1.

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

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

. dfuller rspot, trend lags(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7681

                                 ------------ Interpolated Dickey-Fuller ------------
                    Test         1% Critical       5% Critical      10% Critical
                Statistic             Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -63.787            -3.960            -3.410            -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D.rspot |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------+---------------------------------------------------------------------
      rspot |
        L1. |  -1.005168   .0157581   -63.79   0.000    -1.036058   -.9742776
        LD. |   .0517018   .0113974     4.54   0.000     .0293598    .0740439
     _trend |   9.56e-10   9.19e-09     0.10   0.917    -1.71e-08    1.90e-08
      _cons |   .0000199   .0000408     0.49   0.626      -.00006    .0000998
------------------------------------------------------------------------------

. dfuller rfuture, trend lags(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7681

                                 ------------ Interpolated Dickey-Fuller ------------
                    Test         1% Critical       5% Critical      10% Critical
                Statistic             Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -65.070            -3.960            -3.410            -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D.rfuture |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------+---------------------------------------------------------------------
      rfuture |
        L1. |  -1.063572   .0163449   -65.07   0.000    -1.095612   -1.031531
        LD. |    .03575   .0114053     3.13   0.002     .0133924    .0581076
     _trend |   1.17e-09   1.06e-08     0.11   0.912    -1.96e-08    2.19e-08
      _cons |   .0000231    .000047     0.49   0.624    -.0000691    .0001152
------------------------------------------------------------------------------
```

```
. qui arima rspot, arima(1,0,1) nolog
. est store arima101
. qui arima rspot, arima(1,0,2) nolog
. est store arima102
. qui arima rspot, arima(1,0,3) nolog
. est store arima103
. qui arima rspot, arima(1,0,4) nolog
. est store arima104
. qui arima rspot, arima(1,0,5) nolog
. est store arima105
. qui arima rspot, arima(2,0,1) nolog
. est store arima201
. qui arima rspot, arima(2,0,2) nolog
. est store arima202
. qui arima rspot, arima(2,0,3) nolog
. est store arima203
. qui arima rspot, arima(2,0,4) nolog
. est store arima204
. qui arima rspot, arima(2,0,5) nolog
. est store arima205
```

```
. qui arima rspot, arima(3,0,1) nolog
. est store arima301
. qui arima rspot, arima(3,0,2) nolog
. est store arima302
. qui arima rspot, arima(3,0,3) nolog
. est store arima303
. qui arima rspot, arima(3,0,4) nolog
. est store arima304
. qui arima rspot, arima(3,0,5) nolog
. est store arima305
. qui arima rspot, arima(4,0,1) nolog
. est store arima401
. qui arima rspot, arima(4,0,2) nolog
. est store arima402
. qui arima rspot, arima(4,0,3) nolog
. est store arima403
. qui arima rspot, arima(4,0,4) nolog
. est store arima404
. qui arima rspot, arima(4,0,5) nolog
. est store arima405
. qui arima rspot, arima(5,0,1) nolog
. est store arima501
. qui arima rspot, arima(5,0,2) nolog
. est store arima502
. qui arima rspot, arima(5,0,3) nolog
. est store arima503
. qui arima rspot, arima(5,0,4) nolog
. est store arima504
. qui arima rspot, arima(5,0,5) nolog
. est store arima505
```

```
. est table arima10*,star(0.1 0.5 0.01) stat(N ll chi2 aic bic)
```

Variable	arima101	arima102	arima103	arima104	arima105
rspot					
_cons	.00002358*	.00002358*	.00002358*	.00002357*	.0000236*
ARMA					
ar					
L1.	-.39222121***	.42866768***	.65121793**	-.44187083	.19422255
ma					
L1.	.44515732***	-.38284317***	-.60570251**	.48778128	-.14853288
L2.		-.06805288***	-.0785457***	-.02952615	-.0578027**
L3.			.01541405*	-.04117544	-.00879285
L4.				-.00216734	.00427518
L5.					-.02212732**
sigma					
_cons	.00178634***	.00178491***	.00178487***	.00178491***	.00178452***
Statistics					
N	7683	7683	7683	7683	7683
ll	37713.142	37719.292	37719.478	37719.305	37720.958
chi2	119.51861	100.14226	108.29283	133.21806	101.26927
aic	-75418.284	-75428.583	-75426.956	-75424.609	-75425.916
bic	-75390.497	-75393.85	-75385.276	-75375.982	-75370.342

legend: * p<.5; ** p<.1; *** p<.01

