Package: xtbhst (via r-universe)

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Title Bootstrap Slope Heterogeneity Test for Panel Data

Version 1.0.1

Description Implements the bootstrap slope heterogeneity test for panel data based on Blomquist and Westerlund (2015) <doi:10.1007/s00181-015-0978-z>. Tests the null hypothesis that slope coefficients are homogeneous across cross-sectional units. Provides both standard and adjusted Delta statistics with bootstrap p-values. Supports partialling out of control variables and cross-sectional averages for dealing with cross-sectional dependence.

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

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

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Imports stats, graphics, grDevices

Suggests testthat (>= 3.0.0), plm

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

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Contents

`plot.xtbhst` *Plot method for xtbhst objects*

Description

Produces diagnostic plots for the bootstrap slope heterogeneity test.

Usage

```
## S3 method for class 'xtbhst'
plot(x, which = c(1L, 2L), ask = NULL, ...)
```

Arguments

`x`	An object of class `"xtbhst"`.
`which`	Integer vector specifying which plots to produce: 1 = Bootstrap distribution of Delta, 2 = Bootstrap distribution of adjusted Delta, 3+ = Individual coefficient distributions. Default is `c(1, 2)`.
`ask`	Logical. If `TRUE`, prompt before each plot (default: `TRUE` if multiple plots and interactive session).
`...`	Additional arguments passed to plotting functions.

Value

Invisibly returns `NULL`.

`print.xtbhst` *Print method for xtbhst objects*

Description

Print method for xtbhst objects

Usage

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

Arguments

x	An object of class "xtbhst".
digits	Number of digits to display (default: 4).
...	Additional arguments (ignored).

Value

Invisibly returns the input object.

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summary.xtbhst *Summary method for xtbhst objects*

Description

Summary method for xtbhst objects

Usage

```
## S3 method for class 'xtbhst'
summary(object, digits = 4L, ...)
```

Arguments

object	An object of class "xtbhst".
digits	Number of digits to display (default: 4).
...	Additional arguments (ignored).

Value

Invisibly returns a list with summary statistics.

---

xtbhst *Bootstrap Slope Heterogeneity Test for Panel Data*

Description

Implements the bootstrap slope heterogeneity test based on Blomquist and Westerlund (2015). Tests the null hypothesis that slope coefficients are homogeneous across cross-sectional units.

Usage

```
xtbhst(
  formula,
  data,
  id,
  time,
  reps = 999L,
  blocklength = NULL,
  partial = NULL,
  csa = NULL,
  csa_lags = 0L,
  constant = TRUE,
  seed = NULL
)
```

Arguments

formula	A formula of the form y ~ x1 + x2 + ... specifying the dependent variable and regressors.
data	A data frame containing the panel data.
id	A character string specifying the name of the cross-sectional identifier variable.
time	A character string specifying the name of the time variable.
reps	Integer. Number of bootstrap replications (default: 999).
blocklength	Integer. Block length for the block bootstrap. If NULL (default), set automatically to floor(2 * T^(1/3)) where T is the number of time periods.
partial	Optional formula specifying variables to be partialled out. For example, ~ z1 + z2.
csa	Optional formula specifying variables for which cross-sectional averages should be computed and included. Used to handle cross-sectional dependence following Pesaran (2006).
csa_lags	Integer. Number of lags of the cross-sectional averages to include (default: 0).
constant	Logical. If TRUE (default), include a constant (partialled out).
seed	Optional integer seed for reproducibility.

Details

The test is based on the following Delta statistic:

$$\Delta = \sqrt{N}\frac{\tilde{S}/N - K}{\sqrt{2K}}$$

where $\tilde{S}$ is a weighted sum of squared deviations of individual slope estimates from the weighted pooled estimate.

The adjusted Delta statistic corrects for small sample bias:

$$\Delta_{adj} = \sqrt{N}\frac{\tilde{S}/N - K}{\sqrt{V}}$$

where $V = 2K(T - K - K_{partial} - 1)/(T - K_{partial} + 1)$.

Under the null hypothesis of slope homogeneity, both statistics are asymptotically standard normal. The bootstrap procedure provides finite-sample p-values.

The function requires a strongly balanced panel (all units observed for all time periods).

Value

An object of class `"xtbhst"` containing:

delta The Delta test statistic.

delta_adj The adjusted Delta test statistic.

pval Bootstrap p-value for the Delta statistic.

pval_adj Bootstrap p-value for the adjusted Delta statistic.

blocklength The block length used in the bootstrap.

reps Number of bootstrap replications.

N Number of cross-sectional units.

T Number of time periods.

K Number of regressors.

beta_i Matrix of individual slope estimates (N x K).

beta_fe Vector of weighted fixed effects (pooled) estimates.

delta_stars Vector of bootstrap Delta statistics.

delta_adj_stars Vector of bootstrap adjusted Delta statistics.

call The matched call.

References

Blomquist, J., & Westerlund, J. (2015). Panel bootstrap tests of slope homogeneity. *Empirical Economics*, 48(1), 1191-1204. doi:10.1007/s001810150978z

Pesaran, M. H. (2006). Estimation and inference in large heterogeneous panels with a multifactor error structure. *Econometrica*, 74(4), 967-1012. doi:10.1111/j.14680262.2006.00692.x

Examples

```
# Generate example panel data
set.seed(123)
N <- 20  # cross-sectional units
T_periods <- 30  # time periods

# Homogeneous slopes (H0 is true)
data_hom <- data.frame(
  id = rep(1:N, each = T_periods),
  time = rep(1:T_periods, N),
  x = rnorm(N * T_periods)
)
data_hom$y <- 1 + 0.5 * data_hom$x + rnorm(N * T_periods)
```

```
# Test for slope heterogeneity
result <- xtbhst(y ~ x, data = data_hom, id = "id", time = "time",
                 reps = 199, seed = 42)
print(result)
summary(result)
```

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