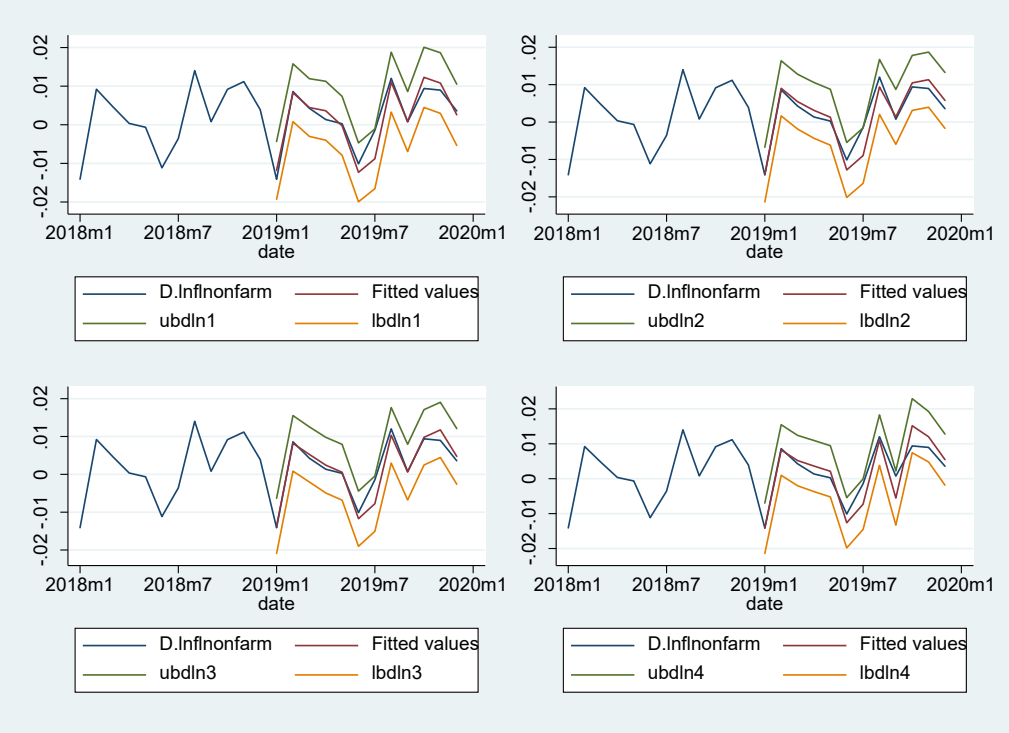
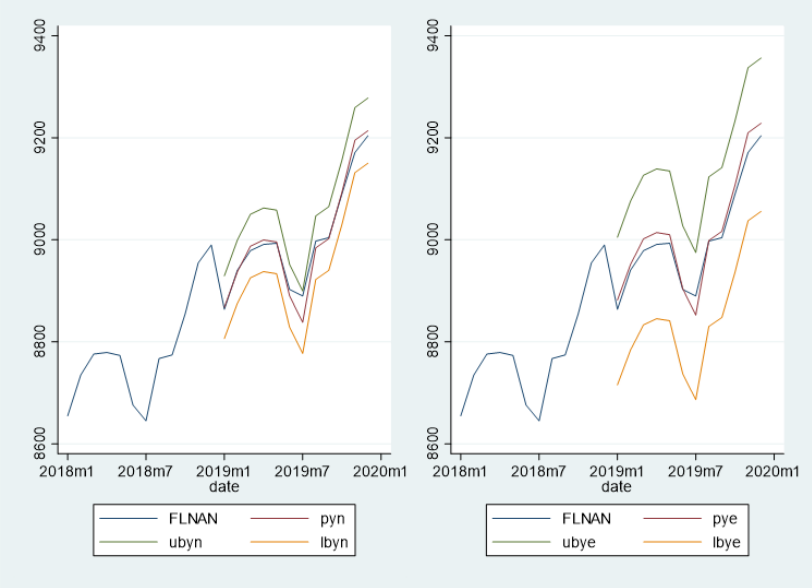
The table shows the fit statistics for the models. Model 3 is first on three criteria and second on two. Looking at the visuals below, model 3 is at least as good as the others at matching the overall pattern over the past two years.

