systemfit: A Package to Estimate Simultaneous Equation Systems in R

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Many theoretical models that are econometrically estimated consist of more than one equation. In this case, the disturbance terms of these equations are likely to be contemporaneously correlated, because some unconsidered factors that influence the disturbance term in one equation probably influence the disturbance terms in other equations of this model, too. Ignoring this contemporaneous correlation and estimating these equations separately leads to inefficient parameter estimates. However, estimating all equations simultaneously, taking the covariance structure of the residuals into account, leads to efficient estimates. This estimation procedure is generally called "Seemingly Unrelated Regression" (SUR) (Zellner, 1962). Another reason to estimate an equation system simultaneously are cross-equation parameter restrictions.[1] These restrictions can be tested and/or imposed only in a simultaneous estimation approach.

Furthermore, these models can contain variables that appear on the left-hand side in one equation and on the right-hand side of another equation. Ignoring the endogeneity of these variables can lead to inconsistent parameter estimates. This simultaneity bias can be circumvented by applying a "Two-Stage Least Squares" (2SLS) or "Three-Stage Least Squares" (3SLS) estimation of the equation system.

The **systemfit** package provides the capability to estimate linear equation systems in R (R Development Core Team, 2005). Although linear equation systems can be estimated with several other statistical and econometric software packages, **systemfit** has several advantages. First, all estimation procedures are publicly available in the source code. Second, the estimation algorithms can be easily modified to meet specific requirements. Third, the (advanced) user can control estimation details generally not available in other software packages by overriding reasonable defaults.

The **systemfit** package has been tested on a variety of datasets and has produced satisfactory for a few years. On the useR! conference, we would like to present some of the basic features of the **systemfit** package, some of the many details that can be controlled by the user, and the statistical tests for parameter restrictions and consistency of 3SLS estimation that are included in the package. While the **systemfit** package performs the basic fitting methods, more sophisticated methods are still missing. We hope to implement missing functionalities in the near future — maybe with the help of other useRs.

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[1] Especially the economic theory suggests many cross-equation parameter restrictions (e.g. the symmetry restriction in demand models).

References

R Development Core Team (2005). *R: A language and environment for statistical computing.* R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org.

Zellner A (1962). "An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias." *Journal of the American Statistical Association*, **57**, 348–368.