

Assignment 15

1. Estimate VARs models using spot return (rspot) and future return (rfuture) as endogenous variables and determine the most appropriated lags models using SBIC.

```
. tsset time
      time variable:  time, 1 to 795
              delta:  1 unit
```

```
. g rspot=(spot/l.spot)-1
(1 missing value generated)
```

```
. g rfuture=(future/l.future)-1
(1 missing value generated)
```

```
. varsoc rspot rfuture, maxlag(5)
```

```
Selection-order criteria
Sample: 7 - 795                                Number of obs = 789
-----+-----+-----+-----+-----+-----+-----+-----+-----+
|lag |   LL   LR   df   p   FPE   AIC   HQIC   SBIC   |
|----+-----+-----+-----+-----+-----+-----+-----+-----+
| 0 | 4774.48                1.9e-08 -12.0975 -12.093 -12.0857 |
| 1 | 4837.65 126.33   4 0.000 1.6e-08 -12.2475 -12.2339 -12.212 |
| 2 | 4857.92 40.555   4 0.000 1.6e-08 -12.2888 -12.266 -12.2296 |
| 3 | 4882.17 48.486*   4 0.000 1.5e-08* -12.3401* -12.3082* -12.2572* |
| 4 | 4884.45 4.5566   4 0.336 1.5e-08 -12.3357 -12.2948 -12.2292 |
| 5 | 4886.05 3.2155   4 0.522 1.5e-08 -12.3297 -12.2796 -12.1994 |
-----+-----+-----+-----+-----+-----+-----+-----+-----+
Endogenous:  rspot rfuture
Exogenous:   _cons
```

The most appropriate lag is lag3.

2. Perform stability test and Granger exogeneity test.

```
. *Perform stability test.
```

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

Vector autoregression

```

Sample: 5 - 795
Log likelihood = 4792.689
FPE = 1.90e-08
Det(Sigma_ml) = 1.87e-08

Number of obs = 791
AIC = -12.10288
HQIC = -12.08925
SBIC = -12.06743

```

```

Equation      Parms    RMSE    R-sq    chi2    P>chi2
-----
rspot         3      .01866  0.0036  2.8357  0.2422
rfuture       3      .022016 0.0004  .2922264 0.8641

```

```

-----
|          Coef.   Std. Err.    z    P>|z|    [95% Conf. Interval]
-----+-----
rspot |
  rspot |
    L3. | -.1337006   .1055832   -1.27  0.205   -.3406399   .0732388
    |
  rfuture |
    L3. | .1403907   .089659    1.57  0.117   -.0353377   .3161192
    |
    _cons | -.0000461   .0006622   -0.07  0.944   -.001344   .0012518
-----+-----
rfuture |
  rspot |
    L3. | -.0630787   .1245721   -0.51  0.613   -.3072355   .1810782
    |
  rfuture |
    L3. | .0571784   .105784    0.54  0.589   -.1501543   .2645112
    |
    _cons | 5.44e-06   .0007813    0.01  0.994   -.0015259   .0015368
-----

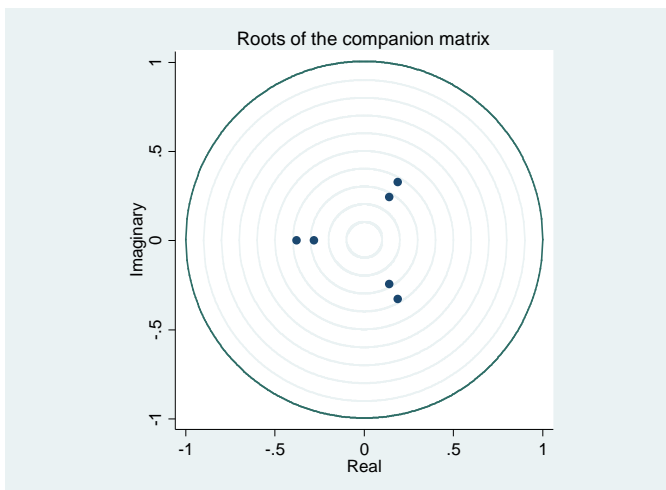
```

```
. varstable, graph
```

Eigenvalue stability condition

Eigenvalue	Modulus
.1891842 + .3276766i	.378368
.1891842 - .3276766i	.378368
-.3783683	.378368
.1408493 + .2439581i	.281699
.1408493 - .2439581i	.281699
-.2816986	.281699

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



. \*Perform Granger exogeneity test

. vargranger

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
rspot	rfuture	2.4518	1	0.117
rspot	ALL	2.4518	1	0.117
rfuture	rspot	.2564	1	0.613
rfuture	ALL	.2564	1	0.613

According to the p-value, we cannot reject the null hypothesis. The test does not guarantee endogeneity. Thus, `rspot` and `rfuture` do not have interdependent relationship.