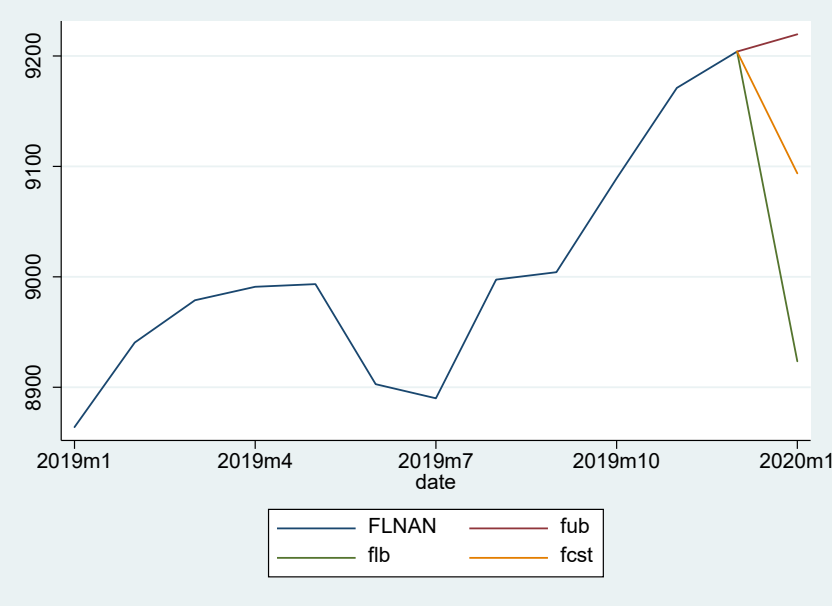
Model	# Vars	AIC	BIC	10-Fold RMSE	N-Fold RMSE	Out Smpl RMSE
1	60	-2897	-2662	0.00380	0.00390	0.00195
2	30	**-2899**	**-2779**	0.00376	0.00382	**0.00126**
3	30	**-2903**	**-2784**	**0.00375**	**0.00381**	**0.00089**
4	32	-2805	-2679	**0.00374**	**0.00370**	0.00216



The figure shows the point forecast and the normal and empirical forecast intervals.



The point forecast is 9093.688, and the empirical prediction interval is 8923.5 to 9219.6. This is shown in the figure below.



Appendix A: Do file for Problem Set 4

```
*Problem Set 4 Solution

clear
set more off
cd "C:\Users\jdewey\Documents\A S20 Time Series\Problem Sets\"
log using "Problem Set 4 Work", replace

** data prep
import delimited using "us and florida economic time series.txt"
rename observation_date datestring
gen dateday=date(datestring,"YMD")
gen date=mofd(dateday)
format date %tm
tsset date
generate month=month(dateday)
keep if tin(1990m1,2019m12)
rename flbppriv fl_bp
rename fllfn fl_lf
rename flnan fl_nonfarm
rename lnu02300000_20200110 us_epr
gen lnflnonfarm=ln( fl_nonfarm)
gen lnfllf=ln( fl_lf)
gen lnusepr = ln(us_epr)
gen lnflbp=ln( fl_bp)

tsappend, add(1)
replace month=month(dofm(date)) if month==.

*fit and evaluate models
*Note I restricted estimation to year>1989 so the same observations are
* compared for all models by dropping earlier years above

*Model 1
set seed 22045 // to  make sure the same folds are used for each model
crossfold reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/12)d.lnfllf ///
      l(1/12)d.lnusepr l(1/12)d.lnflbp i.month date , k(10)
scalar define k=10
matrix kSSE=r(est)'*r(est)
scalar krmse1=(el(kSSE,1,1)/k)^.5
matrix drop kSSE
scalar drop k
loocv reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/12)d.lnfllf ///
      l(1/12)d.lnusepr l(1/12)d.lnflbp i.month date
scalar loormse1=r(rmse)
reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/12)d.lnfllf ///
      l(1/12)d.lnusepr l(1/12)d.lnflbp i.month date
estat ic
scalar aic1=(el(r(S),1,5))
scalar bic1=(el(r(S),1,6))
reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/12)d.lnfllf ///
      l(1/12)d.lnusepr l(1/12)d.lnflbp i.month date if tin(1991m1,2018m12)
scalar NVar1=e(df_m)
predict res, residual
predict pdln1
predict stdf1, stdf
gen ressq=res^2
```

```
summ ressq if tin(2018q1,2018q4)
scalar osrmse1=r(mean)^0.5
drop res ressq
gen ubdln1=pdln1+1.96*stdf1
gen lbdln1=pdln1-1.96*stdf1
twoway (tsline d.lnflnonfarm if tin(2018m1,2019m12)) ///
      (tsline pdln1 ubdln1 lbdln1 if tin(2019m1,2019m12) ) , ///
      saving(m1tslines, replace)

*Model 2
set seed 22045 // to  make sure the same folds are used for each model
crossfold reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2)d.lnfllf ///
      l(1/2)d.lnusepr l(1/2)d.lnflbp i.month date , k(10)
scalar define k=10
matrix kSSE=r(est)'*r(est)
scalar krmse2=(el(kSSE,1,1)/k)^.5
matrix drop kSSE
scalar drop k
loocv reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2)d.lnfllf ///
      l(1/2)d.lnusepr l(1/2)d.lnflbp i.month date
scalar loormse2=r(rmse)
reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2)d.lnfllf l(1/2)d.lnusepr ///
      l(1/2)d.lnflbp i.month date
estat ic
scalar aic2=(el(r(S),1,5))
scalar bic2=(el(r(S),1,6))
reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2)d.lnfllf l(1/2)d.lnusepr ///
      l(1/2)d.lnflbp i.month date if tin(1991m1,2018m12)
scalar NVar2=e(df_m)
predict res, residual
predict pdln2
predict stdf2, stdf
gen ressq=res^2
summ ressq if tin(2018q1,2018q4)
scalar osrmse2=r(mean)^0.5
drop res ressq
gen ubdln2=pdln2+1.96*stdf2
gen lbdln2=pdln2-1.96*stdf2
twoway (tsline d.lnflnonfarm if tin(2018m1,2019m12)) ///
