# Title

stata.com

**vecnorm —** Test for normally distributed disturbances after vec



## Description

`vecnorm` computes and reports a series of statistics against the null hypothesis that the disturbances in a VECM 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
```

As above, but only report the Jarque–Bera statistic

```
vecnorm, jbera
```

As above, but only report kurtosis

```
vecnorm, kurtosis
```

## Menu

Statistics > Multivariate time series > VEC diagnostics and tests > Test for normally distributed disturbances

# 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 |
| kurtosis | report kurtosis statistic; default is to report all three statistics |
| estimates(*estname*) | 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 |
| separator(#) | draw separator line after every # rows |

vecnorm can be used only after vec; see [TS] **vec**.

# 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

stata.com

vecnorm computes a series of test statistics of the null hypothesis that the disturbances in a VECM 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 VECM 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 VECM are normally distributed.

## Example 1

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

```
. use http://www.stata-press.com/data/r15/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 | .05982 | 0.032 | 1 | 0.85890 |
| D_ln_se | .243 | 0.522 | 1 | 0.47016 |
| ALL | | 0.553 | 2 | 0.75835 |

Kurtosis test

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

◁

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 $\chi^2$, df, and $p$-values |
| `r(skewness)` | skewness $\chi^2$, df, and $p$-values |
| `r(kurtosis)` | kurtosis $\chi^2$, df, and $p$-values |

## Methods and formulas

As discussed in *Methods and formulas* of [TS] **vec**, a cointegrating VECM can be rewritten as a VAR 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 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.

Jarque, C. M., and A. K. Bera. 1987. A test for normality of observations and regression residuals. *International Statistical Review* 2: 163–172.

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] **vec** — Vector error-correction models

[TS] **varnorm** — Test for normally distributed disturbances after var or svar

[TS] **vec intro** — Introduction to vector error-correction models