

## Assignment 8

1)

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. varsoc rspot rfuture, maxlag(10)
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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

. var rspot rfuture, lag(1/6)

Vector autoregression

|                |            |               |   |           |
|----------------|------------|---------------|---|-----------|
| Sample:        | 8 - 7684   | Number of obs | = | 7,677     |
| Log likelihood | = 77062.5  | AIC           | = | -20.06943 |
| FPE            | = 6.59e-12 | HQIC          | = | -20.06136 |
| Det(Sigma_ml)  | = 6.55e-12 | SBIC          | = | -20.0459  |

| Equation | Parms | RMSE    | R-sq   | chi2     | P>chi2 |
|----------|-------|---------|--------|----------|--------|
| rspot    | 13    | .001777 | 0.0159 | 124.0308 | 0.0000 |
| rfuture  | 13    | .002042 | 0.0211 | 165.0864 | 0.0000 |

|         | Coef.     | Std. Err. | z      | P> z  | [95% Conf. Interval] |           |
|---------|-----------|-----------|--------|-------|----------------------|-----------|
| rspot   |           |           |        |       |                      |           |
| rspot   |           |           |        |       |                      |           |
| L1.     | -.0429887 | .0160995  | -2.67  | 0.008 | -.0745432            | -.0114342 |
| L2.     | -.1255145 | .0163803  | -7.66  | 0.000 | -.1576194            | -.0934097 |
| L3.     | -.0654555 | .0165559  | -3.95  | 0.000 | -.0979044            | -.0330066 |
| L4.     | -.0555308 | .0165648  | -3.35  | 0.001 | -.0879973            | -.0230644 |
| L5.     | -.0646528 | .0163598  | -3.95  | 0.000 | -.0967173            | -.0325882 |
| L6.     | -.0420281 | .0160563  | -2.62  | 0.009 | -.0734979            | -.0105584 |
| rfuture |           |           |        |       |                      |           |
| L1.     | .1025108  | .0140081  | 7.32   | 0.000 | .0750554             | .1299661  |
| L2.     | .0827253  | .0143869  | 5.75   | 0.000 | .0545274             | .1109231  |
| L3.     | .0530446  | .0145602  | 3.64   | 0.000 | .0245072             | .081582   |
| L4.     | .057478   | .0145501  | 3.95   | 0.000 | .0289603             | .0859958  |
| L5.     | .0435619  | .0143967  | 3.03   | 0.002 | .0153449             | .0717788  |
| L6.     | .0372007  | .0140183  | 2.65   | 0.008 | .0097254             | .064676   |
| _cons   | .0000232  | .0000203  | 1.14   | 0.252 | -.0000165            | .0000629  |
| rfuture |           |           |        |       |                      |           |
| rspot   |           |           |        |       |                      |           |
| L1.     | .2117743  | .0185008  | 11.45  | 0.000 | .1755133             | .2480352  |
| L2.     | .0743206  | .0188235  | 3.95   | 0.000 | .0374272             | .1112139  |
| L3.     | .0828566  | .0190252  | 4.36   | 0.000 | .0455679             | .1201454  |
| L4.     | .0448446  | .0190355  | 2.36   | 0.018 | .0075357             | .0821535  |
| L5.     | .0674903  | .0187999  | 3.59   | 0.000 | .0306433             | .1043374  |
| L6.     | .0590473  | .0184511  | 3.20   | 0.001 | .0228838             | .0952109  |
| rfuture |           |           |        |       |                      |           |
| L1.     | -.1623592 | .0160974  | -10.09 | 0.000 | -.1939096            | -.1308088 |
| L2.     | -.1054217 | .0165328  | -6.38  | 0.000 | -.1378253            | -.073018  |
| L3.     | -.0724314 | .0167319  | -4.33  | 0.000 | -.1052253            | -.0396376 |
| L4.     | -.042915  | .0167203  | -2.57  | 0.010 | -.0756863            | -.0101437 |
| L5.     | -.0604119 | .016544   | -3.65  | 0.000 | -.0928375            | -.0279863 |
| L6.     | -.0392965 | .0161092  | -2.44  | 0.015 | -.0708699            | -.0077232 |
| _cons   | .0000259  | .0000233  | 1.11   | 0.266 | -.0000198            | .0000715  |