      (tsline pdln2 ubdln2 lbdln2 if tin(2019m1,2019m12) ) , ///
      saving(m2tslines, replace)

*Model 3
set seed 22045 // to  make sure the same folds are used for each model
crossfold reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2,12)d.lnfllf ///
      l(1/2,12)d.lnflbp i.month date , k(10)
scalar define k=10
matrix kSSE=r(est)'*r(est)
scalar krmse3=(el(kSSE,1,1)/k)^.5
matrix drop kSSE
scalar drop k
loocv reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2,12)d.lnfllf ///
      l(1/2,12)d.lnflbp i.month date
scalar loormse3=r(rmse)
reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2,12)d.lnfllf ///
      l(1/2,12)d.lnflbp i.month date
estat ic
```

```
scalar aic3=(el(r(S),1,5))
scalar bic3=(el(r(S),1,6))
reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2,12)d.lnfllf ///
      l(1/2,12)d.lnflbp i.month date if tin(1991m1,2018m12)
scalar NVar3=e(df_m)
predict res, residual
predict pdln3
predict stdf3, stdf
gen ressq=res^2
summ ressq if tin(2018q1,2018q4)
scalar osrmse3=r(mean)^0.5
drop res ressq
gen ubdln3=pdln3+1.96*stdf3
gen lbdln3=pdln3-1.96*stdf3
twoway (tsline d.lnflnonfarm if tin(2018m1,2019m12)) ///
      (tsline pdln3 ubdln3 lbdln3 if tin(2019m1,2019m12) ) , ///
      saving(m3tslines, replace)


*Model 4
set seed 22045 // to  make sure the same folds are used for each model
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 , k(10)
scalar define k=10
matrix kSSE=r(est)'*r(est)
scalar krmse4=(el(kSSE,1,1)/k)^.5
matrix drop kSSE
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 loormse4=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 aic4=(el(r(S),1,5))
scalar bic4=(el(r(S),1,6))
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 if tin(1991m1,2018m12)
scalar NVar4=e(df_m)
predict res, residual
predict pdln4
predict stdf4, stdf
gen ressq=res^2
summ ressq if tin(2018q1,2018q4)
scalar osrmse4=r(mean)^0.5
drop res ressq
gen ubdln4=pdln4+1.96*stdf4
gen lbdln4=pdln4-1.96*stdf4
twoway (tsline d.lnflnonfarm if tin(2018m1,2019m12)) ///
      (tsline pdln4 ubdln4 lbdln4 if tin(2019m1,2019m12) ) ///
      , saving(m4tslines, replace)

matrix M1=(NVar1,aic1,bic1,krmse1,loormse1,osrmse1)
matrix M2=(NVar2,aic2,bic2,krmse2,loormse2,osrmse2)
matrix M3=(NVar3,aic3,bic3,krmse3,loormse3,osrmse3)
matrix M4=(NVar4,aic4,bic4,krmse4,loormse4,osrmse4)
matrix MStats=(M1\M2\M3\M4)
```

```
matrix colnames MStats=NVar AIC BIC RMSE10F RMSENF RMSEOS
matrix rownames MStats=Model1 Model2 Model3 Model4
matrix list MStats

graph combine m1tslines.gph m2tslines.gph m3tslines.gph m4tslines.gph , ///
      saving(mtslines, replace)

STOP

*Going to go with model 3

drop pdl* ub* lb* stdf*
scalar drop _all

reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2,12)d.lnfllf ///
      l(1/2,12)d.lnflbp i.month date
predict pdln
predict stdf
scalar rmse=e(rmse)
gen corrnorm=exp((rmse^2)/2)
predict res
gen expres=exp(res)
summ expres
gen corremp=r(mean)

gen pyn=corrnorm*exp(l.lnflnon+pdln)
gen ubyn=corrnorm*exp(l.lnflnon+pdln+1.96*rmse)
gen lbyn=corrnorm*exp(l.lnflnon+pdln-1.96*rmse)
twoway (tsline fl_nonfarm if tin(2018m1,2019m12)) ///
      (tsline pyn ubyn lbyn if tin(2019m1,2019m12) ) ///
      , saving(m3ynorm, replace)

_pctile res, percentiles(2.5,97.5)
gen pye=corremp*exp(l.lnflnon+pdln)
gen ubye=corremp*exp(l.lnflnon+pdln+r(r2))
gen lbye=corremp*exp(l.lnflnon+pdln+r(r1))
twoway (tsline fl_nonfarm if tin(2018m1,2019m12)) ///
      (tsline pye ubye lbye if tin(2019m1,2019m12) ) ///
      , saving(m3yemp, replace)

graph combine m3ynorm.gph m3yemp.gph , ///
      saving(m3yen, replace)

gen fub=ubye if tin(2020m1,)
gen flb=lbye if tin(2020m1,)
gen fcst=pye if tin(2020m1,)
replace fcst=fl_non if tin(2019m12,2019m12)
