Bartlett's test

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In statistics, **Bartlett's test** (see Snedecor and Cochran, 1989) is used to test if *k* samples are from populations with equal variances. Equal variances across samples is called homoscedasticity or homogeneity of variances. Some statistical tests, for example the analysis of variance, assume that variances are equal across groups or samples. The Bartlett test can be used to verify that assumption.

Bartlett's test is sensitive to departures from normality. That is, if the samples come from non-normal distributions, then Bartlett's test may simply be testing for non-normality. Levene's test and the Brown–Forsythe test are alternatives to the Bartlett test that are less sensitive to departures from normality.[1]

The test is named after Maurice Stevenson Bartlett.

Specification

Bartlett's test is used to test the null hypothesis, H_0 that all *k* population variances are equal against the alternative that at least two are different.

If there are *k* samples with size n_i and sample variances S_i^2 then Bartlett's test statistic is

$$\chi^2 = \frac{(N-k)\ln(S_p^2) - \sum_{i=1}^{k}(n_i-1)\ln(S_i^2)}{1 + \frac{1}{3(k-1)}\left(\sum_{i=1}^{k}\left(\frac{1}{n_i-1}\right) - \frac{1}{N-k}\right)}$$

where $N = \sum_{i=1}^{k} n_i$ and $S_p^2 = \frac{1}{N-k}\sum_i (n_i-1)S_i^2$ is the pooled estimate for the variance.

The test statistic has approximately a χ^2_{k-1} distribution. Thus the null hypothesis is rejected if $\chi^2 > \chi^2_{k-1,\alpha}$ (where $\chi^2_{k-1,\alpha}$ is the upper tail critical value for the χ^2_{k-1} distribution).

Bartlett's test is a modification of the corresponding likelihood ratio test designed to make the approximation to the χ^2_{k-1} distribution better (Bartlett, 1937).

References

1. *NIST/SEMATECH e-Handbook of Statistical Methods*. Available online, URL: http://www.itl.nist.gov/div898/handbook/eda/section3/eda357.htm. Retrieved December 31, 2013.

- Bartlett, M. S. (1937). "Properties of sufficiency and statistical tests". *Proceedings of the Royal Statistical Society*, Series A 160, 268–282 JSTOR 96803 (http://www.jstor.org/stable/96803)
- Snedecor, George W. and Cochran, William G. (1989), *Statistical Methods*, Eighth Edition, Iowa State University Press. ISBN 978-0-8138-1561-9

External links

- NIST page on Bartlett's test (http://www.itl.nist.gov/div898/handbook/eda/section3/eda357.htm)

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