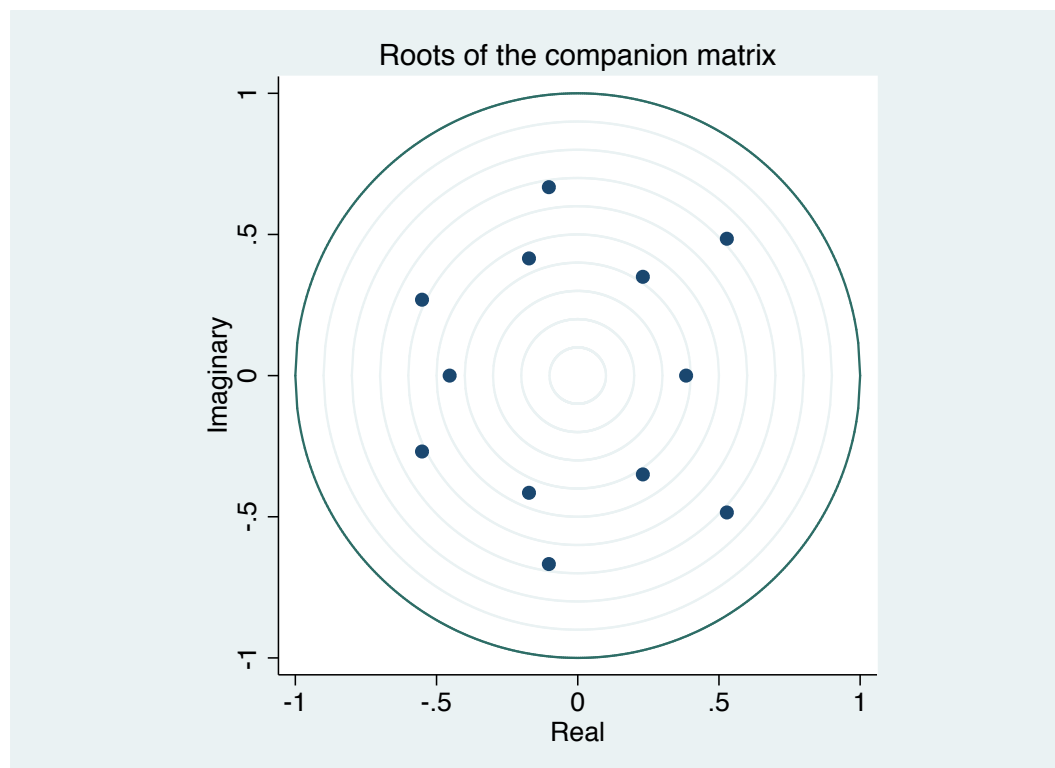
2)

. varstable, graph

Eigenvalue stability condition

| Eigenvalue            | Modulus |
|-----------------------|---------|
| .5279554 + .4847924i  | .716771 |
| .5279554 - .4847924i  | .716771 |
| -.1022778 + .6675194i | .67531  |
| -.1022778 - .6675194i | .67531  |
| -.5513603 + .2689237i | .613448 |
| -.5513603 - .2689237i | .613448 |
| -.4536067             | .453607 |
| -.1726167 + .4151256i | .449584 |
| -.1726167 - .4151256i | .449584 |
| .2305361 + .3500458i  | .419141 |
| .2305361 - .3500458i  | .419141 |
| .3837855              | .383786 |

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  | <b>82.299</b> | <b>6</b> | <b>0.000</b> |
| rspot    | ALL      | <b>82.299</b> | <b>6</b> | <b>0.000</b> |
| rfuture  | rspot    | <b>148.42</b> | <b>6</b> | <b>0.000</b> |
| rfuture  | ALL      | <b>148.42</b> | <b>6</b> | <b>0.000</b> |

3)

