Assignment 14

ARIMA & GARCH Models

From the data set `assign_timeseries.dta`:

Part I

1. Estimate Autoregressive Integrated Moving Average (ARIMA(p,d,q)) model for spot and future – determine the most appropriated order for p, d, and q using SBIC given the maximum lag equals 4.
2. Make dynamic forecast for period time = 796 to 800.

Part II

The following GARCH model:

Mean Equation: $$rfuture_t = \alpha + \beta rspot_t + \varepsilon_t \quad (1)$$

Variance Equation: $$\sigma_t^2 = \alpha_0 + \sum_{j=1}^{p} \delta_j \sigma_{t-j}^2 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 \quad (2)$$

3. Estimate model (1) using OLS by employing future return (rfuture) as dependent variable and spot return (rspot) as explanatory variable, and determine whether ARCH-effect significantly occurs.
4. Estimate GARCH(p,q) for future return (rfuture) using spot return (rspot) as explanatory variable for mean equation (model (1) and (2)) – determine the most appropriated order p and q for variance equation using SBIC given the maximum lag equals to 2.
5. From (6), predict the variance of future return (rfuture).

```
      log type:  smcl
          name:  <unnamed>
           log:  C:\Users\Kang\Downloads\ASS14_1.smcl
      log type:  smcl
     opened on:   3 May 2021, 22:15:29

1 . use "C:\Users\Kang\Downloads\assign_timeseries.dta", clear

2 . do "C:\Users\Kang\AppData\Local\Temp\STD01000000.tmp"

3 . tsset t
        time variable:  time, 1 to 795
                delta:  1 unit

4 . dfuller spot, trend lag(1) reg

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
------------------------------------------------------------------------------

5 . dfuller spot, lag(1) reg

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
------------------------------------------------------------------------------
```

1

1

```
 6 . dfuller d.spot, trend lag(1) reg

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

                                         ---------- Interpolated Dickey-Fuller ---------
                      Test            1% Critical        5% Critical       10% Critical
                    Statistic             Value              Value              Value
   ------------------------------------------------------------------------------
    Z(t)              -18.296             -3.960             -3.410             -3.120
   ------------------------------------------------------------------------------
   MacKinnon approximate p-value for Z(t) = 0.0000

   ------------------------------------------------------------------------------
   D2.spot     |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
   ------------+-----------------------------------------------------------------
         D.spot |
            L1. |  -.8828574    .048255   -18.30   0.000    -.9775809   -.7881338
            LD. |  -.0392219   .0355982    -1.10   0.271    -.1091005    .0306567
         _trend |   .0001744   .0012696     0.14   0.891    -.0023179    .0026666
          _cons |  -.1693079   .5822401    -0.29   0.771    -1.312233    .9736172
   ------------------------------------------------------------------------------

 7 . qui arima spot, arima(1,1,1) nolog

 8 . est store arima111

 9 . qui arima spot, arima(1,1,2) nolog

10 . est store arima112

11 . qui arima spot, arima(1,1,3) nolog

12 . est store arima113

13 . qui arima spot, arima(1,1,4) nolog

14 . est store arima114

15 . qui arima spot, arima(2,1,1) nolog

16 . est store arima211

17 . qui arima spot, arima(2,1,2) nolog

18 . est store arima212

19 . qui arima spot, arima(2,1,3) nolog

20 . est store arima213

21 . qui arima spot, arima(2,1,4) nolog

22 . est store arima214
```

1

```
23 . qui arima spot, arima(3,1,1) nolog

24 . est store arima311

25 . qui arima spot, arima(3,1,2) nolog

26 . est store arima312

27 . qui arima spot, arima(3,1,3) nolog

28 . est store arima313

29 . qui arima spot, arima(3,1,4) nolog

30 . est store arima314

31 . qui arima spot, arima(4,1,1) nolog

32 . est store arima411

33 . qui arima spot, arima(4,1,2) nolog

34 . est store arima412

35 . qui arima spot, arima(4,1,3) nolog

36 . est store arima413

37 . qui arima spot, arima(4,1,4) nolog

38 . est store arima414

39 . est table arima11*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
```