```
. . est table arima20*,star(0.1 0.5 0.01) stat(N ll chi2 aic bic)
```

Variable	arima201	arima202	arima203	arima204	arima205
rspot					
_cons	.00002357*	.00002358*	.00002357*	.00002358*	.00002356*
ARMA					
ar					
L1.	.38018903***	.4428634***	-.29668626	.20849639	.63271495***
L2.	-.06525664***	.06485063	.18525538	.3777193*	-.9174531***
ma					
L1.	-.33467542**	-.39715673***	.3426502	-.16259964	-.58719207***
L2.		-.13338401*	-.22062902	-.4368354*	.83979784***
L3.			-.0455461	-.02891993	.05477838***
L4.				.02145033*	-.0341015***
L5.					-.03010547***
sigma					
_cons	.00178498***	.00178489***	.00178489***	.00178475***	.00178388***
Statistics					
N	7683	7683	7683	7683	7683
ll	37719.008	37719.388	37719.394	37719.987	37723.723
chi2	97.508642	100.31373	120.1281	104.88266	710.97147
aic	-75428.017	-75426.777	-75424.788	-75423.974	-75429.446
bic	-75393.283	-75385.096	-75376.161	-75368.4	-75366.925

legend: * p<.5; ** p<.1; *** p<.01

```
. est table arima30*,star(0.1 0.5 0.01) stat(N ll chi2 aic bic)
```

Variable	arima301	arima302	arima303	arima304	arima305
rspot					
_cons	.00002358*	.00002358*	.00002358*	.00002358*	.00002358*
ARMA					
ar					
L1.	.77437319***	.75391093*	-.00931271	.11658227*	.1701239
L2.	-.08500113***	-.07142142	.14076076	-.77533773***	-.75368747***
L3.	.02486609*	.02349348	.27348399**	.50689845***	.56032548**
ma					
L1.	-.72875825***	-.70829213*	.05444554	-.07070647	-.12433777
L2.		-.0126675	-.19087608*	.72188531***	.69756857***
L3.			-.29968133**	-.48362803***	-.53417632**
L4.				-.06737448***	-.06847815***
L5.					.00392646
sigma					
_cons	.00178484***	.00178484***	.00178455***	.00178409***	.00178409***
Statistics					
N	7683	7683	7683	7683	7683
ll	37719.588	37719.589	37720.837	37722.792	37722.804
chi2	116.99403	115.5826	113.25114	10208.991	9995.0318
aic	-75427.175	-75425.178	-75425.675	-75427.585	-75425.609
bic	-75385.495	-75376.55	-75370.101	-75365.064	-75356.141

legend: * p<.5; ** p<.1; *** p<.01

```
. est table arima40*,star(0.1 0.5 0.01) stat(N ll chi2 aic bic)
```

Variable	arima401	arima402	arima403	arima404	arima405
rspot					
_cons	.00002358*	.00002358*	.00002358*	.00002358*	.00002358*
ARMA					
ar					
L1.	.7666053**	.19158964	.11455665*	.11554831*	-.54927322
L2.	-.0847024***	.40155116	-.84432053***	-.7579017***	-.78567965***
L3.	.02504525*	-.03039789	.4764288***	.51349215***	-.04793383
L4.	-.00097078	.02217215*	-.06669135***	.01738201	.25111025
ma					
L1.	-.72097599**	-.14607877	-.0688967	-.0697206	.59533818
L2.		-.45952184	.79187066***	.70442344***	.76310459***
L3.			-.45274427***	-.49036213***	.03649951
L4.				-.08464192	-.30317115
L5.					-.04483284
sigma					
_cons	.00178484***	.0017848***	.00178412***	.00178409***	.00178407***
Statistics					
N	7683	7683	7683	7683	7683
ll	37719.59	37719.787	37722.647	37722.799	37722.91
chi2	116.13751	103.18568	9970.8895	10384.247	10621.886
aic	-75425.181	-75423.574	-75427.294	-75425.598	-75423.821
bic	-75376.553	-75368	-75364.773	-75356.131	-75347.407

legend: * p<.5; ** p<.1; *** p<.01