**. 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    | <b>1</b>   | <b>1</b>     | <b>1</b>     | <b>0</b>   | <b>0</b>     | <b>0</b>     |
| 1    | -.042989   | -.074543     | -.011434     | .211774    | .175513      | .248035      |
| 2    | -.101957   | -.133505     | -.070409     | .030833    | -.00561      | .067276      |
| 3    | -.034997   | -.066566     | -.003428     | .030738    | -.005677     | .067153      |
| 4    | -.02148    | -.052956     | .009995      | .002714    | -.033596     | .039023      |
| 5    | -.033647   | -.06485      | -.002443     | .034962    | -.001046     | .070971      |
| 6    | -.010717   | -.041519     | .020085      | .017646    | -.017933     | .053226      |
| 7    | .032265    | .020916      | .043615      | -.03579    | -.049542     | -.022038     |
| 8    | .012189    | .004402      | .019975      | -.007864   | -.015341     | -.000387     |
| 9    | .001296    | -.00312      | .005713      | -.000034   | -.004255     | .004186      |
| 10   | .000061    | -.003519     | .003642      | .000285    | -.003305     | .003874      |

| step | (3)<br>irf | (3)<br>Lower | (3)<br>Upper | (4)<br>irf | (4)<br>Lower | (4)<br>Upper |
|------|------------|--------------|--------------|------------|--------------|--------------|
| 0    | <b>0</b>   | <b>0</b>     | <b>0</b>     | <b>1</b>   | <b>1</b>     | <b>1</b>     |
| 1    | .102511    | .075055      | .129966      | -.162359   | -.19391      | -.130809     |
| 2    | .061675    | .034224      | .089126      | -.057352   | -.089063     | -.025641     |
| 3    | .018216    | -.009265     | .045697      | -.025324   | -.057023     | .006376      |
| 4    | .026291    | -.001106     | .053688      | -.004062   | -.035665     | .027541      |
| 5    | .01553     | -.011653     | .042713      | -.029332   | -.060699     | .002035      |
| 6    | .006933    | -.01982      | .033686      | -.003566   | -.034475     | .027344      |
| 7    | -.026277   | -.036538     | -.016016     | .03073     | .017939      | .043521      |
| 8    | -.008158   | -.014491     | -.001824     | .003756    | -.002191     | .009704      |
| 9    | -.0002     | -.003504     | .003105      | -.000652   | -.003805     | .002502      |
| 10   | .000499    | -.00231      | .003308      | -.000346   | -.003173     | .002482      |

95% lower and upper bounds reported

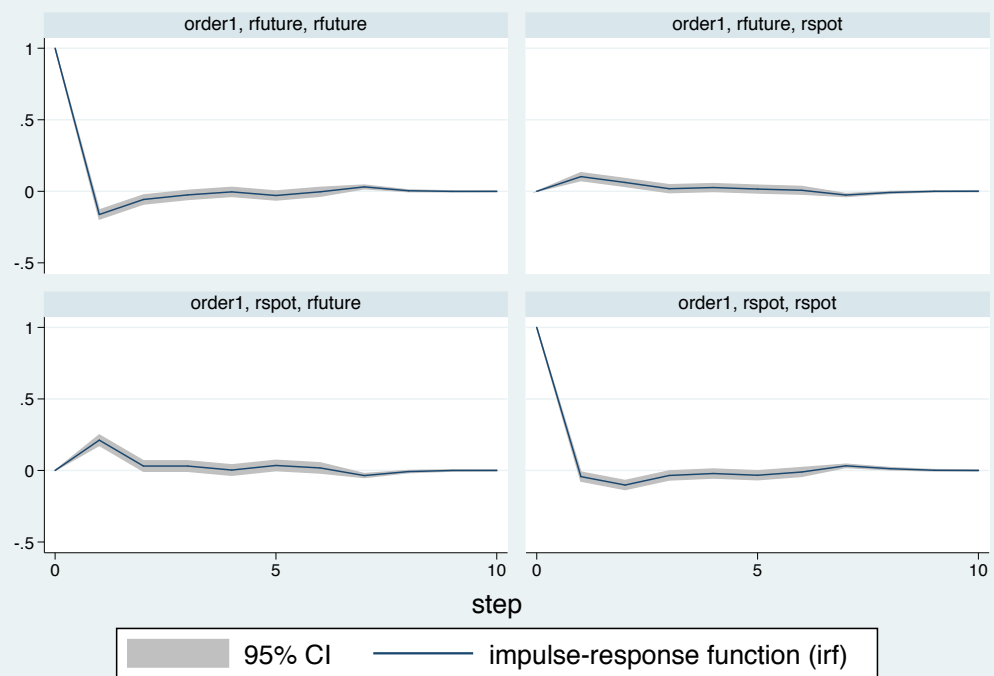
(1) irfname = order1, impulse = rspot, and response = rspot

