Assignment 6
Guideline Solution

The following VARs models:

$$Y_t = A_0 + A_1 Y_{t-1} + \in_t$$

where: $Y_t = \begin{pmatrix} rspot_t \\ rfuture_t \end{pmatrix}$, $A_0 = \begin{pmatrix} a_{10} \\ a_{20} \end{pmatrix}$, $A_1 = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}$, $\in_t = \begin{pmatrix} e_{1t} \\ e_{2t} \end{pmatrix}$

From the data set assign04.dta:

Requirements:

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

```
. varsoc rspot rfuture

   Selection-order criteria
   Sample:  6 - 7684                               Number of obs      =      7679
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 |  76705.7                      7.2e-12  -19.9775  -19.9769  -19.9757  |
  |  1 |  76876.4  341.45    4  0.000  6.9e-12  -20.0209  -20.0191  -20.0155  |
  |  2 |  76966.2  179.52    4  0.000  6.8e-12  -20.0433  -20.0402  -20.0342  |
  |  3 |  76999.2   66.06    4  0.000  6.7e-12  -20.0508  -20.0465  -20.0382* |
  |  4 |  77015.7  32.907*   4  0.000  6.7e-12* -20.0541* -20.0485* -20.0378  |
  +---------------------------------------------------------------------------+
   Endogenous:  rspot rfuture
    Exogenous:  _cons
```

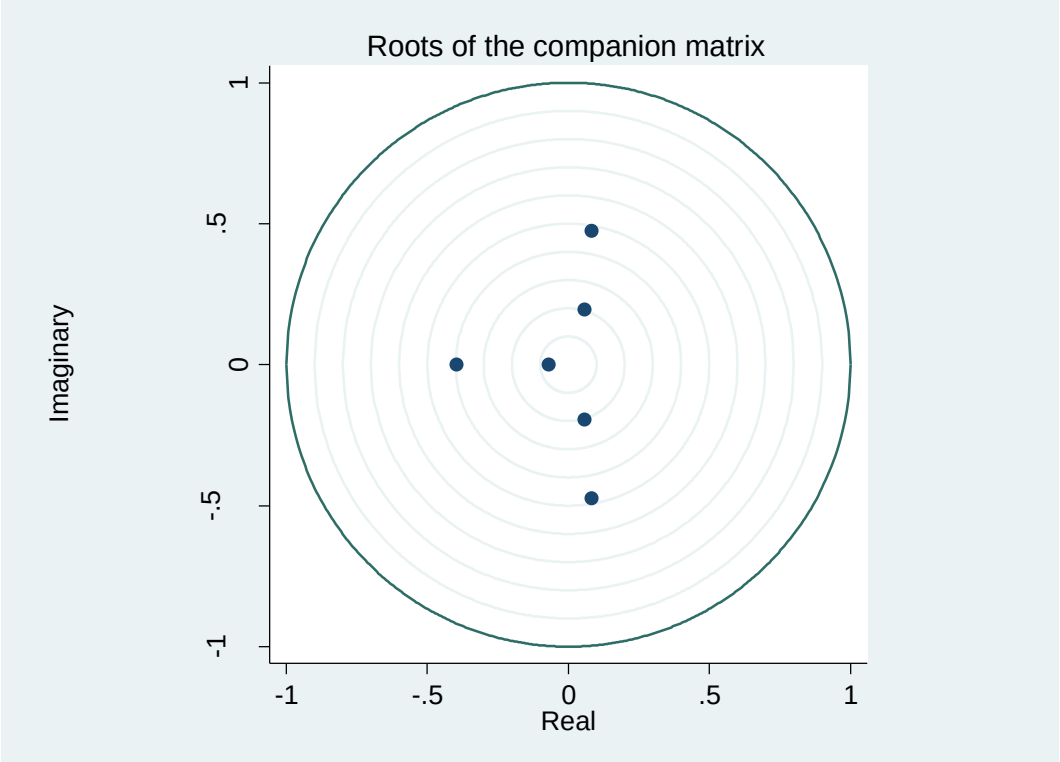
- ***According to SBIC, the most appropriated lag order is 3.***