```
. est table arima50*,star(0.1 0.5 0.01) stat(N ll chi2 aic bic)
```

Variable	arima501	arima502	arima503	arima504	arima505
rspot					
_cons	.00002358*	.00002357*	.00002356*	.00002358*	.00002357*
ARMA					
ar					
L1.	.16545423	.27864545	.40295474*	.45006125	.64948609*
L2.	-.05696613**	-.38380205*	-.81262761**	-.79649687***	-.844491*
L3.	-.00729372	.0132755	-.23254742	.79695972	.13043438
L4.	.00131372	-.01409715	-.01690687	-.14085523	-.03624586
L5.	-.02387488**	-.027723**	-.03802772*	.02389748	.21166048*
ma					
L1.	-.11967988	-.23291976	-.35731992*	-.40421962	-.60425085*
L2.		.32183899	.7460888**	.72684872***	.76637039*
L3.			.27286254	-.75498242	-.07798537
L4.				.06527172	.00341651
L5.					-.24345546*
sigma					
_cons	.0017845***	.00178443***	.00178393***	.00178407***	.00178371***
Statistics					
N	7683	7683	7683	7683	7683
ll	37721.078	37721.395	37723.49	37722.895	37724.453
chi2	102.58864	114.46132	754.18517	7125.4394	2753.0424
aic	-75426.156	-75424.789	-75426.981	-75423.79	-75424.907
bic	-75370.582	-75362.269	-75357.513	-75347.376	-75341.546

legend: * p<.5; ** p<.1; *** p<.01

By looking at BIC, we can conclude that ARIMA(1,0,2) has the lowest BIC value so it's the most appropriate model to use.

```
. qui arima rfuture, arima(1,0,1) nolog

. est store arima101

. qui arima rfuture, arima(1,0,2) nolog

. est store arima102

. qui arima rfuture, arima(1,0,3) nolog

. est store arima103

. qui arima rfuture, arima(1,0,4) nolog

. est store arima104

. qui arima rfuture, arima(1,0,5) nolog

. est store arima105

. qui arima rfuture, arima(2,0,1) nolog

. est store arima201

. qui arima rfuture, arima(2,0,2) nolog

. est store arima202

. qui arima rfuture, arima(2,0,3) nolog

. est store arima203

. qui arima rfuture, arima(2,0,4) nolog

. est store arima204

. qui arima rfuture, arima(2,0,5) nolog
flat log likelihood encountered, cannot find uphill direction
r(430);
. est store arima205

. qui arima rfuture, arima(3,0,1) nolog

. est store arima301

. qui arima rfuture, arima(3,0,2) nolog

. est store arima302

. qui arima rfuture, arima(3,0,3) nolog

. est store arima303

. qui arima rfuture, arima(3,0,4) nolog

. est store arima304

. qui arima rfuture, arima(3,0,5) nolog
flat log likelihood encountered, cannot find uphill direction
r(430);
.
. est store arima305

. qui arima rfuture, arima(4,0,1) nolog

. est store arima401

. qui arima rfuture, arima(4,0,2) nolog

. est store arima402

. qui arima rfuture, arima(4,0,3) nolog
flat log likelihood encountered, cannot find uphill direction
r(430);
.
. est store arima403

. qui arima rfuture, arima(4,0,4) nolog

. est store arima404

. qui arima rfuture, arima(4,0,5) nolog

. est store arima405

. qui arima rfuture, arima(5,0,1) nolog

. est store arima501
```

```
. qui arima rfuture, arima(5,0,2) nolog
flat log likelihood encountered, cannot find uphill direction
r(430);
.
. est store arima502

