

## Assignment 8

```
varsoc rspot rfuture, maxlag(10)
```

Selection-order criteria

Sample: 12 - 7684

Number of obs

=

7673

| lag | LL      | LR     | df | p     | FPE      | AIC       | HQIC      | SBIC     |
|-----|---------|--------|----|-------|----------|-----------|-----------|----------|
| 0   | 76671.7 |        |    |       | 7.2e-12  | -19.9843  | -19.9837  | -19.9825 |
| 1   | 76840.9 | 338.5  | 4  | 0.000 | 6.9e-12  | -20.0274  | -20.0255  | -20.0219 |
| 2   | 76931.4 | 180.85 | 4  | 0.000 | 6.7e-12  | -20.0499  | -20.0468  | -20.0408 |
| 3   | 76963.2 | 63.709 | 4  | 0.000 | 6.7e-12  | -20.0571  | -20.0528  | -20.0445 |
| 4   | 76979.4 | 32.291 | 4  | 0.000 | 6.7e-12  | -20.0603  | -20.0547  | -20.044  |
| 5   | 77017.6 | 76.544 | 4  | 0.000 | 6.6e-12  | -20.0692  | -20.0624  | -20.0493 |
| 6   | 77049.6 | 63.872 | 4  | 0.000 | 6.5e-12  | -20.0765  | -20.0684  | -20.053* |
| 7   | 77059.6 | 20.054 | 4  | 0.000 | 6.5e-12  | -20.0781  | -20.0688  | -20.0509 |
| 8   | 77070.3 | 21.332 | 4  | 0.000 | 6.5e-12  | -20.0798  | -20.0693* | -20.0491 |
| 9   | 77076.4 | 12.37* | 4  | 0.015 | 6.5e-12* | -20.0804* | -20.0686  | -20.046  |
| 10  | 77080.2 | 7.4487 | 4  | 0.114 | 6.5e-12  | -20.0803  | -20.0673  | -20.0423 |

Endogenous: rspot rfuture

Exogenous: \_cons

- Based on SBIC, 3 is the most appropriate lag order because of lowest value.

```
. var rspot rfuture, lag(1/3)
```

Vector autoregression

Sample: 5 - 7684

Number of obs

=

7,680

Log likelihood = 77010.15

AIC

=

-20.05108

FPE = 6.71e-12

HQIC

=

-20.04674

Det(Sigma\_ml) = 6.69e-12

SBIC

=

-20.03842

| Equation | Parms | RMSE    | R-sq   | chi2     | P>chi2 |
|----------|-------|---------|--------|----------|--------|
| rspot    | 7     | .001779 | 0.0122 | 95.07421 | 0.0000 |
| rfuture  | 7     | .002044 | 0.0181 | 141.3296 | 0.0000 |