replace fub=fl_non if tin(2019m12,2019m12)
replace flb=fl_non if tin(2019m12,2019m12)

tsline fl_nonfarm fub flb fcst if tin(2019m1,2020m1) , saving(fcst, replace)

list fcst fup flb if date=tm(2020m1)

log close
```

Appendix B: Log File

```
-------------------------------------------------------------------------------
      name:  <unnamed>
       log:  C:\Users\jdewey\Documents\A S20 Time Series\Problem Sets\Problem Set 4
Work.smcl
  log type:  smcl
 opened on:   5 Apr 2020, 21:37:41

.
.
. ** data prep
. import delimited using "us and florida economic time series.txt"
(5 vars, 972 obs)

. rename observation_date datestring

. gen dateday=date(datestring,"YMD")

. gen date=mofd(dateday)

. format date %tm

. tsset date
        time variable:  date, 1939m1 to 2019m12
                delta:  1 month

. generate month=month(dateday)

. keep if tin(1990m1,2019m12)
(612 observations deleted)

. rename flbppriv fl_bp

. rename fllfn fl_lf

. rename flnan fl_nonfarm

. rename lnu02300000_20200110 us_epr

. gen lnflnonfarm=ln( fl_nonfarm)

. gen lnfllf=ln( fl_lf)

. gen lnusepr = ln(us_epr)

. gen lnflbp=ln( fl_bp)

.
. tsappend, add(1)

. replace month=month(dofm(date)) if month==.
(1 real change made)

.
.
.
.
. *fit and evaluate models
. *Note I restricted estimation to year>1989 so the same observations are
. * compared for all models by dropping earlier years above
.
.
. *Model 1
```

```
. set seed 22045 // to  make sure the same folds are used for each model

. crossfold reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/12)d.lnfllf ///
>         l(1/12)d.lnusepr l(1/12)d.lnflbp i.month date , k(10)

             |      RMSE
-------------+----------
        est1 |  .0042477
        est2 |  .0046809
        est3 |  .0036137
        est4 |  .0049964
        est5 |  .0031522
        est6 |  .0040797
        est7 |  .0026135
        est8 |  .0035943
        est9 |  .0029642
       est10 |  .0033241

. scalar define k=10

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

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

. matrix drop kSSE

. scalar drop k

. loocv reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/12)d.lnfllf ///
>         l(1/12)d.lnusepr l(1/12)d.lnflbp i.month date


 Leave-One-Out Cross-Validation Results
----------------------------------------
         Method          |    Value
-------------------------+--------------
Root Mean Squared Errors |   .0039009
Mean Absolute Errors     |   .00282589
Pseudo-R2                |   .84712569
----------------------------------------

. scalar loormse1=r(rmse)

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

      Source |       SS           df       MS      Number of obs   =       347
-------------+----------------------------------   F(60, 286)      =     43.24
       Model |  .030722026        60  .000512034   Prob > F        =    0.0000
    Residual |  .003386356       286   .00001184   R-squared       =    0.9007
-------------+----------------------------------   Adj R-squared   =    0.8799
       Total |  .034108382       346  .000098579   Root MSE        =    .00344

------------------------------------------------------------------------------
D.           |
 lnflnonfarm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lnflnonfarm |
         LD. |   -.186234    .056416    -3.30   0.001    -.2972773   -.0751908
        L2D. |  -.1547999   .0587146    -2.64   0.009    -.2703675   -.0392324
        L3D. |   .1401796   .0598191     2.34   0.020     .0224379    .2579212
        L4D. |   .1286005   .0601072     2.14   0.033      .010292     .246909
        L5D. |   .0462484   .0611613     0.76   0.450     -.074135    .1666317