2. Perform stability test and Granger exogeneity test.

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

Vector autoregression

Sample:  5 - 7684                               No. of obs      =      7680
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

- ***According to stability test, the system is stable since all the eigenvalues lie inside the unit circle.***
- ***According to Granger exogeneity, both rspot and rfuture are all endogenous variables since all the tests are significant.***

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

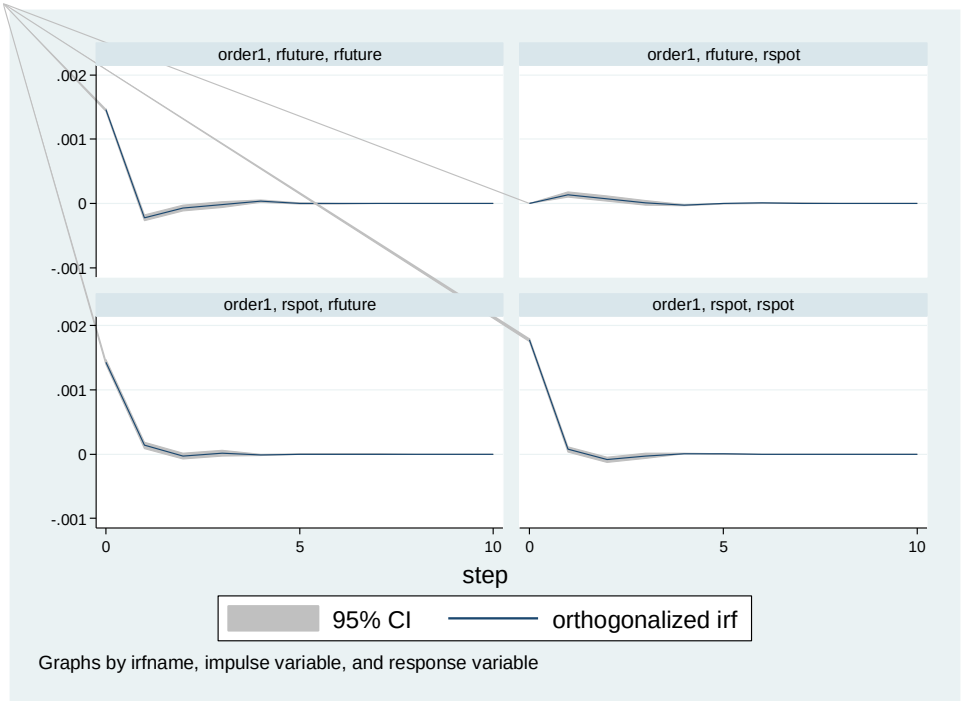
```
. irf create order1, o(rspot rfuture) step(10) set(irf01)
(file irf01.irf created)
(file irf01.irf now active)
(file irf01.irf updated)

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

Results from order1

step	(1) oirf	(1) Lower	(1) Upper	(2) oirf	(2) Lower	(2) Upper	(3) oirf	(3) Lower	(3) Upper
0	.001778	.00175	.001806	.001434	.001395	.001474	0	0	0
1	.000076	.000036	.000116	.000137	.000091	.000183	.000136	.000096	.000175
2	-.000086	-.000126	-.000047	-.000032	-.000078	.000014	.000075	.000036	.000114
3	-.000028	-.000068	.000012	.000013	-.000033	.000058	6.6e-06	-.000032	.000045
4	.000011	3.5e-06	.000018	-.000012	-.00002	-4.5e-06	-.000028	-.00004	-.000016
5	5.1e-06	3.5e-07	9.8e-06	-2.5e-06	-7.0e-06	2.1e-06	-3.4e-06	-.00001	3.3e-06
6	-8.3e-07	-2.8e-06	1.1e-06	8.0e-07	-1.0e-06	2.6e-06	4.7e-06	2.1e-06	7.3e-06
7	-1.5e-06	-2.7e-06	-2.5e-07	1.5e-06	1.3e-07	2.9e-06	2.1e-06	-3.3e-07	4.6e-06
8	4.6e-08	-4.1e-07	5.0e-07	-2.1e-07	-5.6e-07	1.3e-07	-9.4e-07	-1.5e-06	-3.4e-07
9	3.1e-07	6.8e-08	5.4e-07	-2.8e-07	-5.2e-07	-3.8e-08	-5.7e-07	-1.1e-06	-4.2e-08
10	5.4e-08	-1.0e-07	2.1e-07	-4.3e-08	-1.9e-07	1.0e-07	9.1e-08	-1.3e-07	3.1e-07

step	(4) oirf	(4) Lower	(4) Upper
0	.001454	.001431	.001477
1	-.000222	-.000268	-.000177
2	-.000074	-.000119	-.000028
3	-.000021	-.000066	.000024
4	.000036	.00002	.000052
5	-3.4e-07	-6.6e-06	5.9e-06
6	-4.1e-06	-6.9e-06	-1.4e-06
7	-2.2e-06	-4.9e-06	5.1e-07
8	1.2e-06	5.8e-07	1.9e-06
9	4.6e-07	-5.3e-08	9.7e-07
10	-1.1e-07	-3.1e-07	8.6e-08

