Package 'BayesPanelUR'

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Type Package

Title Bayesian Unit Root Test for Panel Data Models

Version 0.1.0

Description Implements the Bayesian unit root test for Panel Autoregressive (PAR) time series models developed by Kumar et al. (2016) <https://hdl.handle.net/10419/179393>. The package evaluates the unit root hypothesis (difference stationarity versus trend stationarity) in panel data using the Posterior Odds Ratio (POR). It accommodates PAR models with linear time trend as well as linear time trend with augmentation terms of arbitrary order. Full posterior probabilities, Bayes factors, and individual panel estimates are computed automatically.

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Imports stats, graphics

Suggests testthat (>= 3.0.0), knitr, rmarkdown

VignetteBuilder knitr

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NeedsCompilation no

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`BayesPanelUR-package` *Bayesian Unit Root Test for Panel Data Models*

Description

Implements the Bayesian unit root test for Panel Autoregressive (PAR) time series models developed by Kumar et al. (2016) <https://hdl.handle.net/10419/179393>. The package evaluates the unit root hypothesis (difference stationarity versus trend stationarity) in panel data using the Posterior Odds Ratio (POR). It accommodates PAR models with linear time trend as well as linear time trend with augmentation terms of arbitrary order. Full posterior probabilities, Bayes factors, and individual panel estimates are computed automatically.

Details

The main function of the package is `bayes_panel_ur`, which performs the Bayesian panel unit root test and computes posterior odds ratios, Bayes factors, and structural parameter estimates.

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References

Kumar, J., Chaturvedi, A., & Afifa, U. (2016). Bayesian unit root test for panel data. EERI Research Paper Series, No. 14/2016, Economics and Econometrics Research Institute (EERI), Brussels. <https://hdl.handle.net/10419/179393>

Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data: asymptotic and finite-sample properties. Journal of Econometrics, 108(1), 1-24.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. Journal of Econometrics, 115(1), 53-74.

bayes_panel_ur *Bayesian Unit Root Test for Panel Data Models*

Description

Evaluates the unit root hypothesis for panel data autoregressive (PAR) models using the Bayesian Posterior Odds Ratio (POR) approach of Kumar et al. (2016).

Usage

```
bayes_panel_ur(
  data,
  id = NULL,
  time = NULL,
  y = NULL,
  trend = TRUE,
  p = 0,
  a = 0.999,
  vtheta = 1,
  p0 = 0.5,
  lower = 0,
  upper = 0.9999
)
```

Arguments

data	A numeric matrix (T x n), wide data.frame, or long data.frame containing panel time series data.
id	Character string or column index for cross-sectional unit identifier (if data is in long format).
time	Character string or column index for time period identifier (if data is in long format).
y	Character string or column index for dependent variable (if data is in long format).
trend	Logical. If TRUE (default), includes a linear time trend in the model.
p	Non-negative integer specifying the order of augmentation terms (lagged differences). Default is 0.
a	Numeric bound parameter specifying the alternative hypothesis domain $S = (-a, 1)$. Default is 0.999.
vtheta	Numeric prior hyperparameter ϑ. Default is 1.0.
p0	Numeric prior probability of the null hypothesis $H_0 : \rho = 1$. Default is 0.5.
lower	Numeric lower integration limit for ρ. Default is 0.0.
upper	Numeric upper integration limit for ρ. Default is 0.9999.

Details

The function computes the Posterior Odds Ratio (POR) for testing the panel unit root hypothesis:

$$H_0 : \rho = 1 \quad \text{vs} \quad H_1 : \rho \in (-a, 1)$$

under a Panel Autoregressive PAR(1) process with cross-sectional heterogeneity in drift and trend, as well as optional augmentation terms of order p.

The posterior odds ratio β_{01} is calculated via exact 1D numerical integration of the marginal posterior integrand. The posterior probability of the null hypothesis $P(H_0|\text{data}) = \beta_{01}/(1+\beta_{01})$ serves as the Bayesian p-value.

