

Problem Set 3

1

A

| 30 Observations | df | AIC | BIC | K(10)RMSE | LOORMSE |
|-----------------|----|------------------|------------------|------------------|-----------------|
| Model 1 | 2 | 96.287195 | 98.951604 | .95207289 | 1.3616366 |
| Model 2 | 2 | 91.889926 | 94.4816 | .90405284 | 1.356985 |
| Model 3 | 2 | 90.028458 | 92.544651 | .96983151 | 1.443163 |
| Model 12 | 3 | 93.570654 | 97.458165 | .98902607 | 1.3845023 |
| Model 13 | 3 | 91.221146 | 94.995435 | 1.0090104 | 1.4675022 |
| Model 23 | 3 | 89.685273 | 93.459562 | .98595497 | 1.4442447 |
| Model 123 | 4 | 90.613095 | 95.645481 | .90078153 | 1.4592071 |

B

| 300 Observations | df | AIC | BIC | K(10)RMSE | LOORMSE |
|------------------|----|------------------|------------------|------------------|------------------|
| Model 1 | 2 | 922.28935 | 929.68354 | .81262585 | 1.1338151 |
| Model 2 | 2 | 909.51605 | 916.90352 | .79089382 | 1.1218131 |
| Model 3 | 2 | 926.4476 | 933.82832 | .81547326 | 1.1579294 |
| Model 12 | 3 | 873.69372 | 884.77491 | .74679534 | 1.0577271 |
| Model 13 | 3 | 914.62743 | 925.6985 | .80468719 | 1.1355557 |
| Model 23 | 3 | 906.59798 | 917.66906 | .79506088 | 1.1173397 |
| Model 123 | 4 | 872.61172 | 887.37316 | .74912768 | 1.0557316 |

C

2. Compare model selection using the four criteria. Did they agree in both cases (n=30 and n=300)?

For each criterion, are the differences between the “best” model and the next best more or less pronounced with more data?

Note: I know I probably should have set a seed for the data, but because the objective of the exercise is to compare how results compare between datasets of different sizes.

In the smaller dataset, the best model differs greatly between the tests. In the larger dataset, the results are more consistent where the model with lags 1 and 2 and 1, 2, and 3 are split 50/50 between the four tests. In the smaller dataset, the results of each test are much closer for the AIC and BIC while for the crossfold and LOOCV the differences between results are similar for the small and large datasets. That said, while the spread is similar, the actual values are different.

2

| Dataset | df | AIC | BIC | K(10)RMSE | LOORMSE |
|---------|----|-------------------|-------------------|------------------|------------------|
| Model 1 | 64 | -3105.8368 | -2853.1626 | .00579331 | .00746943 |
| Model 2 | 34 | -3164.4562 | -3029.3467 | .00489408 | .00634841 |
| Model 3 | 33 | -2874.5257 | -2744.2405 | .00603002 | .00808926 |
| Model 4 | 33 | -3612.8403 | -3472.7828 | .00734835 | .01062333 |

Use the data you used for problem set 1 and 2, prepared for analysis in the same way. Make a table with the model selection measures for each model below. Based on the information in that table, which model do you think is best? Explain why.

Models 2 and 4 each have half the measurements on their side. Model 2 has the crossfold and LOOCV while model 4 has the AIC and BIC. I would choose model 2 because it has more degrees of freedom and the difference between model 2 and 4's AIC and BIC is smaller proportionally than the difference between the crossfold and LOOCV.

Appendix A

```

1 log using "Problem Set 3", replace
2 *1a
3 clear
4 set obs 30
5 gen t=[_n]
6 tsset t
7 gen r=rnormal()
8 gen y=r if t<4
9 replace y=0.5+0.5*1.y-0.1*12.y+0.25*13.y+r if t>=4
10 drop r
11
12 *model
13 reg d.y l1d.y
14 *aic/bic
15 estat ic
16 scalar define df1=el(r(S),1,4)
17 scalar define aic1=el(r(S),1,5)
18 scalar define bic1=el(r(S),1,6)
19 *10 fold cv rmse
20 crossfold reg d.y l1d.y

```

```

21 scalar define k=10
22 matrix kMSE=r(est)/*r(est)
23 scalar krmse1=(el(kMSE,1,1)/k)^.5
24 scalar list krmse1
25 matrix drop kMSE
26 scalar drop k
27 *loocv
28 loocv reg d.y l1d.y
29 scalar define loormse1=r(rmse)
30
31 reg d.y l2d.y
32 estat ic
33 scalar define df2=el(r(S),1,4)
34 scalar define aic2=el(r(S),1,5)
35 scalar define bic2=el(r(S),1,6)
36 crossfold reg d.y l2d.y
37 scalar define k=10
38 matrix kMSE=r(est)/*r(est)
39 scalar krmse2=(el(kMSE,1,1)/k)^.5
40 scalar list krmse2
41 matrix drop kMSE
42 scalar drop k
43 loocv reg d.y l2d.y
44 scalar define loormse2=r(rmse)
45
46 reg d.y l3d.y
47 estat ic
48 scalar define df3=el(r(S),1,4)
49 scalar define aic3=el(r(S),1,5)
50 scalar define bic3=el(r(S),1,6)
51 crossfold reg d.y l3d.y
52 scalar define k=10
53 matrix kMSE=r(est)/*r(est)
54 scalar krmse3=(el(kMSE,1,1)/k)^.5
55 scalar list krmse3
56 matrix drop kMSE
57 scalar drop k
58 loocv reg d.y l3d.y
59 scalar define loormse3=r(rmse)
60
61 reg d.y l1d.y l2d.y
62 estat ic
63 scalar define df12=el(r(S),1,4)
64 scalar define aic12=el(r(S),1,5)
65 scalar define bic12=el(r(S),1,6)
66 crossfold reg d.y l1d.y l2d.y
67 scalar define k=10
68 matrix kMSE=r(est)/*r(est)
69 scalar krmse12=(el(kMSE,1,1)/k)^.5
70 scalar list krmse12
71 matrix drop kMSE

```

```

72 scalar drop k
73 loocv reg d.y l1d.y l2d.y
74 scalar define loormse12=r(rmse)
75
76 reg d.y l1d.y l3d.y
77 estat ic
78 scalar define df13=el(r(S),1,4)
79 scalar define aic13=el(r(S),1,5)
80 scalar define bic13=el(r(S),1,6)
81 crossfold reg d.y l1d.y l3d.y
82 scalar define k=10
83 matrix kMSE=r(est)/*r(est)
84 scalar krmse13=(el(kMSE,1,1)/k)^.5
85 scalar list krmse13
86 matrix drop kMSE
87 scalar drop k
88 loocv reg d.y l1d.y l3d.y
89 scalar define loormse13=r(rmse)
90
91 reg d.y      l2d.y l3d.y
92 estat ic
93 scalar define df23=el(r(S),1,4)
94 scalar define aic23=el(r(S),1,5)
95 scalar define bic23=el(r(S),1,6)
96 crossfold reg d.y      l2d.y l3d.y
97 scalar define k=10
98 matrix kMSE=r(est)/*r(est)
99 scalar krmse23=(el(kMSE,1,1)/k)^.5
100 scalar list krmse23
101 matrix drop kMSE
102 scalar drop k
103 loocv reg d.y      l2d.y l3d.y
104 scalar define loormse23=r(rmse)
105
106 reg d.y l1d.y l2d.y l3d.y
107 estat ic
108 scalar define df123=el(r(S),1,4)
109 scalar define aic123=el(r(S),1,5)
110 scalar define bic123=el(r(S),1,6)
111 crossfold reg d.y l1d.y l2d.y l3d.y
112 scalar define k=10
113 matrix kMSE=r(est)/*r(est)
114 scalar krmse123=(el(kMSE,1,1)/k)^.5
115 scalar list krmse123
116 matrix drop kMSE
117 scalar drop k
118 loocv reg d.y l1d.y l2d.y l3d.y
119 scalar define loormse123=r(rmse)
120
121 matrix drop _all
122 matrix fit1=(df1,aic1,bic1,krmse1,loormse1)

