

Package ‘ezCutoffs’

May 8, 2026

Date 2025-04-05

Type Package

Title Fit Measure Cutoffs in SEM

Version 1.0.2

Depends R (>= 2.15.1)

Description Calculate cutoff values for model fit measures used in structural equation modeling (SEM) by simulating and testing data sets (cf. Hu & Bentler, 1999 <[doi:10.1080/10705519909540118](https://doi.org/10.1080/10705519909540118)>) with the same parameters (population model, number of observations, etc.) as the model under consideration.

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Imports doSNOW, foreach, ggplot2, lavaan, moments, parallel, progress, stats, utils

Suggests boot

Maintainer Bjarne Schmalbach <bjarne.schmalbach@gmail.com>

Encoding UTF-8

RoxygenNote 6.1.1

Author Bjarne Schmalbach [aut, cre] (ORCID:
<<https://orcid.org/0000-0001-6853-412X>>),
Julien Patrick Irmer [aut],
Martin Schultze [aut]

NeedsCompilation no

Repository CRAN

Date/Publication 2025-04-08 09:50:01 UTC

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`compareFit`*Compare two Fit Measure Distributions Using the Wilcoxon-test*

Description

Significance test of the difference between two randomly generated fit index distributions using the Wilcoxon rank sum test.

Usage

```
compareFit(x, y, ...)
```

Arguments

<code>x</code>	An object of the class <code>ezCutoffs</code> to use in comparison.
<code>y</code>	A second <code>ezCutoffs</code> object to compare <code>x</code> to.
<code>...</code>	Additional arguments to pass to wilcox.test .

Details

Non-overlapping fit measures will be disregarded by the function.

Value

An object of the class `wilc_result`, inspectable via `summary`.

See Also

[ezCutoffs](#)

Examples

```
## model specification examples

# simple uni-factorial model
model <- "F1 =~ a1 + a2 + a3 + a4 + a5"

## two function calls
a <- ezCutoffs(model = model, n_obs = 1000, n_rep = 10, n_cores = 1, normality = "assumed")
b <- ezCutoffs(model = model, n_obs = 1000, n_rep = 10, n_cores = 1, normality = "empirical")

## comparison of the fit measure distributions yielded by the simulations
w <- compareFit(a, b)
summary(w)
```

Description

Calculate cutoff values for model fit measures used in structural equation modeling (SEM) by simulating and testing data sets (cf. Hu & Bentler, 1999 <doi:10.1080/10705519909540118>) with the same parameters (population model, number of observations, etc.) as the model under consideration.

Usage

```
ezCutoffs(model = NULL, data = NULL, n_obs = NULL, n_rep = 1000,
  fit_indices = c("chisq", "cfi", "tli", "rmsea", "srmr"),
  alpha_level = 0.05, normality = "assumed", missing_data = FALSE,
  bootstrapped_ci = FALSE, n_boot = 1000, boot_alpha = 0.05,
  boot_internal = FALSE, n_cores = NULL, ...)
```

Arguments

model	lavaan -style Syntax of a user-specified model.
data	A data frame containing the variables specified in model.
n_obs	Specifies the number of observations. Only needed if no data frame is given. Can be given as a numeric vector representing the exact group sizes in multi-group analyses. In this case, the grouping variable needs to be called "group".
n_rep	Number of replications.
fit_indices	Character vector, containing a selection of fit indices for which to calculate cutoff values. Only measures produced by fitMeasures can be chosen.
alpha_level	Type I-error rate for the generated cutoff values: Between 0 and 1; 0.05 per default.
normality	Specify distributional assumptions for the simulated data: Either "assumed" for normal distribution, or "empirical" for distributions based on the skewness and kurtosis values of the empirical data.
missing_data	Specify handling of missing values: Either FALSE to generate complete data sets, or TRUE to generate data with the same number of missing values on the observed variables as in the empirical data.
bootstrapped_ci	Specify whether a bootstrapped confidence interval for the empirical model fit statistics should be drawn; default = FALSE.
n_boot	Number of replications in bootstrap for confidence intervals for empirical model fit statistics.
boot_alpha	Type I-error rate chosen for the bootstrap-confidence interval: Between 0 and 1; 0.05 per default.

<code>boot_internal</code>	Whether to use the internal bootstrap implemented in <code>bootstrapLavaan</code> or a standard implementation in the <code>boot</code> package. Defaults to FALSE
<code>n_cores</code>	The number of cores to use. If NULL (the default) all available cores will be used.
<code>...</code>	Additional arguments to pass to <code>lavaan</code> .

Details

`model` is expected in standard lavaan nomenclature. The typical pre-multiplication mechanism is supported, with the exception of vectors (see Examples). Multigroup models should instead be specified using the `group` argument.

If data is not specified, the program will generate data based on the given `model` and `n_obs`. A numeric vector would signify multiple groups and `group` needs to be set to "group" in this case. Otherwise, `n_obs` is disregarded.

`missing_data = TRUE` assumes that the data is missing completely at random. That, is missings should not be distributed unevenly in multigroup models, for instance.

`bootstrapped_ci = "TRUE"` Returns a nonparametric bootstrap confidence interval that quantifies the uncertainty within a data set with regard to the empirical fit indices. Larger sample sizes should, under ideal circumstances, have smaller confidence intervals. For more information see, e.g., Efron (1981; 1987). Bootstrapping uses the `library(boot)` and (if available) several CPUs to compute the confidence intervals via `snow`.

`...` allows the user to pass lavaan arguments to the model fitting procedure. Options include multi-group, repeated measures, growth curve, and multilevel models.

Value

An object of the class `ezCutoffs`, inspectable via `print`, `summary`, `plot`, and `compareFit`

References

Efron, D. (1981). Nonparametric estimates of standard error: The jackknife, the bootstrap and other methods, *Biometrika*, 68(3), 589-599. doi: 10.1093/biomet/68.3.589

Efron, B. (1987). Better bootstrap confidence intervals. *Journal of the American statistical Association*, 82(397), 171-185.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55. doi: 10.1080/10705519909540118

See Also

[compareFit](#)

Examples

```
## model specification examples

# simple uni-factorial model
model1 <- "F1 =~ a1 + a2 + a3 + a4 + a5"

# path model
model2 <- "m ~ 0.6*x1
          m ~ 0.5*x2
          m ~ 0.4*x3
          y ~ 0.7*m"

# two-factorial model with some exemplary pre-multiplications
model3 <- "F1 =~ NA*a1 + a2 + a3 + 0.8*a4 + a5
          F2 =~ b1 + start(0.8)*b2 + b3 + equal('F2 =~ b2')*b4 + b5
          F1 ~~ 0*F2"

## function call
out <- ezCutoffs(model = model1, n_obs = 1000, n_rep = 10, n_cores = 1)

out <- ezCutoffs(
  model = model1, n_obs = c(300, 400), n_rep = 9999, fit_indices = c("cfi.robust"),
  estimator = "MLM", group = "group", group.equal = c("loadings", "intercepts"), n_cores = 1
)

## retrieve output
summary(out)
plot(out)
```

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