. qui arima rfuture, arima(5,0,3) nolog
flat log likelihood encountered, cannot find uphill direction
r(430);
.
. est store arima503

. qui arima rfuture, arima(5,0,4) nolog

. est store arima504

. qui arima rfuture, arima(5,0,5) nolog

. est store arima505

. est table arima10*,star(0.1 0.5 0.01) stat(N ll chi2 aic bic)
```

Variable	arima101	arima102	arima103	arima104	arima105
rfuture					
_cons	.00002616*	.00002615*	.00002616*	.00002616*	.00002616*
ARMA					
ar					
L1.	.57862596***	.1646139*	-.99197447***	.79841544	-.18361821
ma					
L1.	-.61250239***	-.19269514*	.96410656***	-.82650053	.15556594
L2.		-.03060977**	-.06340407***	-.01279972	-.04031228*
L3.			-.03781316***	.02245519	-.01199443
L4.				.00291512	-.00091534
L5.					-.00688194
sigma					
_cons	.00205937***	.00205903***	.00205869***	.00205902***	.00205897***
Statistics					
N	7683	7683	7683	7683	7683
ll	36620.387	36621.683	36622.888	36621.711	36621.87
chi2	81.753207	31.061825	22854.409	198.49394	20.219307
aic	-73232.774	-73233.366	-73233.777	-73229.421	-73227.74
bic	-73204.987	-73198.632	-73192.096	-73180.794	-73172.166

legend: * p<.5; ** p<.1; *** p<.01

```
. est table arima20*,star(0.1 0.5 0.01) stat(N ll chi2 aic bic)
```

Variable	arima201	arima202	arima203	arima204	arima205
rfuture					
_cons	.00002615*	.00002616*	.00002616*	.00002616*	
ARMA					
ar					
L1.	.1969293*	.15226368	-.89465216***	-.21191276	
L2.	-.02961053**	.01296947	.09670737	.7739461*	
ma					
L1.	-.22502128*	-.18034761	.86690892***	.18414572	
L2.		-.04390959	-.15716989*	-.81541951*	
L3.			-.03516526***	.0087431	
L4.				.02645814*	
sigma					
_cons	.00205903***	.00205902***	.00205868***	.00205865***	
_					
__000001					
L1.					-.20330359*
L2.					-.26517311*
__000002					
L1.					.1763371*
L2.					.22465735*
L3.					-.01997915*
L4.					-.01071388*
L5.					-.00857039*
Statistics					
N	7683	7683	7683	7683	7647
ll	36621.673	36621.684	36622.933	36622.979	36449.918
chi2	31.861358	30.829039	19162.658	7252.7011	
aic	-73233.346	-73231.368	-73231.866	-73229.957	-72885.836
bic	-73198.612	-73189.687	-73183.239	-73174.383	-72837.241

legend: * p<.5; ** p<.1; *** p<.01

```
. est table arima30*,star(0.1 0.5 0.01) stat(N ll chi2 aic bic)
```

Variable	arima301	arima302	arima303	arima304	arima305
rfuture					
_cons	.00002616*	.00002616*	.00002616*	.00002616*	
ARMA					
ar					
L1.	.43719971	-.85909988***	-.52747572***	-.82736723***	
L2.	-.02300883*	.09775979	-.40407854**	-.74587198***	
L3.	.00949671	-.03402297**	.51713482***	.23650853*	
ma					
L1.	-.46528441	.83132969***	.4970627***	.80029577***	
L2.		-.15697594*	.36091826**	.68901778***	
L3.			-.55335106***	-.29264193*	
L4.				-.025065*	
sigma					
_cons	.00205902***	.00205869***	.00205828***	.00205707***	
_					
__000001					
L1.					-.18924579*
L2.					-.24847615*
L3.					.11181123
__000002					
L1.					.16231046
L2.					.20835636*
L3.					-.13083923
L4.					-.00698344
L5.					-.00455255
Statistics					
N	7683	7683	7683	7683	7647
ll	36621.693	36622.898	36624.395	36628.568	36450.025
chi2	52.845219	16988.837	3955.2326	1315798.4	
aic	-73231.387	-73231.797	-73232.791	-73239.136	-72884.051
bic	-73189.706	-73183.17	-73177.217	-73176.615	-72828.514

legend: * p<.5; ** p<.1; *** p<.01