```

L6D.	.1077401	.0613787	1.76	0.080	-.0130711	.2285513
L7D.	.0218677	.061864	0.35	0.724	-.0998988	.1436343
L8D.	-.0431733	.0618821	-0.70	0.486	-.1649755	.0786288
L9D.	.0889303	.0600003	1.48	0.139	-.0291679	.2070284
L10D.	-.194563	.0588503	-3.31	0.001	-.3103977	-.0787283
L11D.	-.0458498	.0583995	-0.79	0.433	-.1607971	.0690976
L12D.	.3152677	.0570512	5.53	0.000	.2029741	.4275613
lnfllf						
LD.	-.1375696	.1011412	-1.36	0.175	-.3366451	.061506
L2D.	-.1430712	.1026083	-1.39	0.164	-.3450345	.058892
L3D.	-.1307211	.1038122	-1.26	0.209	-.3350539	.0736117
L4D.	-.0463644	.1055798	-0.44	0.661	-.2541764	.1614476
L5D.	-.0220199	.1045149	-0.21	0.833	-.2277358	.1836961
L6D.	-.073281	.1038964	-0.71	0.481	-.2777796	.1312176
L7D.	-.0004624	.104082	-0.00	0.996	-.2053263	.2044015
L8D.	.0108387	.1048545	0.10	0.918	-.1955457	.2172232
L9D.	.1967346	.1046425	1.88	0.061	-.0092326	.4027017
L10D.	.2476003	.1075338	2.30	0.022	.0359424	.4592583
L11D.	.0133503	.1079256	0.12	0.902	-.1990789	.2257794
L12D.	-.1570608	.1068642	-1.47	0.143	-.3674008	.0532793
lnusepr						
LD.	.2110302	.1362474	1.55	0.123	-.0571446	.479205
L2D.	.0944642	.1395361	0.68	0.499	-.1801838	.3691122
L3D.	.1740808	.1387099	1.25	0.211	-.0989409	.4471026
L4D.	.1557738	.1381626	1.13	0.260	-.1161707	.4277182
L5D.	-.0132056	.1370974	-0.10	0.923	-.2830536	.2566424
L6D.	.2790443	.1353574	2.06	0.040	.0126214	.5454673
L7D.	.1298337	.1376584	0.94	0.346	-.1411183	.4007857
L8D.	-.0757072	.1389392	-0.54	0.586	-.3491802	.1977658
L9D.	-.1653567	.1396094	-1.18	0.237	-.4401489	.1094354
L10D.	-.3470377	.1422668	-2.44	0.015	-.6270605	-.0670149
L11D.	.1304803	.142392	0.92	0.360	-.149789	.4107496
L12D.	.1802605	.137825	1.31	0.192	-.0910195	.4515404
lnflbp						
LD.	.0014532	.0016699	0.87	0.385	-.0018337	.0047401
L2D.	.0048252	.0019409	2.49	0.013	.0010049	.0086456
L3D.	.0062142	.0020251	3.07	0.002	.0022282	.0102001
L4D.	.0045958	.0020418	2.25	0.025	.0005769	.0086146
L5D.	.0045223	.0020493	2.21	0.028	.0004886	.0085559
L6D.	.0049516	.0020707	2.39	0.017	.0008759	.0090272
L7D.	.0041298	.0020715	1.99	0.047	.0000525	.0082071
L8D.	.0038086	.0021258	1.79	0.074	-.0003756	.0079928
L9D.	.0034564	.0021233	1.63	0.105	-.0007229	.0076357
L10D.	.0041043	.0020888	1.96	0.050	-7.01e-06	.0082155
L11D.	.0034516	.0019993	1.73	0.085	-.0004836	.0073869
L12D.	.003117	.001649	1.89	0.060	-.0001287	.0063626
month						
2	.0089558	.0036845	2.43	0.016	.0017036	.016208
3	.0082561	.003799	2.17	0.031	.0007785	.0157338
4	.0081944	.0042342	1.94	0.054	-.0001398	.0165285
5	.0028597	.0033823	0.85	0.399	-.0037976	.009517
6	-.004196	.00394	-1.06	0.288	-.0119511	.003559
7	.0023721	.0037789	0.63	0.531	-.0050659	.0098101
8	.0120413	.0039413	3.06	0.002	.0042835	.019799
9	.0092995	.0033932	2.74	0.007	.0026206	.0159784
10	.0152326	.0042659	3.57	0.000	.0068361	.0236291
11	.008236	.0038779	2.12	0.035	.0006031	.0158689
12	.0144426	.0036928	3.91	0.000	.007174	.0217111

```
        date |  -3.79e-06   2.03e-06    -1.87   0.062    -7.78e-06    1.99e-07
       _cons |   -.003468   .0029584    -1.17   0.242    -.0092911    .0023551
------------------------------------------------------------------------------

. estat ic

Akaike's information criterion and Bayesian information criterion

------------------------------------------------------------------------------
       Model |        Obs  ll(null)  ll(model)      df         AIC         BIC
-------------+----------------------------------------------------------------
           . |        347  1108.606   1509.354      61   -2896.709    -2661.9
------------------------------------------------------------------------------
               Note: N=Obs used in calculating BIC; see [R] BIC note.

