
GMM(HETERO, ITEROC, ITERU, LSQSTART,
COVOC=OWN or *covariance matrix of orthogonality conditions*,
COVU=*covariance matrix of residuals*, INST=*list of instruments*,
KERNEL=*spectral density kernel type*, MASK=matrix of zeros and ones,
NMA=*number of autocorrelation terms*, OPTCOV, nonlinear options)
list of equations;

Function:

GMM does General Methods of Moments estimation on a set of orthogonality conditions which are the products of equations and instruments. Initial conditions for estimation are obtained with three-stage least squares. The instrument list may be different for each equation (see the MASK option) and the form of the covariance matrix used for weighting the estimator is under user control (the HETERO option for heteroskedastic-consistency and the NMA= option for moving average disturbances).

Usage:

List the instruments in the INST= option and list the equations after the options; the products of these two are the orthogonality conditions, which are minimized in the metric of an estimate of their expected covariance (computed using 3SLS estimates of the parameters, unless the NOLSQSTART option has been specified). If the HETERO and NMA= options are not used, this coincides with conventional 3SLS estimation.

The GMM estimator prints the Sargan or J test of overidentifying restrictions if the degrees of freedom are positive. If you want to nest overidentifying tests of a series of models, be sure to specify the NOLSQSTART option so that the variance-covariance matrix of the OC's will be held fixed across the tests (otherwise the chi-squared for the difference between two nested model may have the wrong sign).

Options:

COVOC= covariance matrix of the orthogonality conditions. The default is to compute starting values with 3SLS and form the covariance matrix from these.

COVOC=OWN computes residuals from the current starting values and forms the covariance matrix from these.

COVU= covariance matrix of residuals. This is used for the initial 3SLS estimates if the default LSQSTART option is in effect. The default is the identity matrix. This option is the same as the old WNAME= option in LSQ.

HETERO/NOHETERO specifies conditional heteroscedasticity of the residuals, and causes the COVOC matrix to include interaction terms of the residuals and the derivatives with respect to the parameters. Specify this option to obtain the usual Hansen or Chamberlain estimator. When HETERO is on, GMM checks that the number of OC's is less that the number of observations so that COVOC will be positive definite (if not, an error message is printed).

INST= list of instrumental variables, orthogonal to the residuals of the supplied equations by assumption. In some models these variables are referred to as the "information set." Don't forget to include C, the constant, unless your model does not require one.

ITEROC/**NOITEROC** causes iteration on the COVOC matrix. Normally it is left fixed at its initial estimate. If MASK and LSQSTART are used, one iteration is made on the COVOC matrix. This also occurs if NOLSQSTART is used and COVOC= is not specified.

ITERU/NOITERU causes iteration on the COVU matrix. This is the same as the old MAXITW= option in LSQ.

KERNEL=**BARTLETT** or PARZEN. The spectral density kernel used to insure positive definiteness of the COVOC matrix when NMA > 0. BARTLETT is discussed by Newey and West, while PARZEN is discussed by Gallant (both are reviewed by Andrews).

LSQSTART/NOLSQSTART specifies if 3SLS should be used to obtain starting values for the parameters and COVOC. NOLSQSTART should be specified if you are restarting iterations with old parameter values and a COVOC matrix. This will be important for testing (see the discussion above).

MASK= a matrix of zeroes and ones which specifies which instruments are to be used for which equations. The matrix is # of instruments by # of equations and the default is a matrix of ones (all instruments used for all equations).

NMA= number of autocorrelation terms (AR and/or MA) to be used in computing COVOC. Some forecasting-type models imply a given NMA value, but other models have no natural choice. See the Andrews reference for automatic bandwidth selection procedures. When there are missing values in the series, NMA does not include terms which cross the gaps in the data. This is useful in panel data estimation.

