

Package ‘BayesURTrend’

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Type Package

Title Bayesian Unit Root Test for Model with Maintained Trend

Version 0.1.0

Description Performs Bayesian unit root testing for time series models with maintained polynomial trend components as proposed by Chaturvedi and Kumar (2005) <[doi:10.1016/j.spl.2005.04.044](https://doi.org/10.1016/j.spl.2005.04.044)>. The package 'BayesURTrend' computes posterior odds ratios, Bayes factors, and posterior probabilities for unit root hypotheses against stationary alternatives in autoregressive models augmented with polynomial trends. Methodological foundations for Bayesian unit root testing under structural breaks and maintained trends are drawn from Schotman and van Dijk (1991) <[doi:10.1016/0304-4076\(91\)90038-F](https://doi.org/10.1016/0304-4076(91)90038-F)>, Phillips and Perron (1988) <[doi:10.1093/biomet/75.2.335](https://doi.org/10.1093/biomet/75.2.335)>, and Ouliaris et al. (1988) <[doi:10.1007/978-94-009-2953-1_10](https://doi.org/10.1007/978-94-009-2953-1_10)>.

License GPL (>= 3)

Encoding UTF-8

LazyData true

RoxygenNote 7.3.3

Depends R (>= 3.5.0)

Imports stats, graphics

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

VignetteBuilder knitr

NeedsCompilation no

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bayes_ur_test	<i>Bayesian Unit Root Test for Model with Maintained Trend</i>
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Description

Computes the posterior odds ratio, Bayes factor, and posterior probabilities for testing the unit root hypothesis in an autoregressive model with maintained polynomial trend, as proposed by Chaturvedi and Kumar (2005).

Usage

```
bayes_ur_test(y, p = 1, k = 1, a = 0, p0 = 0.5, V = NULL, n_grid = 200)
chaturvedi_test(y, p = 1, k = 1, a = 0, p0 = 0.5, V = NULL, n_grid = 200)
```

Arguments

y	A numeric vector or univariate time series.
p	Non-negative integer specifying the degree of the polynomial trend (default is 1 for linear trend).
k	Non-negative integer specifying the order of augmentation / lagged differences (default is 1).
a	Lower bound of the prior interval (a, 1) for autoregressive parameter rho under H1 (default is 0). Must satisfy $-1 < a < 1$.
p0	Prior probability of the unit root hypothesis H0 (default is 0.5). Must satisfy $0 < p0 < 1$.
V	Optional prior precision matrix for trend coefficients mu (p x p matrix) or scalar scaling parameter (default is $1e-4 * I_p$).
n_grid	Integer specifying the number of grid points for evaluating posterior density of rho under H1 (default is 200).

Value

An object of class "bayes_ur_test" and "htest" containing:

statistic	The posterior odds ratio (b01) in favor of the unit root hypothesis H0.
p.value	The posterior probability $P(H_0 y)$ of the unit root hypothesis.
bayes_factor	The Bayes factor (BF01) in favor of H0 relative to H1.
posterior_h0	Posterior probability of the unit root hypothesis H0.
posterior_h1	Posterior probability of the stationary alternative hypothesis H1.
rho_summary	Vector of summary statistics for rho under H1 (mean, sd, median, 2.5%, 97.5% quantiles).
rho_grid	Vector of evaluation grid points for rho in (a, 1).
rho_density	Vector of normalized posterior density values for rho under H1.
parameter	Named vector of test settings (p, k, a, p0).
method	Character string describing the test method.
data.name	Character string providing the data name.
estimates	Named vector of estimated parameter values.

References

- Chaturvedi, A., & Kumar, J. (2005). Bayesian unit root test for model with maintained trend. *Statistics & Probability Letters*, 74(1), 109–115. doi:[10.1016/j.spl.2005.04.044](https://doi.org/10.1016/j.spl.2005.04.044)
- Schotman, P., & van Dijk, H. K. (1991). A Bayesian analysis of the unit root in real exchange rates. *Journal of Econometrics*, 49(1-2), 195–238. doi:[10.1016/03044076\(91\)90038F](https://doi.org/10.1016/03044076(91)90038F)
- Phillips, P. C. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335–346. doi:[10.1093/biomet/75.2.335](https://doi.org/10.1093/biomet/75.2.335)

Examples

```
set.seed(123)
# Simulated random walk (Unit root process)
y_rw <- cumsum(rnorm(60))
res_rw <- bayes_ur_test(y_rw, p = 1, k = 1)
print(res_rw)
summary(res_rw)

# Stationary AR(1) process
y_stat <- numeric(60)
for (t in 2:60) y_stat[t] <- 0.5 * y_stat[t - 1] + rnorm(1)
res_stat <- bayes_ur_test(y_stat, p = 1, k = 1)
print(res_stat)
```

macro_data	<i>Simulated Macroeconomic Time Series Data</i>
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Description

A simulated univariate time series vector containing 100 observations exhibiting a random walk with drift, suitable for demonstrating unit root testing.

Usage

```
macro_data
```

Format

A numeric vector of length 100.

Source

Simulated dataset generated for package documentation and examples.

Examples

```
data(macro_data)
res <- bayes_ur_test(macro_data, p = 1, k = 1)
print(res)
```

plot.bayes_ur_test	<i>Plot Method for Bayesian Unit Root Test</i>
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Description

Plots the posterior density of the autoregressive parameter ρ under H_1 along with prior density and unit root probability.

Usage

```
## S3 method for class 'bayes_ur_test'
plot(x, ...)
```

Arguments

x	An object of class "bayes_ur_test".
...	Further graphical arguments.

Value

No return value, called for side effects (plotting).

print.bayes_ur_test	<i>Print Method for Bayesian Unit Root Test</i>
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Description

Prints a concise summary of the Bayesian unit root test results.

Usage

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

Arguments

x	An object of class "bayes_ur_test".
...	Further arguments passed to or from other methods.

Value

Invisibly returns the input object x.

summary.bayes_ur_test	<i>Summary Method for Bayesian Unit Root Test</i>
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Description

Provides detailed summary output for a Bayesian unit root test object.

Usage

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

Arguments

object	An object of class "bayes_ur_test".
...	Further arguments passed to or from other methods.

Value

Invisibly returns the input object object.

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