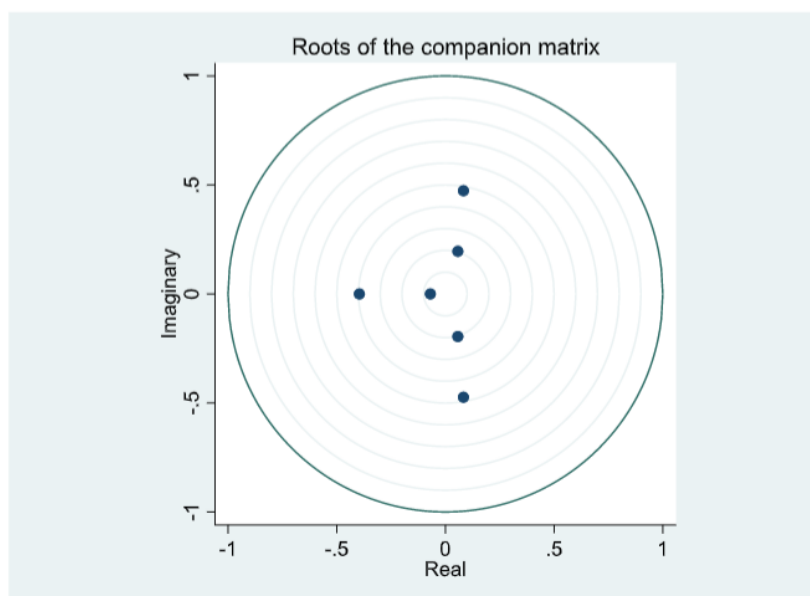
|         | Coef.     | Std. Err. | z     | P> z  | [95% Conf. Interval] |           |
|---------|-----------|-----------|-------|-------|----------------------|-----------|
| rspot   |           |           |       |       |                      |           |
| rspot   |           |           |       |       |                      |           |
| L1.     | -.0323987 | .0159661  | -2.03 | 0.042 | -.0636918            | -.0011057 |
| L2.     | -.1099664 | .0160841  | -6.84 | 0.000 | -.1414905            | -.0784422 |
| L3.     | -.0418984 | .0159205  | -2.63 | 0.008 | -.0731019            | -.0106949 |
| rfuture |           |           |       |       |                      |           |
| L1.     | .0933035  | .0138966  | 6.71  | 0.000 | .0660668             | .1205403  |
| L2.     | .0688434  | .0141336  | 4.87  | 0.000 | .0411421             | .0965447  |
| L3.     | .0317131  | .0139194  | 2.28  | 0.023 | .0044315             | .0589946  |
| _cons   | .0000231  | .0000203  | 1.14  | 0.256 | -.0000167            | .0000629  |
| rfuture |           |           |       |       |                      |           |
| rspot   |           |           |       |       |                      |           |
| L1.     | .2004382  | .0183405  | 10.93 | 0.000 | .1644915             | .2363849  |
| L2.     | .0600679  | .018476   | 3.25  | 0.001 | .0238557             | .0962801  |
| L3.     | .0609707  | .018288   | 3.33  | 0.001 | .0251268             | .0968146  |
| rfuture |           |           |       |       |                      |           |
| L1.     | -.1528221 | .0159632  | -9.57 | 0.000 | -.1841093            | -.1215349 |
| L2.     | -.0926647 | .0162354  | -5.71 | 0.000 | -.1244855            | -.0608439 |
| L3.     | -.0524571 | .0159894  | -3.28 | 0.001 | -.0837958            | -.0211184 |
| _cons   | .0000262  | .0000233  | 1.12  | 0.262 | -.0000195            | .0000719  |

```
. varstable, graph
```

Eigenvalue stability condition

| Eigenvalue           | Modulus |
|----------------------|---------|
| .0829301 + .4737693i | .480973 |
| .0829301 - .4737693i | .480973 |
| -.3959128            | .395913 |
| .0571976 + .1954789i | .203675 |
| .0571976 - .1954789i | .203675 |
| -.06956342           | .069563 |

All the eigenvalues lie inside the unit circle.  
VAR satisfies stability condition.



```
. vargranger
```

Granger causality Wald tests

| Equation | Excluded | chi2   | df | Prob > chi2 |
|----------|----------|--------|----|-------------|
| rspot    | rfuture  | 58.069 | 3  | 0.000       |
| rspot    | ALL      | 58.069 | 3  | 0.000       |
| rfuture  | rspot    | 125.3  | 3  | 0.000       |
| rfuture  | ALL      | 125.3  | 3  | 0.000       |

- Based on stability test, eigenvalues are inside unit circle. Also, from Granger exogeneity tests, the test is significant. Thus, rspot and rfuture are endogenous variables.

```
. irf create order1, order( rspot rfuture ) step(10) set(irf01)
(file irf01.irf created)
(file irf01.irf now active)
(file irf01.irf updated)
```

```
. irf table irf, impulse( rspot rfuture ) response( rspot rfuture )
```

Results from order1

| step | (1)<br>irf | (1)<br>Lower | (1)<br>Upper | (2)<br>irf | (2)<br>Lower | (2)<br>Upper |
|------|------------|--------------|--------------|------------|--------------|--------------|
| 0    | 1          | 1            | 1            | 0          | 0            | 0            |
| 1    | -.032399   | -.063692     | -.001106     | .200438    | .164491      | .236385      |
| 2    | -.090215   | -.121306     | -.059124     | .022943    | -.01296      | .058845      |
| 3    | -.019473   | -.050159     | .011212      | .018862    | -.016576     | .054301      |
| 4    | .021605    | .012806      | .030404      | -.026821   | -.038162     | -.015479     |
| 5    | .004745    | -.000783     | .010273      | -.001192   | -.006505     | .00412       |
| 6    | -.003073   | -.00529      | -.000856     | .00274     | .000517      | .004962      |
| 7    | -.002004   | -.003907     | -.000102     | .002085    | -.000046     | .004216      |
| 8    | .000549    | .000026      | .001073      | -.000807   | -.001286     | -.000328     |
| 9    | .000487    | .000092      | .000881      | -.000411   | -.000804     | -.000018     |
| 10   | -.00002    | -.000217     | .000177      | .000037    | -.000136     | .000209      |