. scalar aic1=(el(r(S),1,5))

. scalar bic1=(el(r(S),1,6))

. reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/12)d.lnfllf ///
>         l(1/12)d.lnusepr l(1/12)d.lnflbp i.month date if tin(1991m1,2018m12)

      Source |       SS           df       MS      Number of obs   =       335
-------------+----------------------------------   F(60, 274)      =     41.35
       Model |  .030103405        60  .000501723   Prob > F        =    0.0000
    Residual |  .003324854       274  .000012135   R-squared       =    0.9005
-------------+----------------------------------   Adj R-squared   =    0.8788
       Total |   .03342826       334  .000100085   Root MSE        =    .00348

------------------------------------------------------------------------------
D.           |
 lnflnonfarm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lnflnonfarm |
         LD. |  -.1930854   .0579173    -3.33   0.001    -.3071049   -.0790659
        L2D. |  -.1553992   .0601116    -2.59   0.010    -.2737385   -.0370599
        L3D. |   .1418981   .0609142     2.33   0.021     .0219788    .2618173
        L4D. |   .1296244   .0613088     2.11   0.035     .0089282    .2503206
        L5D. |   .0437587   .0624723     0.70   0.484    -.0792279    .1667454
        L6D. |   .1075893   .0626099     1.72   0.087    -.0156682    .2308468
        L7D. |   .0162405   .0632799     0.26   0.798     -.108336     .140817
        L8D. |  -.0519209   .0634909    -0.82   0.414    -.1769129    .0730711
        L9D. |   .0872121   .0618319     1.41   0.160    -.0345138     .208938
       L10D. |  -.1969749   .0603978    -3.26   0.001    -.3158776   -.0780721
       L11D. |  -.0514218   .0598301    -0.86   0.391    -.1692069    .0663633
       L12D. |    .300731   .0586177     5.13   0.000     .1853327    .4161292
             |
      lnfllf |
         LD. |  -.1626785   .1087132    -1.50   0.136    -.3766978    .0513407
        L2D. |  -.1595182   .1091353    -1.46   0.145    -.3743684     .055332
        L3D. |  -.0926912   .1109798    -0.84   0.404    -.3111727    .1257903
        L4D. |   .0237447   .1140586     0.21   0.835     -.200798    .2482873
        L5D. |    .008565   .1131701     0.08   0.940    -.2142284    .2313583
        L6D. |  -.0801172   .1125639    -0.71   0.477    -.3017172    .1414828
        L7D. |  -.0344974   .1119908    -0.31   0.758    -.2549691    .1859744
        L8D. |   -.018564   .1120342    -0.17   0.869    -.2391211    .2019932
        L9D. |   .1765756   .1111867     1.59   0.113    -.0423131    .3954643
       L10D. |    .245674   .1110628     2.21   0.028     .0270291    .4643189
       L11D. |   .0221368   .1111832     0.20   0.842    -.1967451    .2410188
       L12D. |  -.1376978   .1096828    -1.26   0.210    -.3536259    .0782304
             |
     lnusepr |
         LD. |    .245242   .1441601     1.70   0.090    -.0385602    .5290441
```

```
        L2D. |   .1329345   .1469418     0.90   0.366     -.156344     .422213
        L3D. |   .1485017    .146062     1.02   0.310    -.1390447    .4360481
        L4D. |   .0878049   .1462348     0.60   0.549    -.2000817    .3756916
        L5D. |  -.0549679   .1450908    -0.38   0.705    -.3406023    .2306666
        L6D. |   .2834977   .1449964     1.96   0.052    -.0019509    .5689463
        L7D. |   .1775538   .1473984     1.20   0.229    -.1126235     .467731
