vecnorm — Test for normally distributed disturbances after vec

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Description

vecnorm computes and reports a series of statistics against the null hypothesis that the disturbances in a vector error-correction (VEC) model are normally distributed.

Quick start

Compute Jarque-Bera, skewness, and kurtosis statistics after vec to test the null hypothesis that the residuals are normally distributed

vecnorm

Same as above, but only report the Jarque-Bera statistic

vecnorm, jbera

Same as above, but only report kurtosis

vecnorm, kurtosis

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Syntax

vecnorm [, options]

options	Description
jbera	report Jarque-Bera statistic; default is to report all three statistics
skewness	report skewness statistic; default is to report all three statistics
<u>k</u> urtosis	report kurtosis statistic; default is to report all three statistics
<u>est</u> imates(<i>estname</i>)	use previously stored results estname; default is to use active results
dfk	make small-sample adjustment when computing the estimated variance–covariance matrix of the disturbances
<pre>separator(#)</pre>	draw separator line after every # rows

vecnorm can be used only after vec; see [TS] vec. collect is allowed; see [U] 11.1.10 Prefix commands.

Options

- jbera requests that the Jarque-Bera statistic and any other explicitly requested statistic be reported. By default, the Jarque-Bera, skewness, and kurtosis statistics are reported.
- skewness requests that the skewness statistic and any other explicitly requested statistic be reported. By default, the Jarque–Bera, skewness, and kurtosis statistics are reported.
- kurtosis requests that the kurtosis statistic and any other explicitly requested statistic be reported. By default, the Jarque–Bera, skewness, and kurtosis statistics are reported.

estimates (*estname*) requests that vecnorm use the previously obtained set of vec estimates stored as *estname*. By default, vecnorm uses the active results. See [R] **estimates** for information on manipulating estimation results.

- dfk requests that a small-sample adjustment be made when computing the estimated variance-covariance matrix of the disturbances.
- separator(#) specifies how many rows should appear in the table between separator lines. By default, separator lines do not appear. For example, separator(1) would draw a line between each row, separator(2) between every other row, and so on.

Remarks and examples

vecnorm computes a series of test statistics of the null hypothesis that the disturbances in a VEC model are normally distributed. For each equation and all equations jointly, up to three statistics may be computed: a skewness statistic, a kurtosis statistic, and the Jarque–Bera statistic. By default, all three statistics are reported; if you specify only one statistic, the others are not reported. The Jarque–Bera statistic tests skewness and kurtosis jointly. The single-equation results are against the null hypothesis that the disturbance for that particular equation is normally distributed. The results for all the equations are against the null that all K disturbances have a K-dimensional multivariate normal distribution. Failure to reject the null hypothesis indicates lack of model misspecification.

As noted by Johansen (1995, 141), the log likelihood for the VEC model is derived assuming the errors are independent and identically distributed normal, though many of the asymptotic properties can be derived under the weaker assumption that the errors are merely independent and identically distributed. Many researchers still prefer to test for normality. vecnorm uses the results from vec to produce a series of statistics against the null hypothesis that the K disturbances in the VEC model are normally distributed.

Example 1

This example uses vecnorm to test for normality after estimating the parameters of a VEC model using the regional income data.

- . use https://www.stata-press.com/data/r19/rdinc
- . vec ln_ne ln_se
 (output omitted)
- . vecnorm

Jarque-Bera test

Equation	chi2	df	Prob > chi2
D_ln_ne	0.094	2	0.95417
D_ln_se	0.586	2	0.74608
ALL	0.680	4	0.95381

Skewness test

Equation	Skewness	chi2	df	Prob > chi2
D_ln_ne D_ln_se ALL	.05982 .243	0.032 0.522 0.553	1 1 2	0.85890 0.47016 0.75835

Kurtosis test

Equation	Kurtosis	chi2	df	Prob > chi2
D_ln_ne D_ln_se ALL	3.1679 2.8294	0.062 0.064 0.126	1 1 2	0.80302 0.79992 0.93873

The Jarque–Bera results present test statistics for each equation and for all equations jointly against the null hypothesis of normality. For the individual equations, the null hypothesis is that the disturbance term in that equation has a univariate normal distribution. For all equations jointly, the null hypothesis is that the K disturbances come from a K-dimensional normal distribution. In this example, the single-equation and overall Jarque–Bera statistics do not reject the null of normality.

The single-equation skewness test statistics are of the null hypotheses that the disturbance term in each equation has zero skewness, which is the skewness of a normally distributed variable. The row marked ALL shows the results for a test that the disturbances in all equations jointly have zero skewness. The skewness results shown above do not suggest nonnormality.

The kurtosis of a normally distributed variable is three, and the kurtosis statistics presented in the table test the null hypothesis that the disturbance terms have kurtosis consistent with normality. The results in this example do not reject the null hypothesis.

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The statistics computed by vecnorm are based on the estimated variance-covariance matrix of the disturbances. vec saves the ML estimate of this matrix, which vecnorm uses by default. Specifying the dfk option instructs vecnorm to make a small-sample adjustment to the variance-covariance matrix before computing the test statistics.

Stored results

vecnorm stores the following in r():

Macros	
r(dfk)	dfk, if specified
Matrices	
r(jb)	Jarque–Bera χ^2 , df, and p-values
r(skewness)	skewness χ^2 , df, and <i>p</i> -values
r(kurtosis)	kurtosis χ^2 , df, and <i>p</i> -values

Methods and formulas

As discussed in *Methods and formulas* of [TS] **vec**, a cointegrating VEC model can be rewritten as a VAR model in first differences that includes the predicted cointegrating equations as exogenous variables. vecnorm computes the tests discussed in [TS] **varnorm** for the corresponding augmented VAR model in first differences. See *Methods and formulas* of [TS] **veclmar** for more information on this approach.

When the parameters of the cointegrating equations are not identified, the consistent estimates of the cointegrating equations are not available, and, in these cases, vecnorm exits with an error message.

References

- Hamilton, J. D. 1994. Time Series Analysis. Princeton, NJ: Princeton University Press. https://doi.org/10.2307/j. ctv14jx6sm.
- Jarque, C. M., and A. K. Bera. 1987. A test for normality of observations and regression residuals. *International Statistical Review* 2: 163–172. https://doi.org/10.2307/1403192.
- Johansen, S. 1995. Likelihood-Based Inference in Cointegrated Vector Autoregressive Models. Oxford: Oxford University Press.

Lütkepohl, H. 2005. New Introduction to Multiple Time Series Analysis. New York: Springer.

Also see

- [TS] varnorm Test for normally distributed disturbances
- [TS] vec Vector error-correction models
- [TS] vec intro Introduction to vector error-correction models

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