Variable	arima111	arima112	arima113	arima114
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**

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

1

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

Variable	arima211	arima212	arima213	arima214
spot				
_cons	-.10453586	-.10767544	-.10609456	-.10747348
ARMA				
ar				
L1.	.30210361	1.3247307***	.46523894***	1.3085163***
L2.	.02452891	-.92390999***	-.83397031***	-.92906275***
ma				
L1.	-.22494448	-1.3022249***	-.39216993***	-1.2433923***
L2.		.94779741***	.82697929***	.88679294***
L3.			.09595475***	.05677728
L4.				.00003471
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	3656.4675	241.72156	4791.704
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

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

Variable	arima311	arima312	arima313	arima314
spot				
_cons	-.10486338	-.10606431	-.10806841	-.10765208
ARMA				
ar				
L1.	-.56058829	.56814277***	.66749387**	.58444954
L2.	.08569307*	-.8976285***	-.06995188	.02671133
L3.	.06374492**	.09752317***	-.59846871*	-.67269654
ma				
L1.	.63856195	-.49161072***	-.61040004*	-.51894361
L2.		.88783711***	.0556601	-.03501301
L3.			.65798111**	.71899187
L4.				.02307553
sigma				
_cons	8.1302906***	8.1136284***	8.0655263***	8.0640794***
Statistics				
N	794	794	794	794
ll	-2790.5308	-2788.9397	-2784.4054	-2784.2793
chi2	21.334447	289.47769	1722.9017	1770.3817
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

1 Continued

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

Variable	arima411	arima412	arima413	arima414
spot				
_cons	-.10781888	-.10749327	-.10780392	-.10764567
ARMA				
ar				
L1.	.6019371*	1.3677052***	.61506334	.83812567
L2.	-.00196743	-1.0093112***	.00987044	-.12991248
L3.	.02357655	.05747166	-.67679672	-.67756534
L4.	-.074501**	-.00154962	.02301436	.16988073
ma				
L1.	-.52565375	-1.3026469***	-.54871587	-.77079898
L2.		.96444591***	-.019867	.10762793
L3.			.7224928	.72472881
L4.				-.15698666
sigma				
_cons	8.1178063***	8.0663663***	8.0638699***	8.0633672***
Statistics				
N	794	794	794	794
ll	-2789.3297	-2784.5185	-2784.2686	-2784.2263
chi2	30.742143	5308.5698	1878.2067	2719.3632
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

```
43 .
   end of do-file

44 .
45 .
46 .
47 . do "C:\Users\Kang\AppData\Local\Temp\STD01000000.tmp"

48 . dfuller future, trend lag(1) reg
```

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

1

```
49 . dfuller future, lag(1) reg

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)             -1.264            -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
------------------------------------------------------------------------------

50 . dfuller d.future, trend lag(1) reg

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

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -19.705            -3.960            -3.410            -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D2.future    |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    D.future |
         L1. |  -1.010373   .0512742   -19.71   0.000    -1.111023   -.9097223
         LD. |  -.0248604   .0356334    -0.70   0.486    -.0948081    .0450873
      _trend |   .0001652   .0014885     0.11   0.912    -.0027566     .003087
       _cons |  -.1844909    .682591    -0.27   0.787    -1.524403    1.155421
------------------------------------------------------------------------------

51 . qui arima spot, arima(1,1,1) nolog

52 . est store arima111

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

54 . est store arima112

55 . qui arima future, arima(1,1,3) nolog
```

