(R)
Statistics/Data Analysis

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Project: Assignment 13

(R)
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Notes:
1. Unicode is supported; see help unicode_advice.
2. More than 2 billion observations are allowed; see help obs_advice.
3. Maximum number of variables is set to 5000; see help set_maxvar.

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```
1 . use "C:\Users\Kriss\OneDrive\เดสก์ท็อป\426\assign_timeseries.dta"

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

3 . dfuller y,trend lags(1) regress
variable y not found
r(111);

4 . dfuller y,trend lags(1) regress
variable y not found
r(111);

5 . dfuller future,trend lags(1) regress
```

Augmented Dickey-Fuller test for unit root Number of obs = **793**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-1.374**	**-3.960**	**-3.410**	**-3.120**

MacKinnon approximate p-value for Z(t) = **0.8685**

D.future	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
future						
L1.	-.0050243	.0036579	-1.37	0.170	-.0122046	.002156
LD.	-.0335608	.0355846	-0.94	0.346	-.1034125	.036291
_trend	-.0009128	.0016705	-0.55	0.585	-.0041919	.0023663
_cons	2.67398	2.183399	1.22	0.221	-1.611978	6.959937

```
. dfuller future,lags(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =       793
```

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
		Interpolated Dickey-Fuller		
Z(t)	**-1.264**	**-3.430**	**-2.860**	**-2.570**

MacKinnon approximate p-value for Z(t) = **0.6453**

D.future	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
future						
L1.	**-.0041054**	**.0032469**	**-1.26**	**0.206**	**-.0104789**	**.0022682**
LD.	**-.0340903**	**.0355556**	**-0.96**	**0.338**	**-.103885**	**.0357044**
_cons	**1.866323**	**1.606292**	**1.16**	**0.246**	**-1.286783**	**5.019429**

```
. dfuller d.future,lags(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =       792
```

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
		Interpolated Dickey-Fuller		
Z(t)	**-19.717**	**-3.430**	**-2.860**	**-2.570**

MacKinnon approximate p-value for Z(t) = **0.0000** < 0.05 I(d) = I(1)

D2.future	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
future						
LD.	**-1.010352**	**.0512418**	**-19.72**	**0.000**	**-1.110938**	**-.9097652**
LD2.	**-.0248666**	**.0356111**	**-0.70**	**0.485**	**-.0947703**	**.0450371**
_cons	**-.1188031**	**.3401442**	**-0.35**	**0.727**	**-.7864979**	**.5488916**

```
. qui arima y, arima(1,1,1) nolog
variable y not found
r(111);

. qui arima future, arima(1,1,1) nolog

. est store arima111

. qui arima y, arima(1,1,2) nolog
variable y not found
r(111);

. qui arima future, arima(1,1,2) nolog

. est store arima112
```

```
14 . qui arima future, arima(1,1,3) nolog
15 . est store arima113
16 . qui arima future, arima(1,1,4) nolog
17 . est store arima114
18 . qui arima future, arima(2,1,1) nolog
19 . est store arima211
20 . qui arima future, arima(2,1,2) nolog
21 . est store arima212
22 . qui arima future, arima(2,1,3) nolog
23 . est store arima213
24 . qui arima future, arima(2,1,4) nolog
25 . est store arima214
26 . qui arima future, arima(3,1,1) nolog
27 . est store arima311
28 . qui arima future, arima(3,1,2) nolog
29 . est store arima312
30 . qui arima future, arima(3,1,3) nolog
31 . est store arima313
32 . qui arima future, arima(3,1,4) nolog
33 . est store arima314
34 . qui arima future, arima(4,1,1) nolog
35 . est store arima411
36 . qui arima future, arima(4,1,1) nolog
37 . qui arima future, arima(4,1,2) nolog
38 . est store arima412
39 . qui arima future, arima(4,1,3) nolog
40 . est store arima413
41 . qui arima future, arima(4,1,4) nolog
42 . est store arima414
43 . est table arima11*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
```

Variable	arima111	arima112	arima113	arima114
future				
_cons	**-.11424575**	**-.11408115**	**-.1139183**	**-.11370744**
ARMA				
ar L1.	**-.36850497**	**.30224152**	**.07471074**	**-.26441554**
ma L1.	**.33119538**	**-.33885872**	**-.11128313**	**.23060131**

L2.		.04456173	.0345267	.02935071
L3.			.03319847	.04074154
L4.				.03843721
sigma				
_cons	9.5427695***	9.5390832***	9.5360585***	9.532552***
Statistics				
N	794	794	794	794
ll	-2917.724	-2917.4236	-2917.166	-2916.8767
chi2	3.3320137	3.4714053	5.5726249	7.6343946
aic	5843.4479	5844.8473	5846.3321	5847.7535
bic	5862.1563	5868.2327	5874.3946	5880.493

legend: * p<.1; ** p<.05; *** p<.01

