Package 'qadf'

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Type Package

Title Quantile Autoregressive Distributed Lag Unit Root Test

Version 1.0.0

Description Implements the Quantile Autoregressive Distributed Lag (QADF) unit root test proposed by Koenker and Xiao (2004) <doi:10.1198/016214504000001114>. The test examines unit root behaviour across the conditional distribution of a time series using quantile regression, providing a richer characterisation of persistence than standard ADF tests. Critical values follow Hansen (1995) <doi:10.1017/S0266466600009713>. Lag order selection is supported via AIC, BIC, or the t-statistic sequential testing approach.

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Encoding UTF-8

RoxygenNote 7.3.2

Depends R (>= 3.5.0)

Imports stats, quantreg

Suggests testthat (>= 3.0.0)

Config/testthat/edition 3

URL https://github.com/muhammedalkhalaf/qadf

BugReports https://github.com/muhammedalkhalaf/qadf/issues

NeedsCompilation no

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`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)
```

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