```

```

123 matrix fit2=(df2,aic2,bic2,krmse2,loormse2)
124 matrix fit3=(df3,aic3,bic3,krmse3,loormse3)
125 matrix fit12=(df12,aic12,bic12,krmse12,loormse12)
126 matrix fit13=(df13,aic13,bic13,krmse13,loormse13)
127 matrix fit23=(df23,aic23,bic23,krmse23,loormse23)
128 matrix fit123=(df123,aic123,bic123,krmse123,loormse123)
129 matrix FIT=fit1\fit2\fit3\fit12\fit13\fit23\fit123
130 matrix rownames FIT="Model 1" "Model 2" "Model 3" "Model 12" "Model 13" "Model 23"
  "Model 123"
131 matrix colnames FIT=df AIC BIC K(10)RMSE LOORMSE
132 matrix list FIT
133
134 *lb
135 clear
136 set obs 300
137 gen t=[_n]
138 tsset t
139 gen r=rnormal()
140 gen y=r if t<4
141 replace y=0.5+0.5*l.y-0.1*l2.y+0.25*l3.y+r if t>=4
142 drop r
143
144 *model
145 reg d.y l1d.y
146 *aic/bic
147 estat ic
148 scalar define df1=el(r(S),1,4)
149 scalar define aic1=el(r(S),1,5)
150 scalar define bic1=el(r(S),1,6)
151 *10 fold cv rmse
152 crossfold reg d.y l1d.y
153 scalar define k=10
154 matrix kMSE=r(est)'*r(est)
155 scalar krmse1=(el(kMSE,1,1)/k)^.5
156 scalar list krmse1
157 matrix drop kMSE
158 scalar drop k
159 *loocv
160 loocv reg d.y l1d.y
161 scalar define loormse1=r(rmse)
162
163 reg d.y l2d.y
164 estat ic
165 scalar define df2=el(r(S),1,4)
166 scalar define aic2=el(r(S),1,5)
167 scalar define bic2=el(r(S),1,6)
168 crossfold reg d.y l2d.y
169 scalar define k=10
170 matrix kMSE=r(est)'*r(est)
171 scalar krmse2=(el(kMSE,1,1)/k)^.5
172 scalar list krmse2

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```

173 matrix drop kMSE
174 scalar drop k
175 loocv reg d.y 12d.y
176 scalar define loormse2=r(rmse)
177
178 reg d.y 13d.y
179 estat ic
180 scalar define df3=el(r(S),1,4)
181 scalar define aic3=el(r(S),1,5)
182 scalar define bic3=el(r(S),1,6)
183 crossfold reg d.y 13d.y
184 scalar define k=10
185 matrix kMSE=r(est)/*r(est)
186 scalar krmse3=(el(kMSE,1,1)/k)^.5
187 scalar list krmse3
188 matrix drop kMSE
189 scalar drop k
190 loocv reg d.y 13d.y
191 scalar define loormse3=r(rmse)
192
193 reg d.y 11d.y 12d.y
194 estat ic
195 scalar define df12=el(r(S),1,4)
196 scalar define aic12=el(r(S),1,5)
197 scalar define bic12=el(r(S),1,6)
198 crossfold reg d.y 11d.y 12d.y
199 scalar define k=10
200 matrix kMSE=r(est)/*r(est)
201 scalar krmse12=(el(kMSE,1,1)/k)^.5
202 scalar list krmse12
203 matrix drop kMSE
204 scalar drop k
205 loocv reg d.y 11d.y 12d.y
206 scalar define loormse12=r(rmse)
207
208 reg d.y 11d.y 13d.y
209 estat ic
210 scalar define df13=el(r(S),1,4)
211 scalar define aic13=el(r(S),1,5)
212 scalar define bic13=el(r(S),1,6)
213 crossfold reg d.y 11d.y 13d.y
214 scalar define k=10
215 matrix kMSE=r(est)/*r(est)
216 scalar krmse13=(el(kMSE,1,1)/k)^.5
217 scalar list krmse13
218 matrix drop kMSE
219 scalar drop k
220 loocv reg d.y 11d.y 13d.y
221 scalar define loormse13=r(rmse)
222
223 reg d.y      12d.y 13d.y

```

```

224 estat ic
225 scalar define df23=el(r(S),1,4)
226 scalar define aic23=el(r(S),1,5)
227 scalar define bic23=el(r(S),1,6)
228 crossfold reg d.y      12d.y 13d.y
229 scalar define k=10
230 matrix kMSE=r(est)'*r(est)
231 scalar krmse23=(el(kMSE,1,1)/k)^.5
232 scalar list krmse23
233 matrix drop kMSE
234 scalar drop k
235 loocv reg d.y      12d.y 13d.y
236 scalar define loormse23=r(rmse)
237
238 reg d.y 11d.y 12d.y 13d.y
239 estat ic
240 scalar define df123=el(r(S),1,4)
241 scalar define aic123=el(r(S),1,5)
242 scalar define bic123=el(r(S),1,6)
243 crossfold reg d.y 11d.y 12d.y 13d.y
244 scalar define k=10
245 matrix kMSE=r(est)'*r(est)
246 scalar krmse123=(el(kMSE,1,1)/k)^.5
247 scalar list krmse123
248 matrix drop kMSE
249 scalar drop k
250 loocv reg d.y 11d.y 12d.y 13d.y
251 scalar define loormse123=r(rmse)
252
253 matrix drop _all
254 matrix fit1=(df1,aic1,bic1,krmse1,loormse1)
255 matrix fit2=(df2,aic2,bic2,krmse2,loormse2)
256 matrix fit3=(df3,aic3,bic3,krmse3,loormse3)
257 matrix fit12=(df12,aic12,bic12,krmse12,loormse12)
258 matrix fit13=(df13,aic13,bic13,krmse13,loormse13)
259 matrix fit23=(df23,aic23,bic23,krmse23,loormse23)
260 matrix fit123=(df123,aic123,bic123,krmse123,loormse123)
261 matrix FIT=fit1\fit2\fit3\fit12\fit13\fit23\fit123
262 matrix rownames FIT="Model 1" "Model 2" "Model 3" "Model 12" "Model 13" "Model 23"
   "Model 123"
263 matrix colnames FIT=df AIC BIC K(10)RMSE LOORMSE
264 matrix list FIT
265
266 *2
267 clear
268 cd "/Users/guslipkin/Documents/Spring2020/CAP 4763 ~ Time Series/Problem
   Sets/Problem Set 3"
269 import delimited "Assignment_1_Monthly.txt"
270
271 rename lnu02300000 us_epr
272 rename flnan fl_nonfarm

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```

273 rename fllfn fl_lf
274 rename flbpriv fl_bp
275 rename date datestring
276
277 *2d Generate a monthly date variable (make its display format monthly time, %tm)
278 gen datec=date(datestring, "YMD")
279 gen date=mofd(datec)
280 format date %tm
281
282 *2e tsset your data
283 tsset date
284 gen month=month(datec)
285
286 *2f
287 gen lnusepr=log(us_epr)
288 gen lnflnonfarm=log(fl_nonfarm)
289 gen lnfllf=log(fl_lf)
290 gen lnflbp=log(fl_bp)
291
292 *model
293 reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/12)d.lnfllf l(0/12)d.lnusepr
294 l(0/12)d.lnflbp i.month date
295 *aic/bic
296 estat ic
297 scalar define df1=el(r(S),1,4)
298 scalar define aic1=el(r(S),1,5)
299 scalar define bic1=el(r(S),1,6)
300 *10 fold cv rmse
301 crossfold reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/12)d.lnfllf l(0/12)d.lnusepr
302 l(0/12)d.lnflbp i.month date
303 scalar define k=10
304 matrix kMSE=r(est)/*r(est)
305 scalar krmse1=(el(kMSE,1,1)/k)^.5
306 scalar list krmse1
307 matrix drop kMSE
308 scalar drop k
309 *loocv
310 loocv reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/12)d.lnfllf l(0/12)d.lnusepr
311 l(0/12)d.lnflbp i.month date
312 scalar define loormse1=r(rmse)
313
314 reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/2)d.lnfllf l(0/2)d.lnusepr l(0/2)d.lnflbp
315 i.month date
316 estat ic
317 scalar define df2=el(r(S),1,4)
318 scalar define aic2=el(r(S),1,5)
319 scalar define bic2=el(r(S),1,6)
320 crossfold reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/2)d.lnfllf l(0/2)d.lnusepr
321 l(0/2)d.lnflbp i.month date
322 scalar define k=10
323 matrix kMSE=r(est)/*r(est)

```

```

319 scalar krmse2=(el(kMSE,1,1)/k)^.5
320 scalar list krmse2
321 matrix drop kMSE
322 scalar drop k
323 loocv reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/2)d.lnfllf l(0/2)d.lnusepr
l(0/2)d.lnflbp i.month date
324 scalar define loormse2=r(rmse)
325
326 reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/2,12)d.lnfllf l(0/2,12)d.lnflbp i.month
date
327 estat ic
328 scalar define df3=el(r(S),1,4)
329 scalar define aic3=el(r(S),1,5)
330 scalar define bic3=el(r(S),1,6)
331 crossfold reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/2,12)d.lnfllf l(0/2,12)d.lnflbp
i.month date
332 scalar define k=10
333 matrix kMSE=r(est)'*r(est)
334 scalar krmse3=(el(kMSE,1,1)/k)^.5
335 scalar list krmse3
336 matrix drop kMSE
337 scalar drop k
338 loocv reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/2,12)d.lnfllf l(0/2,12)d.lnflbp
i.month date
339 scalar define loormse3=r(rmse)
340
341 reg d.lnflnonfarm l(1/12,24)d.lnflnonfarm l(1/2,12,24)d.lnfllf l(1/2,12,24)d.lnusepr
i.month
342 estat ic
343 scalar define df4=el(r(S),1,4)
344 scalar define aic4=el(r(S),1,5)
345 scalar define bic4=el(r(S),1,6)
346 crossfold reg d.lnflnonfarm l(1/12,24)d.lnflnonfarm l(1/2,12,24)d.lnfllf
l(1/2,12,24)d.lnusepr i.month
347 scalar define k=10
348 matrix kMSE=r(est)'*r(est)
349 scalar krmse4=(el(kMSE,1,1)/k)^.5
350 scalar list krmse4
351 matrix drop kMSE
352 scalar drop k
353 loocv reg d.lnflnonfarm l(1/12,24)d.lnflnonfarm l(1/2,12,24)d.lnfllf
l(1/2,12,24)d.lnusepr i.month
354 scalar define loormse4=r(rmse)
355
356 matrix drop _all
357 matrix fit1=(df1,aic1,bic1,krmse1,loormse1)
358 matrix fit2=(df2,aic2,bic2,krmse2,loormse2)
359 matrix fit3=(df3,aic3,bic3,krmse3,loormse3)
360 matrix fit4=(df4,aic4,bic4,krmse4,loormse4)
361 matrix FIT=fit1\fit2\fit3\fit4
362 matrix rownames FIT="Model 1" "Model 2" "Model 3" "Model 4"

```

```

363 matrix colnames FIT=df AIC BIC K(10)RMSE LOORMSE
364 matrix list FIT
365
366 log close

