3SLS

3SLS (NOHETERO, NOINTERU, MAXITW=0, COVU=*own or residual covariance matrix*,
NOROBUST,INST=(*list of instrumental variables*), nonlinear options)
list of equation names ;

Function:

3SLS obtains three stage least squares estimates of a set of nonlinear equations. It is a special case of LSQ with the options set for 3SLS estimation. The LSQ entry has a more complete description of the command.

Three stage least squares estimates are consistent and asymptotically normal, and, under some conditions, asymptotically more efficient than single equation estimates. 3SLS is asymptotically less efficient than FIML.

Usage:

Three stage least squares is a combination of multivariate regression (SUR estimation) and two stage least squares. It obtains instrumental variable estimates, taking into account the covariances across equation disturbances as well. The objective function for three stage least squares is the sum of squared transformed fitted residuals.

Specification of the 3SLS command is the same as that of the LSQ command, except that the INST list is required. The variables in the INST list will be used to instrument all the equations, so that the actual instrumental variable matrix has the form given by Jorgenson and Laffont, rather than that given by Amemiya. In a simultaneous equations model, this means that a variable cannot be exogenous to one equation and endogenous to another. If you need equation-specific instruments use the GMM command with the MASK option.

Example:

Klein-I model:

```
FORM(VARPREF=C_)  CONS     CX  C P P(-1) W;
FORM(VARPREF=I_)  INV       I     C P P(-1) K(-1);
FORM(VARPREF=W_) WAGES  W1  C E E(-1) TM;
3SLS(INST=(C,TM,W2,G,TX,P(-1),K(-1),E(-1))) CONS INV WAGES;
```

Method:

Three stage least squares estimates are obtained by estimating a set of nonlinear (or linear) equations with cross-equation constraints imposed, but with a diagonal covariance matrix of the disturbances across equations. This is the constrained two stage least squares estimator. The parameter estimates thus obtained are used to form a consistent estimate of the covariance matrix of the disturbances, which is then used as a weighting matrix when the model is reestimated to obtain new values of the parameters.

The actual method of parameter estimation is the Gauss-Newton method for nonlinear least squares described under LSQ. If the model is linear in the parameters and endogenous variables, only two iterations will be required, one to obtain the

covariance matrix estimate, and one to obtain parameter estimates.

For further details on the properties of the linear three stage least squares estimator see the Theil text or Zellner and Theil. Note: Zellner and Theil used some special assumptions to simplify their calculations, so their results for the Klein-I model are not correct. For correct Klein-I results, see Zellner and Thornber or Theil. For the nonlinear three stage least squares estimator, see Amemiya and Jorgenson and Laffont. The method of estimation in TSP is described more fully in Berndt, Hall, Hall, and Hausman.

References:

Amemiya, Takeshi, "The Maximum Likelihood and the Nonlinear Three-Stage Least Squares Estimator in the General Nonlinear Simultaneous Equation Model," **Econometrica,** May 1977, pp. 955-975.

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