1

```
56 . est store arima113
57 . qui arima future, arima(1,1,4) nolog
58 . est store arima114
59 . qui arima future, arima(2,1,1) nolog
60 . est store arima211
61 . qui arima future, arima(2,1,2) nolog
62 . est store arima212
63 . qui arima future, arima(2,1,3) nolog
64 . est store arima213
65 . qui arima future, arima(2,1,4) nolog
66 . est store arima214
67 . qui arima future, arima(3,1,1) nolog
68 . est store arima311
69 . qui arima future, arima(3,1,2) nolog
70 . est store arima312
71 . qui arima future, arima(3,1,3) nolog
72 . est store arima313
73 . qui arima future, arima(3,1,4) nolog
74 . est store arima314
75 . qui arima future, arima(4,1,1) nolog
76 . est store arima411
77 . qui arima future, arima(4,1,2) nolog
78 . est store arima412
79 . qui arima future, arima(4,1,3) nolog
80 . est store arima413
81 . qui arima future, arima(4,1,4) nolog
82 . est store arima414
```

①

83 . est table arima11*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)

Variable	arima111	arima112	arima113	arima114
spot				
_cons	-.10471744			
ARMA				
ar				
L1.	.43536547*	.30224152	.07471074	-.26441554
ma				
L1.	-.35351081	-.33885872	-.11128313	.23060131
L2.		.04456173	.0345267	.02935071
L3.			.03319847	.04074154
L4.				.03843721
sigma				
_cons	8.1399985***	9.5390832***	9.5360585***	9.532552***
future				
_cons		-.11408115	-.1139183	-.11370744
Statistics				
N	794	794	794	794
ll	-2791.4965	-2917.4236	-2917.166	-2916.8767
chi2	18.312657	3.4714053	5.5726249	7.6343946
aic	5590.993	5844.8473	5846.3321	5847.7535
bic	5609.7013	5868.2327	5874.3946	5880.493

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

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

Variable	arima211	arima212	arima213	arima214
future				
_cons	-.11399264	-.11468686	-.11518755	-.114745
ARMA				
ar				
L1.	.26006773	1.2835845***	.39680958***	.29779715***
L2.	.03927244	-.90741041***	-.83492246***	-.89274399***
ma				
L1.	-.29537225	-1.2846838***	-.43709178***	-.33588403***
L2.		.95026799***	.86844397***	.9442071***
L3.			.02125732	.00060118
L4.				.05136959*
sigma				
_cons	9.5398841***	9.4618855***	9.4808276***	9.473342***
Statistics				
N	794	794	794	794
ll	-2917.4896	-2911.1516	-2912.6217	-2912.0146
chi2	2.8388146	3448.4649	566.77521	690.44183
aic	5844.9792	5834.3032	5839.2433	5840.0292
bic	5868.3646	5862.3657	5871.9829	5877.4458

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

1

```
85 . 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	-.11478801	-.11489771
ARMA				
ar				
L1.	.06416111	1.3204613***	-.56212344***	.01972589
L2.	.02920804	-.90163025***	-.42052406***	-.77499053***
L3.	.02294871	-.05791248**	-.83397003***	-.25249026
ma				
L1.	-.10003354	-1.3735497	.51812134	-.05826621
L2.		1.0000008	.40800786	.81652449***
L3.			.88988554	.26256084
L4.				.05469308*
sigma				
_cons	9.5380895***	9.4185571	9.4576111	9.4722994***
Statistics				
N	794	794	794	794
ll	-2917.3418	-2909.7635	-2911.5297	-2911.9403
chi2	3.8262796	32923.581	7405.3239	480.87614
aic	5846.6836	5833.5271	5839.0595	5841.8806
bic	5874.7461	5866.2666	5876.4762	5883.9743

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

```
86 . 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***	1.7676399***	-.41944632***
L2.	.01694481	-.85050807***	-1.5054801*	.36718541***
L3.	.03124469	.00130972	.41843725	-.35522863***
L4.	.0307881	.04773204	.00058669	-.86090936***
ma				
L1.	.22521179	-.35750674***	-1.8167692***	.38743681***
L2.		.90090477***	1.6207449*	-.30501342***
L3.			-.4995255	.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	661.06101	4207.3326	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

The most appropriated order for rspot is ARIMA(1,1,1)
The most appropriated order for rfuture is ARIMA(1,1,1)

```
87 .
   end of do-file

88 . do "C:\Users\Kang\AppData\Local\Temp\STD01000000.tmp"
```

2

```
89 . 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
```

D.spot	Coef.	OPG 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.