```

Appendix B

```

name: <unnamed>
log: /Users/guslipkin/Documents/Spring2020/CAP 4763 ~ Time Series/Problem Sets/Problem Set 3/Problem Set 3.smcl
log type: smcl
opened on: 15 Mar 2021, 19:19:30

. *1a
. clear

. set obs 30
number of observations (_N) was 0, now 30

. gen t=[_n]

. tsset t
      time variable: t, 1 to 30
                  delta: 1 unit

. gen r=rnormal()

. gen y=r if t<4
(27 missing values generated)

. replace y=0.5+0.5*y-0.1*t2.y+0.25*t3.y+r if t>=4
(27 real changes made)

. drop r

.

. *model
. reg d.y l1d.y

Source |      SS        df       MS   Number of obs =      28
Model  | 5.98982946      1  5.98982946   F(1, 26)    =     7.29
Residual | 21.3591043     26  .821504011   Prob > F    =  0.0120
          |                         R-squared =  0.2190
          |                         Adj R-squared =  0.1890
Total   | 27.3489337     27  1.01292347   Root MSE   =  .90637

D.y |      Coef.    Std. Err.      t    P>|t| [95% Conf. Interval]
y |  -.4480631   .1659346    -2.70  0.012  -.7891465  -.1069798
LD. |                         _cons |  .0946765   .1720709     0.55  0.587  -.2590203  .4483734

. *aic/bic
. estat ic

Akaike's information criterion and Bayesian information criterion

Model |      N    ll(null)    ll(model)      df       AIC       BIC
. |      28  -39.4009  -35.94011      2  75.88022  78.54463

Note: BIC uses N = number of observations. See [R] BIC note.

. scalar define df1=el(r(S),1,4)
. scalar define aic1=el(r(S),1,5)
. scalar define bic1=el(r(S),1,6)

. *10 fold cv rmse
. crossfold reg d.y l1d.y

. scalar define RMSE
est1 |  .7602895
est2 |  .6312166
est3 |  1.110403
est4 |  1.269966
est5 |  .4469951

. scalar define k=10
. matrix KMSE=r(est)'*r(est)

```

```

. scalar krmse1=(el(kMSE,1,1)/k)^.5
. scalar list krmse1
  krmse1 = .63419929
. matrix drop kMSE
. scalar drop k
. *loocv
. loocv reg d.y l1d.y

```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | .95384454 |
| Mean Absolute Errors | .77314162 |
| Pseudo-R2 | .0999433 |

```

. scalar define loormse1=r(rmse)

.
. reg d.y l2d.y

Source | SS           df          MS          Number of obs   =    27
        | .141091522      1  .141091522  F(1, 25)       =     0.14
Model  | 25.8136069      25  1.03254427  Prob > F       =    0.7148
Residual |                           R-squared      =    0.0054
          |                           Adj R-squared = -0.0343
          |                           Root MSE      =    1.0161

D.y | Coef.  Std. Err.      t  P>|t|  [95% Conf. Interval]
y | -.06877  .1860386    -0.37  0.715  -.4519236  .3143836
L2D. | .1002526  .1964497    0.51  0.614  -.3043431  .5048482
_cons |
```

```
. estat ic
```

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|----|----------|-----------|----|----------|----------|
| . | 27 | -37.7783 | -37.70472 | 2 | 79.40943 | 82.00111 |

Note: BIC uses N = number of observations. See [\[R\] BIC note](#).

```

. scalar define df2=el(r(S),1,4)
. scalar define aic2=el(r(S),1,5)
. scalar define bic2=el(r(S),1,6)
. crossfold reg d.y l2d.y

```

| | RMSE |
|------|----------|
| est1 | .9021655 |
| est2 | .7459198 |
| est3 | 1.167232 |
| est4 | 1.243048 |
| est5 | 1.326711 |

```

. scalar define k=10
. matrix kMSE=r(est)'*r(est)
. scalar krmse2=(el(kMSE,1,1)/k)^.5
. scalar list krmse2
  krmse2 = .77704956
. matrix drop kMSE
. scalar drop k
. loocv reg d.y l2d.y

```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | 1.110311 |
| Mean Absolute Errors | .8857642 |
| Pseudo-R2 | .30515038 |

```
. scalar define loormse2=r(rmse)
```

```
. reg d.y l3d.y
```

| Source | SS | df | MS | Number of obs | = | 26 |
|--------|------------|----|------------|---------------|---|---------|
| Model | .100885437 | 1 | .100885437 | F(1, 24) | = | 0.09 |
| | 25.778986 | 24 | 1.07412442 | Prob > F | = | 0.7619 |
| Total | 25.8798714 | 25 | 1.03519486 | R-squared | = | 0.0039 |
| | | | | Adj R-squared | = | -0.0376 |
| | | | | Root MSE | = | 1.0364 |

| D.y | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] |
|-----------|----------|-----------|------|-------|----------------------|
| y L3D. | .0592101 | .1932007 | 0.31 | 0.762 | -.3395366 .4579567 |
| _cons | .0747593 | .2050307 | 0.36 | 0.719 | -.3484032 .4979218 |

```
. estat ic
```

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|----|----------|-----------|----|----------|----------|
| . | 26 | -36.8322 | -36.78142 | 2 | 77.56284 | 80.07904 |

Note: BIC uses N = number of observations. See [R] BIC note.

```
. scalar define df3=el(r(S),1,4)
```

```
. scalar define aic3=el(r(S),1,5)
```

```
. scalar define bic3=el(r(S),1,6)
```

```
. crossfold reg d.y l3d.y
```

| | RMSE |
|------|----------|
| est1 | 1.260278 |
| est2 | .5783534 |
| est3 | .4936832 |
| est4 | 1.409555 |
| est5 | 1.043313 |

```
. scalar define k=10
```

```
. matrix KMSE=r(est)'\*r(est)
```

```
. scalar krmse3=(el(kMSE,1,1)/k)^.5
```

```
. scalar list krmse3  
krmse3 = .72400711
```

```
. matrix drop KMSE
```

```
. scalar drop k
```

```
. loocv reg d.y l3d.y
```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | 1.1233063 |
| Mean Absolute Errors | .89965294 |
| Pseudo-R2 | .59352903 |

```
. scalar define loormse3=r(rmse)
```

```
. reg d.y l1d.y l2d.y
```

| Source | SS | df | MS | Number of obs | = | 27 |
|--------|------------|----|------------|---------------|---|--------|
| Model | 7.35816653 | 2 | 3.67908326 | F(2, 24) | = | 4.75 |
| | 18.5965319 | 24 | .774855494 | Prob > F | = | 0.0183 |
| Total | 25.9546984 | 26 | .99825763 | R-squared | = | 0.2835 |
| | | | | Adj R-squared | = | 0.2238 |
| | | | | Root MSE | = | .88026 |

| D.y | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] |
|----------|-----------|-----------|-------|-------|----------------------|
| y LD. | -.5821105 | .1907371 | -3.05 | 0.005 | -.9757726 -.1884485 |
| L2D. | -.3293629 | .1823834 | -1.81 | 0.083 | -.7057837 .047058 |
| cons | .1501327 | .1709626 | 0.88 | 0.389 | -.2027167 .502982 |

```
. estat ic
```

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|----|----------|-----------|----|----------|----------|
| . | 27 | -37.7783 | -33.27771 | 3 | 72.55541 | 76.44292 |

Note: BIC uses N = number of observations. See [R] BIC note.

```
. scalar define df12=el(r(S),1,4)  
. scalar define aic12=el(r(S),1,5)  
. scalar define bic12=el(r(S),1,6)  
. crossfold reg d.y l1d.y l2d.y
```

| | RMSE |
|------|----------|
| est1 | .2755585 |
| est2 | 1.280924 |
| est3 | .8959287 |
| est4 | .8905425 |
| est5 | .782406 |

```
. scalar define k=10  
. matrix KMSE=r(est)'\*r(est)  
. scalar krmse12=(el(KMSE,1,1)/k)^.5  
. scalar list krmse12  
krmse12 = .62646722  
. matrix drop KMSE  
. scalar drop k  
. loocv reg d.y l1d.y l2d.y
```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | .97005343 |
| Mean Absolute Errors | .76316726 |
| Pseudo-R2 | .13999295 |

| Source | SS | df | MS | Number of obs | = | 26 |
|----------|------------|----|------------|---------------|---|--------|
| Model | 4.83662497 | 2 | 2.41831248 | F(2, 23) | = | 2.64 |
| Residual | 21.0432464 | 23 | .914923758 | Prob > F | = | 0.0926 |
| Total | 25.8798714 | 25 | 1.03519486 | R-squared | = | 0.1869 |
| | | | | Adj R-squared | = | 0.1162 |
| | | | | Root MSE | = | .95652 |

| D.y | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] |
|-------|-----------|-----------|-------|-------|----------------------|
| y | | | | | |
| LD. | -.4285231 | .1883531 | -2.28 | 0.033 | -.8181613 -.038885 |
| L3D. | .0320856 | .1787074 | 0.18 | 0.859 | -.3375988 .40177 |
| _cons | .1149156 | .1900488 | 0.60 | 0.551 | -.2782303 .5080615 |

```
. estat ic
```

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|----|----------|-----------|----|----------|----------|
| . | 26 | -36.8322 | -34.14268 | 3 | 74.28537 | 78.05965 |

Note: BIC uses N = number of observations. See [R] BIC note.

```
. scalar define df13=el(r(S),1,4)  
. scalar define aic13=el(r(S),1,5)  
. scalar define bic13=el(r(S),1,6)  
. crossfold reg d.y l1d.y l3d.y
```

| | RMSE |
|------|----------|
| est1 | .8978038 |
| est2 | .7710074 |
| est3 | 1.453003 |
| est4 | .9490036 |
| est5 | .5381048 |

```

. scalar define k=10
. matrix KMSE=r(est)'*r(est)
. scalar krmse13=(el(kMSE,1,1)/k)^.5
. scalar list krmse13
  krmse13 = .68570296
. matrix drop KMSE
. scalar drop k
. loocv reg d.y l1d.y l3d.y

