Assignment 8

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

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

. g rfuture=(future/l.future)-1
(1 missing value generated)
 . varsoc rspot rfuture, maxlag(6)

   Selection-order criteria
   Sample:  8 - 7684                              Number of obs      =      7677
```

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	76684.3				7.2e-12	-19.9772	-19.9765	-19.9754
1	76855.1	341.57	4	0.000	6.9e-12	-20.0206	-20.0187	-20.0152
2	76944.6	178.91	4	0.000	6.8e-12	-20.0429	-20.0398	-20.0338
3	76977.6	66.057	4	0.000	6.7e-12	-20.0504	-20.0461	-20.0378
4	76994	32.874	4	0.000	6.7e-12	-20.0537	-20.0481	-20.0374
5	77031.8	75.59	4	0.000	6.6e-12	-20.0625	-20.0557	-20.0426
6	77062.5	61.332*	4	0.000	6.6e-12*	-20.0694*	-20.0614*	-20.0459*

```
  Endogenous:  rspot rfuture
   Exogenous:  _cons
```

From SBIC, the most appropriate lag order is 6 since it gives the lowest value.

2. Perform stability test and Granger exogeneity test

```
. 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
------------------------------------------------------------------
```

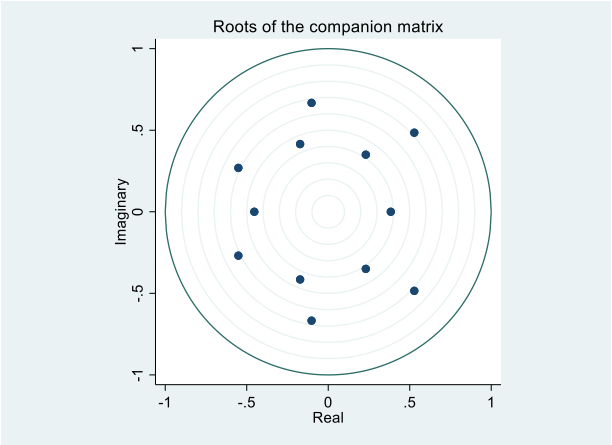
	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
rspot						
rspot						
L1.	-.0429887	.0160995	-2.67	0.008	-.0745432	-.0114342
L2.	-.1255145	.0163803	-7.66	0.000	-.1576194	-.0934097
L3.	-.0654555	.0165559	-3.95	0.000	-.0979044	-.0330066
L4.	-.0555308	.0165648	-3.35	0.001	-.0879973	-.0230644
L5.	-.0646528	.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

```
. 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.



From stability test, all the eigenvalues lies inside the Unit circle. So, it satisfies stability condition.

```
. vargranger
```

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
rspot	rfuture	82.299	6	0.000
rspot	ALL	82.299	6	0.000
rfuture	rspot	148.42	6	0.000
rfuture	ALL	148.42	6	0.000

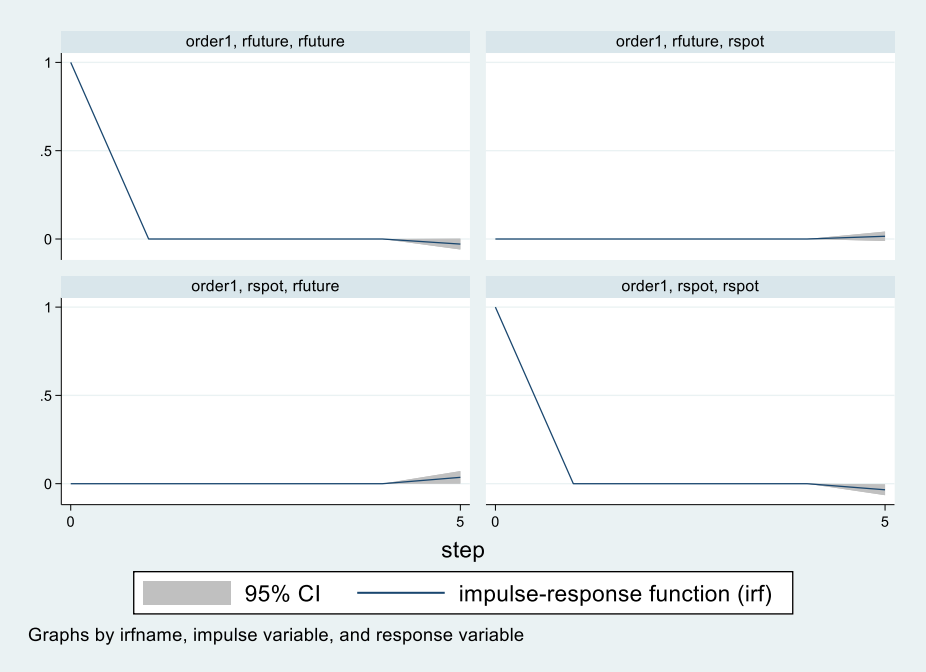
From Granger exogeneity tests, all test is significant. So, both rspot and rfuture are endogenous variable.