3. Perform Impulse response function analysis (irf), Orthogonal impulse response function analysis (oirf), Cumulative impulse response function analysis (coirf), make interpretation of the analysis, and determine which variable has more impact (using Cholesky order – `rspot` `rfuture`).

```
. *Impulse response function analysis (irf)
```

```
. irf create order3, order ( rspot rfuture ) step(5) set(irf03)
```

```
(file irf03.irf now active)
```

```
(file irf03.irf updated)
```

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

Results from order3

-----						
	(1)	(1)	(1)	(2)	(2)	(2)
step	irf	Lower	Upper	irf	Lower	Upper
-----						
0	1	1	1	0	0	0
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	-.133701	-.34064	.073239	-.063079	-.307236	.181078
4	0	0	0	0	0	0
5	0	0	0	0	0	0
-----						

-----						
	(3)	(3)	(3)	(4)	(4)	(4)
step	irf	Lower	Upper	irf	Lower	Upper
-----						
0	0	0	0	1	1	1
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	.140391	-.035338	.316119	.057178	-.150154	.264511
4	0	0	0	0	0	0
5	0	0	0	0	0	0
-----						

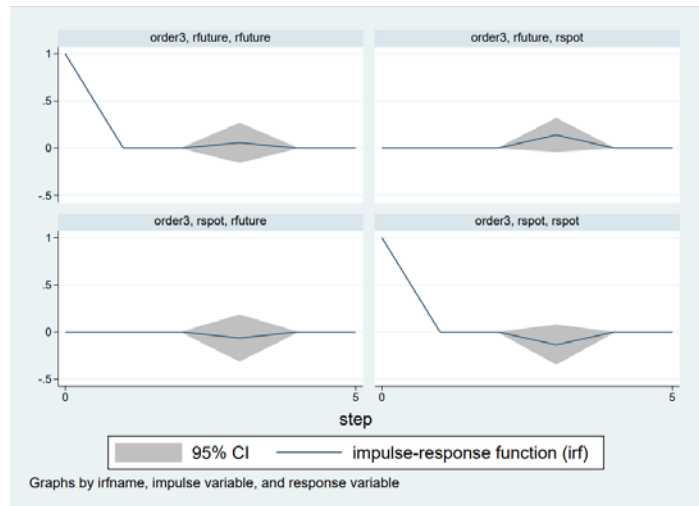
+-----+-----+

95% lower and upper bounds reported

- (1) irfname = order3, impulse = rspot, and response = rspot
- (2) irfname = order3, impulse = rspot, and response = rfuture
- (3) irfname = order3, impulse = rfuture, and response = rspot
- (4) irfname = order3, impulse = rfuture, and response = rfuture

**All the impulse-response results are insignificant. If we do not consider about the insignificant stated in the last sentence, the impulse=rspot and response=rfuture generate more impact than others.**

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



**\*Orthogonal Impulse Response Function Analysis(OIRF)**

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

Results from order3

+-----+-----+

	(1)	(1)	(1)	(2)	(2)	(2)
step	oirf	Lower	Upper	oirf	Lower	Upper
0	.018624	.017707	.019542	.02071	.019568	.021851
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	.000417	<b>-.000881</b>	<b>.001716</b>	9.3e-06	<b>-.00152</b>	<b>.001539</b>
4	0	0	0	0	0	0

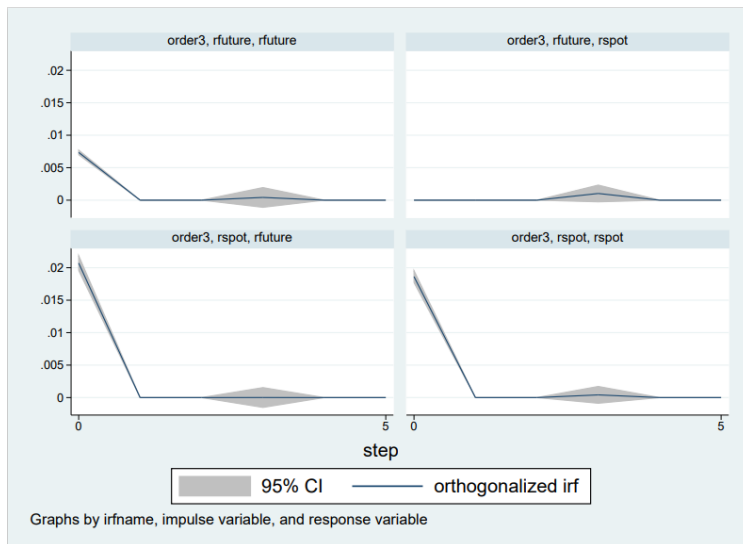
+-----+-----+

step	oirf	Lower	Upper	oirf	Lower	Upper
0	0	0	0	.007346	.006984	.007708
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	.001031	-.000261	.002323	.00042	-.001103	.001943
4	0	0	0	0	0	0
5	0	0	0	0	0	0