```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | 1.0320119 |
| Mean Absolute Errors | .83683368 |
| Pseudo-R2 | .07234527 |

```

. scalar define loormse13=r(rmse)

. reg d.y      l2d.y l3d.y

Source |   SS          df          MS
Model  | .237741921    2  .118870961
Residual | 25.6421295   23  1.1148752
Total   | 25.8798714   25  1.03519486
Number of obs = 26
F(2, 23) = 0.11
Prob > F = 0.8993
R-squared = 0.0092
Adj R-squared = -0.0770
Root MSE = 1.0559

D.y | Coef.  Std. Err.      t  P>|t| [95% Conf. Interval]
y | -.0805558  .2299203  -0.35  0.729  -.5561822  .3950705
L2D. | .0218562  .2238511  0.10  0.923  -.441215  .4849274
L3D. |
_cons | .0832065  .2102705  0.40  0.696  -.3517713  .5181842

```

. estat ic

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|----|----------|-----------|----|----------|----------|
| . | 26 | -36.8322 | -36.71222 | 3 | 79.42445 | 83.19874 |

Note: BIC uses N = number of observations. See [\[R\] BIC note](#).

```

. scalar define df23=el(r(S),1,4)
. scalar define aic23=el(r(S),1,5)
. scalar define bic23=el(r(S),1,6)
. crossfold reg d.y      l2d.y l3d.y

```

| | RMSE |
|------|----------|
| est1 | 1.202326 |
| est2 | 1.176127 |
| est3 | .7737328 |
| est4 | 1.260123 |
| est5 | 1.24396 |

```

. scalar define k=10
. matrix KMSE=r(est)'*r(est)
. scalar krmse23=(el(kMSE,1,1)/k)^.5
. scalar list krmse23
  krmse23 = .81011538
. matrix drop KMSE

```

```
. scalar drop k
. loocv reg d.y      l1d.y l2d.y
```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | 1.1743793 |
| Mean Absolute Errors | .93166705 |
| Pseudo-R2 | .6235484 |

```
. scalar define loormse23=r(rmse)
```

```
. reg d.y l1d.y l2d.y l3d.y
```

| Source | SS | df | MS | Number of obs | = | 26 |
|----------|------------|----|------------|---------------|---|--------|
| Model | 8.04353552 | 3 | 2.68117851 | F(3, 22) | = | 3.31 |
| Residual | 17.8363359 | 22 | .81074254 | Prob > F | = | 0.0390 |
| Total | 25.8798714 | 25 | 1.03519486 | R-squared | = | 0.3108 |
| | | | | Adj R-squared | = | 0.2168 |
| | | | | Root MSE | = | .90041 |

| D.y | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] |
|-------|-----------|-----------|-------|-------|----------------------|
| y | | | | | |
| LD. | -.6480901 | .2088663 | -3.10 | 0.005 | -1.081252 -.2149279 |
| L2D. | -.4593609 | .2309682 | -1.99 | 0.059 | -.9383596 .0196377 |
| L3D. | -.1948192 | .2032633 | -0.96 | 0.348 | -.6163615 .226723 |
| _cons | .18366 | .18221 | 1.01 | 0.324 | -.1942205 .5615405 |

```
. estat ic
```

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|----|----------|-----------|----|----------|----------|
| . | 26 | -36.8322 | -31.99324 | 4 | 71.98647 | 77.01886 |

Note: BIC uses N = number of observations. See [\[R\] BIC note](#).

```
. scalar define df123=el(r(S),1,4)
. scalar define aic123=el(r(S),1,5)
. scalar define bic123=el(r(S),1,6)
. crossfold reg d.y l1d.y l2d.y l3d.y
```

| | RMSE |
|------|----------|
| est1 | 1.277871 |
| est2 | .4126419 |
| est3 | 1.187153 |
| est4 | .7160594 |
| est5 | .7569776 |

```
. scalar define k=10
. matrix KMSE=r(est)'*r(est)
. scalar krmse123=(el(KMSE,1,1)/k)^.5
. scalar list krmse123
krmse123 = .65561544
. matrix drop KMSE
. scalar drop k
. loocv reg d.y l1d.y l2d.y l3d.y
```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | 1.0025941 |
| Mean Absolute Errors | .78300616 |
| Pseudo-R2 | .14309964 |

```
. scalar define loormse123=r(rmse)
. matrix drop _all
```

```

. matrix fit1=(df1,aic1,bic1,krmse1,loormse1)
. matrix fit2=(df2,aic2,bic2,krmse2,loormse2)
. matrix fit3=(df3,aic3,bic3,krmse3,loormse3)
. matrix fit12=(df12,aic12,bic12,krmse12,loormse12)
. matrix fit13=(df13,aic13,bic13,krmse13,loormse13)
. matrix fit23=(df23,aic23,bic23,krmse23,loormse23)
. matrix fit123=(df123,aic123,bic123,krmse123,loormse123)
. matrix FIT=fit1\fit2\fit3\fit12\fit13\fit23\fit123
. matrix rownames FIT="Model 1" "Model 2" "Model 3" "Model 12" "Model 13" "Model 23" "Model 123"
. matrix colnames FIT=df AIC BIC K(10)RMSE LOORMSE
. matrix list FIT

FIT[7,5]
      df          AIC         BIC   K(10)RMSE   LOORMSE
Model 1      2  75.880218  78.544627  .63419929  .95384454
Model 2      2  79.489433  82.001106  .77704956  1.118311
Model 3      2  77.562845  80.079038  .72400711  1.1233063
Model 12     3  72.555413  76.442924  .62646722  .97005343
Model 13     3  74.285365  78.059655  .68570296  1.0320119
Model 23     3  79.424447  83.198737  .81011538  1.1743793
Model 123    4  71.986474  77.018861  .65561544  1.0025941

.
. *1b
. clear

. set obs 300
number of observations (_N) was 0, now 300

. gen t=[_n]

. tsset t
      time variable: t, 1 to 300
                  delta: 1 unit

. gen r=rnormal()

. gen y=r if t<4
(297 missing values generated)

. replace y=0.5+0.5*y-0.1*t2.y+0.25*t3.y+r if t>=4
(297 real changes made)

. drop r

.
. *model
. reg d.y lid.y

Source |      SS        df       MS   Number of obs =      298
       | 40.2287435      1  40.2287435   F(1, 296)      =  30.29
       | 393.11806     296  1.32810155   Prob > F      =  0.0000
       |                               R-squared      =  0.0928
       |                               Adj R-squared =  0.0898
       |                               Root MSE      =  1.1524

.
      D.y |   Coef.  Std. Err.      t   P>|t| [95% Conf. Interval]
      y | -.3047742  .0553765    -5.50  0.000  -.4137557  -.1957926
      _cons |  .0055929  .0667596     0.08  0.933  -.1257907  .1369765

.
. *aic/bic
. estat ic

```

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|-----|----------|-----------|----|----------|----------|
| . | 298 | -478.636 | -464.1191 | 2 | 932.2383 | 939.6325 |

Note: BIC uses N = number of observations. See [\[R\] BIC note](#).

```

. scalar define df1=el(r(S),1,4)
. scalar define aic1=el(r(S),1,5)
. scalar define bic1=el(r(S),1,6)
. *10 fold cv rmse

```

```

. crossfold reg d.y l1d.y

| RMSE
---+-
 est1 | 1.070865
 est2 | 1.397489
 est3 | 1.076643
 est4 | 1.144266
 est5 | 1.153222

. scalar define k=10

. matrix KMSE=r(est)'*r(est)

. scalar krmse1=(el(KMSE,1,1)/k)^.5

. scalar list krmse1
 krmse1 = .81576385

. matrix drop KMSE

. scalar drop k

. *loocv
. loocv reg d.y l1d.y

```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | 1.1602627 |
| Mean Absolute Errors | .9370285 |
| Pseudo-R2 | .08032407 |

```

. scalar define loormse1=r(rmse)

. reg d.y l2d.y

Source | SS df MS Number of obs = 297
Model | 37.8014875 1 37.8014875 F(1, 295) = 28.21
Residual | 395.272758 295 1.33990765 Prob > F = 0.0000
Total | 433.074246 296 1.46308867 R-squared = 0.0873
                                                Adj R-squared = 0.0842
                                                Root MSE = 1.1575

D.y | Coef. Std. Err. t P>|t| [95% Conf. Interval]
y | -.2956623 .0556646 -5.31 0.000 -.4052123 -.1861123
L2D. |
_cons | .0080967 .0671695 0.12 0.904 -.1240954 .1402888

```

. estat ic

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|-----|-----------|-----------|----|----------|----------|
| . | 297 | -477.4355 | -463.8726 | 2 | 931.7451 | 939.1326 |

Note: BIC uses N = number of observations. See [\[R\] BIC note](#).

```

. scalar define df2=el(r(S),1,4)
. scalar define aic2=el(r(S),1,5)
. scalar define bic2=el(r(S),1,6)
. crossfold reg d.y l2d.y

| RMSE
---+-
 est1 | 1.155929
 est2 | 1.318321
 est3 | 1.195786
 est4 | 1.208012
 est5 | 1.006752

. scalar define k=10

. matrix KMSE=r(est)'*r(est)

. scalar krmse2=(el(KMSE,1,1)/k)^.5

. scalar list krmse2
 krmse2 = .82278473

. matrix drop KMSE

```

```
. scalar drop k
. loocv reg d.y l2d.y
```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | 1.164344 |
| Mean Absolute Errors | .96184136 |
| Pseudo-R2 | .07534286 |

```
. scalar define loormse2=r(rmse)
```

```
. reg d.y l3d.y
```

| Source | SS | df | MS | Number of obs | = | 296 |
|----------|------------|-----|------------|---------------|---|--------|
| Model | 19.9598466 | 1 | 19.9598466 | F(1, 294) | = | 14.20 |
| Residual | 413.112855 | 294 | 1.40514577 | Prob > F | = | 0.0002 |
| Total | 433.072702 | 295 | 1.46804306 | R-squared | = | 0.0461 |
| | | | | Adj R-squared | = | 0.0428 |
| | | | | Root MSE | = | 1.1854 |

| D.y | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] |
|-----------|----------|-----------|------|-------|----------------------|
| y L3D. | .214962 | .0570353 | 3.77 | 0.000 | .1027128 .3272113 |
| _cons | .0037681 | .0689004 | 0.05 | 0.956 | -.1318325 .1393686 |

```
. estat ic
```

