Breusch-Pagan-Godfrey Test

Heteroscedastic data.

The Breusch-Pagan-Godfrey Test (sometimes shorted to the Breusch-Pagan test) is a test for heteroscedasticity of errors in regression. Heteroscedasticity means "differently scattered"; this is opposite to homoscedastic, which means "same scatter." Homoscedasticity in regression is an important assumption; if the assumption is violated, you won't be able to use regression analysis.

Running the Test

The test statistic for the Breusch-Pagan-Godfrey test is:

N * R^2 (with k degrees of freedom)

Where:

- **n = sample size**
- **R^2 = R^2(Coefficient of Determination) of the regression of squared residuals from the original regression.**
- **k = number of independent variables.**

The test statistic approximately follows a chi-square distribution.

- **The null hypothesis for this test is that the error variances are all equal.**
- **The alternate hypothesis is that the error variances are *not* equal. More specifically, as Y increases, the variances increase (or decrease).**

A small chi-square value (along with an associated small p-value) indicates the null hypothesis is true (i.e. that the variances are all equal).

Note that the Breush-Pagan test measures how errors increase across the explanatory variable, Y. The test assumes the error variances are due to a linear function of one or more explanatory variables in the model. That means heteroskedasticity could still be present in your regression model, but those errors (if present) are not correlated with the Y-values.

If you suspect that a small subset of values is causing heteroskedasticity, you can run a modified Breusch-Pagan test on those values alone.

Caution: Some authors (including Bickel(1978) and Koenker(1981) have suggested the Breusch-Pagan-Godfrey test statistic may not be accurate for non-normal data.