3. Perform Impulse response analysis and determine which variable has more impact

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

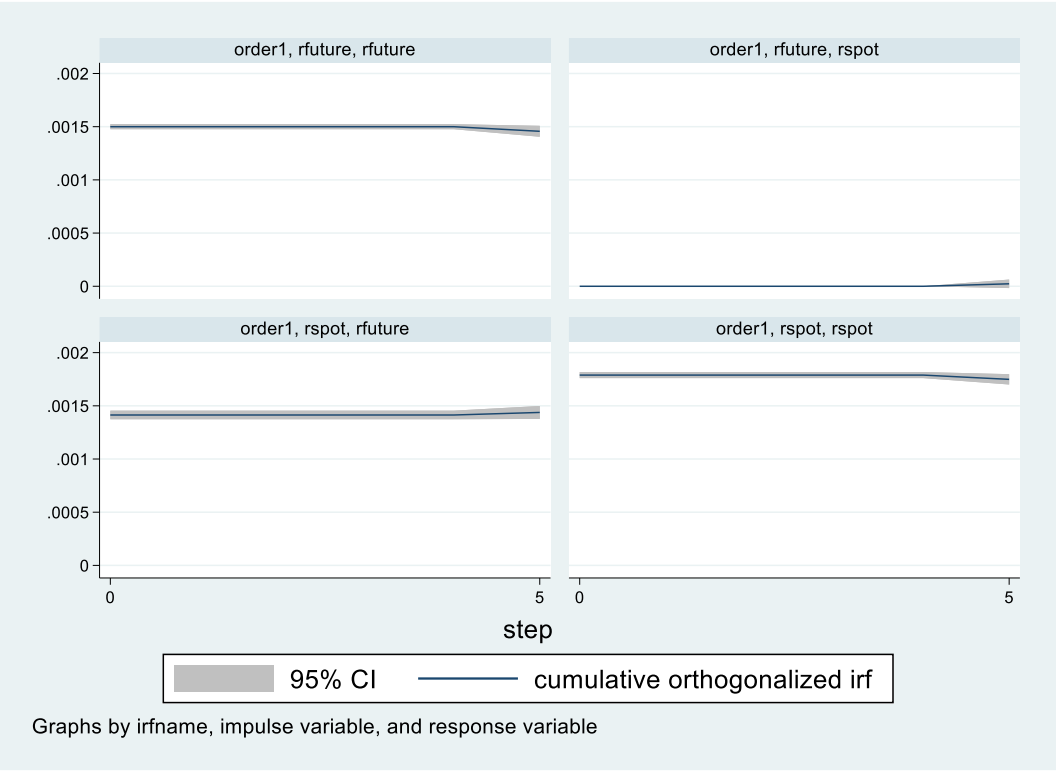
```
. irf table irf, impulse(rspot rfuture) response(rspot rfuture)

                              Results from order1

+-------------------------------------------+
|      |    (1)        (1)         (1)     |
| step |   irf        Lower       Upper    |
|------+------------------------------------|
|0     | 1            1           1        |
|1     | -.042989     -.074543    -.011434 |
|2     | -.101957     -.133505    -.070409 |
|3     | -.034997     -.066566    -.003428 |
|4     | -.02148      -.052956    .009995  |
|5     | -.033647     -.06485     -.002443 |
|6     | -.010717     -.041519    .020085  |
+-------------------------------------------+

+-------------------------------------------+
|      |    (2)        (2)         (2)     |
| step |   irf        Lower       Upper    |
|------+------------------------------------|
|0     | 0            0           0        |
|1     | .211774      .175513     .248035  |
|2     | .030833      -.00561     .067276  |
|3     | .030738      -.005677    .067153  |
|4     | .002714      -.033596    .039023  |
|5     | .034962      -.001046    .070971  |
|6     | .017646      -.017933    .053226  |
+-------------------------------------------+

+-------------------------------------------+
|      |    (3)        (3)         (3)     |
| step |   irf        Lower       Upper    |
|------+------------------------------------|
|0     | 0            0           0        |
|1     | .102511      .075055     .129966  |
|2     | .061675      .034224     .089126  |
|3     | .018216      -.009265    .045697  |
|4     | .026291      -.001106    .053688  |
|5     | .01553       -.011653    .042713  |
|6     | .006933      -.01982     .033686  |
+-------------------------------------------+

+-------------------------------------------+
|      |    (4)        (4)         (4)     |
| step |   irf        Lower       Upper    |
|------+------------------------------------|
|0     | 1            1           1        |
|1     | -.162359     -.19391     -.130809 |
|2     | -.057352     -.089063    -.025641 |
|3     | -.025324     -.057023    .006376  |
|4     | -.004062     -.035665    .027541  |
|5     | -.029332     -.060699    .002035  |
|6     | -.003566     -.034475    .027344  |
+-------------------------------------------+
```