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|-----|-----------|-----------|----|----------|----------|
| . | 296 | -476.3266 | -469.3433 | 2 | 942.6866 | 950.0673 |

Note: BIC uses N = number of observations. See [\[R\] BIC note](#).

```
. scalar define df3=el(r(S),1,4)
. scalar define aic3=el(r(S),1,5)
. scalar define bic3=el(r(S),1,6)
. crossfold reg d.y l3d.y
```

| | RMSE |
|------|----------|
| est1 | 1.220885 |
| est2 | 1.300472 |
| est3 | 1.206425 |
| est4 | 1.047378 |
| est5 | 1.156072 |

```
. scalar define k=10
. matrix KMSE=r(est)'*r(est)
. scalar krmse3=(el(KMSE,1,1)/k)^.5
. scalar list krmse3
  krmse3 = .84087751
. matrix drop KMSE
. scalar drop k
. loocv reg d.y l3d.y
```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | 1.1927634 |
| Mean Absolute Errors | .97432674 |
| Pseudo-R2 | .03508471 |

```
. scalar define loormse3=r(rmse)
```

```
. reg d.y l1d.y l2d.y
```

| Source | SS | df | MS | Number of obs | = | 297 |
|--------|----|----|----|---------------|---|-----|
| | | | | | | |

| | | | | | | |
|----------|------------|-----|------------|------------|---|--------|
| Model | 112.32631 | 2 | 56.163155 | F(14, 274) | = | 01.40 |
| Residual | 320.747936 | 294 | 1.09097937 | Prob > F | = | 0.0000 |
| Total | 433.074246 | 296 | 1.46308867 | R-squared | = | 0.2594 |

| D.y | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] |
|-------|-----------|-----------|-------|-------|----------------------|
| y | | | | | |
| LD. | -.4357756 | .0527255 | -8.26 | 0.000 | -.5395429 -.3320084 |
| L2D. | -.4291487 | .0527612 | -8.13 | 0.000 | -.5329862 -.3253111 |
| _cons | .0117439 | .0606114 | 0.19 | 0.846 | -.1075433 .1310311 |

. estat ic

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|-----|-----------|-----------|----|----------|----------|
| . | 297 | -477.4355 | -432.8479 | 3 | 871.6957 | 882.7769 |

Note: BIC uses N = number of observations. See [R] BIC note.

```
. scalar define df12=el(r(S),1,4)
. scalar define aic12=el(r(S),1,5)
. scalar define bic12=el(r(S),1,6)
. crossfold reg d.y l1d.y l2d.y
```

| | RMSE |
|------|----------|
| est1 | .9054228 |
| est2 | .9939704 |
| est3 | 1.153992 |
| est4 | 1.044548 |
| est5 | 1.095283 |

```
. scalar define k=10
. matrix KMSE=r(est)'*r(est)
. scalar krmse12=(el(kMSE,1,1)/k)^.5
. scalar list krmse12
  krmse12 = .73689822
. matrix drop KMSE
. scalar drop k
. loocv reg d.y l1d.y l2d.y
```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | 1.0505398 |
| Mean Absolute Errors | .8495225 |
| Pseudo-R2 | .2471428 |

```
. scalar define loormse12=r(rmse)
. reg d.y l1d.y l3d.y
```

| Source | SS | df | MS | Number of obs | = | 296 |
|----------|------------|-----|------------|---------------|---|--------|
| Model | 47.5617458 | 2 | 23.7808729 | F(2, 293) | = | 18.07 |
| Residual | 385.510956 | 293 | 1.31573705 | Prob > F | = | 0.0000 |
| Total | 433.072702 | 295 | 1.46804306 | R-squared | = | 0.1098 |
| | | | | Adj R-squared | = | 0.1037 |
| | | | | Root MSE | = | 1.1471 |

| D.y | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] |
|-------|-----------|-----------|-------|-------|----------------------|
| y | | | | | |
| LD. | -.2642997 | .0577048 | -4.58 | 0.000 | -.3778681 -.1507313 |
| L3D. | .1369759 | .0577577 | 2.37 | 0.018 | .0233034 .2506484 |
| _cons | .0062375 | .0666745 | 0.09 | 0.926 | -.1249842 .1374591 |

. estat ic

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|-----|-----------|-----------|----|----------|----------|
| . | 296 | -476.3266 | -459.1089 | 3 | 924.2178 | 935.2889 |

Note: BIC uses N = number of observations. See [\[R\] BIC note](#).

```
. scalar define df13=el(r(S),1,4)
. scalar define aic13=el(r(S),1,5)
. scalar define bic13=el(r(S),1,6)
. crossfold reg d.y l1d.y l3d.y
```

| | RMSE |
|------|----------|
| est1 | 1.144654 |
| est2 | 1.043574 |
| est3 | 1.244819 |
| est4 | 1.14139 |
| est5 | 1.214143 |

```
. scalar define k=10
. matrix KMSE=r(est)/*r(est)
. scalar krmse13=(el(KMSE,1,1)/k)^.5
. scalar list krmse13
krmse13 = .82010777
. matrix drop KMSE
. scalar drop k
. loocv reg d.y l1d.y l3d.y
```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | 1.1555101 |
| Mean Absolute Errors | .9348069 |
| Pseudo-R2 | .09434506 |

| Source | SS | df | MS | Number of obs | = | 296 |
|----------|------------|-----|------------|---------------|---|--------|
| Model | 45.215903 | 2 | 22.6079515 | F(2, 293) | = | 17.08 |
| Residual | 387.856799 | 293 | 1.32374334 | Prob > F | = | 0.0000 |
| Total | 433.072702 | 295 | 1.46804306 | R-squared | = | 0.1044 |
| | | | | Adj R-squared | = | 0.0983 |
| | | | | Root MSE | = | 1.1505 |

| D.y | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] |
|-------|-----------|-----------|-------|-------|----------------------|
| y | | | | | |
| L2D. | -.2538017 | .058105 | -4.37 | 0.000 | -.3681577 -.1394456 |
| L3D. | .1374621 | .0581324 | 2.36 | 0.019 | .023052 .2518721 |
| _cons | .0064038 | .0668776 | 0.10 | 0.924 | -.1252176 .1380252 |

```
. estat ic
```

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|-----|-----------|-----------|----|----------|----------|
| . | 296 | -476.3266 | -460.0068 | 3 | 926.0135 | 937.0846 |

Note: BIC uses N = number of observations. See [\[R\] BIC note](#).

```
. scalar define df23=el(r(S),1,4)
. scalar define aic23=el(r(S),1,5)
. scalar define bic23=el(r(S),1,6)
. crossfold reg d.y 12d.y l3d.y
```

| | RMSE |
|------|----------|
| est1 | 1.261762 |
| est2 | 1.151197 |
| est3 | 1.047751 |
| est4 | 1.195764 |

```

est5 | 1.0922

. scalar define k=10

. matrix KMSE=r(est)'*r(est)

. scalar krmse23=(el(KMSE,1,1)/k)^.5

. scalar list krmse23
krmse23 = .81472913

. matrix drop KMSE

. scalar drop k

. loocv reg d.y      l1d.y l2d.y l3d.y

```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | 1.1606538 |
| Mean Absolute Errors | .94993411 |
| Pseudo-R2 | .08627031 |

```

. scalar define loormse23=r(rmse)

. reg d.y l1d.y l2d.y l3d.y

Source | SS          df          MS          Number of obs   =    296
        | 113.494499     3  37.8314998  F(3, 292)       =    34.57
        | 319.578203   292  1.0944459  Prob > F       =  0.0000
        |                               R-squared      =  0.2621
        |                               Adj R-squared =  0.2545
        |                               Root MSE      =  1.0462

D.y | Coef.  Std. Err.      t      P>|t|  [95% Conf. Interval]
y  LD. | -.4616699  .0584503  -7.90  0.000  -.5767071  -.3466327
L2D. | -.4554328  .0586774  -7.76  0.000  -.5709171  -.3399486
L3D. | -.0603309  .0584902  -1.03  0.303  -.1754466  .0547848
_cons | .0128112  .0608155  0.21  0.833  -.1068812  .1325036

```

```
. estat ic
```

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|-----|-----------|-----------|----|----------|----------|
| . | 296 | -476.3266 | -431.3489 | 4 | 870.6978 | 885.4592 |

Note: BIC uses N = number of observations. See [\[R\] BIC note](#).

```

. scalar define df123=el(r(S),1,4)

. scalar define aic123=el(r(S),1,5)

. scalar define bic123=el(r(S),1,6)

. crossfold reg d.y l1d.y l2d.y l3d.y

RMSE
est1 | 1.193648
est2 | .9485697
est3 | 1.119405
est4 | 1.049818
est5 | .9232315

. scalar define k=10

. matrix KMSE=r(est)'*r(est)

. scalar krmse123=(el(KMSE,1,1)/k)^.5

. scalar list krmse123
krmse123 = .74378241

. matrix drop KMSE

. scalar drop k

. loocv reg d.y l1d.y l2d.y l3d.y