(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)**



Graphs by irfname, impulse variable, and response variable

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. irf table coirf, impulse(rspot rfuture) response(rspot rfuture)
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Results from order1

| step | (1)<br>coirf | (1)<br>Lower | (1)<br>Upper | (2)<br>coirf | (2)<br>Lower | (2)<br>Upper |
|------|--------------|--------------|--------------|--------------|--------------|--------------|
| 0    | .001775      | .001747      | .001803      | .001444      | .001404      | .001483      |
| 1    | .001847      | .001798      | .001896      | .001585      | .001527      | .001644      |
| 2    | .001755      | .001691      | .001819      | .001557      | .001484      | .00163       |
| 3    | .001719      | .001644      | .001794      | .001575      | .001491      | .001659      |
| 4    | .001719      | .001635      | .001803      | .001574      | .00148       | .001668      |
| 5    | .001682      | .001589      | .001774      | .001594      | .001491      | .001697      |
| 6    | .001673      | .001573      | .001772      | .00162       | .001509      | .001731      |
| 7    | .001692      | .001594      | .00179       | .001601      | .001492      | .00171       |
| 8    | .001702      | .001606      | .001797      | .001592      | .001485      | .001699      |
| 9    | .001704      | .001609      | .001798      | .001591      | .001485      | .001698      |
| 10   | .001705      | .00161       | .001799      | .001591      | .001485      | .001698      |

| step | (3)<br>coirf | (3)<br>Lower | (3)<br>Upper | (4)<br>coirf | (4)<br>Lower | (4)<br>Upper |
|------|--------------|--------------|--------------|--------------|--------------|--------------|
| 0    | 0            | 0            | 0            | .001441      | .001419      | .001464      |
| 1    | .000148      | .000108      | .000187      | .001207      | .001158      | .001257      |
| 2    | .000237      | .00018       | .000294      | .001125      | .001059      | .00119       |
| 3    | .000263      | .000194      | .000332      | .001088      | .00101       | .001166      |
| 4    | .000301      | .000223      | .000379      | .001082      | .000995      | .00117       |
| 5    | .000323      | .000238      | .000409      | .00104       | .000945      | .001136      |
| 6    | .000333      | .000242      | .000424      | .001035      | .000934      | .001136      |
| 7    | .000295      | .000216      | .000374      | .001079      | .000991      | .001167      |
| 8    | .000284      | .00021       | .000357      | .001085      | .001001      | .001168      |
| 9    | .000283      | .000211      | .000355      | .001084      | .001001      | .001166      |
| 10   | .000284      | .000212      | .000356      | .001083      | .001001      | .001166      |

95% lower and upper bounds reported

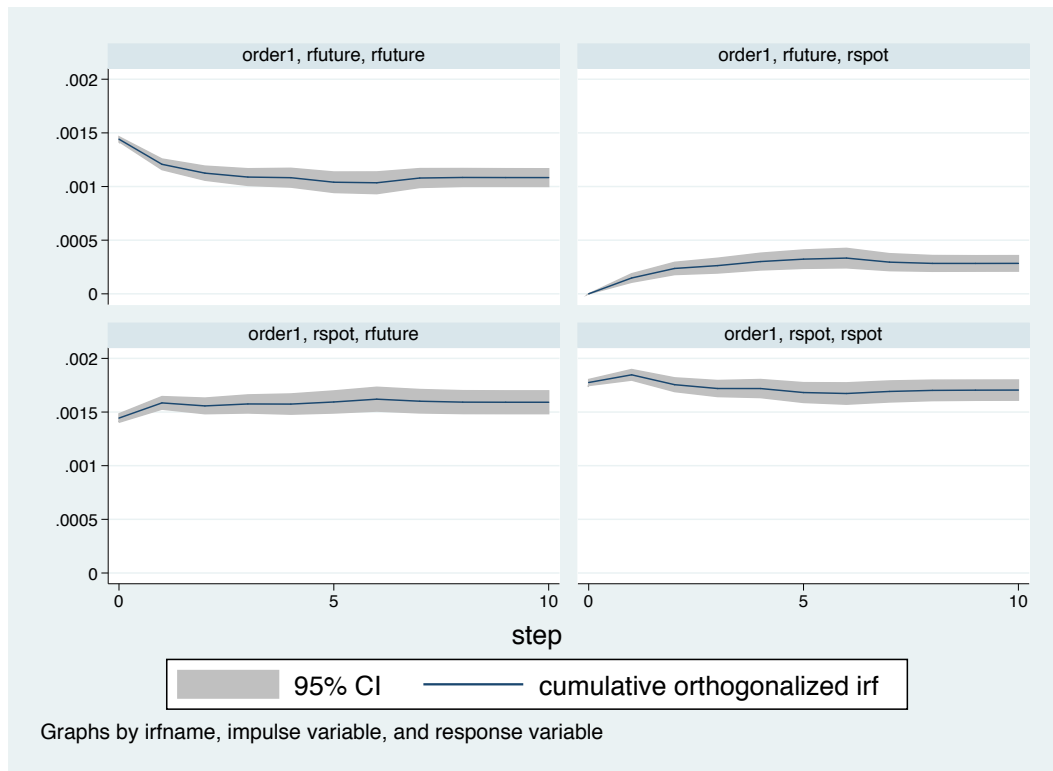
(1) irfname = order1, impulse = rspot, and response = rspot