        L8D. |   -.035584   .1478749    -0.24   0.810    -.3266993    .2555312
        L9D. |   -.125733   .1480825    -0.85   0.397     -.417257     .165791
       L10D. |  -.3463431   .1472148    -2.35   0.019    -.6361589   -.0565273
       L11D. |   .1366832   .1466964     0.93   0.352     -.152112    .4254784
       L12D. |   .1575691   .1415662     1.11   0.267    -.1211265    .4362647
             |
      lnflbp |
         LD. |   .0018831   .0017334     1.09   0.278    -.0015294    .0052957
        L2D. |   .0053573   .0020279     2.64   0.009      .001365    .0093496
        L3D. |    .006421    .002118     3.03   0.003     .0022513    .0105907
        L4D. |   .0044499    .002123     2.10   0.037     .0002705    .0086293
        L5D. |   .0044712   .0021038     2.13   0.034     .0003296    .0086128
        L6D. |   .0052013   .0021137     2.46   0.014       .00104    .0093625
        L7D. |   .0042838   .0021139     2.03   0.044     .0001223    .0084454
        L8D. |   .0036872   .0021623     1.71   0.089    -.0005696    .0079441
        L9D. |   .0034861   .0021654     1.61   0.109    -.0007769    .0077491
       L10D. |   .0042454   .0021347     1.99   0.048     .0000428    .0084479
       L11D. |   .0035563   .0020478     1.74   0.084    -.0004752    .0075877
       L12D. |   .0033161   .0016977     1.95   0.052     -.000026    .0066583
             |
       month |
          2  |   .0100688   .0039138     2.57   0.011     .0023639    .0177737
          3  |   .0096305   .0040135     2.40   0.017     .0017292    .0175317
          4  |   .0090093   .0044667     2.02   0.045      .000216    .0178027
          5  |   .0025839   .0035085     0.74   0.462    -.0043232    .0094909
          6  |  -.0042804   .0041245    -1.04   0.300    -.0124002    .0038393
          7  |   .0027876   .0038998     0.71   0.475    -.0048898    .0104651
          8  |   .0133054   .0041323     3.22   0.001     .0051703    .0214406
          9  |   .0103615   .0035622     2.91   0.004     .0033488    .0173742
         10  |   .0169306   .0045707     3.70   0.000     .0079325    .0259287
         11  |   .0089775    .004059     2.21   0.028     .0009867    .0169683
         12  |   .0146969   .0038918     3.78   0.000     .0070352    .0223585
             |
        date |  -4.02e-06   2.15e-06    -1.87   0.063    -8.25e-06    2.20e-07
       _cons |  -.0040271   .0030982    -1.30   0.195    -.0101264    .0020723
------------------------------------------------------------------------------

. scalar NVar1=e(df_m)

. predict res, residual
(14 missing values generated)

. predict pdln1
(option xb assumed; fitted values)
(13 missing values generated)

. predict stdf1, stdf
(13 missing values generated)

. gen ressq=res^2
(14 missing values generated)

. summ ressq if tin(2018q1,2018q4)

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
       ressq |          4    3.81e-06    4.28e-06   7.82e-08   8.88e-06
```

```
. scalar osrmse1=r(mean)^0.5

. drop res ressq

. gen ubdln1=pdln1+1.96*stdf1
(13 missing values generated)

. gen lbdln1=pdln1-1.96*stdf1
(13 missing values generated)

. twoway (tsline d.lnflnonfarm if tin(2018m1,2019m12)) ///
>         (tsline pdln1 ubdln1 lbdln1 if tin(2019m1,2019m12) ) , ///
>         saving(m1tslines, replace)
(file m1tslines.gph saved)

.
.
.
.
.