```
44 . est table arima21*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
```

Variable	arima211	arima212	arima213	arima214
future				
_cons	-.11399264	-.11287823	-.11518755	-.114745
ARMA				
ar				
L1.	.26006773	1.195716***	.39680958***	.29779715***
L2.	.03927244	-.91443516***	-.83492246***	-.89274399***
ma				
L1.	-.29537225	-1.2256939***	-.43709178***	-.33588403***
L2.		.97207528***	.86844397***	.9442071***
L3.			.02125732	.00060118
L4.				.05136959*
sigma				
_cons	9.5398841***	9.450677***	9.4808276***	9.473342***
Statistics				
N	794	794	794	794
ll	-2917.4896	-2910.3454	-2912.6217	-2912.0146
chi2	2.8388146	6764.7279	566.77521	690.44183
aic	5844.9792	5832.6907	5839.2433	5840.0292
bic	5868.3646	5860.7532	5871.9829	5877.4458

legend: * p<.1; ** p<.05; *** p<.01

lowest bic

```
45 . est table arima231*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
estimation result arima231* not found
r(111);
```

```
46 . est table arima31*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
```

Variable	arima311	arima312	arima313	arima314
future				
_cons	-.11395314	-.11434855	-.11482479	-.11489771
ARMA				
ar				
L1.	.06416111	1.3204613***	-.56192851***	.01972589
L2.	.02920804	-.90163025***	-.42025281***	-.77499053***
L3.	.02294871	-.05791248**	-.8338931***	-.25249026
ma				
L1.	-.10003354	-1.3735497	.51793325	-.05826621
L2.		1.0000008	.40777617	.81652449***
L3.			.8898383	.26256083
L4.				.05469308*
sigma				

_cons	9.5380895***	9.4185571	9.4577904	9.4722994***
Statistics				
N	794	794	794	794
ll	-2917.3418	-2909.7635	-2911.5297	-2911.9403
chi2	3.8262796	32923.58	7392.6231	480.87615
aic	5846.6836	5833.5271	5839.0595	5841.8806
bic	5874.7461	5866.2666	5876.4761	5883.9743

legend: * p<.1; ** p<.05; *** p<.01

```
47 . est table arima41*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
```

Variable	arima411	arima412	arima413	arima414
future				
_cons	-.11336618	-.11461152	-.11590868	-.11376705
ARMA				
ar				
L1.	-.26142231	.3181852***	1.7676398***	-.41944632***
L2.	.01694481	-.85050807***	-1.50548*	.36718541***
L3.	.03124469	.00130972	.41843716	-.35522863***
L4.	.0307881	.04773204	.00058669	-.86090936***
ma				
L1.	.22521179	-.35750674***	-1.8167691***	.38743681***
L2.		.90090477***	1.6207448*	-.30501342***
L3.			-.4995254	.42560261***
L4.				.8658178***
sigma				
_cons	9.5350812***	9.4739792***	9.4436415***	9.4058783***
Statistics				
N	794	794	794	794
ll	-2917.0927	-2912.0811	-2909.6096	-2906.4848
chi2	5.4882963	661.06102	4207.3322	932.73412
aic	5848.1853	5840.1622	5837.2193	5832.9696
bic	5880.9249	5877.5789	5879.313	5879.7404

legend: * p<.1; ** p<.05; *** p<.01

```
48 . predict futurehat, future dynamic(.) t0(795)
option future not allowed
r(198);

49 . predict yhat, y dynamic(.) t0(795)
Note: beginning dynamic predictions in period       10.
(794 missing values generated)

50 . predict yhat2, y dynamic(.) t0(796
) required
r(100);

51 . predict yhat2, y dynamic(.) t0(796)
Note: beginning dynamic predictions in period       10.
(795 missing values generated)
```

```
72 . predict yhat5, y dynamic(.) t0(799)
Note: beginning dynamic predictions in period       10.
(795 missing values generated)

73 . drop yhat5

74 . predict yhat4, y dynamic(.) t0(798)
Note: beginning dynamic predictions in period       10.
(795 missing values generated)

75 . predict yhat5, y dynamic(.) t0(799)
Note: beginning dynamic predictions in period       10.
(795 missing values generated)