```
. est table arima40*,star(0.1 0.5 0.01) stat(N ll chi2 aic bic)
```

Variable	arima401	arima402	arima403	arima404	arima405
rfuture					
_cons	.00002615*	.00002616*		.00002616*	.00002616*
ARMA					
ar					
L1.	.76058435*	-.25527038		-1.0425111*	-1.8573076***
L2.	-.01390815	.71171913*		-.79921724**	-1.6443249***
L3.	.02101897	.00567706		.17857969	-.58098208*
L4.	.00315781	.02457106*		.1386749	.19738539*
ma					
L1.	-.78867414*	.22752078		1.014861*	1.8305835***
L2.		-.75436369*		.73536519**	1.5600418***
L3.				-.24349783*	.46380195*
L4.				-.16638352	-.28342558*
L5.					-.02886948**
sigma					
_cons	.00205902***	.00205868***		.00205819***	.00205674***
_					
__000001					
L1.			-.18517822*		
L2.			-.23095887*		
L3.			.15772674*		
L4.			-.00484301		
__000002					
L1.			.15784926		
L2.			.19096724*		
L3.			-.17612485*		
Statistics					
N	7683	7683	7649	7683	7683
ll	36621.713	36622.973	36459.436	36624.797	36629.763
chi2	166.77546	7255.7719		6825.9109	1522945.7
aic	-73229.427	-73229.946	-72904.872	-73229.594	-73237.526
bic	-73180.799	-73174.372	-72856.276	-73160.126	-73161.112

legend: * p<.5; ** p<.1; *** p<.01

```
. est table arima50*,star(0.1 0.5 0.01) stat(N ll chi2 aic bic)
```

Variable	arima501	arima502	arima503	arima504	arima505
rfuture					
_cons	.00002616*			.00002615*	.00002616*
ARMA					
ar					
L1.	-.17881777			-1.2088095***	-.79758143***
L2.	-.04028792*			-1.1649322***	-1.5288687***
L3.	-.01301738			-.75929455**	-.09243149
L4.	-.00282876			.15079556	-.23653186*
L5.	-.00826276*			-.03135393**	.52788065***
ma					
L1.	.15074717			1.1813416***	.76659346***
L2.				1.0976641***	1.4784826***
L3.				.6778281**	.01626756
L4.				-.21960633*	.1865648*
L5.					-.56308807***
sigma					
_cons	.00205896***			.00205707***	.00205767***
_					
__000001					
L1.		-.20262924*	-.19167923*		
L2.		-.25266835*	-.24450765*		
L3.		-.01930101*	.11301221		
L4.		-.01061853*	-.00665161		
L5.		-.00920511*	-.00441732		
__000002					
L1.		.17526386*	.16433907*		
L2.		.21217017*	.20433355*		
L3.			-.13201063		
Statistics					
N	7683	7650	7649	7683	7683
ll	36621.909	36462.282	36459.482	36626.203	36626.651
chi2	20.150745			1.266e+08	200769.26
aic	-73227.818	-72910.563	-72902.965	-73230.405	-73229.302
bic	-73172.244	-72861.966	-72847.426	-73153.991	-73145.941

legend: * p<.5; ** p<.1; *** p<.01

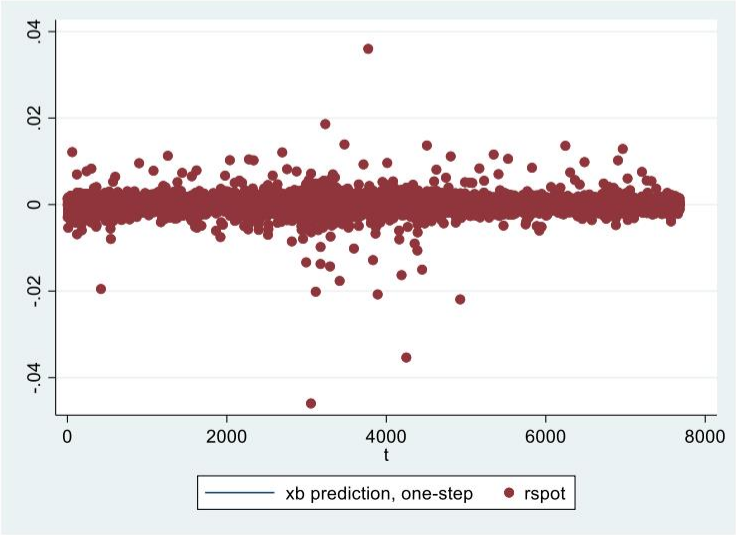
By looking at BIC, we can conclude that ARIMA(1,0,1) has the lowest BIC value so it's the most appropriate model to use.

2.