```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|------------------|
| Root Mean Squared Errors | 1.0551773 |
| Mean Absolute Errors | .85532304 |
| Pseudo-R2 | .24451175 |

```

. scalar define loormse123=r(rmse)

. matrix drop _all

. matrix fit1=(df1,aic1,bic1,krmse1,loormse1)

. matrix fit2=(df2,aic2,bic2,krmse2,loormse2)

. matrix fit3=(df3,aic3,bic3,krmse3,loormse3)

. matrix fit12=(df12,aic12,bic12,krmse12,loormse12)

. matrix fit13=(df13,aic13,bic13,krmse13,loormse13)

. matrix fit23=(df23,aic23,bic23,krmse23,loormse23)

. matrix fit123=(df123,aic123,bic123,krmse123,loormse123)

. matrix FIT=fit1\fit2\fit3\fit12\fit13\fit23\fit123

. matrix rownames FIT="Model 1" "Model 2" "Model 3" "Model 12" "Model 13" "Model 23" "Model 123"

. matrix colnames FIT=df AIC BIC K(10)RMSE LOORMSE

. matrix list FIT

FIT[7,5]
      df      AIC      BIC   K(10)RMSE   LOORMSE
Model 1    2  932.23828  939.63247  .81576385  1.1602627
Model 2    2  931.74513  939.1326   .82278473  1.164344
Model 3    2  942.68657  950.06729  .84087751  1.1927634
Model 12   3  871.69575  882.77694  .73689822  1.0505398
Model 13   3  924.21782  935.2889   .82010777  1.1555101
Model 23   3  926.01353  937.08461  .81472913  1.1606538
Model 123  4  870.69781  885.45925  .74378241  1.0551773

.

. *2
. clear

. cd "/Users/guslipkin/Documents/Spring2020/CAP 4763 ~ Time Series/Problem Sets/Problem Set 3"
/Users/guslipkin/Documents/Spring2020/CAP 4763 ~ Time Series/Problem Sets/Problem Set 3

. import delimited "Assignment_1_Monthly.txt"
(5 vars, 984 obs)

.

. rename lnu02300000 us_epr

. rename flnan fl_nonfarm

. rename flfn fl_lf

. rename flbpriv fl_bp

. rename date datestring

.

. *2d Generate a monthly date variable (make its display format monthly time, %tm)
. gen datec=date(datestring, "YMD")

. gen date=mofd(datec)

. format date %tm

.

. *2e tsset your data
. tsset date
      time variable: date, 1939m1 to 2020m12
      delta: 1 month

. gen month=month(datec)

.

. *2f
. gen lnusepr=log(us_epr)
(108 missing values generated)

. gen lnflnonfarm=log(fl_nonfarm)

. gen lnfllf=log(fl_lf)
(444 missing values generated)

. gen lnflbp=log(fl_bp)
(588 missing values generated)

```

```

. *model
. reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/12)d.lnfllf l(0/12)d.lnusepr l(0/12)d.lnflbp i.month date

```

| Source | SS | df | MS | Number of obs | = | 383 |
|-------------------|------------|-----------|------------|---------------|----------------------|-----------|
| Model | .050768432 | 63 | .000805848 | F(63, 319) | = | 53.24 |
| Residual | .004828206 | 319 | .000015135 | Prob > F | = | 0.0000 |
| Total | .055596638 | 382 | .000145541 | R-squared | = | 0.9132 |
| | | | | Adj R-squared | = | 0.8960 |
| | | | | Root MSE | = | .00389 |
| D. lnflnonfarm | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] | |
| lnflnonfarm | | | | | | |
| LD. | -.3187209 | .0520581 | -6.12 | 0.000 | -.4211416 | -.2163003 |
| L2D. | -.1993953 | .0546776 | -3.65 | 0.000 | -.3869696 | -.091821 |
| L3D. | .004615 | .0556328 | 0.08 | 0.934 | -.1048386 | .1140686 |
| L4D. | .0520114 | .0553102 | 0.94 | 0.348 | -.0568075 | .1608302 |
| L5D. | -.0290364 | .0550957 | -0.53 | 0.599 | -.1374333 | .0793605 |
| L6D. | -.0411661 | .0575557 | -0.72 | 0.475 | -.1544829 | .0720706 |
| L7D. | -.0589717 | .0560994 | -1.05 | 0.294 | -.1693433 | .0514 |
| L8D. | -.06692 | .0555654 | -1.20 | 0.229 | -.1762409 | .042401 |
| L9D. | .0735794 | .0592884 | 1.24 | 0.216 | -.0430663 | .198225 |
| L10D. | -.1280257 | .0580919 | -2.20 | 0.028 | -.2423174 | -.013734 |
| L11D. | -.0562037 | .0581423 | -0.97 | 0.334 | -.1705946 | .0581872 |
| L12D. | .4026367 | .0587393 | 6.85 | 0.000 | .2870713 | .5182021 |
| lnfllf | | | | | | |
| D1. | -.4678501 | .091836 | -5.09 | 0.000 | -.6485309 | -.2871693 |
| LD. | -.1874345 | .0955731 | -1.96 | 0.051 | -.3754677 | .0005987 |
| L2D. | -.1532159 | .0957994 | -1.60 | 0.111 | -.3416944 | .0352626 |
| L3D. | .186449 | .0979739 | 1.90 | 0.058 | -.0063077 | .3792057 |
| L4D. | .0760726 | .0990118 | 0.77 | 0.443 | -.118726 | .2708713 |
| L5D. | .0351072 | .0990036 | 0.35 | 0.723 | -.1597391 | .2299535 |
| L6D. | .0231131 | .0990097 | 0.23 | 0.816 | -.1716814 | .2179075 |
| L7D. | .1259544 | .0974149 | 1.29 | 0.197 | -.0657025 | .3176112 |
| L8D. | .024699 | .0982434 | 0.25 | 0.802 | -.1685878 | .2179858 |
| L9D. | .1150141 | .1100678 | 1.04 | 0.297 | -.1015364 | .3315646 |
| L10D. | .2080239 | .1108839 | 1.88 | 0.062 | -.0101322 | .42618 |
| L11D. | -.0752819 | .1117702 | -0.67 | 0.501 | -.2951818 | .1446179 |
| L12D. | -.1248653 | .1111426 | -1.12 | 0.262 | -.3435303 | .0937998 |
| lnusepr | | | | | | |
| D1. | 1.058897 | .0618861 | 17.11 | 0.000 | .937141 | 1.180654 |
| LD. | .376984 | .084734 | 4.45 | 0.000 | .2102759 | .5436921 |
| L2D. | .2272904 | .0866516 | 2.62 | 0.009 | .0568095 | .3977713 |
| L3D. | -.1902081 | .087627 | -2.17 | 0.031 | -.3626078 | -.0178083 |
| L4D. | .00045 | .0885154 | 0.01 | 0.996 | -.1736977 | .1745976 |
| L5D. | -.0261134 | .0874342 | -0.30 | 0.765 | -.1981339 | .1459071 |
| L6D. | .1609474 | .0889456 | 1.81 | 0.071 | -.0140467 | .3359415 |
| L7D. | .0157551 | .0888144 | 0.18 | 0.859 | -.1589808 | .190491 |
| L8D. | .0633536 | .0901157 | 0.70 | 0.483 | -.1139427 | .2406498 |
| L9D. | .0217037 | .1470597 | 0.15 | 0.883 | -.2676257 | .3118332 |
| L10D. | -.1641384 | .1480045 | -1.11 | 0.268 | -.4553266 | .1270498 |
| L11D. | .2149393 | .1460384 | 1.47 | 0.142 | -.0723808 | .5022593 |
| L12D. | .0161647 | .1416189 | 0.11 | 0.909 | -.2624602 | .2947897 |
| lnflbp | | | | | | |
| D1. | .0043768 | .0017545 | 2.49 | 0.013 | .000925 | .0078286 |
| LD. | .0049935 | .0020942 | 2.38 | 0.018 | .0008732 | .0091137 |
| L2D. | .0051854 | .0022195 | 2.34 | 0.020 | .0008187 | .009552 |
| L3D. | .0065461 | .0022284 | 2.94 | 0.004 | .002162 | .0109302 |
| L4D. | .0055029 | .0022297 | 2.47 | 0.014 | .001116 | .0098898 |
| L5D. | .0067131 | .0022143 | 3.03 | 0.003 | .0023567 | .0110696 |
| L6D. | .0071818 | .0022379 | 3.17 | 0.002 | .002699 | .0115047 |
| L7D. | .007351 | .002247 | 3.27 | 0.001 | .0029301 | .0117719 |
| L8D. | .0054368 | .0023044 | 2.36 | 0.019 | .0009031 | .0099705 |
| L9D. | .004466 | .0022983 | 1.94 | 0.053 | -.0000558 | .0089878 |
| L10D. | .0061294 | .0022689 | 2.70 | 0.007 | .0016656 | .0105932 |
| L11D. | .0032694 | .0021733 | 1.50 | 0.133 | -.0010063 | .0075452 |
| L12D. | .0026534 | .001789 | 1.48 | 0.139 | -.0008664 | .0061731 |
| month | | | | | | |
| 2 | -.0019614 | .0032441 | -0.60 | 0.546 | -.0083439 | .0044211 |
| 3 | -.0024974 | .0033763 | -0.74 | 0.460 | -.00914 | .0041452 |
| 4 | -.007529 | .0038677 | -1.95 | 0.052 | -.0151384 | .0000805 |
| 5 | -.0039676 | .0033266 | -1.19 | 0.234 | -.0105125 | .0025772 |
| 6 | -.0144882 | .0036057 | -4.02 | 0.000 | -.0215823 | -.0073942 |
| 7 | -.0097851 | .0032285 | -3.03 | 0.003 | -.016137 | -.0034332 |
| 8 | -.0000542 | .0035161 | -0.02 | 0.988 | -.0069719 | .0068635 |
| 9 | .0051214 | .0032399 | 1.58 | 0.115 | -.0012529 | .0114956 |
| 10 | .0025358 | .0044185 | 0.57 | 0.566 | -.0061572 | .0112288 |
| 11 | -.0004647 | .0037668 | -0.12 | 0.902 | -.0078757 | .0069462 |
| 12 | .0024219 | .003508 | 0.69 | 0.490 | -.0044799 | .0093237 |
| date | -5.37e-06 | 2.17e-06 | -2.48 | 0.014 | -9.64e-06 | -1.11e-06 |
| _cons | .0079011 | .0030662 | 2.58 | 0.010 | .0018685 | .0139337 |

```

. *aic/bic
. estat ic