OPTCOV/**NOOPTCOV** specifies whether or not the COVOC matrix is optimal. Under the default NOOPTCOV, the @VCOV matrix is computed using the "sandwich" formula of Hansen's Theorem 3.1 (p.1042). This is appropriate, for example, if the user has supplied a COVOC matrix, but has not scaled it properly. Note: in this (improperly scaled COVOC) case, the @GMMOVID statistic will be invalid. When OPTCOV is in effect, formula (10) of Hansen's Theorem 3.2 (p.1048) is used for the @VCOV matrix. When the user has not supplied a COVOC matrix, the OPTCOV and NOOPTCOV options produce almost exactly the same results. The only difference is due to the difference between the COVOC matrix that was used for iterations, and the COVOC matrix evaluated at the final parameter/residual values. This difference is usually small.

Examples:

```
GMM(INST=(C,Z1-Z10),NMA=2,HET) EQ1 EQ2;
```

To exclude Z2 as instrument for EQ1, Z1 as instrument for EQ2:

```
READ(NROW=3,NCOL=2) SEL;
  1 1
  1 0
  0 1;         ? C,Z1 enter EQ1; C,Z2 enter EQ2
GMM(INST=(C,Z1,Z2),MASK=SEL) EQ1 EQ2;
```

Method:

See the first Hansen reference for most of the details. If the equations are nonlinear, the iteration method is the usual LSQ method with analytical derivatives (a variant of the method of scoring). See our web page for examples of the 1-step and 2-step estimators described by Arellano and Bond for panel data with first differences.

Output:

The following results are stored:

Name	Type	Length	Variable Description
@PHI	scalar	1	E'PZ*E, the objective function for instrumental variable estimation.
@GMMOVID	scalar	1	test of overidentifying restrictions (@PHI*@NOB)
%GMMOVID	scalar	1	P-value of the above test (using degrees of freedom)
@NOVID	scalar	1	number of overidentifying restrictions (degrees of freedom)
@RNMS	list	#params	Parameter names.
@COEF	vector	#params	Estimated values of parameters, also stored under their names.
@SES	vector	#params	Standard Errors of estimated parameters.
@T	vector	#params	T-statistics.
@SSR	vector	#eqs	Sum of the squared residuals for each of the equations, stored in a vector.
@YMEAN	vector	#eqs	Mean of the dependent variable for each of the equations, stored in a vector.
@SDEV	vector	#eqs	Standard deviation of the dependent variable for each of the equations, stored in a vector.
@S	vector	#eqs	Standard error of each of the equations, stored in a vector.
@DW	vector	#eqs	Durbin-Watson statistic for each equation, stored in a vector.
@RSQ	vector	#eqs	R-squared for each equation.
@ARSQ	vector	#eqs	Adjusted R-squared for each equation.
@OC	vector	#eqs*#inst by 1	Orthogonality conditions.
@COVOC	matrix	#eqs*#inst by #eqs*#inst	Estimated covariance of OC.
@COVU	matrix	#eqs*#eqs	Residual covariance matrix.
@VCOV	matrix	#par*#par	Estimated variance-covariance of estimated parameters.
@RES	matrix	#obs*#eqs	Residuals=actual - fitted values of the dependent variable.
@FIT	matrix	#obs* #choices	Fitted values of the dependent variables,stored as a matrix.

References:

Andrews, Donald W.K., "Heteroskedasticity and Autocorrelation Consistent Covariance Matrix Estimation," **Econometrica** 59, 1991, pp. 307-345.

Arellano, Manuel and Stephen Bond, "Some Tests of Specification for Panel Data: Monte Carlo Evidence and Application to Employment Equations," **Review of Economic Studies** 58, 1991, pp. 277-297.

Chamberlain, Gary. 1982. "Multivariate Regression Models for Panel Data." **Journal of Econometrics** 18: 5-45.

Gallant, A. Ronald, **Nonlinear Statistical Models**, Wiley, 1987.

Hansen, Lars Peter, "Large Sample Properties of Generalized Method of Moments Estimation," **Econometrica** 50, July 1982, pp. 1029-1054.

Hansen, Lars Peter, and Singleton, Kenneth J., "Generalized Instrumental Variables Estimation of Nonlinear Rational Expectations Models," **Econometrica** 50, September 1982, pp. 1269-1286.

Newey, Whitney K., and West, Kenneth D., "A Simple Positive Semi-Definite Heteroskedasticity and Autocorrelation Consistent Covariance Matrix," **Econometrica** 55, pp. 703-708.