```
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 oirf, impulse(rspot rfuture) response(rspot rfuture)
```




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

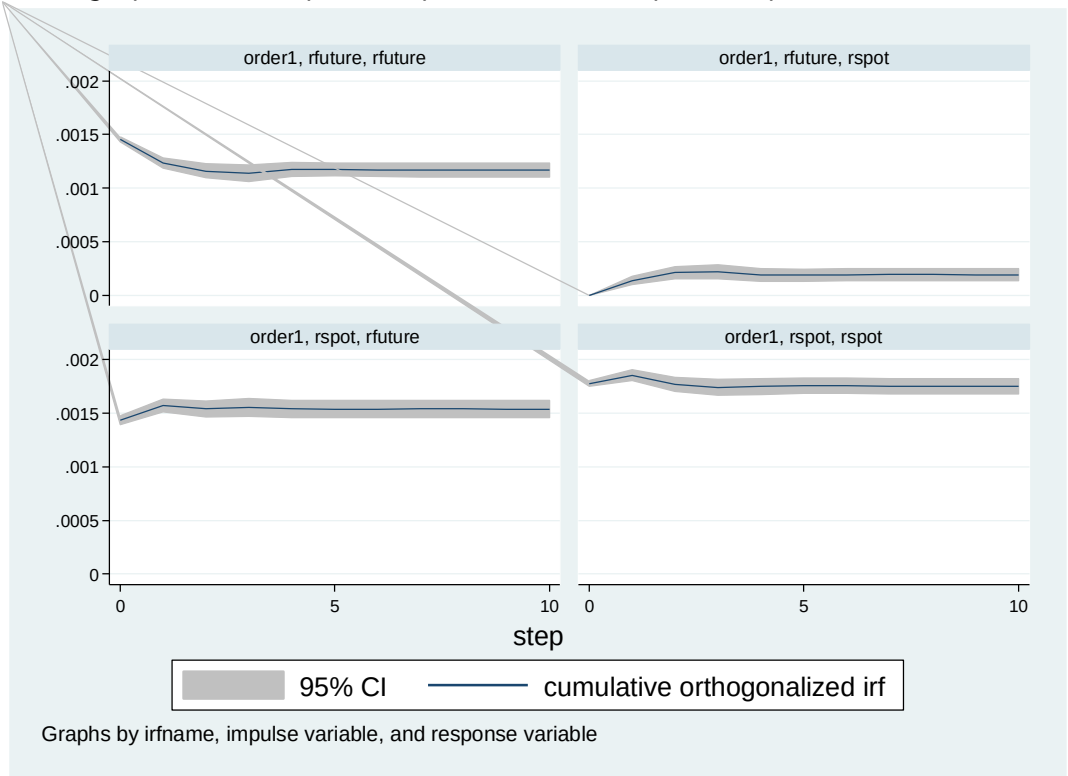
Results from order1

step	(1) coirf	(1) Lower	(1) Upper	(2) coirf	(2) Lower	(2) Upper	(3) coirf	(3) Lower	(3) Upper
0	.001778	.00175	.001806	.001434	.001395	.001474	0	0	0
1	.001855	.001805	.001904	.001572	.001513	.00163	.000136	.000096	.000175
2	.001768	.001704	.001832	.00154	.001467	.001613	.000211	.000154	.000268
3	.00174	.001665	.001815	.001552	.001468	.001637	.000217	.00015	.000285
4	.00175	.001676	.001825	.00154	.001457	.001623	.000189	.000132	.000247
5	.001756	.001684	.001827	.001538	.001457	.001618	.000186	.000132	.00024
6	.001755	.001683	.001826	.001538	.001458	.001619	.00019	.000135	.000245
7	.001753	.001681	.001825	.00154	.001459	.001621	.000192	.000136	.000249
8	.001753	.001681	.001825	.00154	.001459	.001621	.000192	.000135	.000248
9	.001754	.001682	.001826	.001539	.001459	.00162	.000191	.000135	.000247
10	.001754	.001682	.001826	.001539	.001459	.00162	.000191	.000135	.000247

step	(4) coirf	(4) Lower	(4) Upper
0	.001454	.001431	.001477
1	.001232	.001183	.001282
2	.001159	.001093	.001224
3	.001137	.001061	.001214
4	.001173	.001109	.001238
5	.001173	.001111	.001235
6	.001169	.001105	.001232
7	.001166	.001102	.001231
8	.001168	.001104	.001232
9	.001168	.001104	.001232
10	.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)
```