```

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|-----|----------|-----------|----|-----------|-----------|
| . | 383 | 1148.96 | 1616.918 | 64 | -3105.837 | -2853.163 |

Note: BIC uses N = number of observations. See [R] **BIC note**.

```
. scalar define df1=el(r(S),1,4)
. scalar define aic1=el(r(S),1,5)
. scalar define bic1=el(r(S),1,6)
. *10 fold cv rmse
. crossfold reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/12)d.lnfllf l(0/12)d.lnusepr l(0/12)d.lnflbp i.month date
```

| | RMSE |
|------|----------|
| est1 | .0041889 |
| est2 | .0108909 |
| est3 | .0039031 |
| est4 | .0059736 |
| est5 | .0061815 |

```
. scalar define k=10
. matrix KMSE=r(est)'\*r(est)
. scalar krmse1=(el(KMSE,1,1)/k)^.5
. scalar list krmse1
  krmse1 = .00474646
. matrix drop KMSE
. scalar drop k
. *loocv
. loocv reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/12)d.lnfllf l(0/12)d.lnusepr l(0/12)d.lnflbp i.month date
```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | .00746943 |
| Mean Absolute Errors | .00370951 |
| Pseudo-R2 | .62103068 |

```
. scalar define loormse1=r(rmse)

. reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/2)d.lnfllf l(0/2)d.lnusepr l(0/2)d.lnflbp i.month date
```

| Source | SS | df | MS | Number of obs | = | 393 |
|----------|------------|-----|------------|---------------|---|--------|
| Model | .050628703 | 33 | .001534203 | F(33, 359) | = | 89.36 |
| Residual | .006163276 | 359 | .000017168 | Prob > F | = | 0.0000 |
| Total | .056791979 | 392 | .000144877 | R-squared | = | 0.8915 |
| | | | | Adj R-squared | = | 0.8815 |
| | | | | Root MSE | = | .00414 |

| D. lnflnonfarm | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] |
|-------------------|-----------|-----------|-------|-------|----------------------|
| lnflnonfarm | | | | | |
| LD. | -.2879019 | .0460794 | -6.25 | 0.000 | -.3785214 -.1972825 |
| L2D. | -.1514457 | .0463813 | -3.27 | 0.001 | -.242659 -.0602325 |
| L3D. | -.0567902 | .0294329 | -1.93 | 0.054 | -.1146727 .0010924 |
| L4D. | .0805401 | .029035 | 2.77 | 0.006 | .0234401 .1376402 |
| L5D. | .0148106 | .0285969 | 0.52 | 0.605 | -.0414279 .0710492 |
| L6D. | .1156142 | .0294928 | 3.92 | 0.000 | .0576138 .1736146 |
| L7D. | .0569047 | .0295656 | 1.92 | 0.055 | -.001239 .1150483 |
| L8D. | .0333213 | .02999318 | 1.11 | 0.266 | -.0255424 .092185 |
| L9D. | .0904818 | .0496354 | 1.82 | 0.069 | -.0071309 .1880945 |
| L10D. | -.0920517 | .0486864 | -1.89 | 0.059 | -.1877981 .0036947 |
| L11D. | -.041793 | .0502562 | -0.83 | 0.406 | -.1406266 .0570406 |
| L12D. | .5067995 | .0521856 | 9.71 | 0.000 | .4041716 .6094273 |
| lnfllf | | | | | |
| D1. | -.5263049 | .089119 | -5.91 | 0.000 | -.7015658 -.3510439 |
| LD. | -.2330839 | .0937837 | -2.49 | 0.013 | -.4175183 -.0486495 |
| L2D. | -.1589497 | .0933952 | -1.70 | 0.090 | -.3426201 .0247208 |
| lnusepr | | | | | |
| D1. | 1.060432 | .0618714 | 17.14 | 0.000 | .9387559 1.182108 |
| LD. | .3727363 | .0796402 | 4.68 | 0.000 | .2161164 .5293561 |
| L2D. | .18183 | .0794706 | 2.29 | 0.023 | .0255436 .3381164 |
| lnflbp | | | | | |
| LD. | | | | | |

| | | | | | | |
|-------|-----------|----------|-------|-------|-----------|-----------|
| D1. | .0039846 | .0017113 | 2.33 | 0.020 | .0000191 | .00735 |
| LD. | .002868 | .0019597 | 1.46 | 0.144 | -.000986 | .006722 |
| L2D. | .0007752 | .0017454 | 0.44 | 0.657 | -.0026574 | .0042078 |
| month | | | | | | |
| 2 | -.0067672 | .0019876 | -3.40 | 0.001 | -.0106759 | -.0028585 |
| 3 | -.0075077 | .0021433 | -3.50 | 0.001 | -.0117227 | -.0032928 |
| 4 | -.0145828 | .0023379 | -6.24 | 0.000 | -.0191805 | -.0099851 |
| 5 | -.0115104 | .0023047 | -4.99 | 0.000 | -.0160428 | -.0069781 |
| 6 | -.0201266 | .0021525 | -9.35 | 0.000 | -.0243597 | -.0158934 |
| 7 | -.0165043 | .0020312 | -8.13 | 0.000 | -.0204989 | -.0125097 |
| 8 | -.0060822 | .0023503 | -2.59 | 0.010 | -.0107044 | -.00146 |
| 9 | -.0003452 | .0020707 | -0.17 | 0.868 | -.0044175 | .0037271 |
| 10 | -.0031356 | .0022726 | -1.38 | 0.169 | -.007605 | .0013337 |
| 11 | -.0021778 | .0022087 | -0.99 | 0.325 | -.0065215 | .0021659 |
| 12 | -.0005171 | .0019811 | -0.26 | 0.794 | -.0044131 | .0033788 |
| date | -3.85e-06 | 1.97e-06 | -1.95 | 0.052 | -7.73e-06 | 2.76e-08 |
| _cons | .0119425 | .0019422 | 6.15 | 0.000 | .008123 | .015762 |

. estat ic

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|-----|----------|-----------|----|-----------|-----------|
| . | 393 | 1179.844 | 1616.228 | 34 | -3164.456 | -3029.347 |

Note: BIC uses N = number of observations. See [R] BIC note.

```
. scalar define df2=el(r(S),1,4)
. scalar define aic2=el(r(S),1,5)
. scalar define bic2=el(r(S),1,6)
. crossfold reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/2)d.lnfllf l(0/2)d.lnusepr l(0/2)d.lnflbp i.month date
```

| | RMSE |
|------|----------|
| est1 | .0083028 |
| est2 | .0107218 |
| est3 | .0037125 |
| est4 | .0057848 |
| est5 | .0054343 |

```
. scalar define k=10
. matrix KMSE=r(est)'*r(est)
. scalar krmse2=(el(KMSE,1,1)/k)^.5
. scalar list krmse2
  krmse2 = .0051056
. matrix drop KMSE
. scalar drop k
. loocv reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/2)d.lnfllf l(0/2)d.lnusepr l(0/2)d.lnflbp i.month date
```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | .00634841 |
| Mean Absolute Errors | .00352834 |
| Pseudo-R2 | .7235841 |

```
. scalar define loormse2=r(rmse)
. reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/2,12)d.lnfllf l(0/2,12)d.lnflbp i.month date
```

| Source | SS | df | MS | Number of obs | = | 383 |
|----------|------------|-----|------------|---------------|---|--------|
| Model | .045212283 | 32 | .001412884 | F(32, 350) | = | 47.62 |
| Residual | .010384356 | 350 | .00002967 | Prob > F | = | 0.0000 |
| Total | .055596638 | 382 | .000145541 | R-squared | = | 0.8132 |
| | | | | Adj R-squared | = | 0.7961 |
| | | | | Root MSE | = | .00545 |

| D. lnflnonfarm | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] |
|-------------------|-----------|-----------|-------|-------|----------------------|
| LD. | -.1740883 | .0474513 | -3.67 | 0.000 | -.2674139 -.0807628 |
| L2D. | -.1796728 | .0482708 | -3.72 | 0.000 | -.2746102 -.0847355 |
| L3D. | .0482014 | .037623 | 1.28 | 0.201 | -.0257942 .122197 |
| L4D. | .0632059 | .0373781 | 1.69 | 0.092 | -.0103081 .1367199 |
| i _{5D} | -.0000745 | .0000744 | -0.00 | 0.999 | -.0000070 .0000000 |