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

91 . replace time=_n
   (5 real changes made)

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

93 . twoway(line spot time, sort) (scatter yhat time,sort)

94 .
   end of do-file
```

Pic on page 15

```
95 . do "C:\Users\Kang\AppData\Local\Temp\STD01000000.tmp"

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

   ARIMA regression

   Sample:  2 - 795                              Number of obs     =        794
                                                 Wald chi2(2)      =       3.33
   Log likelihood = -2917.724                    Prob > chi2       =     0.1890
```

2

D.future	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
future						
_cons	**-.1142458**	**.3326737**	**-0.34**	**0.731**	**-.7662743**	**.5377828**
ARMA						
ar L1.	**-.368505**	**.5847749**	**-0.63**	**0.529**	**-1.514643**	**.7776328**
ma L1.	**.3311954**	**.5949511**	**0.56**	**0.578**	**-.8348873**	**1.497278**
/sigma	**9.54277**	**.1687756**	**56.54**	**0.000**	**9.211975**	**9.873564**

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

 97 . predict yhat2, y dynamic(.) t0(795)
    Note: beginning dynamic predictions in period        4.
    (794 missing values generated)

 98 . twoway(line spot time, sort) (scatter yhat2 time,sort)
```

future Pic on page 16

```
 99 .
    end of do-file
```

3

```
100 . clear

101 . use "C:\Users\Kang\Downloads\assign_timeseries.dta", clear

102 . tsset t
            time variable:  time, 1 to 795
                    delta:  1 unit

103 . do "C:\Users\Kang\AppData\Local\Temp\STD01000000.tmp"

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

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

106 . reg rfuture rspot
```

Source	SS	df	MS
Model	**.338771077**	**1**	**.338771077**
Residual	**.043348982**	**792**	**.000054734**
Total	**.382120059**	**793**	**.000481866**

Number of obs	=	**794**
F(1, 792)	=	**6189.46**
Prob > F	=	**0.0000**
R-squared	=	**0.8866**
Adj R-squared	=	**0.8864**
Root MSE	=	**.0074**

rfuture	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rspot	**1.108778**	**.0140935**	**78.67**	**0.000**	**1.081113**	**1.136443**
_cons	**.0000525**	**.0002626**	**0.20**	**0.841**	**-.0004629**	**.0005679**

3

107 . estat archlm

LM test for autoregressive conditional heteroskedasticity (ARCH)

lags(*p*)	chi2	df	Prob > chi2
1	**43.545**	**1**	**0.0000**

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

108 .

end of do-file

109 . do "C:\Users\Kang\AppData\Local\Temp\STD01000000.tmp"