76 . predict yhat6, y dynamic(.) t0(800)
Note: beginning dynamic predictions in period       10.
(795 missing values generated)

77 . dfuller spot,trend lags(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =       793

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -1.339            -3.960            -3.410           -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.8780

------------------------------------------------------------------------------
D.spot |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------+----------------------------------------------------------------------
spot   |
   L1. |  -.0042396   .0031666    -1.34   0.181    -.0104556    .0019764
   LD. |   .0832853    .035481     2.35   0.019      .013637    .1529337
_trend |   -.000739   .0014208    -0.52   0.603    -.0035281      .00205
 _cons |   2.253569   1.884627     1.20   0.232    -1.445907    5.953046
------------------------------------------------------------------------------

78 . dfuller spot,lags(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =       793

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -1.238            -3.430            -2.860           -2.570
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.6570

------------------------------------------------------------------------------
  D.spot |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------+----------------------------------------------------------------------
spot   |
   L1. |  -.0034926    .002821    -1.24   0.216    -.0090301    .0020448
   LD. |   .0828543    .035455     2.34   0.020     .0132572    .1524514

 _cons |   1.597051   1.39888      1.14   0.254     -1.14891    4.343012
------------------------------------------------------------------------------
```

```
79 . dfuller d.spot,lags(1) regress
```

Augmented Dickey-Fuller test for unit root Number of obs = **792**

	Test Statistic	Interpolated Dickey-Fuller: 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-18.307**	**-3.430**	**-2.860**	**-2.570**

MacKinnon approximate p-value for Z(t) = **0.0000** I(d) = I(1)

D2.spot	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
spot						
LD.	**-.882836**	**.0482247**	**-18.31**	**0.000**	**-.9774999**	**-.788172**
LD2.	**-.0392282**	**.0355761**	**-1.10**	**0.271**	**-.1090631**	**.0306068**
_cons	**-.0999981**	**.2901434**	**-0.34**	**0.730**	**-.6695424**	**.4695461**

```
80 . qui arima spot, arima(1,1,1) nolog
81 . est store sarima111
82 . qui arima spot, arima(1,1,2) nolog
83 . est store sarima112
84 . qui arima spot, arima(1,1,3) nolog
85 . est store sarima113
86 . qui arima spot, arima(1,1,4) nolog
87 . est store sarima114
88 . qui arima spot, arima(2,1,1) nolog
89 . est store sarima211
90 . qui arima spot, arima(2,1,2) nolog
91 . est store sarima212
92 . qui arima spot, arima(2,1,3) nolog
93 . est store sarima213
94 . qui arima spot, arima(2,1,4) nolog
95 . est store sarima214
96 . qui arima spot, arima(3,1,1) nolog
97 . est store sarima311
98 . qui arima spot, arima(3,1,2) nolog
```

```
 99 . est store sarima312
100 . qui arima spot, arima(3,1,3) nolog
101 . est store sarima313
102 . qui arima spot, arima(3,1,4) nolog
103 . est store sarima314
104 . qui arima spot, arima(4,1,1) nolog
105 . est store sarima411
106 . qui arima spot, arima(4,1,2) nolog
107 . est store sarima412
108 . qui arima spot, arima(4,1,3) nolog
109 . est store sarima413
110 . qui arima spot, arima(4,1,4) nolog
111 . est store sarima414
112 . est table sarima11*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
```

Variable	sarima111	sarima112	sarima113	sarima114
spot				
_cons	-.10471744	-.10468155	-.10474014	-.10717398
ARMA				
ar				
L1.	.43536547*	.32884791	-.21609401	.59490084
ma				
L1.	-.35351081	-.25287121	.29330109	-.52209152
L2.		.02661686	.06275321	-.00167449
L3.			.07084457**	.03360908
L4.				-.07201064*
sigma				
_cons	8.1399985***	8.1383248***	8.1283318***	8.1204174***
Statistics				
N	794	794	794	794
ll	-2791.4965	-2791.3458	-2790.3816	-2789.5823
chi2	18.312657	16.97941	13.218602	28.319443
aic	5590.993	5592.6915	5592.7633	5593.1646
bic	5609.7013	5616.077	5620.8258	5625.9042

lowest bic

legend: * p<.1; ** p<.05; *** p<.01