```
. arima rspot, arima(1,0,2) nolog

ARIMA regression

Sample:  2 - 7684                               Number of obs     =       7683
                                                Wald chi2(3)      =     100.14
Log likelihood =  37719.29                      Prob > chi2       =     0.0000
```

rspot	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
rspot						
_cons	.0000236	.0000205	1.15	0.251	-.0000167	.0000639
ARMA						
ar						
L1.	.4286677	.14387	2.98	0.003	.1466877	.7106476
ma						
L1.	-.3828432	.1441239	-2.66	0.008	-.6653209	-.1003655
L2.	-.0680529	.0088279	-7.71	0.000	-.0853552	-.0507505
/sigma	.0017849	2.07e-06	861.95	0.000	.0017809	.001789

```
Note: The test of the variance against zero is one sided, and the two-sided
      confidence interval is truncated at zero.
. predict rspothat_s, xb
.  twoway (line rspothat_s t, sort) (scatter rspot t, sort)
```



```
. g fe_spot=rspot-rspothat_s
. g sfe=fe^2
. sum sfe if t>=2
```

RMSE Static

Variable	Obs	Mean	Std. Dev.	Min	Max
sfe	7,683	3.19e-06	.0000348	1.61e-15	.0020963

```
. arima rspot, arima(1,0,2) nolog

ARIMA regression

Sample:  2 - 7684                               Number of obs     =       7683
                                                Wald chi2(3)      =     100.14
Log likelihood =  37719.29                      Prob > chi2       =     0.0000
```

rspot	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
rspot						
_cons	.0000236	.0000205	1.15	0.251	-.0000167	.0000639
ARMA						
ar						
L1.	.4286677	.14387	2.98	0.003	.1466877	.7106476
ma						
L1.	-.3828432	.1441239	-2.66	0.008	-.6653209	-.1003655
L2.	-.0680529	.0088279	-7.71	0.000	-.0853552	-.0507505
/sigma	.0017849	2.07e-06	861.95	0.000	.0017809	.001789

```
Note: The test of the variance against zero is one sided, and the two-sided
      confidence interval is truncated at zero.
```


```
. g fe_spot=rspot-rspothat_s
. g sfe=fe^2
. sum sfe if t>=2
```

Variable	Obs	Mean	Std. Dev.	Min	Max
sfe	7,683	3.19e-06	.0000348	1.61e-15	.0020963

```
. arima rspot, arima(1,0,2) nolog

ARIMA regression

Sample:  2 - 7684                               Number of obs     =       7683
                                                Wald chi2(3)      =     100.14
Log likelihood =  37719.29                      Prob > chi2       =     0.0000
```

rspot	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
rspot						
_cons	.0000236	.0000205	1.15	0.251	-.0000167	.0000639
ARMA						
ar						
L1.	.4286677	.14387	2.98	0.003	.1466877	.7106476
ma						
L1.	-.3828432	.1441239	-2.66	0.008	-.6653209	-.1003655
L2.	-.0680529	.0088279	-7.71	0.000	-.0853552	-.0507505
/sigma	.0017849	2.07e-06	861.95	0.000	.0017809	.001789

```
Note: The test of the variance against zero is one sided, and the two-sided
      confidence interval is truncated at zero.
```


```
. predict rspothat_d, y dynamic(.)
Note: beginning dynamic predictions in period        5.