95% lower and upper bounds reported

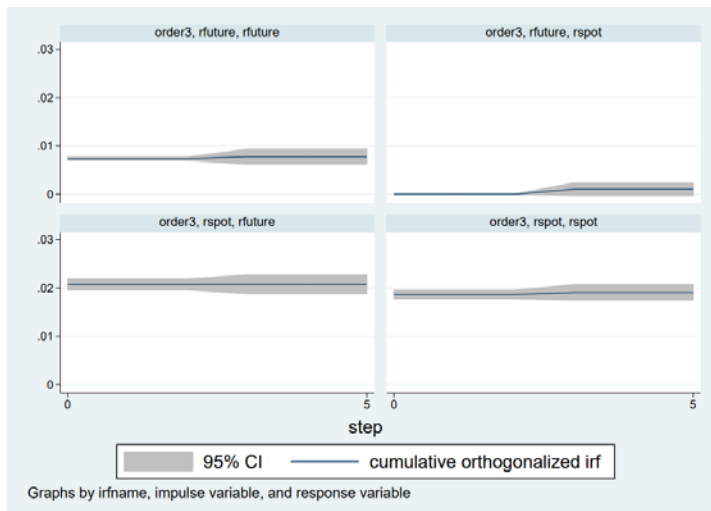
- (1) irfname = order3, impulse = rspot, and response = rspot
- (2) irfname = order3, impulse = rspot, and response = rfuture
- (3) irfname = order3, impulse = rfuture, and response = rspot
- (4) irfname = order3, impulse = rfuture, and response = rfuture

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



. \*Cumulative impulse response function analysis (coirf),

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



4. Perform Forecast error variance decomposition (fevd) and determine variable that has more impact on each endogenous variable.

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

Results from order3

step	(1)			(2)		
	fevd	Lower	Upper	fevd	Lower	Upper
0	0	0	0	0	0	0
1	1	1	1	0	0	0
2	1	1	1	0	0	0
3	1	1	1	0	0	0
4	.996945	.989307	1.00458	.003055	-.004582	.010693
5	.996945	.989307	1.00458	.003055	-.004582	.010693

95% lower and upper bounds reported

(1) irfname = order3, impulse = rspot, and response = rspot

(2) irfname = order3, impulse = rfuture, and response = rspot

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

Results from order3

-----

	(1)	(1)	(1)	(2)	(2)	(2)
step	fevd	Lower	Upper	fevd	Lower	Upper
0	0	0	0	0	0	0
1	.888241	.873561	.902921	.111759	.097079	.126439
2	.888241	.873561	.902921	.111759	.097079	.126439
3	.888241	.873561	.902921	.111759	.097079	.126439
4	.887917	.873012	.902821	.112083	.097179	.126988
5	.887917	.873012	.902821	.112083	.097179	.126988

95% lower and upper bounds reported

(1) irfname = order3, impulse = rspot, and response = rfuture

(2) irfname = order3, impulse = rfuture, and response = rfuture

It can clearly be seen that rspot has more impact on each endogenous variable.

### 5. Determine whether changing Cholesky order from – “rspot rfuture” to “rfuture rspot” will change the results of irf, oirf, coirf, and fevd. Why? or why not?

**Yes, because the Cholesky order form matters. The evidence is shown below.**

```
. *Impulse response function analysis (irf)
```

```
. *Impulse response function analysis (irf)
```

```
. irf create order5, order ( rspot rfuture ) step(5) set(irf05)
```

```
(file irf05.irf created)
```

```
(file irf05.irf now active)
```

```
(file irf05.irf updated)
```

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

Results from order5

	(1)	(1)	(1)	(2)	(2)	(2)
step	irf	Lower	Upper	irf	Lower	Upper
0	1	1	1	0	0	0

1	0	0	0	0	0	0	
2	0	0	0	0	0	0	
3	.057178	-.150154	.264511	.140391	-.035338	.316119	
4	0	0	0	0	0	0	
5	0	0	0	0	0	0	

