Exercises - Day II

Ashish Rajbhandari
Stata
arajbhandari@stata.com

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1 Exercise 3

1. `dunrate.dta` contains data on the unemployment rate in the U.S. Use `tsline` to plot the level of the U.S. unemployment rate contained in `UNRATE`. Do think that there is a deterministic trend in this variable?

   Use `dfgsls` to test for a unit root in `UNRATE`. If you do not think that there is a deterministic trend, specify the `notrend` option. Use the number of lags selected by minimizing the SC and a 5% level.

   Use `dfgsls` to test for a unit root in `D.UNRATE`. If you do not think that there is a deterministic trend, specify the `notrend` option. Use the number of lags selected by minimizing the SC and a 5% level.

2. This question and the next look at the ability of the DFGLS unit-root test to reject a false null hypothesis.

   Let's start with a clearly stationary process.

   The follow code generates a sample of size 1,000 drawn from an AR(1) process with AR coefficient of .25.

```
clear all
set obs 2000
set seed 12345671
generate double y = rnormal() in 1
generate t = _n
tsset t
generate double e = rnormal()
replace y = .25*L.y + e in 2/L

drop in 1/1000
```

Run this code to simulate the data and use `dfgls` to test the false null hypothesis of a unit root.

How strongly can you reject the false null hypothesis?

3. Repeat the experiment from question 1, but set the AR parameter to .98.

4. This question illustrates the relationship between the AR parameter, the spectral density function, and what they mean for a stationary process.

   A stationary AR(1) process with a positive AR term will have more runs above and below the long-run mean than an IID process and its spectral density will have a mode at a low frequency.

   A stationary AR(1) process with a negative AR term will have fewer runs above and below the long-run mean than an IID process and its spectral density will have a mode at a high frequency.

   The spectral density of an IID process will be a flat line.

   To illustrate these points, we will use the code from the previous problem, with minor changes, to draw samples of size 1,000 from three distinct AR(1) processes.

   Simulate an AR(1) process with an AR term of .6, idiosyncratic variance of 1, call it y_low.

   Simulate an IID normal series with variance 1, call it y_iid.

   Simulate AR(1) process with an AR term of -.6, idiosyncratic variance of 1, call it y_high.

   Use `tsline` to plot `y_log`, `y_iid`, and `y_high` on one graph. Note how `y_low` has more runs above and below the mean of 0 than `y_iid`, and that `y_high` has fewer. (`y_high` is more "jagged" than `y_iid`, while `y_low` is "smoother" than `y_iid`.)

   Use the following graph commands to plot the series

   ```
   tsline y_low , name(ylow) nodraw
   tsline y_iid , name(yiid) nodraw
   tsline y_high, name(yhigh) nodraw
   graph combine ylow yiid yhigh, xcommon cols(1)
   ```

   Now for each series, use `arima` to estimate the AR(1) term, use `psdensity` to estimate the spectral density implied by the model, and plot all three estimated spectral densities on one graph. The graph will be much clearer if you use `label variable "`*text*`"` to label the three estimated densities

2 Exercise 4

1. Repeat the SVAR example in the notes

Verify that the structural IRFs are the same as the orthogonal IRFs from the VAR

2. In this question we use the VEC methodology presented in the notes to select an appropriate model for the Lutkepohl data in logs.

   (a) Read in the Lutkepohl data, use `tsline` to plot `linvestment lincome lconsumption`, and run `varsoc` on `linvestment lincome lconsumption`

       Look at the `tsline` graph. To me, this data looks to have one cointegrating equation and an unrestricted constant seems appropriate.

       How many lags does `varsoc` select?

   (b) In this case, I recommend trying 2 lags, which is between the selections of 1 and 3

       Now run `vecrank` on the variables with option `trend(constant)`.

       How many cointegraing equations does it recommend? Do this fit with the graph in part 1?

   (c) Run `vec` on the model with 2 lags, an unrestricted constant, and 1 cointegrating vector. Then use `veclmar` to test for residual serial correlation. Are you going to proceed with interpretation or change the model?

3 Exercise 5

We have percentage changes in the indices for the Willshire 5000, the Dow Jones Industrial, and the SP500 indicies in `sindices.dta`.

We want to fit these changes to 3 multivariate GARCH models, to see how much they are correlated with each other. The variables are `w5000pc`, `djpc`, and `sp500pc`.

Previous analysis indicates the that there is no relationship between `w5000pc` and its lag, while `djpc` depends on its first lag and `sp500pc` depends on its first lag.

1. Estimate the parameters of a DVECH model with one ARCH term.

2. Estimate the parameters of a CCC model with one ARCH term.

   Do you notice the difference in the number of parameters and the estimation time required. */

3. Estimate the parameters of a DCC model with one ARCH term.

   Are the quasicorrelations very different from the correlations estimated by CCC?

4 Exercise 6

1. Use the state-space method in the notes to estimate the parameters of ARMA(1,1) model for the first differences of the Ohio unemployment rate in `modata`.

   Check your answer using -arima-

2. Fit D.miur and D.ohur to the VARMA model in the notes. Let D.miur depend on D.ohur but fix the coefficient on D.ohur to zero in the equation for D.miur.