| step | (3)<br>irf | (3)<br>Lower | (3)<br>Upper | (4)<br>irf | (4)<br>Lower | (4)<br>Upper |
|------|------------|--------------|--------------|------------|--------------|--------------|
| 0    | 0          | 0            | 0            | 1          | 1            | 1            |
| 1    | .093304    | .066067      | .12054       | -.152822   | -.184109     | -.121535     |
| 2    | .051562    | .024473      | .07865       | -.050609   | -.081888     | -.01933      |
| 3    | .00454     | -.022106     | .031185      | -.014622   | -.045403     | .016158      |
| 4    | -.019421   | -.027623     | -.011219     | .024637    | .013742      | .035531      |
| 5    | -.002343   | -.006941     | .002254      | -.000232   | -.004535     | .004071      |
| 6    | .003232    | .001433      | .005031      | -.00284    | -.004733     | -.000947     |
| 7    | .001467    | -.000225     | .003159      | -.001514   | -.00338      | .000353      |
| 8    | -.000649   | -.001065     | -.000233     | .000852    | .0004        | .001304      |
| 9    | -.000391   | -.000752     | -.000029     | .000314    | -.000036     | .000665      |
| 10   | .000063    | -.000091     | .000216      | -.000075   | -.00021      | .000059      |

95% lower and upper bounds reported

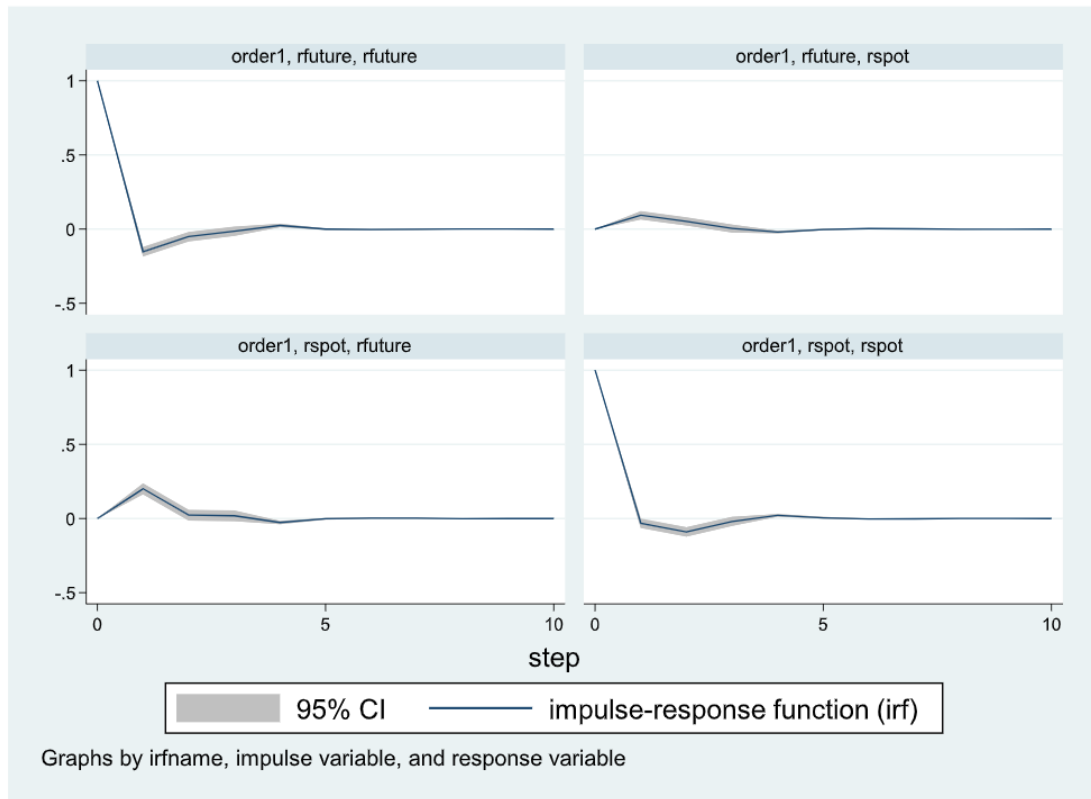
(1) irfname = order1, impulse = rspot, and response = rspot