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

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

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

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The graph shows positive direction of the graph meaning there is significant positive impact. The table shows that change in rspot cause change in rspot has more impact than cause change in rfuture and change in rfuture cause change in rfuture has more impact than cause change in rspot. As shown in the table, you can see that the change in rspot cause change in rspot has the most impact.

4)

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. irf table fevd, impulse(rspot rfuture) response(rspot)
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Results from order1

| step | (1)<br>fevd | (1)<br>Lower | (1)<br>Upper | (2)<br>fevd | (2)<br>Lower | (2)<br>Upper |
|------|-------------|--------------|--------------|-------------|--------------|--------------|
| 0    | 0           | 0            | 0            | 0           | 0            | 0            |
| 1    | 1           | 1            | 1            | 0           | 0            | 0            |
| 2    | .993131     | .989465      | .996798      | .006869     | .003202      | .010535      |
| 3    | .990693     | .98638       | .995006      | .009307     | .004994      | .01362       |
| 4    | .990483     | .986145      | .994821      | .009517     | .005179      | .013855      |
| 5    | .990038     | .98565       | .994426      | .009962     | .005574      | .01435       |
| 6    | .989888     | .985487      | .994289      | .010112     | .005711      | .014513      |
| 7    | .989857     | .985466      | .994248      | .010143     | .005752      | .014534      |
| 8    | .989415     | .984856      | .993973      | .010585     | .006027      | .015144      |
| 9    | .989372     | .9848        | .993944      | .010628     | .006056      | .0152        |
| 10   | .989372     | .9848        | .993944      | .010628     | .006056      | .0152        |

95% lower and upper bounds reported

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

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

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. irf table fevd, impulse(rspot rfuture) response(rfuture)
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Results from order1

| step | (1)<br>fevd | (1)<br>Lower | (1)<br>Upper | (2)<br>fevd | (2)<br>Lower | (2)<br>Upper |
|------|-------------|--------------|--------------|-------------|--------------|--------------|
| 0    | 0           | 0            | 0            | 0           | 0            | 0            |
| 1    | .500791     | .484986      | .516596      | .499209     | .483404      | .515014      |
| 2    | .496679     | .480799      | .512558      | .503321     | .487442      | .519201      |
| 3    | .495972     | .480066      | .511879      | .504028     | .488121      | .519934      |
| 4    | .495855     | .479951      | .51176       | .504145     | .48824       | .520049      |
| 5    | .495851     | .479947      | .511756      | .504149     | .488244      | .520053      |
| 6    | .495689     | .479783      | .511594      | .504311     | .488406      | .520217      |
| 7    | .495767     | .479862      | .511672      | .504233     | .488328      | .520138      |
| 8    | .495582     | .479675      | .511488      | .504418     | .488512      | .520325      |
| 9    | .495587     | .479681      | .511493      | .504413     | .488507      | .520319      |
| 10   | .495587     | .479681      | .511493      | .504413     | .488507      | .520319      |

95% lower and upper bounds reported

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

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

The result shows that the impulse of rspot has the most impact on rspot and the impulse of rfuture has the most impact on rfuture.