| | | | | | | |
|---------------|-------------------|------------------|--------------|--------------|------------------|-----------------|
| L5D. | -.00240749 | .00000744 | -7.70 | 7.70 | -.0735777 | .0070400 |
| L6D. | -.0245775 | .0368577 | -0.67 | 0.505 | -.097068 | .0479131 |
| L7D. | .0020704 | .0365831 | 0.06 | 0.955 | -.0698801 | .0746208 |
| L8D. | -.0138142 | .0369521 | -0.37 | 0.709 | -.0864984 | .058862 |
| L9D. | .00905825 | .0658306 | 1.38 | 0.170 | -.0388908 | .2200557 |
| L10D. | .0013538 | .0624801 | 0.02 | 0.983 | -.1215299 | .1242374 |
| L11D. | .0933649 | .0634182 | 1.47 | 0.142 | -.0313638 | .2180935 |
| L12D. | .5476684 | .0667124 | 8.21 | 0.000 | .4164608 | .678876 |
| lnflff | | | | | | |
| D1. | .928238 | .0488357 | 19.01 | 0.000 | .8321896 | 1.024286 |
| LD. | .2156929 | .0625792 | 3.45 | 0.001 | .0926143 | .3387715 |
| L2D. | -.031619 | .0633368 | -0.50 | 0.618 | -.1561876 | .0929497 |
| L12D. | -.3699158 | .0765149 | -4.83 | 0.000 | -.5204027 | -.219429 |
| lnflbp | | | | | | |
| D1. | .0063989 | .0022569 | 2.84 | 0.005 | .0019601 | .0108378 |
| LD. | .0023471 | .0025799 | 0.91 | 0.364 | -.0027269 | .0074211 |
| L2D. | .0019136 | .0023019 | 0.83 | 0.406 | -.0026138 | .0064409 |
| L12D. | -.0005871 | .0019573 | -0.30 | 0.764 | -.0044366 | .0032625 |
| month | | | | | | |
| 2 | .0038169 | .0025894 | 1.47 | 0.141 | -.0012758 | .0089095 |
| 3 | .0021932 | .002851 | 0.77 | 0.442 | -.0034141 | .0078005 |
| 4 | .0060381 | .0027741 | 2.18 | 0.030 | .000582 | .0114941 |
| 5 | .0021218 | .0028366 | 0.75 | 0.455 | -.0034572 | .0077007 |
| 6 | -.0044018 | .0025573 | -1.72 | 0.086 | -.0094314 | .0006277 |
| 7 | -.007066 | .0025453 | -2.78 | 0.006 | -.0120719 | -.00206 |
| 8 | .0048701 | .0029279 | 1.66 | 0.097 | -.0008884 | .0106287 |
| 9 | .006203 | .002778 | 2.23 | 0.026 | .0007394 | .0116666 |
| 10 | .0122795 | .0027643 | 4.44 | 0.000 | .0068429 | .0177162 |
| 11 | .0128943 | .0026646 | 4.84 | 0.000 | .0076537 | .0181349 |
| 12 | .0111956 | .0024931 | 4.49 | 0.000 | .0062924 | .0160989 |
| date | -8.62e-08 | 2.63e-06 | -0.03 | 0.974 | -5.27e-06 | 5.09e-06 |
| _cons | -.0044995 | .0022885 | -1.97 | 0.050 | -.0090005 | 1.56e-06 |

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Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|-----|----------|-----------|----|-----------|-----------|
| . | 383 | 1148.96 | 1470.263 | 33 | -2874.526 | -2744.241 |

Note: BIC uses N = number of observations. See [R] BIC note.

```
. scalar define df3=el(r(S),1,4)
scalar define aic3=el(r(S),1,5)
scalar define bic3=el(r(S),1,6)

crossfold reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/2,12)d.lnflff l(0/2,12)d.lnflbp i.month date

    RMSE
    est1 .0049165
    est2 .0059758
    est3 .0057349
    est4 .0069113
    est5 .0156106

scalar define k=10
matrix KMSE=r(est)'*r(est)
scalar krmse3=(el(KMSE,1,1)/k)^.5
scalar list krmse3
krmse3 = .00619861

matrix drop KMSE
scalar drop k

loocv reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/2,12)d.lnflff l(0/2,12)d.lnflbp i.month date
```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | .00808926 |
| Mean Absolute Errors | .00433674 |
| Pseudo-R2 | .55858806 |

```
. scalar define loormse3=r(rmse)
reg d.lnflnonfarm l(1/12,24)d.lnflnonfarm l(1/2,12,24)d.lnflff l(1/2,12,24)d.lnusepr i.month
```

| Source | SS | df | MS | Number of obs | = | 515 |
|----------|------------|-----|------------|---------------|---|--------|
| Model | .043561062 | 32 | .001361283 | F(32, 482) | = | 27.54 |
| Residual | .023823343 | 482 | .000049426 | Prob > F | = | 0.0000 |
| Total | .067384405 | 514 | .000131098 | R-squared | = | 0.6465 |
| | | | | Adj R-squared | = | 0.6230 |
| | | | | Root MSE | = | .00703 |

| D. lnflnonfarm | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] |
|--------------------|-----------|-----------|-------|-------|----------------------|
| lnflnonfarm | | | | | |
| LD. | -.0532095 | .0602857 | -0.88 | 0.378 | -.1716647 .0652456 |
| L2D. | -.0454893 | .0610899 | -0.74 | 0.457 | -.1655247 .074546 |
| L3D. | -.002843 | .0435375 | -0.07 | 0.948 | -.0883896 .0827037 |
| L4D. | .0464336 | .0433763 | 1.07 | 0.285 | -.0387964 .1316636 |
| L5D. | -.0013076 | .0431507 | -0.03 | 0.976 | -.0860943 .0834792 |
| L6D. | .0200798 | .0443166 | 0.45 | 0.651 | -.0669978 .1071574 |
| L7D. | .0224034 | .0456573 | 0.49 | 0.624 | -.0673086 .1121153 |
| L8D. | -.0328449 | .0459038 | -0.72 | 0.475 | -.1230412 .0573514 |
| L9D. | .0396597 | .069747 | 0.57 | 0.570 | -.0973861 .1767054 |
| L10D. | -.0055183 | .0689159 | -0.08 | 0.936 | -.140931 .1298945 |
| L11D. | .0773934 | .0698507 | 1.11 | 0.269 | -.0599461 .2145529 |
| L12D. | .52293 | .0889544 | 5.88 | 0.000 | .3481438 .6977163 |
| L24D. | .1727222 | .0828627 | 2.08 | 0.038 | .0099055 .3355389 |
| lnfllf | | | | | |
| LD. | .0987675 | .1177628 | 0.84 | 0.402 | -.1326242 .3301593 |
| L2D. | -.0771596 | .1180294 | -0.65 | 0.514 | -.3890752 .1547561 |
| L12D. | .037179 | .1402792 | 0.27 | 0.791 | -.2384553 .3128133 |
| L24D. | .2524612 | .13061 | 1.93 | 0.054 | -.0041741 .5090966 |
| lnusepr | | | | | |
| LD. | .011417 | .1047318 | 0.11 | 0.913 | -.1943703 .2172043 |
| L2D. | -.0696112 | .1055857 | -0.66 | 0.510 | -.2770762 .1378538 |
| L12D. | .0186543 | .1853382 | 0.10 | 0.920 | -.3455162 .3828249 |
| L24D. | -.4320365 | .1733143 | -2.49 | 0.013 | -.7725814 -.0914916 |
| month | | | | | |
| 2 | .0101444 | .0037078 | 2.74 | 0.006 | .0028589 .01743 |
| 3 | .0082944 | .0040339 | 2.06 | 0.040 | .0003681 .0162207 |
| 4 | .0073699 | .0043026 | 1.71 | 0.087 | -.0010844 .0158242 |
| 5 | .0099262 | .0038417 | 2.58 | 0.010 | .0023776 .0174749 |
| 6 | .0069505 | .0039997 | 1.74 | 0.083 | -.0009085 .0148094 |
| 7 | .0039967 | .0035296 | 1.13 | 0.258 | -.0029385 .018932 |
| 8 | .0087545 | .0035631 | 2.46 | 0.014 | .0017533 .0157557 |
| 9 | .00794 | .0031884 | 2.49 | 0.013 | .0016752 .0142048 |
| 10 | .0129886 | .0042968 | 3.02 | 0.003 | .0045458 .0214313 |
| 11 | .0119932 | .0037839 | 3.17 | 0.002 | .0045582 .0194281 |
| 12 | .0116251 | .0031936 | 3.64 | 0.000 | .00535 .0179002 |
| _cons | -.0086323 | .0031025 | -2.78 | 0.006 | -.0147284 -.0025362 |

. estat ic

Akaike's information criterion and Bayesian information criterion

| Model | N | ll(null) | ll(model) | df | AIC | BIC |
|-------|-----|----------|-----------|----|----------|-----------|
| . | 515 | 1571.685 | 1839.42 | 33 | -3612.84 | -3472.783 |

Note: BIC uses N = number of observations. See [R] BIC note.

```
. scalar define df4=el(r(S),1,4)
. scalar define aic4=el(r(S),1,5)
. scalar define bic4=el(r(S),1,6)
. crossfold reg d.lnflnonfarm l(1/12,24)d.lnflnonfarm l(1/2,12,24)d.lnfllf l(1/2,12,24)d.lnusepr i.month
. matrix RMSE
est1 .0041409
est2 .0152337
est3 .0066411
est4 .0048066
est5 .006126
. scalar define k=10
. matrix KMSE=r(est)'*r(est)
. scalar krmse4=(el(KMSE,1,1)/k)^.5
. scalar list krmse4
  krmse4 = .00594936
. matrix drop KMSE
. scalar drop k
```

```
. loocv reg d.lnflnonfarm l(1/12,24)d.lnflnonfarm l(1/2,12,24)d.lnfllf l(1/2,12,24)d.lnusepr i.month
```

Leave-One-Out Cross-Validation Results

| Method | Value |
|--------------------------|-----------|
| Root Mean Squared Errors | .01062333 |
| Mean Absolute Errors | .00394285 |
| Pseudo-R2 | .31761928 |

```
. scalar define loormse4=r(rmse)

.

. matrix drop _all

. matrix fit1=(df1,aic1,bic1,krmse1,loormse1)

. matrix fit2=(df2,aic2,bic2,krmse2,loormse2)

. matrix fit3=(df3,aic3,bic3,krmse3,loormse3)

. matrix fit4=(df4,aic4,bic4,krmse4,loormse4)

. matrix FIT=fit1\fit2\fit3\fit4

. matrix rownames FIT="Model 1" "Model 2" "Model 3" "Model 4"

. matrix colnames FIT=df AIC BIC K(10)RMSE LOORMSE

. matrix list FIT

FIT[4,5]
      df          AIC          BIC    K(10)RMSE    LOORMSE
Model 1   64  -3105.8368  -2853.1626  .00474646  .00746943
Model 2   34  -3164.4562  -3029.3467  .0051056   .00634841
Model 3   33  -2874.5257  -2744.2405  .00019861  .00808926
Model 4   33  -3612.8403  -3472.7828  .00594936  .01062333

.

. log close
  name: <unnamed>
  log: /Users/guslipkin/Documents/Spring2020/CAP 4763 ~ Time Series/Problem Sets/Problem Set 3/Problem Set 3.smcl
log type: smcl
closed on: 15 Mar 2021, 19:20:04
```
