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Estimating VECMs

General approach:

i. Test for stationarity → If variables are I(1) they might be CI

ii. Confirm CI w/ tests → Using the EG or J methodologies

iii. Estimate if variables are CI → Using EC or J methodologies

This note walks through (ii) & (iii), assuming (i) applies

Engle-Granger (EG) method

G/C residuals should be WN. ← "type 1" in the printout

→ EG test is a kind of ADF test which always uses "Model 1"

→ When you are running the tests, do it twice swapping dependents.

→ There are several steps to actually estimating the VECM:

i. estimate the LR r/ship b/w variables: $lm(y \sim x)$

ii. Save the residuals from this regression

iii. Take the first difference of the dependent variable

iv. Take the lag of the residuals from the LR equilibrium eqn

v. To get the first VECM eqn, regress (iii) on (iv)

$\Delta y = \beta_0 + \beta_1(\text{lagged\_error})$

vi. Regress the original independent variable on (iii)

Johansen (J) method

→ The tricky part about J tests is figuring out how to treat deterministic terms in the VECM. There are three possibilities, and three different function arguments to consider:

- "none": no determ. term in EC/a constant outside EC
  - ↳ Appropriate for linearly trending series (assuming all trends = stochastic)
- "constant": a constant in EC/no determ. term outside EC.
  - ↳ Appropriate only if no variables appear to have sustained increase/decrease tendency

- "trend": a trend variable but no constant in EC/a constant outside EC.
  ↳ Reasonable when there's some LR linear growth which CI relation doesn't capture

→ Once you've dealt with deterministic trends you need to determine lag length for the test, to do this use the normal method for determining VAR model lag-lengths.

→ Then conduct the "trace" J test:
- Evaluate $r=0$ first & then $r<=1$
- If $r=0$ is rejected, but $r<=1$ is maintained, suggests $r=1$.
- If $r=1$, only consider the first column of the "Eigenvectors" part of the output to determine EC term: $y=\beta_0+\beta_1 x+\xi_t$, $\xi=y-\beta_0-\beta_1 x$
- The last part of the printout shows the speed of adjustment coefficients, → if $r=1$ refer to first column only.

→ then conduct the "maximum eigenvalue" J test:
- The only thing that changes is the second part of the printout - use the same approach as before: evaluate $r=0$ & the $r<=1$ sequentially.

→ To estimate the VECM simply pass the object you conducted the test on (to cajorls()) and specify the cointegration rank.