Homogeneity of variance test

One of the assumptions of analysis of variance is that variances of the observations in the individual groups are equal, a situations referred to as *homogeneity of variance* (and the absence of which is referred to *heteroscedasticty*). Of equal importance to its role in satisfying the assumptions of ANOVA, homogeneity of group variances, or the absence of it, may be of equal scientific interest as whether or not the means of the groups are equal.

Bartlett's test of the null hypothesis of equality of group variances is based on comparing (the logarithm) of a pooled estimate of variance (across all of the groups) with the sum of the logarithms of the variances of individual groups. The test statistic is given by

$$M = v \log s^2 - \sum_{i=1}^{k} v_i \log s_i^2, \text{ where}$$

$$v_i = (n_i - 1),$$

$$v = \sum_{i=1}^{k} v_i,$$

$$s_i^2 = \frac{1}{(n_i - 1)} \sum_{j=1}^{n_i} (X_{ij} - \bar{X}_i)^2, \text{ and}$$

$$s^2 = \frac{\sum_{i=1}^{k} v_i s_i^2}{v}.$$

To evaluate the significance of M, the value of $X^2 = M / C$, (i.e. Chi-squared $= M / C$) where

$$C = 1 + \frac{1}{3(k-1)} \left(\left(\sum_{i=1}^{k} \frac{1}{v_i} \right) - \frac{1}{v} \right)$$

can be compared to the Chi-square distribution with $k-1$ degrees of freedom. $\left(X_{k-1}^2 \right)$

Bartlett's test is known to be sensitive to non-normality, and other related tests can be used when that situation arises.