4

110 . qui arch rfuture rspot, arch(1) garch(1) nolog

111 . est store garch11

112 . qui arch rfuture rspot, arch(1) garch(1/2) nolog

113 . est store garch21

114 . qui arch rfuture rspot, arch(1/2) garch(1) nolog

115 . est store garch12

116 . qui arch rfuture rspot, arch(1/2) garch(1/2) nolog

117 . est store garch22

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

Variable	garch11	garch21	garch12	garch22
rfuture				
rspot	**1.066779*** **	**1.0662306*** **	**1.0686232*** **	**1.0681952*** **
_cons	**.00003063**	**.00002879**	**.00002254**	**.00002246**
ARCH				
arch				
L1.	**.08462311*** **	**.11369072*** **	**.21216575*** **	**.21614044*** **
L2.			**-.14954552*** **	**-.17303698*** **
garch				
L1.	**.89700599*** **	**.54514867**	**.92239363*** **	**1.1227148*** **
L2.		**.31487288**		**-.17547369**
_cons	**9.850e-07*** **	**1.380e-06** **	**7.744e-07*** **	**5.016e-07** **
Statistics				
N	**794**	**794**	**794**	**794**
ll	**2856.1421**	**2857.27**	**2860.4654**	**2860.969**
chi2	**10757.643**	**10547.688**	**10668.218**	**11008.25**
aic	**-5702.2841**	**-5702.54**	**-5708.9307**	**-5707.938**
bic	**-5678.8987**	**-5674.4775**	**-5680.8682**	**-5675.1984**

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

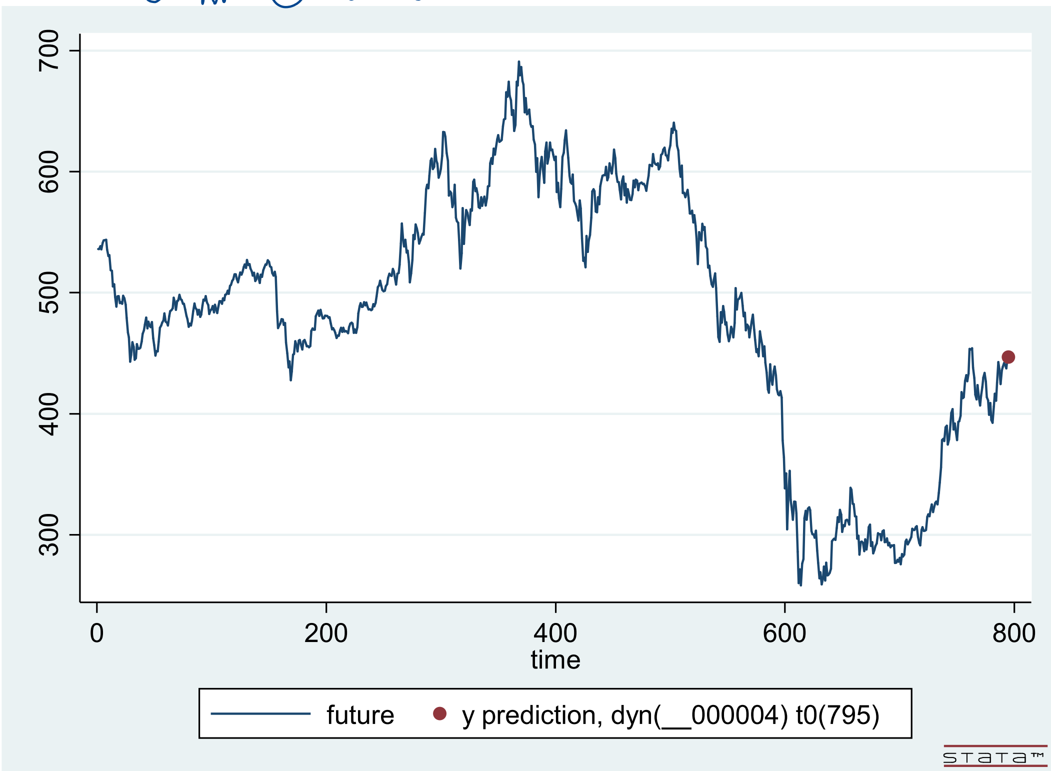
5

```
119 .
    end of do-file

120 .
121 . predict sigmahat, v

122 . line sigmahat time

123 . log close
          name:  <unnamed>
           log:  C:\Users\Kang\Downloads\ASS14_1.smcl
      log type:  smcl
     closed on:   3 May 2021, 22:23:34
```

2

Picture for 2 Spot

② Pic for ② Future



5

Picture for 5