(2) irfname = order1, impulse = rspot, and response = rfuture

(3) irfname = order1, impulse = rfuture, and response = rspot

(4) irfname = order1, impulse = rfuture, and response = rfuture

```
. irf graph irf, impulse( rspot rfuture ) response( rspot rfuture )
```



```
. irf table coirf, impulse( rspot rfuture ) response( rspot rfuture )
```

Results from order1

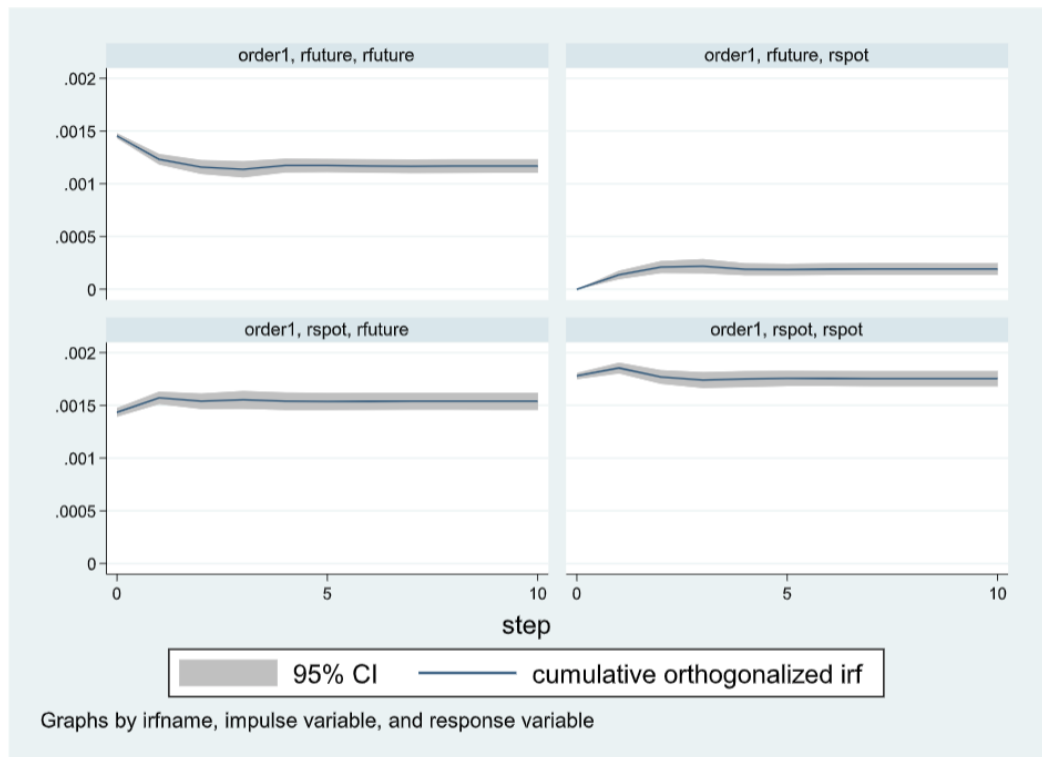
| step | (1)<br>coirf | (1)<br>Lower | (1)<br>Upper | (2)<br>coirf | (2)<br>Lower | (2)<br>Upper |
|------|--------------|--------------|--------------|--------------|--------------|--------------|
| 0    | .001778      | .00175       | .001806      | .001434      | .001395      | .001474      |
| 1    | .001855      | .001805      | .001904      | .001572      | .001513      | .00163       |
| 2    | .001768      | .001704      | .001832      | .00154       | .001467      | .001613      |
| 3    | .00174       | .001665      | .001815      | .001552      | .001468      | .001637      |
| 4    | .00175       | .001676      | .001825      | .00154       | .001457      | .001623      |
| 5    | .001756      | .001684      | .001827      | .001538      | .001457      | .001618      |
| 6    | .001755      | .001683      | .001826      | .001538      | .001458      | .001619      |
| 7    | .001753      | .001681      | .001825      | .00154       | .001459      | .001621      |
| 8    | .001753      | .001681      | .001825      | .00154       | .001459      | .001621      |
| 9    | .001754      | .001682      | .001826      | .001539      | .001459      | .00162       |
| 10   | .001754      | .001682      | .001826      | .001539      | .001459      | .00162       |