. g dfe=rspot-rspothat_d if t<7685
(1 missing value generated)

. g sdfe=dfe^2
(1 missing value generated)

. sum sdfe
```

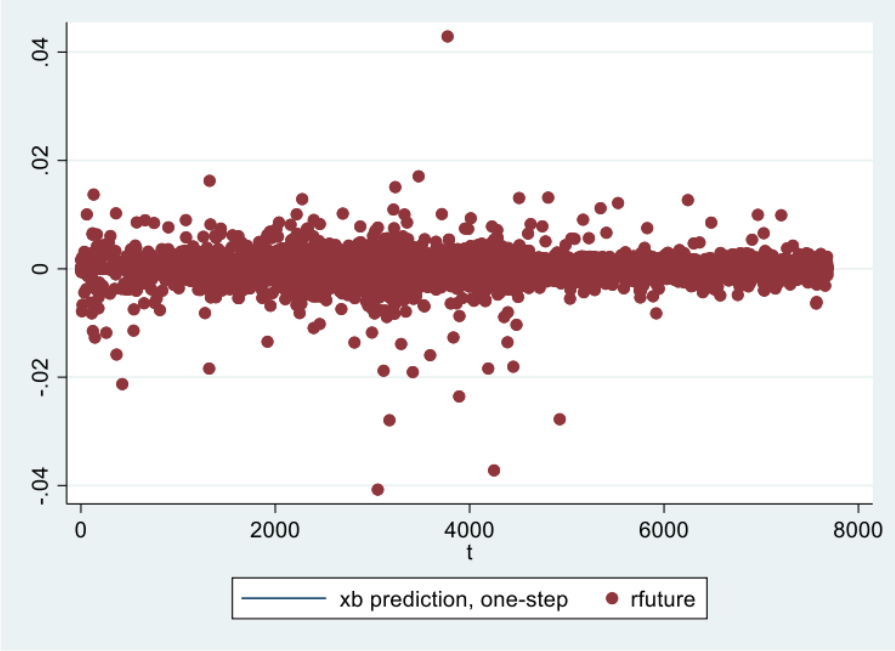
RMSE Dynamic

Variable	Obs	Mean	Std. Dev.	Min	Max
sdfe	7,683	3.20e-06	.000035	8.09e-12	.0021155

```
. arima rfuture, arima(1,0,1) nolog

ARIMA regression

Sample:  2 - 7684                               Number of obs     =       7683
                                                Wald chi2(2)      =      81.75
Log likelihood =  36620.39                      Prob > chi2       =     0.0000
```

rfuture	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
rfuture						
_cons	.0000262	.0000221	1.18	0.237	-.0000172	.0000695
ARMA						
ar L1.	.578626	.142571	4.06	0.000	.299192	.8580599
ma L1.	-.6125024	.1373304	-4.46	0.000	-.881665	-.3433398
/sigma	.0020594	2.64e-06	779.58	0.000	.0020542	.0020645

```
Note: The test of the variance against zero is one sided, and the two-sided
      confidence interval is truncated at zero.

. predict rfuturehat_s, xb

. twoway (line rfuturehat_s t, sort) (scatter rfuture t,sort)
```



```
. g fe_future=rfuture-rfuturehat_s
(1 missing value generated)

. g sfe_future=fe_future^2
(1 missing value generated)

. sum sfe_future if t>=2 // static f
```

RMSE Static

Variable	Obs	Mean	Std. Dev.	Min	Max
sfe_future	7,683	4.24e-06	.0000388	1.12e-17	.0018431