```
113 . est table sarima21*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
```

Variable	sarima211	sarima212	sarima213	sarima214
spot				
_cons	-.10453586	-.10767542	-.10609456	-.10747347
ARMA				
ar				
L1.	.30210361	1.3247307***	.46523894***	1.3085163***
L2.	.02452891	-.92390998***	-.83397031***	-.92906275***
ma				
L1.	-.22494448	-1.3022249***	-.39216993***	-1.2433923***
L2.		.94779741***	.82697929***	.88679293***

	L3.		.09595475***	.05677728
	L4.			.00003472
sigma				
	_cons	8.1387104***	8.077039***	8.1149358***	8.0663508***
Statistics				
	N	794	794	794	794
	ll	-2791.3835	-2785.5252	-2789.1057	-2784.5179
	chi2	16.085901	3656.4671	241.72156	4791.7034
	aic	5592.7671	5583.0504	5592.2113	5585.0358
	bic	5616.1525	5611.1129	5624.9509	5622.4524

legend: * p<.1; ** p<.05; *** p<.01

```
114 . est table sarima31*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
```

Variable	sarima311	sarima312	sarima313	sarima314
spot				
_cons	-.10486338	-.10606433	-.10806841	-.10765191
ARMA				
ar				
L1.	-.56058829	.56814277***	.66749387**	.58444973
L2.	.08569307*	-.89762847***	-.06995188	.02671112
L3.	.06374492**	.09752317***	-.59846871*	-.67269639
ma				
L1.	.63856195	-.49161073***	-.61040004*	-.5189438
L2.		.88783708***	.0556601	-.03501278
L3.			.65798111**	.71899171
L4.				.02307553
sigma				
_cons	8.1302906***	8.1136284***	8.0655263***	8.0640793***
Statistics				
N	794	794	794	794
ll	-2790.5308	-2788.9397	-2784.4054	-2784.2793
chi2	21.334447	289.47751	1722.9017	1770.384
aic	5593.0617	5591.8793	5584.8108	5586.5587
bic	5621.1242	5624.6189	5622.2274	5628.6524

legend: * p<.1; ** p<.05; *** p<.01

```
115 . est table sarima41*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
```

Variable	sarima411	sarima412	sarima413	sarima414
spot				
_cons	-.10781888	-.10752733	-.10764238	-.10766283
ARMA				
ar				
L1.	.6019371*	1.3677506***	.61524226	.8391139
L2.	-.00196743	-1.0093802***	.00960034	-.13065856
L3.	.02357655	.05753428	-.67663352	-.67731235
L4.	-.074501**	-.00157074	.02301592	.1703585
ma				
L1.	-.52565375	-1.3026494***	-.54889172	-.77179962
L2.		.964438***	-.01961375	.10834369
L3.			.72233737	.72448925
L4.				-.15754229
sigma				
_cons	8.1178063***	8.0662434***	8.0638126***	8.0634989***
Statistics				

N	794	794	794	794
ll	-2789.3297	-2784.5185	-2784.2686	-2784.2263
chi2	30.742143	5306.7984	1879.7454	2719.397
aic	5592.6594	5585.037	5586.5371	5588.4525
bic	5625.399	5622.4537	5628.6309	5635.2234

legend: * p<.1; ** p<.05; *** p<.01

```
116 . drop yhat

117 . drop yhat2

118 . drop yhat3

119 . drop yhat4

120 . drop yhat5

121 . drop yhat6
```

Dynamic forecast.

