Package: qadf (via r-universe)

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Type Package

Title Quantile Autoregressive Distributed Lag Unit Root Test

Version 1.0.2

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/S0266466600009993>. 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

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

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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"` (largest lag whose last coefficient is significant at the 5% level).

Details

The quantile autoregression is estimated in levels,

$$Q_{y_t}(\tau) = \alpha_0(\tau) + \rho(\tau) y_{t-1} + \sum_{j=1}^{p} \alpha_j(\tau) \Delta y_{t-j},$$

with a linear trend added for `model = "ct"`. The lag order p is chosen from the ADF regression on a common sample. The statistic is equation (9) of Koenker and Xiao (2004),

$$t_n(\tau) = \frac{\hat{f}(F^{-1}(\tau))}{\sqrt{\tau(1-\tau)}} (Y_{-1}' P_X Y_{-1})^{1/2} (\hat{\rho}(\tau) - 1),$$

where P_X projects off the other regressors and the density is estimated by the difference quotient of the fitted conditional quantile at $\tau \pm h$ with the Hall-Sheather bandwidth h. It tests $H_0 : \rho(\tau) = 1$ against $H_1 : \rho(\tau) < 1$.

The limiting distribution depends on δ^2; the critical values are those of Hansen (1995) for the covariate augmented Dickey-Fuller test, linearly interpolated on the grid $\delta^2 = 0.1, \ldots, 1$.

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 $\hat{\delta}^2$, the squared correlation between Δy_t and $\psi_\tau(\hat{u}_t)$; it indexes the critical values.

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), interpolated in $\hat{\delta}^2$.

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/S0266466600009993

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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