| step | (3)<br>coirf | (3)<br>Lower | (3)<br>Upper | (4)<br>coirf | (4)<br>Lower | (4)<br>Upper |
|------|--------------|--------------|--------------|--------------|--------------|--------------|
| 0    | 0            | 0            | 0            | .001454      | .001431      | .001477      |
| 1    | .000136      | .000096      | .000175      | .001232      | .001183      | .001282      |
| 2    | .000211      | .000154      | .000268      | .001159      | .001093      | .001224      |
| 3    | .000217      | .00015       | .000285      | .001137      | .001061      | .001214      |
| 4    | .000189      | .000132      | .000247      | .001173      | .001109      | .001238      |
| 5    | .000186      | .000132      | .00024       | .001173      | .001111      | .001235      |
| 6    | .00019       | .000135      | .000245      | .001169      | .001105      | .001232      |
| 7    | .000192      | .000136      | .000249      | .001166      | .001102      | .001231      |
| 8    | .000192      | .000135      | .000248      | .001168      | .001104      | .001232      |
| 9    | .000191      | .000135      | .000247      | .001168      | .001104      | .001232      |
| 10   | .000191      | .000135      | .000247      | .001168      | .001104      | .001232      |

95% lower and upper bounds reported

- (1) irfname = order1, impulse = rspot, and response = rspot
- (2) irfname = order1, impulse = rspot, and response = rfuture
- (3) irfname = order1, impulse = rfuture, and response = rspot
- (4) irfname = order1, impulse = rfuture, and response = rfuture

```
. irf graph coirf, impulse( rspot rfuture ) response( rspot rfuture )
```



3. All have positive direction. But, the magnitude on `rspot` on `rfuture` is greater than `rfuture` on `rspot` due to bigger shaded areas.

```
. irf table fevd, impulse(rspot rfuture) response(rspot)
```

Results from order1

| step | (1)<br>fevd | (1)<br>Lower | (1)<br>Upper |
|------|-------------|--------------|--------------|
| 0    | 0           | 0            | 0            |
| 1    | 1           | 1            | 1            |
| 2    | .993131     | .989465      | .996798      |
| 3    | .990693     | .98638       | .995006      |
| 4    | .990483     | .986145      | .994821      |
| 5    | .990038     | .98565       | .994426      |
| 6    | .989888     | .985487      | .994289      |

| step | (2)<br>fevd | (2)<br>Lower | (2)<br>Upper |
|------|-------------|--------------|--------------|
| 0    | 0           | 0            | 0            |
| 1    | 0           | 0            | 0            |
| 2    | .006869     | .003202      | .010535      |
| 3    | .009307     | .004994      | .01362       |
| 4    | .009517     | .005179      | .013855      |
| 5    | .009962     | .005574      | .01435       |
| 6    | .010112     | .005711      | .014513      |

95% lower and upper bounds reported

(1) irfname = order1, impulse = rspot, and response = rspot

(2) irfname = order1, impulse = rfuture, and response = rspot

```
. irf table fevd, impulse(rspot rfuture) response(rfuture)
```

Results from order1

| step | (1)<br>fevd | (1)<br>Lower | (1)<br>Upper |
|------|-------------|--------------|--------------|
| 0    | 0           | 0            | 0            |
| 1    | .500791     | .484986      | .516596      |
| 2    | .496679     | .480799      | .512558      |
| 3    | .495972     | .480066      | .511879      |
| 4    | .495855     | .479951      | .51176       |
| 5    | .495851     | .479947      | .511756      |
| 6    | .495689     | .479783      | .511594      |

| step | (2)<br>fevd | (2)<br>Lower | (2)<br>Upper |
|------|-------------|--------------|--------------|
| 0    | 0           | 0            | 0            |
| 1    | .499209     | .483404      | .515014      |
| 2    | .503321     | .487442      | .519201      |
| 3    | .504028     | .488121      | .519934      |
| 4    | .504145     | .48824       | .520049      |
| 5    | .504149     | .488244      | .520053      |
| 6    | .504311     | .488406      | .520217      |

95% lower and upper bounds reported

(1) irfname = order1, impulse = rspot, and response = rfuture

(2) irfname = order1, impulse = rfuture, and response = rfuture

- Rspot on rfuture has greater impact than rfuture on rspot.