```
122 . arima future, arima(2,1,2) nolog

ARIMA regression

Sample:  2 - 795                                Number of obs     =        794
                                                Wald chi2(4)      =    6764.73
Log likelihood = -2910.345                      Prob > chi2       =     0.0000
```

D.future	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
future						
_cons	-.1128782	.349684	-0.32	0.747	-.7982463	.5724898
ARMA						
ar						
L1.	1.195716	.0265992	44.95	0.000	1.143583	1.247849
L2.	-.9144352	.0262073	-34.89	0.000	-.9658005	-.8630698
ma						
L1.	-1.225694	.0174523	-70.23	0.000	-1.2599	-1.191488
L2.	.9720753	.0174437	55.73	0.000	.9378863	1.006264
/sigma	9.450677	.1666523	56.71	0.000	9.124045	9.777309

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

123 . predict futurehat, future dynamic(.) t0(795)
option future not allowed
r(198);

124 . predict futurehat, y dynamic(.) t0(795)
Note: beginning dynamic predictions in period       6.
(794 missing values generated)

125 . predict futurehat, y dynamic(.) t0(796)
variable futurehat already defined
r(110);
```

```
126 . predict futurehat2, y dynamic(.) t0(796)
    Note: beginning dynamic predictions in period       6.
    (795 missing values generated)

127 . predict futurehat3, y dynamic(.) t0(797)
    Note: beginning dynamic predictions in period       6.
    (795 missing values generated)

128 . predict futurehat4, y dynamic(.) t0(798)
    Note: beginning dynamic predictions in period       6.
    (795 missing values generated)

129 . predict futurehat5, y dynamic(.) t0(799)
    Note: beginning dynamic predictions in period       6.
    (795 missing values generated)

130 . predict futurehat6, y dynamic(.) t0(800)
    Note: beginning dynamic predictions in period       6.
    (795 missing values generated)

131 . arima spot, arima(1,1,1) nolog

    ARIMA regression

    Sample:  2 - 795                                Number of obs     =        794
                                                    Wald chi2(2)      =      18.31
    Log likelihood = -2791.496                      Prob > chi2       =     0.0001

    ------------------------------------------------------------------------------
                 |                 OPG
          D.spot |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
    -------------+----------------------------------------------------------------
    spot         |
           _cons |  -.1047174   .3525647    -0.30   0.766    -.7957316    .5862967
    -------------+----------------------------------------------------------------
    ARMA         |
              ar |
             L1. |   .4353655   .2343856     1.86   0.063    -.0240219    .8947528
                 |
              ma |
             L1. |  -.3535108    .242659    -1.46   0.145    -.8291138    .1220922
    -------------+----------------------------------------------------------------
           /sigma |   8.139999   .1507405    54.00   0.000     7.844553    8.435444
    ------------------------------------------------------------------------------
    Note: The test of the variance against zero is one sided, and the two-sided
          confidence interval is truncated at zero.

132 . predict spothat, y dynamic(.) t0(795)
    Note: beginning dynamic predictions in period       4.
    (794 missing values generated)

133 . predict spothat2, y dynamic(.) t0(796)
    Note: beginning dynamic predictions in period       4.
    (795 missing values generated)

134 . predict spothat3, y dynamic(.) t0(797)
    Note: beginning dynamic predictions in period       4.
    (795 missing values generated)

135 . predict spothat4, y dynamic(.) t0(798)
    Note: beginning dynamic predictions in period       4.
    (795 missing values generated)
```

```
136 . predict spothat5, y dynamic(.) t0(799)
Note: beginning dynamic predictions in period        4.
(795 missing values generated)

137 . predict spothat6, y dynamic(.) t0(800)
Note: beginning dynamic predictions in period        4.
(795 missing values generated)

138 . *PartII

139 . reg future spot
```

Source	SS	df	MS	Number of obs	=	795
				F(1, 793)	>	99999.00
Model	8673077.67	1	8673077.67	Prob > F	=	0.0000
Residual	15420.7849	793	19.4461347	R-squared	=	0.9982
				Adj R-squared	=	0.9982
Total	8688498.45	794	10942.6933	Root MSE	=	4.4098

future	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
spot	1.017183	.0015231	667.84	0.000	1.014194	1.020173
_cons	-9.92148	.7552222	-13.14	0.000	-11.40395	-8.439009

```
140 . est store ols

141 . estat archlm
LM test for autoregressive conditional heteroskedasticity (ARCH)
```

lags(*p*)	chi2	df	Prob > chi2
1	125.953	1	0.0000

H0: no ARCH effects *vs.* H1: ARCH(*p*) disturbance

< 0.05

ARCH-effect significantly occurs.

```
142 . qui arch future spot, arch(1) nolog

143 . est store arch1

144 . qui arch future spot, arch(1/2) nolog

145 . est store arch2

146 . qui arch future spot, arch(1/3) nolog

147 . est store arch3

148 . qui arch future spot, arch(1/4) nolog

149 . est store arch4

150 . est table ols arch*, star(0.1 0.05 0.01) stat(N rss ll F chi2 aic bic)
```

Variable	ols	arch1	arch2	arch3	arch4
_					
spot	1.0171834***				
_cons	-9.9214799***				
future					
spot		1.0186334***	1.0192556***	1.0182239***	1.0179255***
_cons		-10.389233***	-10.741853***	-10.273464***	-10.110757***
ARCH					
arch					
L1.		.52395227***	.37888748***	.35534725***	.35768682***
L2.			.1858204***	.15276772**	.12454459*
L3.				.07379296	.01451124
L4.					.09821331**