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



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

                              Results from order1

+---------------------------------------------+
|        |    (1)         (1)         (1)     |
|  step  |  coirf       Lower       Upper     |
|--------+------------------------------------|
|0       | .001775     .001747     .001803    |
|1       | .001847     .001798     .001896    |
|2       | .001755     .001691     .001819    |
|3       | .001719     .001644     .001794    |
|4       | .001719     .001635     .001803    |
|5       | .001682     .001589     .001774    |
|6       | .001673     .001573     .001772    |
+---------------------------------------------+

+---------------------------------------------+
|        |    (2)         (2)         (2)     |
|  step  |  coirf       Lower       Upper     |
|--------+------------------------------------|
|0       | .001444     .001404     .001483    |
|1       | .001585     .001527     .001644    |
|2       | .001557     .001484     .00163     |
|3       | .001575     .001491     .001659    |
|4       | .001574     .00148      .001668    |
|5       | .001594     .001491     .001697    |
|6       | .00162      .001509     .001731    |

|--------+------------------------------------|
|0       | 0           0           0          |
|1       | .000148     .000108     .000187    |
|2       | .000237     .00018      .000294    |
|3       | .000263     .000194     .000332    |
|4       | .000301     .000223     .000379    |
|5       | .000323     .000238     .000409    |
|6       | .000333     .000242     .000424    |
+---------------------------------------------+

+---------------------------------------------+
|        |    (4)         (4)         (4)     |
|  step  |  coirf       Lower       Upper     |
|--------+------------------------------------|
|0       | .001441     .001419     .001464    |
|1       | .001207     .001158     .001257    |
|2       | .001125     .001059     .00119     |
|3       | .001088     .00101      .001166    |
|4       | .001082     .000995     .00117     |
|5       | .00104      .000945     .001136    |
|6       | .001035     .000934     .001136    |
+---------------------------------------------+
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 )
```



From the result, all of these has a positive direction. For magnitude,rspot on rfuture has more impact than rfuture on rspot since the shaded area of rspot on rfuture is greater than rfuture.For duration, it takes around 6 period to goes to zero.

From COIRF test, all value has lower bound more than zero. The lower and upper bound does not cover zero. So, all values are significant.

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

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

                              Results from order1

+---------------------------------------------+
|        |    (1)         (1)         (1)     |
|  step  |   fevd       Lower       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    |
+---------------------------------------------+

+---------------------------------------------+
|        |    (2)         (2)         (2)     |
|  step  |   fevd       Lower       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

+---------------------------------------------+
|        |    (1)         (1)         (1)     |
|  step  |   fevd       Lower       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    |
+---------------------------------------------+

+---------------------------------------------+
|        |    (2)         (2)         (2)     |
|  step  |   fevd       Lower       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
```

From Forecast Error Variance Decomposition, rspot has more impact to rfuture than rfuture has more impact to rspot. Moreover, all the value since the lower bound and upper bound don’t cover zero.