Problem Set 3

> All corrections are underlined

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, I didn't.

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

```
log using "Problem Set 3", replace
*1a
clear
set obs 30
gen t=[_n]
tsset t
gen r=rnormal()
gen y=r if t<4
```

```
replace y=0.5+0.5*l.y-0.1*l2.y+0.25*l3.y+r if t>=4
drop r

*model
reg d.y l1d.y
*aic/bic
estat ic
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 k=10
matrix kMSE=r(est)'*r(est)
scalar krmse1=(el(kMSE,1,1)/k)^.5
scalar list krmse1
matrix drop kMSE
scalar drop k
*loocv
loocv reg d.y l1d.y
scalar define loormse1=r(rmse)

reg d.y l2d.y
estat ic
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
scalar define k=10
matrix kMSE=r(est)'*r(est)
scalar krmse2=(el(kMSE,1,1)/k)^.5
scalar list krmse2
matrix drop kMSE
scalar drop k
loocv reg d.y l2d.y
scalar define loormse2=r(rmse)

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

```
scalar drop k
loocv reg d.y l3d.y
scalar define loormse3=r(rmse)

reg d.y l1d.y l2d.y
estat ic
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
scalar define k=10
matrix kMSE=r(est)'*r(est)
scalar krmse12=(el(kMSE,1,1)/k)^.5
scalar list krmse12
matrix drop kMSE
scalar drop k
loocv reg d.y l1d.y l2d.y
scalar define loormse12=r(rmse)

reg d.y l1d.y l3d.y
estat ic
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
scalar define k=10
matrix kMSE=r(est)'*r(est)
scalar krmse13=(el(kMSE,1,1)/k)^.5
scalar list krmse13
matrix drop kMSE
scalar drop k
loocv reg d.y l1d.y l3d.y
scalar define loormse13=r(rmse)

reg d.y       l2d.y l3d.y
estat ic
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
scalar define k=10
matrix kMSE=r(est)'*r(est)
scalar krmse23=(el(kMSE,1,1)/k)^.5
scalar list krmse23
matrix drop kMSE
scalar drop k
loocv reg d.y       l2d.y l3d.y
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 *1b
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
```

```
crossfold reg d.y l1d.y
scalar define k=10
matrix kMSE=r(est)'*r(est)
scalar krmse1=(el(kMSE,1,1)/k)^.5
scalar list krmse1
matrix drop kMSE
scalar drop k
*loocv
loocv reg d.y l1d.y
scalar define loormse1=r(rmse)

reg d.y l2d.y
estat ic
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
scalar define k=10
matrix kMSE=r(est)'*r(est)
scalar krmse2=(el(kMSE,1,1)/k)^.5
scalar list krmse2
matrix drop kMSE
scalar drop k
loocv reg d.y l2d.y
scalar define loormse2=r(rmse)

reg d.y l3d.y
estat ic
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
scalar define k=10
matrix kMSE=r(est)'*r(est)
scalar krmse3=(el(kMSE,1,1)/k)^.5
scalar list krmse3
matrix drop kMSE
scalar drop k
loocv reg d.y l3d.y
scalar define loormse3=r(rmse)

reg d.y l1d.y l2d.y
estat ic
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
scalar define k=10
```

```
matrix kMSE=r(est)'*r(est)
scalar krmse12=(el(kMSE,1,1)/k)^.5
scalar list krmse12
matrix drop kMSE
scalar drop k
loocv reg d.y l1d.y l2d.y
scalar define loormse12=r(rmse)

reg d.y l1d.y l3d.y
estat ic
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
scalar define k=10
matrix kMSE=r(est)'*r(est)
scalar krmse13=(el(kMSE,1,1)/k)^.5
scalar list krmse13
matrix drop kMSE
scalar drop k
loocv reg d.y l1d.y l3d.y
scalar define loormse13=r(rmse)

reg d.y       l2d.y l3d.y
estat ic
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
scalar define k=10
matrix kMSE=r(est)'*r(est)
scalar krmse23=(el(kMSE,1,1)/k)^.5
scalar list krmse23
matrix drop kMSE
scalar drop k
loocv reg d.y       l2d.y l3d.y
scalar define loormse23=r(rmse)