```
. arima rfuture, arima(1,0,1) nolog

ARIMA regression

Sample:  2 - 7684                               Number of obs     =       7683
                                                Wald chi2(2)      =      81.75
Log likelihood =  36620.39                      Prob > chi2       =     0.0000
```

rfuture	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
rfuture						
_cons	.0000262	.0000221	1.18	0.237	-.0000172	.0000695
ARMA						
ar						
L1.	.578626	.142571	4.06	0.000	.299192	.8580599
ma						
L1.	-.6125024	.1373304	-4.46	0.000	-.881665	-.3433398
/sigma	.0020594	2.64e-06	779.58	0.000	.0020542	.0020645

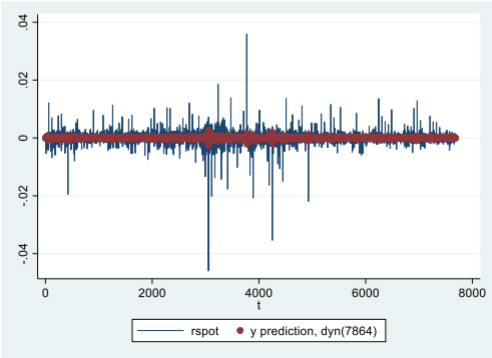
```
Note: The test of the variance against zero is one sided, and the two-sided
      confidence interval is truncated at zero.

. predict rfuturehat_d, y dynamic(.)
Note: beginning dynamic predictions in period       4.

. g dfe_future=rfuture-rfuturehat_d
(1 missing value generated)

. g sdfe_future=dfe_future^2
(1 missing value generated)

. sum sdfe_future if t<7685 // dynamic f-cast
```

RMSE Dynamic

Variable	Obs	Mean	Std. Dev.	Min	Max
sdfe_future	7,683	4.25e-06	.0000388	1.19e-10	.0018373

3.

```
. arima rspot, arima(1,0,2) nolog

ARIMA regression

Sample:  2 - 7684                               Number of obs     =       7683
                                                Wald chi2(3)      =     100.14
Log likelihood =  37719.29                      Prob > chi2       =     0.0000

------------------------------------------------------------------------------
             |                 OPG
      rspot |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
rspot        |
       _cons |   .0000236   .0000205     1.15   0.251    -.0000167    .0000639
-------------+----------------------------------------------------------------
ARMA         |
          ar |
          L1. |   .4286677     .14387     2.98   0.003     .1466877    .7106476
             |
          ma |
          L1. |  -.3828432   .1441239    -2.66   0.008    -.6653209   -.1003655
          L2. |  -.0680529   .0088279    -7.71   0.000    -.0853552   -.0507505
-------------+----------------------------------------------------------------
       /sigma |   .0017849   2.07e-06   861.95   0.000     .0017809    .001789
------------------------------------------------------------------------------
Note: The test of the variance against zero is one sided, and the two-sided
      confidence interval is truncated at zero.

. predict rspothat, y dynamic(7864)

. twoway (line rspot t, sort) (scatter rspothat t,sort)
```




```
. arima rfuture, arima(1,0,1) nolog

ARIMA regression

Sample:  2 - 7684                               Number of obs     =       7683
                                                Wald chi2(2)      =      81.75
Log likelihood =  36620.39                      Prob > chi2       =     0.0000

------------------------------------------------------------------------------
             |                 OPG
    rfuture |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
rfuture      |
       _cons |   .0000262   .0000221     1.18   0.237    -.0000172    .0000695
-------------+----------------------------------------------------------------
ARMA         |
          ar |
          L1. |    .578626   .142571     4.06   0.000     .299192    .8580599
             |
          ma |
          L1. |  -.6125024   .1373304    -4.46   0.000    -.881665   -.3433398
-------------+----------------------------------------------------------------
       /sigma |   .0020594   2.64e-06   779.58   0.000     .0020542    .0020645
------------------------------------------------------------------------------
Note: The test of the variance against zero is one sided, and the two-sided
      confidence interval is truncated at zero.

. predict rfuturehat, y dynamic(7864)

. twoway (line rfuture t, sort) (scatter rfuturehat t,sort)
```