_cons		9.7446313***	8.5248353***	8.1034382***	7.7028373***
Statistics					
N	795	795	795	795	795
rss	15420.785				
ll	-2306.6951	-2248.9103	-2241.4094	-2240.2682	-2236.8987
F	446005.22				
chi2		515234.55	515113.42	485167.46	479715.17
aic	4617.3902	4505.8206	4492.8188	4492.5365	4487.7974
bic	4626.7468	4524.534	4516.2105	4520.6065	4520.5458

legend: * p<.1; ** p<.05; *** p<.01

```
151 . qui arch future spot, arch(1) garch(1) nolog

152 . est store garch11

153 . qui arch future spot, arch(1) garch(1/2) nolog

154 . est store garch21

155 . qui arch future spot, arch(1/2) garch(1) nolog

156 . est store garch12

157 . qui arch future spot, arch(1/2) garch(1/2) nolog

158 . est store garch22

159 . est table garch*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
```

Variable	garch11	garch21	garch12	garch22
future				
spot	1.0172303***	1.0169983***	1.016984***	1.0177802***
_cons	-9.8347827***	-9.7162867***	-9.7000884***	-10.003265***
ARCH				
arch				
L1.	.30003334***	.32745992***	.35387235***	.37462284***
L2.			-.13829484	-.37305921***
garch				
L1.	.51829604***	.36348524	.6693883***	1.4514002***
L2.		.1216699		-.45202831***
_cons	3.4587494***	3.5908286***	2.2240284**	-.01758021
Statistics				
N	795	795	795	795
ll	-2237.4383	-2237.0371	-2236.6884	-2234.0557
chi2	479435.92	482240.4	489732.09	468370.4
aic	4484.8766	4486.0742	4485.3769	4482.1114
bic	4508.2684	4514.1443	4513.4469	4514.8598

lowest bic

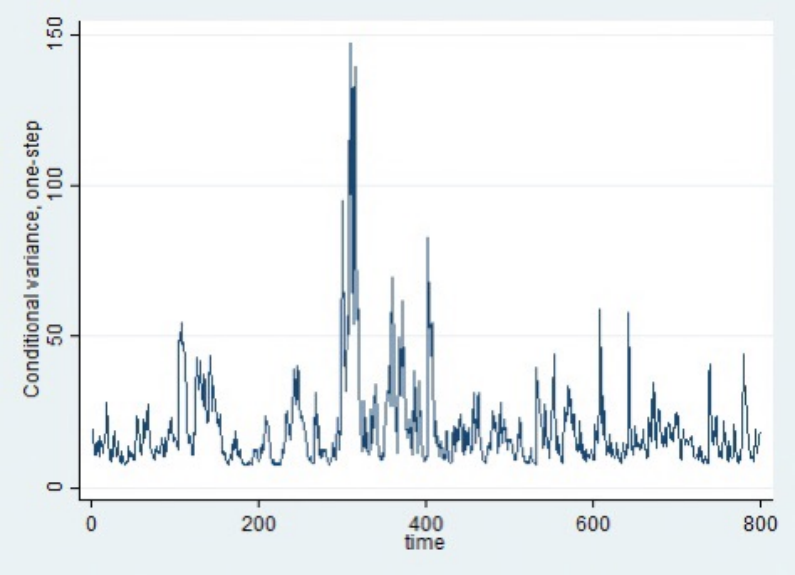
legend: * p<.1; ** p<.05; *** p<.01

```
160 . set obs 800
number of observations (_N) was 795, now 800
```

```
161 . replace time=_n
(5 real changes made)

162 . arch future spot, arch(1) garch(1) nolog

ARCH family regression

Sample: 1 - 795                                 Number of obs   =        795
Distribution: Gaussian                          Wald chi2(1)    =  479435.92
Log likelihood = -2237.438                      Prob > chi2     =     0.0000
```

future	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
future						
spot	**1.01723**	**.0014691**	**692.41**	**0.000**	**1.014351**	**1.02011**
_cons	**-9.834783**	**.7131629**	**-13.79**	**0.000**	**-11.23256**	**-8.437009**
ARCH						
arch L1.	**.3000333**	**.0627674**	**4.78**	**0.000**	**.1770114**	**.4230553**
garch L1.	**.518296**	**.0724759**	**7.15**	**0.000**	**.376246**	**.6603461**
_cons	**3.458749**	**.6806127**	**5.08**	**0.000**	**2.124773**	**4.792726**

```
163 . predict sigma2, variance

164 . line sigma2 t
```




```
ย\426\Graph.png", as(png) replace
6\Graph.png not found)
h.png written in PNG format)
```