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

```
matrix drop kMSE
scalar drop k
loocv reg d.y l1d.y l2d.y l3d.y
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

*2
clear
cd "/Users/guslipkin/Documents/Spring2020/CAP 4763 ~ Time Series/Problem
Sets/Problem Set 3"
import delimited "Assignment_1_Monthly.txt"

rename lnu02300000 us_epr
rename flnan fl_nonfarm
rename fllfn fl_lf
rename flbppriv 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
gen month=month(datec)

*2f
gen lnusepr=log(us_epr)
gen lnflnonfarm=log(fl_nonfarm)
gen lnfllf=log(fl_lf)
gen lnflbp=log(fl_bp)

*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
*aic/bic
estat ic
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
scalar define k=10
matrix kMSE=r(est)'*r(est)
scalar krmse1=(el(kMSE,1,1)/k)^.5
scalar list krmse1
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
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
estat ic
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
scalar define k=10
matrix kMSE=r(est)'*r(est)
scalar krmse2=(el(kMSE,1,1)/k)^.5
scalar list krmse2
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
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
estat ic
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.lnfllf l(0/2,12)d.lnflbp i.month date
scalar define k=10
```

```
matrix kMSE=r(est)'*r(est)
scalar krmse3=(el(kMSE,1,1)/k)^.5
scalar list krmse3
matrix drop kMSE
scalar drop k
loocv reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(0/2,12)d.lnfllf l(0/2,12)d.lnflbp i.month date
scalar define loormse3=r(rmse)

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
estat ic
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
scalar define k=10
matrix kMSE=r(est)'*r(est)
scalar krmse4=(el(kMSE,1,1)/k)^.5
scalar list krmse4
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
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

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]
```

```
. 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*l.y-0.1*l2.y+0.25*l3.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
				F(1, 26)	=	7.29
Model	5.98982946	1	5.98982946	Prob > F	=	0.0120
Residual	21.3591043	26	.821504011	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						
LD.	-.4480631	.1659346	-2.70	0.012	-.7891465	-.1069798
_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
```

	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
				F(1, 25)	=	0.14
Model	.141091522	1	.141091522	Prob > F	=	0.7148
Residual	25.8136069	25	1.03254427	R-squared	=	0.0054
				Adj R-squared	=	-0.0343
Total	25.9546984	26	.99825763	Root MSE	=	1.0161

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

```
. 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
				F(1, 24)	=	0.09
Model	.100885437	1	.100885437	Prob > F	=	0.7619
Residual	25.778986	24	1.07412442	R-squared	=	0.0039
				Adj R-squared	=	-0.0376
Total	25.8798714	25	1.03519486	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		
Model	7.35816653	2	3.67908326	Prob > F	0.0183
Residual	18.5965319	24	.774855494	R-squared	0.2835
				Adj R-squared	0.2238
Total	25.9546984	26	.99825763	Root MSE	.88026

	Number of obs	=	27
	F(2, 24)	=	4.75

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
```

```
. 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

```
. scalar define loormse12=r(rmse)

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

Source	SS	df	MS	Number of obs	=	26
				F(2, 23)	=	2.64
Model	4.83662497	2	2.41831248	Prob > F	=	0.0926
Residual	21.0432464	23	.914923758	R-squared	=	0.1869
				Adj R-squared	=	0.1162
Total	25.8798714	25	1.03519486	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	Number of obs	=	26
				F(2, 23)	=	0.11
Model	.237741921	2	.118870961	Prob > F	=	0.8993
Residual	25.6421295	23	1.1148752	R-squared	=	0.0092
				Adj R-squared	=	-0.0770
Total	25.8798714	25	1.03519486	Root MSE	=	1.0559

D.y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
y						
L2D.	-.0805558	.2299203	-0.35	0.729	-.5561822	.3950705
L3D.	.0218562	.2238511	0.10	0.923	-.441215	.4849274
_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       l2d.y l3d.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
				F(3, 22)	=	3.31
Model	8.04353552	3	2.68117851	Prob > F	=	0.0390
Residual	17.8363359	22	.81074254	R-squared	=	0.3108
				Adj R-squared	=	0.2168
Total	25.8798714	25	1.03519486	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  79.409433  82.001106  .77704956   1.110311
  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*l.y-0.1*l2.y+0.25*l3.y+r if t>=4
(297 real changes made)

