Package 'semTests'

January 18, 2024

Type Package

Title Goodness-of-Fit Testing for Structural Equation Models

Description Supports eigenvalue block-averaging p-values (Foldnes, Grønneberg, 2018) <doi:10.1080/10705511.2017.1373021>, penalized eigenvalue block-averaging p-values (Foldnes, Moss, Grønneberg, WIP), penalized regression p-values (Foldnes, Moss, Grønneberg, WIP), as well as traditional p-values such as Satorra-Bentler. All p-values can be calculated using unbiased or biased gamma estimates (Du, Bentler, 2022) <doi:10.1080/10705511.2022.2063870> and two choices of chi square statistics.

Version 0.5.0

License MIT + file LICENSE

Encoding UTF-8

Imports lavaan (>= 0.6-16), CompQuadForm, progressr, future.apply

Suggests covr, testthat (>= 3.0.0), psych

Config/testthat/edition 3

RoxygenNote 7.3.0

NeedsCompilation no

Author Jonas Moss [aut, cre] (<https://orcid.org/0000-0002-6876-6964>), Njål Foldnes [ctb] (-12957), Steffen Grønneberg [ctb] (<https://orcid.org/0000-0003-2785-6530>)

Maintainer Jonas Moss <jonas.moss.statistics@gmail.com>

Repository CRAN

Date/Publication 2024-01-18 20:40:02 UTC

R topics documented:

pvalues *Calculate p-values for one or two lavaan objects.*

Description

Calculate p-values for a lavaan object using several methods, including penalized eigenvalue block-averaging and penalized regression estimators. The choice peba=4 together with chisq = "rls" and ub is recommended. Multiple p-values can be returned simultaneously.

Usage

```
pvalues(
  object,
  trad = NULL,
  eba = NULL,
  peba = c(2, 4),
  pols = 2,
  unbiased = 1,
  chisq = c("rls", "trad"),
  extras = FALSE
)
```

Arguments

object	A lavaan object.
trad	List of traditional p-values to calculate. Not calculated if NULL.
eba	List of which eba p-values to calculate. Not calculated if NULL.
peba	List of which peba p-values to calculate. Not calculated if NULL.
pols	List of penalization parameters to use in the penalized OLS p-value. Not calculated if NULL.
unbiased	A number between 1 and 3. 1: Calculate using the biased gamma matrix (default). 2: Calculate using the unbiased gamma matrix. 3: Calculate using both gammas.
chisq	Which chi-square statistic to base the calculations on.
extras	Returns the estimated eigenvalues and basic test statistics if checked.

Details

The traditional methods include:

- pstd the standard *p*-value where the choice of chisq is approximated by a chi square distribution.
- psb Satorra-Bentler *p*-value. The *p*-value proposed by Satorra and Bentler (1994).
- pss The scaled and shifted *p*-value proposed by Asparouhov & Muthén (2010).

- `pcf` The Scaled F p-value proposed by Wu and Lin (2016).
- `pfull` p-value based on all eigenvalues of the asymptotic covariance matrix matrix.

The `eba` method partitions the eigenvalues into `j` equally sized sets (if not possible, the smallest set is incomplete), and takes the mean eigenvalue of these sets. Provide a list of integers `j` to partition with respect to. The method was proposed by Foldnes & Grønneberg (2018). `eba` with `j=2` or `j=4` appear to work best.

The `peba` method is a penalized variant of `eba`, described in (Foldnes, Moss, Grønneberg, WIP). It typically outperforms `eba`, and the best choice of `j` is typically `6`.

`pols` is a penalized regression method with a penalization term from ranging from 0 to infitity. Foldnes, Moss, Grønneberg (WIP) studied `pols=2`, which has good performance in a variety of contexts.

The `unbiased` argument is `TRUE` if the the unbiased estimator of the fourth order moment matrix (Du, Bentler, 2022) is used. If `FALSE`, the standard biased matrix is used. There is no simple relationship between p-value performance and the choice of `unbiased`.

The `chisq` argument controls which basic test statistic is used. The `trad` choice uses the chi square based on the normal discrepancy function (Bollen, 2014). The `rls` choice uses the reweighted least squares statistic of Browne (1974).

Value

A named vector of p-values.

References

Satorra, A., & Bentler, P. M. (1994). Corrections to test statistics and standard errors in covariance structure analysis. https://psycnet.apa.org/record/1996-97111-016

Asparouhov, & Muthén. (2010). Simple second order chi-square correction. Mplus Technical Appendix. https://www.statmodel.com/download/WLSMV_new_chi21.pdf

Wu, H., & Lin, J. (2016). A Scaled F Distribution as an Approximation to the Distribution of Test Statistics in Covariance Structure Analysis. Structural Equation Modeling. https://doi.org/10.1080/10705511.2015.1057733

Foldnes, N., & Grønneberg, S. (2018). Approximating Test Statistics Using Eigenvalue Block Averaging. Structural Equation Modeling, 25(1), 101–114. https://doi.org/10.1080/10705511.2017.1373021

Du, H., & Bentler, P. M. (2022). 40-Year Old Unbiased Distribution Free Estimator Reliably Improves SEM Statistics for Nonnormal Data. Structural Equation Modeling: A Multidisciplinary Journal, 29(6), 872–887. https://doi.org/10.1080/10705511.2022.2063870

Bollen, K. A. (2014). Structural Equations with Latent Variables (Vol. 210). John Wiley & Sons. https://doi.org/10.1002/9781118619179

Browne. (1974). Generalized least squares estimators in the analysis of covariance structures. South African Statistical Journal. https://doi.org/10.10520/aja0038271x_175

Index