An estimation method for general heteroscedastic structures in linear models

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Abstract

We consider the classical linear model $\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon}$, where $\boldsymbol{\beta}$ is a vector of unknown regression parameters to be estimated based on a data set consisting of a vector of response variable, $\mathbf{y}$, and a deterministic matrix of predictor variables $\mathbf{X}$. The vector $\boldsymbol{\varepsilon}$ stands for the random errors with mean zero and variance-covariance matrix $E[\boldsymbol{\varepsilon}\boldsymbol{\varepsilon}'] = \boldsymbol{\Sigma} = \text{diag}\left[\sigma_1^2, \sigma_2^2, \ldots, \sigma_n^2\right]$, since the assumption that the errors have constant variance is not always realistic in many practical applications. In order to estimate all the parameters in the model, some structure on $\boldsymbol{\Sigma}$ is needed. See, for example, Judge et al. (1980) where several structures for the variance are analyzed.

In this work, we propose a general method to estimate the variance and the model expectation, under very general conditions on the structure of the variance.

Keywords

Linear regression, Heteroscedasticity.

References

Judge, G.G., W.E. Griffiths, R.C. Hill, H. Lütkepohl, and T.C. Lee (1980). *The Theory and Practice of Econometrics*, John Wiley and Sons.