L models and multiple regressions designs

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Abstract

Suppose that we have $\mathbf{y} \sim N(\mu; \sigma^2 \mathbf{I}_n)$ with $\mu \in \Omega = R(\mathbf{L})$ so that $\mu = \mathbf{Ld}$. We say that the model of fixed effects $\mathbf{y} = \mathbf{Ld} + \mathbf{e}$ is a $\mathbf{L}$ orthogonal model if the column vectors of $\mathbf{L}$ are linearly independent, and $\mathbf{d} = \sum_i \mathbf{X}\beta_i$, with the matrices $\mathbf{M}_i = \mathbf{X}_i \mathbf{X}_i'$ constituting a base for a complete commutative Jordan algebra. We say that $\mathbf{d}$ is the original model.

Special cases of the $\mathbf{L}$ models correspond to block-wise diagonal matrices $\mathbf{L} = D(\mathbf{L}_1, ..., \mathbf{L}_c)$. In multiple regression this matrix will be of the form

$$\mathbf{L} = D(\mathbf{X}_1^\circ, ..., \mathbf{X}_c^\circ)$$

with $\mathbf{X}_j^\circ$ the model matrices of the individual regressions, while the original model will have fixed effects. In this way, we overcome the usual restriction of requiring all regressions to have the same model matrix.

We approach the Unbalanced case.

Keywords

Orthogonal models, $\mathbf{L}$ models, Multiple regression models, Commutative Jordan algebras.

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