- ***According to IRF analysis, rspot has more impact on rfuture.***

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 rfuture)
```

Results from order1

step	(1) fevd	(1) Lower	(1) Upper	(2) fevd	(2) Lower	(2) Upper	(3) fevd	(3) Lower	(3) Upper
0	0	0	0	0	0	0	0	0	0
1	1	1	1	.493053	.47713	.508975	0	0	0
2	.994221	.990856	.997585	.48956	.473586	.505534	.005779	.002415	.009144
3	.992487	.988616	.996357	.489057	.473061	.505053	.007513	.003643	.011384
4	.992475	.988611	.996339	.489024	.47303	.505018	.007525	.003661	.011389
5	.992228	.988242	.996214	.488895	.472897	.504893	.007772	.003786	.011758
6	.992224	.988237	.996212	.488895	.472897	.504893	.007776	.003788	.011763
7	.992218	.988226	.996209	.488894	.472895	.504892	.007782	.003791	.011774
8	.992216	.988224	.996208	.488893	.472895	.504891	.007784	.003792	.011776
9	.992216	.988224	.996208	.488893	.472895	.504891	.007784	.003792	.011776
10	.992216	.988223	.996208	.488893	.472895	.504891	.007784	.003792	.011777

step	(4) fevd	(4) Lower	(4) Upper
0	0	0	0
1	.506947	.491025	.52287
2	.51044	.494466	.526414
3	.510943	.494947	.526939
4	.510976	.494982	.52697
5	.511105	.495107	.527103
6	.511105	.495107	.527103
7	.511106	.495108	.527105
8	.511107	.495109	.527105
9	.511107	.495109	.527105
10	.511107	.495109	.527105

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
```

- ***According to Forecast error variance decomposition, rspot has more impact on rfuture.***