Title

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veclmar — LM test for residual autocorrelation after vec

Description

`veclmar` implements a Lagrange multiplier (LM) test for autocorrelation in the residuals of vector error-correction (VEC) models.

Quick start

Test of residual autocorrelation for the first two lags of the residuals after `vec`

```
veclmar
```

Same as above, but test the first 5 lags

```
veclmar, mlag(5)
```

Same as above, but perform test using stored estimates `myest` from a VEC model

```
veclmar, mlag(5) estimates(myest)
```

Menu

Statistics > Multivariate time series > VEC diagnostics and tests > LM test for residual autocorrelation

Syntax

```
veclmar [ , options ]
```

options	Description
mlag(#)	use # for the maximum order of autocorrelation; default is mlag(2)
estimates(*estname*)	use previously stored results *estname*; default is to use active results
separator(#)	draw separator line after every # rows

veclmar can be used only after vec; see [TS] **vec**.
You must tsset your data before using veclmar; see [TS] **tsset**.
collect is allowed; see [U] **11.1.10 Prefix commands**.

Options

mlag(#) specifies the maximum order of autocorrelation to be tested. The integer specified in mlag() must be greater than 0; the default is 2.

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

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

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Estimation, inference, and postestimation analysis of VEC models is predicated on the errors' not being autocorrelated. veclmar implements the LM test for autocorrelation in the residuals of a VEC model discussed in Johansen (1995, 21–22). The test is performed at lags $j = 1, \ldots,$ mlag(). For each j, the null hypothesis of the test is that there is no autocorrelation at lag j.

▷ Example 1

We fit a VEC model using the regional income data described in [TS] **vec** and then call veclmar to test for autocorrelation.

```
. use https://www.stata-press.com/data/r18/rdinc
. vec ln_ne ln_se
  (output omitted)
. veclmar, mlag(4)
  Lagrange-multiplier test
```

lag	chi2	df	Prob > chi2
1	8.9586	4	0.06214
2	4.9809	4	0.28926
3	4.8519	4	0.30284
4	0.3270	4	0.98801

```
  H0: no autocorrelation at lag order
```

At the 5% level, we cannot reject the null hypothesis that there is no autocorrelation in the residuals for any of the orders tested. Thus this test finds no evidence of model misspecification.

◁

Stored results

`veclmar` stores the following in `r()`:

Matrices

`r(lm)` χ^2, df, and p-values

Methods and formulas

Consider a VEC model without any trend:

$$\Delta \mathbf{y}_t = \boldsymbol{\alpha}\boldsymbol{\beta}\mathbf{y}_{t-1} + \sum_{i=1}^{p-1} \boldsymbol{\Gamma}_i \Delta \mathbf{y}_{t-i} + \boldsymbol{\epsilon}_t$$

As discussed in [TS] **vec**, as long as the parameters in the cointegrating vectors, $\boldsymbol{\beta}$, are exactly identified or overidentified, the estimates of these parameters are superconsistent. This implies that the $r \times 1$ vector of estimated cointegrating relations

$$\widehat{\mathbf{E}}_t = \widehat{\boldsymbol{\beta}}\mathbf{y}_t \tag{1}$$

can be used as data with standard estimation and inference methods. When the parameters of the cointegrating equations are not identified, (1) does not provide consistent estimates of $\widehat{\mathbf{E}}_t$; in these cases, `veclmar` exits with an error message.

The VEC model above can be rewritten as

$$\Delta \mathbf{y}_t = \boldsymbol{\alpha}\widehat{\mathbf{E}}_t + \sum_{i=1}^{p-1} \boldsymbol{\Gamma}_i \Delta \mathbf{y}_{t-i} + \boldsymbol{\epsilon}_t$$

which is just a vector autoregressive (VAR) model with $p-1$ lags where the endogenous variables have been first-differenced and is augmented with the exogenous variables $\widehat{\mathbf{E}}$. `veclmar` fits this VAR model and then calls `varlmar` to compute the LM test for autocorrelation.

The above discussion assumes no trend and implicitly ignores constraints on the parameters in $\boldsymbol{\alpha}$. As discussed in `vec`, the other four trend specifications considered by Johansen (1995, sec. 5.7) complicate the estimation of the free parameters in $\boldsymbol{\beta}$ but do not alter the basic result that the $\widehat{\mathbf{E}}_t$ can be used as data in the subsequent VAR model. Similarly, constraints on the parameters in $\boldsymbol{\alpha}$ imply that the subsequent VAR model must be estimated with these constraints applied, but $\widehat{\mathbf{E}}_t$ can still be used as data in the VAR model.

See [TS] **varlmar** for more information on the Johansen LM test.

Reference

Johansen, S. 1995. *Likelihood-Based Inference in Cointegrated Vector Autoregressive Models*. Oxford: Oxford University Press.

Also see

[TS] **varlmar** — LM test for residual autocorrelation

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

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