equation. The t-statistic $t_n(\tau) = (\hat{\rho}(\tau) - 1)/se$ tests $H_0 : \rho(\tau) = 1$ (unit root) against $H_1 : \rho(\tau) < 1$ (stationarity).

Critical values are from Table 1 of Hansen (1995), interpolated linearly for quantiles between tabulated values. The model `"c"` corresponds to a demeaned ADF regression; `"ct"` adds a linear time trend.

Value

An object of class `"qadf"` with components:

statistic The QADF t-statistic $t_n(\tau)$.

coef_stat The $U_n(\tau) = n(\hat{\rho}(\tau) - 1)$ statistic.

rho_tau Quantile autoregressive coefficient $\hat{\rho}(\tau)$.

rho_ols OLS autoregressive coefficient.

alpha_tau Quantile intercept $\hat{\alpha}_0(\tau)$.

delta2 Nuisance parameter $\hat{\delta}^2$.

half_life Half-life implied by $\hat{\rho}(\tau)$, in periods.

opt_lags Selected lag order.

nobs Number of observations used.

critical_values Named numeric vector of critical values at 1%, 5%, and 10% from Hansen (1995).

tau The quantile used.

model The deterministic model used.

ic The information criterion used.

varname The name of the input series.

References

Koenker, R. and Xiao, Z. (2004). Unit Root Quantile Autoregression Inference. *Journal of the American Statistical Association*, 99(465), 775–787. doi:10.1198/016214504000001114

Hansen, B. E. (1995). Rethinking the Univariate Approach to Unit Root Tests: How to Use Covariates to Increase Power. *Econometric Theory*, 11(5), 1148–1171. doi:10.1017/S0266466600009713

Examples

```
set.seed(42)
y <- cumsum(rnorm(100))
result <- qadf(y, tau = 0.5, model = "c", max_lags = 4)
print(result)
```

urstat *Comprehensive Unified Unit Root and Stationarity Testing*

Description

Runs a comprehensive battery of unit root and stationarity tests on one or more time series, producing formatted summary tables and an integration-order decision following the Elder and Kennedy (2001) strategy.

Usage

```
urstat(
  x,
  tests = "ALL",
  max_lag = 12L,
  crit = "BIC",
  pp_lag = 4L,
  kpss_lags = 8L,
  za_trim = 0.15,
  level = 0.05,
  stars = TRUE,
  strategy = TRUE
)
```

Arguments

x	A numeric vector, ts object, or a named list/data frame of numeric vectors.
tests	Character vector of tests to run. Possible values: "ADF", "PP", "KPSS", "ERS", "ZA", "KM". Default "ALL" runs all supported tests.
max_lag	Integer. Maximum lag order for ADF lag selection (default 12).
crit	Character. Information criterion for ADF lag selection: "BIC" (default) or "AIC".
pp_lag	Integer. Bandwidth (Newey-West lags) for PP test (default 4).
kpss_lags	Integer. Lag truncation for KPSS (default 8).
za_trim	Numeric. Trimming proportion for Zivot-Andrews test (default 0.15).
level	Numeric. Significance level used for decisions (default 0.05).
stars	Logical. Print significance stars (default TRUE).
strategy	Logical. Print Elder-Kennedy decision table (default TRUE).

Value

A list (invisibly) containing one element per series. Each element is itself a named list with components:

adf Results from ADF tests (list).

`pp` Results from PP tests (list).

`kpss` Results from KPSS tests (list).

`ers` Results from ERS/DF-GLS tests (list).

`za` Results from Zivot-Andrews test (list).

`decision` Character. Inferred integration order.

`process` Character. Suggested data transformation.

References

Elder, J. and Kennedy, P. E. (2001). Testing for unit roots: What should students be taught? *Journal of Economic Education*, 32(2), 137-146. doi:10.1080/00220480109595179

Dickey, D. A. and Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, 74(366), 427-431. doi:10.2307/2286348

Phillips, P. C. B. and Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335-346. doi:10.1093/biomet/75.2.335

Kwiatkowski, D., Phillips, P. C. B., Schmidt, P., and Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root. *Journal of Econometrics*, 54(1-3), 159-178. doi:10.1016/03044076(92)90104Y

Elliott, G., Rothenberg, T. J., and Stock, J. H. (1996). Efficient tests for an autoregressive unit root. *Econometrica*, 64(4), 813-836. doi:10.2307/2171846

Zivot, E. and Andrews, D. W. K. (1992). Further evidence on the great crash, the oil-price shock, and the unit-root hypothesis. *Journal of Business & Economic Statistics*, 10(3), 251-270. doi:10.1080/07350015.1992.10509904

Examples

```
set.seed(42)
x <- cumsum(rnorm(60))
res <- urstat(x, tests = c("ADF", "PP", "KPSS"), strategy = FALSE)
```

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