Value

An S3 object of class `"bayes_panel_ur"` containing:

`statistic`	The test statistic value (Posterior Odds Ratio β_{01}).
`p.value`	The posterior probability of the null hypothesis $P(H_0\|\text{data})$.
`bayes_factor`	Bayes factor BF_{01} in favor of unit root H_0.
`bf10`	Bayes factor BF_{10} in favor of trend stationarity H_1.
`prob_H0`	Posterior probability of difference stationarity H_0.
`prob_H1`	Posterior probability of trend stationarity H_1.
`rho_hat`	Estimated AR coefficient $\hat{\rho}$ under the alternative hypothesis.
`se_rho`	Standard error of $\hat{\rho}$.
`method`	Character string describing the test method.
`data.name`	Character string giving the name of the dataset.
`estimates`	Data frame containing unit-specific structural parameter estimates.
`grid`	Data frame containing ρ grid values and posterior densities.
`parameter`	List of input hyperparameter settings.

References

Kumar, J., Chaturvedi, A., & Afifa, U. (2016). Bayesian unit root test for panel data. EERI Research Paper Series, No. 14/2016, Economics and Econometrics Research Institute (EERI), Brussels. <https://hdl.handle.net/10419/179393>

Examples

```
set.seed(123)
# Generate stationary panel data (T = 30, n = 3)
T_len <- 30
n <- 3
y_mat <- matrix(0, nrow = T_len, ncol = n)
for (i in 1:n) {
  y_mat[, i] <- 2 + 0.05 * (1:T_len) + stats::arima.sim(list(ar = 0.7), n = T_len)
}
colnames(y_mat) <- paste0("Unit_", 1:n)
```

```
# Run Bayesian panel unit root test
res <- bayes_panel_ur(y_mat, p = 0)
print(res)
summary(res)
```

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nps_nav *Net Asset Value (NAV) Data of Indian National Pension Scheme (NPS)*

Description

Panel dataset containing daily and monthly Net Asset Value (NAV) time series data for various pension fund managers across Tier-I and Tier-II schemes in India.

Usage

```
data(nps_nav)
```

Format

A data frame with 71 rows and 5 variables:

Date Date of observation (monthly average).

ICICI Monthly average NAV of ICICI Pension Fund.

KM Monthly average NAV of Kotak Mahindra (KM) Pension Fund.

SBI Monthly average NAV of State Bank of India (SBI) Pension Fund.

UTI Monthly average NAV of UTI Retirement Solutions.

Source

Economics and Econometrics Research Institute (EERI) Research Paper Series No. 14/2016. <https://hdl.handle.net/10419/1

References

Kumar, J., Chaturvedi, A., & Afifa, U. (2016). Bayesian unit root test for panel data. EERI Research Paper Series, No. 14/2016.

plot.bayes_panel_ur *Plot Method for bayes_panel_ur*

Description

Visualizes the posterior density of the AR coefficient ρ or panel data series.

Usage

```
## S3 method for class 'bayes_panel_ur'
plot(x, type = c("posterior", "series"), ...)
```

Arguments

x	An object of class "bayes_panel_ur".
type	Character string indicating plot type: "posterior" for the posterior density of ρ, or "series" for panel time series.
...	Further graphical parameters passed to plot.

Value

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

Examples

```
set.seed(123)
data_mat <- matrix(rnorm(100), nrow = 25, ncol = 4)
fit <- bayes_panel_ur(data_mat)
plot(fit, type = "posterior")
```

print.bayes_panel_ur *Print Method for bayes_panel_ur*

Description

Print Method for bayes_panel_ur

Usage

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

Arguments

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

Value

Invisibly returns the input object `x`.

Examples

```
set.seed(123)
data_mat <- matrix(rnorm(100), nrow = 25, ncol = 4)
fit <- bayes_panel_ur(data_mat)
print(fit)
```

`summary.bayes_panel_ur`

Summary Method for bayes_panel_ur

Description

Summary Method for bayes_panel_ur

Usage

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

Arguments

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

Value

Invisibly returns the input object `object`.

Examples

```
set.seed(123)
data_mat <- matrix(rnorm(100), nrow = 25, ncol = 4)
fit <- bayes_panel_ur(data_mat)
summary(fit)
```

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