Title

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estat gof — Goodness-of-fit statistics

Description

`estat gof` is for use after `sem` but not `gsem`.

`estat gof` displays a variety of overall goodness-of-fit statistics.

Menu

Statistics > SEM (structural equation modeling) > Goodness of fit > Overall goodness of fit

Syntax

`estat gof` [, *options*]

options	Description
`stats(`*statlist*`)`	statistics to be displayed
`nodescribe`	suppress descriptions of statistics

statlist	Description
`chi2`	χ^2 tests; the default
`rmsea`	root mean squared error of approximation
`ic`	information indices
`indices`	indices for comparison against baseline
`residuals`	measures based on residuals
`all`	all the above

Note: The statistics reported by `chi2`, `rmsea`, and `indices` are dependent on the assumption of joint normality of the observed variables. If `vce(sbentler)` is specified with `sem`, modified versions of these statistics that are computed using the Satorra–Bentler scaled χ^2 statistics will also be reported.

Options

`stats(`*statlist*`)` specifies the statistics to be displayed. The default is `stats(chi2)`.

`stats(chi2)` reports the model versus saturated test and the baseline versus saturated test. The saturated model is the model that fits the covariances perfectly.

The model versus saturated test is a repeat of the test reported at the bottom of the `sem` output.

In the baseline versus saturated test, the baseline model includes the means and variances of all observed variables plus the covariances of all observed exogenous variables. For a covariance model (a model with no endogenous variables), the baseline includes only the means and variances of observed variables. Be aware that different authors define the baseline model differently.

`stats(rmsea)` reports the root mean squared error of approximation (RMSEA) and its 90% confidence interval, and pclose, the p-value for a test of close fit, namely, RMSEA < 0.05. Most interpreters of this test label the fit close if the lower bound of the 90% CI is below 0.05 and label the fit poor if the upper bound is above 0.10. See Browne and Cudeck (1993).

`stats(ic)` reports the Akaike information criterion (AIC) and Bayesian (or Schwarz) information criterion (BIC). These statistics are available only after estimation with `sem method(ml)` or `method(mlmv)`. These statistics are used not to judge fit in absolute terms but instead to compare the fit of different models. Smaller values indicate a better fit. Be aware that there are many variations (minor adjustments) to statistics labeled AIC and BIC. Reported here are statistics that match `estat ic`; see [R] **estat ic**.

To compare models that use statistics based on likelihoods, such as AIC and BIC, models should include the same variables; see [SEM] **lrtest**. See Akaike (1987), Schwarz (1978), and Raftery (1993).

`stats(indices)` reports CFI and TLI, two indices such that a value close to 1 indicates a good fit. CFI stands for comparative fit index. TLI stands for Tucker–Lewis index and is also known as the nonnormed fit index. See Bentler (1990).

`stats(residuals)` reports the standardized root mean squared residual (SRMR) and the coefficient of determination (CD).

A perfect fit corresponds to an SRMR of 0. A good fit is a small value, considered by some to be limited to 0.08. SRMR is calculated using the first and second moments unless `sem` option `nomeans` was specified or implied, in which case SRMR is calculated based on second moments only. Some software packages ignore the first moments even when available. See Hancock and Mueller (2006, 157).

Concerning CD, a perfect fit corresponds to a CD of 1. CD is like R^2 for the whole model.

`stats(all)` reports all the statistics. You can also specify just the statistics you wish reported, such as

```
. estat gof, stats(indices residuals)
```

`nodescribe` suppresses the descriptions of the goodness-of-fit measures.

Remarks and examples

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See [SEM] **example 4**.

Stored results

`estat gof` stores the following in `r()`:

Scalars

`r(chi2_ms)`	test of target model against saturated model
`r(df_ms)`	degrees of freedom for `r(chi2_ms)`
`r(p_ms)`	p-value for `r(chi2_ms)`
`r(chi2sb_ms)`	Satorra–Bentler scaled test of target model against saturated model
`r(psb_ms)`	p-value for `r(chi2sb_ms)`
`r(chi2_bs)`	test of baseline model against saturated model
`r(df_bs)`	degrees of freedom for `r(chi2_bs)`
`r(p_bs)`	p-value for `r(chi2_bs)`
`r(chi2sb_bs)`	Satorra–Bentler scaled test of baseline model against saturated model
`r(psb_bs)`	p-value for `r(chi2sb_bs)`
`r(rmsea)`	root mean squared error of approximation
`r(lb90_rmsea)`	lower bound of 90% CI for RMSEA
`r(ub90_rmsea)`	upper bound of 90% CI for RMSEA
`r(pclose)`	p-value for test of close fit: RMSEA $<$ 0.05
`r(rmsea_sb)`	RMSEA using Satorra–Bentler χ^2
`r(aic)`	Akaike information criterion
`r(bic)`	Bayesian information criterion
`r(cfi)`	comparative fit index
`r(cfi_sb)`	CFI using Satorra–Bentler χ^2
`r(tli)`	Tucker–Lewis fit index
`r(tli_sb)`	TLI using Satorra–Bentler χ^2
`r(cd)`	coefficient of determination
`r(srmr)`	standardized root mean squared residual
`r(N_groups)`	number of groups

Matrices

`r(nobs)`	sample size for each group

References

Akaike, H. 1987. Factor analysis and AIC. *Psychometrika* 52: 317–332.

Bentler, P. M. 1990. Comparative fit indexes in structural models. *Psychological Bulletin* 107: 238–246.

Browne, M. W., and R. Cudeck. 1993. Alternative ways of assessing model fit. Reprinted in *Testing Structural Equation Models*, ed. K. A. Bollen and J. S. Long, pp. 136–162. Newbury Park, CA: Sage.

Hancock, G. R., and R. O. Mueller, ed. 2006. *Structural Equation Modeling: A Second Course*. Charlotte, NC: Information Age Publishing.

Raftery, A. E. 1993. Bayesian model selection in structural equation models. Reprinted in *Testing Structural Equation Models*, ed. K. A. Bollen and J. S. Long, pp. 163–180. Newbury Park, CA: Sage.

Schwarz, G. 1978. Estimating the dimension of a model. *Annals of Statistics* 6: 461–464.

Also see

[SEM] **example 4** — Goodness-of-fit statistics

[SEM] **estat ggof** — Group-level goodness-of-fit statistics

[SEM] **estat eqgof** — Equation-level goodness-of-fit statistics

[SEM] **estat residuals** — Display mean and covariance residuals

[SEM] **methods and formulas for sem** — Methods and formulas for sem

[SEM] **sem postestimation** — Postestimation tools for sem

[R] **estat ic** — Display information criteria