-----+

-----+

	(3)	(3)	(3)	(4)	(4)	(4)	
step	irf	Lower	Upper	irf	Lower	Upper	
0	0	0	0	1	1	1	
1	0	0	0	0	0	0	
2	0	0	0	0	0	0	
3	-.063079	-.307236	.181078	-.133701	-.34064	.073239	
4	0	0	0	0	0	0	
5	0	0	0	0	0	0	

-----+

95% lower and upper bounds reported

(1) irfname = order5, impulse = rfuture, and response = rfuture

(2) irfname = order5, impulse = rfuture, and response = rspot

(3) irfname = order5, impulse = rspot, and response = rfuture

(4) irfname = order5, impulse = rspot, and response = rspot  
95% lower and upper bounds reported

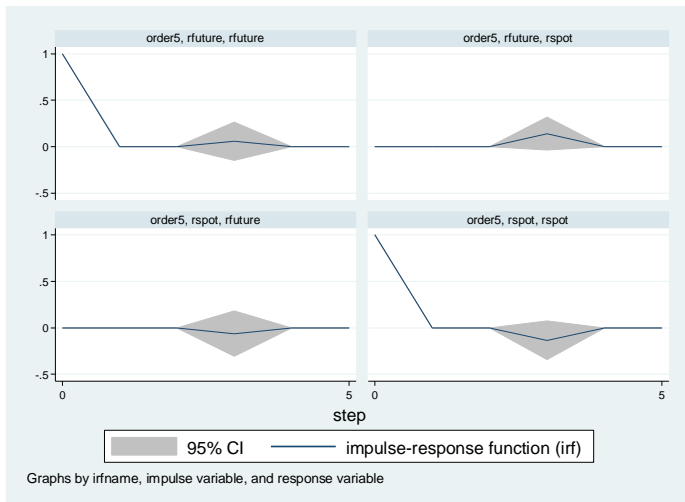
(1) irfname = order4, impulse = rfuture, and response = rfuture

(2) irfname = order4, impulse = rfuture, and response = rspot

(3) irfname = order4, impulse = rspot, and response = rfuture

(4) irfname = order4, impulse = rspot, and response = rspot

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



```
. *Orthogonal Impulse Response Function Analysis(OIRF)
```

```
. *Orthogonal Impulse Response Function Analysis(OIRF)
```

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

Results from order5

-----+-----						
	(1)	(1)	(1)	(2)	(2)	(2)
step	oirf	Lower	Upper	oirf	Lower	Upper
-----+-----						
0	.007346	.006984	.007708	0	0	0
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	.00042	-.001103	.001943	.001031	-.000261	.002323
4	0	0	0	0	0	0
5	0	0	0	0	0	0
-----+-----						

-----+-----						
	(3)	(3)	(3)	(4)	(4)	(4)
step	oirf	Lower	Upper	oirf	Lower	Upper
-----+-----						
0	.02071	.019568	.021851	.018624	.017707	.019542
1	0	0	0	0	0	0
2	0	0	0	0	0	0



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

Results from order5

```
+-----+
|          | (1)      (1)      (1)      | (2)      (2)      (2)      |
| step    | fevd     Lower     Upper     | fevd     Lower     Upper     |
+-----+-----+-----+-----+-----+-----+
| 0       | 0        0         0         | 0        0         0         |
| 1       | .111759  .097079  .126439   | .888241  .873561  .902921   |
| 2       | .111759  .097079  .126439   | .888241  .873561  .902921   |
| 3       | .111759  .097079  .126439   | .888241  .873561  .902921   |
| 4       | .112083  .097179  .126988   | .887917  .873012  .902821   |
| 5       | .112083  .097179  .126988   | .887917  .873012  .902821   |
+-----+-----+-----+-----+-----+-----+

```

95% lower and upper bounds reported

(1) irfname = order5, impulse = rfuture, and response = rfuture

(2) irfname = order5, impulse = rspot, and response = rfuture

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

Results from order5

```
+-----+
|          | (1)      (1)      (1)      | (2)      (2)      (2)      |
| step    | fevd     Lower     Upper     | fevd     Lower     Upper     |
+-----+-----+-----+-----+-----+-----+
| 0       | 0        0         0         | 0        0         0         |
| 1       | 0        0         0         | 1        1         1         |
| 2       | 0        0         0         | 1        1         1         |
| 3       | 0        0         0         | 1        1         1         |
| 4       | .003055  -.004582  .010693   | .996945  .989307  1.00458   |
| 5       | .003055  -.004582  .010693   | .996945  .989307  1.00458   |
+-----+-----+-----+-----+-----+-----+

```

95% lower and upper bounds reported

(1) irfname = order5, impulse = rfuture, and response = rspot

(2) irfname = order5, impulse = rspot, and response = rspot