. drop r

.
. *model
. reg d.y l1d.y
```

Source	SS	df	MS	Number of obs	=	298
				F(1, 296)	=	30.29
Model	40.2287435	1	40.2287435	Prob > F	=	0.0000
Residual	393.11806	296	1.32810155	R-squared	=	0.0928
				Adj R-squared	=	0.0898
Total	433.346804	297	1.45908015	Root MSE	=	1.1524

D.y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
y						
LD.	-.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	1.307489
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		
Model	37.8014875	1	37.8014875	Number of obs	= 297
Residual	395.272758	295	1.33990765	F(1, 295)	= 28.21
				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						
L2D.	-.2956623	.0556646	-5.31	0.000	-.4052123	-.1861123
_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	1.105786
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		
Model	19.9598466	1	19.9598466	Number of obs	= 296
Residual	413.112855	294	1.40514577	F(1, 294)	= 14.20
				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		
Model	112.32631	2	56.163155	Number of obs	= 297
Residual	320.747936	294	1.09097937	F(2, 294)	= 51.48
				Prob > F	= 0.0000
Total	433.074246	296	1.46308867	R-squared	= 0.2594
				Adj R-squared	= 0.2543
				Root MSE	= 1.0445

D.y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]

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		
Model	47.5617458	2	23.7808729	Number of obs	= 296
				F(2, 293)	= 18.07
Residual	385.510956	293	1.31573705	Prob > F	= 0.0000
				R-squared	= 0.1098
				Adj R-squared	= 0.1037
Total	433.072702	295	1.46804306	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

```
. scalar define loormse13=r(rmse)

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

Source	SS	df	MS		
Model	45.215903	2	22.6079515	Number of obs	= 296
Residual	387.856799	293	1.32374334	F(2, 293)	= 17.08
				Prob > F	= 0.0000
				R-squared	= 0.1044
				Adj R-squared	= 0.0983
Total	433.072702	295	1.46804306	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       l2d.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       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
				F(3, 292)	=	34.57
Model	113.494499	3	37.8314998	Prob > F	=	0.0000
Residual	319.578203	292	1.0944459	R-squared	=	0.2621
				Adj R-squared	=	0.2545
Total	433.072702	295	1.46804306	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 fllfn fl_lf

. rename flbppriv 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
				F(63, 319)	=	53.24
Model	.050768432	63	.000805848	Prob > F	=	0.0000
Residual	.004828206	319	.000015135	R-squared	=	0.9132
				Adj R-squared	=	0.8960
Total	.055596638	382	.000145541	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	-.3069696	-.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	-.1544029	.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	.190225
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	.099036	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	.3110332
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.	.0071018	.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		
Model	.050628703	33	.001534203	Number of obs	= 393
				F(33, 359)	= 89.36
Residual	.006163276	359	.000017168	Prob > F	= 0.0000
				R-squared	= 0.8915
				Adj R-squared	= 0.8815
Total	.056791979	392	.000144877	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	.0299318	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						
D1.	.0039846	.0017113	2.33	0.020	.0006191	.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
				F(32, 350)	= 47.62
Model	.045212283	32	.001412884	Prob > F	= 0.0000
Residual	.010384356	350	.00002967	R-squared	= 0.8132
				Adj R-squared	= 0.7961
Total	.055596638	382	.000145541	Root MSE	= .00545

D.	

lnflnonfarm	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnflnonfarm						
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
L5D.	-.0028745	.0368744	-0.08	0.938	-.0753979	.0696488
L6D.	-.0245775	.0368577	-0.67	0.505	-.097068	.0479131
L7D.	.0020704	.0365831	0.06	0.955	-.0698801	.0740208
L8D.	-.0138142	.0369521	-0.37	0.709	-.0864904	.058862
L9D.	.0905825	.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
lnfllf						
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

```
. estat ic
```

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

Source	SS	df	MS	Number of obs	=	515
				F(32, 482)	=	27.54
Model	.043561062	32	.001361283	Prob > F	=	0.0000
Residual	.023823343	482	.000049426	R-squared	=	0.6465
				Adj R-squared	=	0.6230
Total	.067384405	514	.000131098	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.	.0773034	.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	-.3090752	.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	.010932
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
```

	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   .00619861   .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
```