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Assignment 8

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:

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, 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
```

The most appropriate lags model using SBIC is lag term 6 which is -20.053 since it has the lowest value (best model in term of best fit the data)

2. Perform stability test and Granger exogeneity test.

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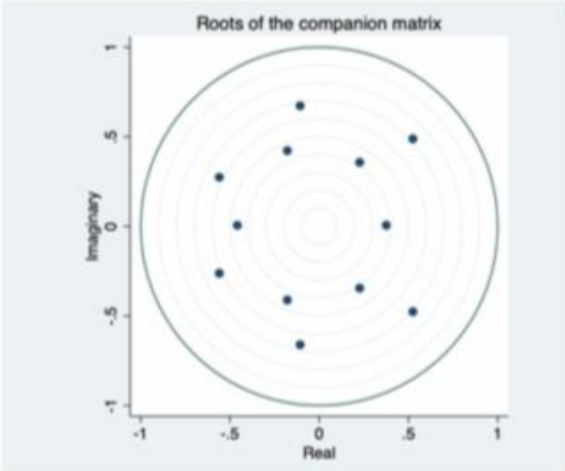
```
. varstable, graph
```

Eigenvalue stability condition

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

According to the stability test, all the eigenvalues are less than 1 and all eigenvalues lie inside the unit circle. VAR satisfies stability condition. We have a stable system. (We have dynamic system and our dynamic system has happen to be stable)

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According to the Granger test, to guarantee endogeneity or the interdependent relationship between rspot and rfuture, the test's Prob > Chi2 are all 0.000 (all the p-value < 0.05), therefore, we reject H_0, rspot and rfuture are endogeneity.

(Note : We set hypothesis of H_0 : $\Delta_{21}(L) = 0$ and $\Delta_{12}(L) = 0$)

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 now active)
(file irf01.irf updated)

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

                                                    Results from order1
```

step	(1) irf	(1) Lower	(1) Upper	(2) irf	(2) Lower	(2) Upper
0	1	1	1	0	0	0
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) irf	(3) Lower	(3) Upper	(4) irf	(4) Lower	(4) Upper
0	0	0	0	1	1	1
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
```

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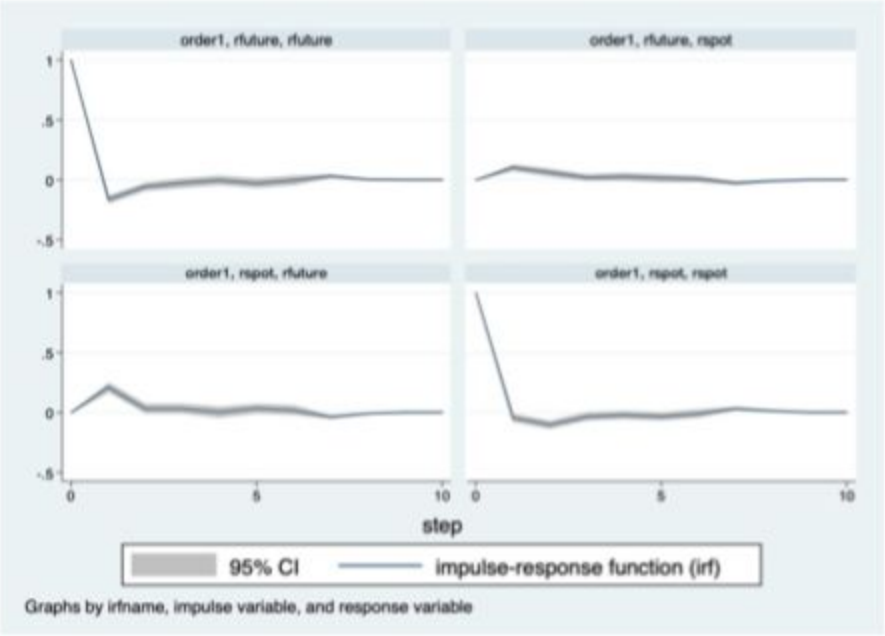


```
. irf table oirf, impulse(rspot rfuture) response(rspot rfuture)

                                                    Results from order1
```

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step	(1) oirf	(1) Lower	(1) Upper	(2) oirf	(2) Lower	(2) Upper
0	.001775	.001747	.001803	.001444	.001404	.001483
1	.000072	.000032	.000112	.000142	.000096	.000188
2	-.000092	-.000132	-.000052	-.000028	-.000074	.000018
3	-.000036	-.000076	4.1e-06	.000018	-.000028	.000064
4	-1.8e-07	-.00004	.00004	-1.0e-06	-.000047	.000045
5	-.000037	-.000077	2.5e-06	.00002	-.000026	.000066
6	-9.0e-06	-.000049	.000031	.000026	-.00002	.000072
7	.000019	.000011	.000028	-.000019	-.000028	-1.0e-05
8	9.9e-06	3.6e-06	.000016	-8.5e-06	-.000015	-2.5e-06
9	2.0e-06	-1.8e-06	5.8e-06	-1.0e-06	-4.7e-06	2.7e-06
10	8.3e-07	-2.1e-06	3.8e-06	6.5e-09	-3.0e-06	3.0e-06

step	(3) oirf	(3) Lower	(3) Upper	(4) oirf	(4) Lower	(4) Upper
0	0	0	0	.001441	.001419	.001464
1	.000148	.000108	.000187	-.000234	-.00028	-.000188
2	.000089	.000049	.000128	-.000083	-.000128	-.000037
3	.000026	-.000013	.000066	-.000037	-.000082	9.2e-06
4	.000038	-1.6e-06	.000077	-5.9e-06	-.000051	.00004
5	.000022	-.000017	.000062	-.000042	-.000087	2.9e-06
6	1.0e-05	-.000029	.000049	-5.1e-06	-.00005	.000039
7	-.000038	-.000053	-.000023	.000044	.000026	.000063
8	-.000012	-.000021	-2.6e-06	5.4e-06	-3.2e-06	.000014
9	-2.9e-07	-5.1e-06	4.5e-06	-9.4e-07	-5.5e-06	3.6e-06
10	7.2e-07	-3.3e-06	4.8e-06	-5.0e-07	-4.6e-06	3.6e-06

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)
```

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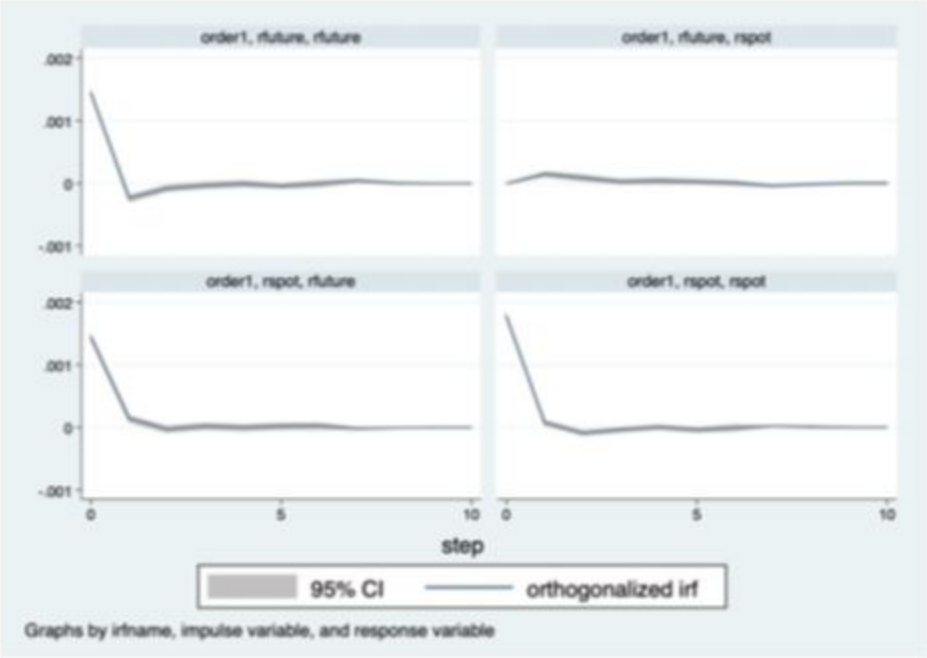


```
. irf table coirf, impulse(rspot rfuture) response(rspot rfuture)

                                                    Results from order1
```

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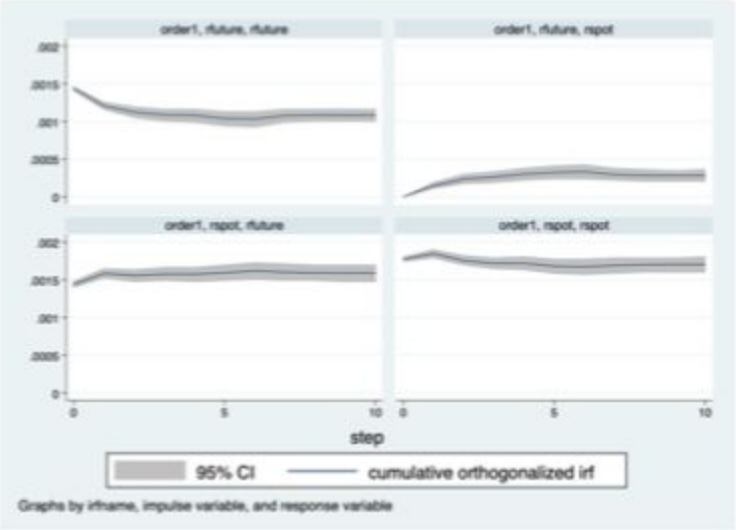
step	(1) coirf	(1) Lower	(1) Upper	(2) coirf	(2) Lower	(2) Upper
0	.001775	.001747	.001803	.001444	.001404	.001483
1	.001847	.001798	.001896	.001585	.001527	.001644
2	.001755	.001691	.001819	.001557	.001484	.00163
3	.001719	.001644	.001794	.001575	.001491	.001659
4	.001719	.001635	.001803	.001574	.00148	.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) coirf	(3) Lower	(3) Upper	(4) coirf	(4) Lower	(4) 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

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



- Direction : According to the IRF graph, all variables have positive impact.
- Magnitude : The impact of rspot on rfuture is larger than rfuture on rspot.
- Duration : It takes 6 periods until the impact goes to zero.

According to COIRF to look at the significance of the impulse response, the result shows that all values have lower bound more than zero. Therefore, the lower and upper bound does not cover zero, 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
```

step	(1) fevd	(1) Lower	(1) Upper	(2) fevd	(2) Lower	(2) 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

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

                    Results from order1
```

step	(1) fevd	(1) Lower	(1) Upper	(2) fevd	(2) Lower	(2) 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
```

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According to the FEVD test, about 99% of variation in rspot caused by rpot itself and less than 1% caused by rfuture. From variation in rfuture, about half of variation in rfuture caused by rfuture itself and the half caused by rspot. Therefore, rspot has greater impact to rfuture than rfuture have impact on rspot.