. *Model 2
. set seed 22045 // to  make sure the same folds are used for each model

. crossfold reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2)d.lnfllf ///
>         l(1/2)d.lnusepr l(1/2)d.lnflbp i.month date , k(10)

             |      RMSE
-------------+-----------
        est1 |  .0044081
        est2 |  .0048725
        est3 |  .0037067
        est4 |   .004862
        est5 |  .0030362
        est6 |  .0038931
        est7 |   .002654
        est8 |  .0028316
        est9 |  .0027686
       est10 |  .0036666

. scalar define k=10

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

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

. matrix drop kSSE

. scalar drop k

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


 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   .00382463
Mean Absolute Errors     |   .00271565
Pseudo-R2                |   .85235776
-----------------------------------------
```

```
. scalar loormse2=r(rmse)

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

      Source |       SS           df       MS      Number of obs   =       347
-------------+----------------------------------   F(30, 316)      =     79.18
       Model |  .030103875        30  .001003463   Prob > F        =    0.0000
    Residual |  .004004507       316  .000012672   R-squared       =    0.8826
-------------+----------------------------------   Adj R-squared   =    0.8714
       Total |  .034108382       346  .000098579   Root MSE        =    .00356

------------------------------------------------------------------------------
D.           |
 lnflnonfarm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lnflnonfarm |
         LD. |  -.1292626   .0520146    -2.49   0.013    -.2316014   -.0269238
        L2D. |  -.0978374   .0545818    -1.79   0.074    -.2052271    .0095523
        L3D. |    .223866   .0542971     4.12   0.000     .1170365    .3306956
        L4D. |   .1581467   .0521274     3.03   0.003     .0555862    .2607073
        L5D. |   .1393954   .0526783     2.65   0.009     .0357509      .24304
        L6D. |   .1399744   .0534127     2.62   0.009     .0348849    .2450639
        L7D. |   .0839072   .0551957     1.52   0.129    -.0246903    .1925047
        L8D. |   .0119944   .0541148     0.22   0.825    -.0944765    .1184652
        L9D. |   .0924972   .0517874     1.79   0.075    -.0093944    .1943889
       L10D. |  -.1661393   .0501878    -3.31   0.001    -.2648838   -.0673948
       L11D. |  -.0841851   .0518044    -1.63   0.105    -.1861104    .0177401
       L12D. |   .3717099   .0518522     7.17   0.000     .2696906    .4737291
             |
      lnfllf |
         LD. |  -.1826015    .097081    -1.88   0.061    -.3736084    .0084054
        L2D. |  -.1482414   .0984729    -1.51   0.133    -.3419868    .0455041
             |
     lnusepr |
         LD. |   .2129745   .1296114     1.64   0.101    -.0420359    .4679849
        L2D. |   .0721516   .1313385     0.55   0.583     -.186257    .3305601
             |
      lnflbp |
         LD. |   .0002202   .0015249     0.14   0.885    -.0027801    .0032205
        L2D. |   .0021079   .0015343     1.37   0.170    -.0009108    .0051266
             |
       month |
          2  |   .0091515   .0023933     3.82   0.000     .0044427    .0138604
          3  |   .0070618   .0028439     2.48   0.014     .0014665    .0126571
          4  |   .0083358   .0028878     2.89   0.004      .002654    .0140176
          5  |   .0017523    .002821     0.62   0.535     -.003798    .0073025
          6  |  -.0003743    .002558    -0.15   0.884    -.0054071    .0046586
          7  |   .0011175   .0022308     0.50   0.617    -.0032717    .0055066
          8  |   .0113968   .0025791     4.42   0.000     .0063225    .0164712
          9  |   .0140913   .0026692     5.28   0.000     .0088397    .0193429
         10  |   .0204449   .0026992     7.57   0.000     .0151342    .0257556
         11  |   .0126423   .0025707     4.92   0.000     .0075843    .0177002
         12  |   .0122226   .0021036     5.81   0.000     .0080837    .0163615
             |
        date |  -2.03e-06   1.94e-06    -1.04   0.297    -5.85e-06    1.80e-06
       _cons |  -.0061237   .0020764    -2.95   0.003     -.010209   -.0020384
------------------------------------------------------------------------------

. estat ic

Akaike's information criterion and Bayesian information criterion
```

```
-----------------------------------------------------------------------------
       Model |        Obs  ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        347  1108.606   1480.264      31   -2898.529    -2779.2
-----------------------------------------------------------------------------
               Note: N=Obs used in calculating BIC; see [R] BIC note.

. scalar aic2=(el(r(S),1,5))

. scalar bic2=(el(r(S),1,6))

. reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2)d.lnfllf l(1/2)d.lnusepr ///
>         l(1/2)d.lnflbp i.month date if tin(1991m1,2018m12)

      Source |       SS           df       MS      Number of obs   =       335
-------------+----------------------------------   F(30, 304)      =     76.16
       Model |  .029502637        30  .000983421   Prob > F        =    0.0000
    Residual |  .003925622       304  .000012913   R-squared       =    0.8826
-------------+----------------------------------   Adj R-squared   =    0.8710
       Total |   .03342826       334  .000100085   Root MSE        =    .00359

------------------------------------------------------------------------------
D.           |
 lnflnonfarm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lnflnonfarm |
         LD. |  -.1432869   .0532355    -2.69   0.008    -.2480436   -.0385301
        L2D. |  -.1039357   .0556954    -1.87   0.063    -.2135331    .0056617
        L3D. |   .2222094   .0552671     4.02   0.000     .1134548     .330964
        L4D. |   .1665216   .0531033     3.14   0.002     .0620252    .2710181
        L5D. |   .1482078   .0539376     2.75   0.006     .0420695     .254346
        L6D. |    .143469   .0546519     2.63   0.009     .0359251     .251013
        L7D. |   .0849044   .0564479     1.50   0.134    -.0261738    .1959825
        L8D. |   .0118469   .0551023     0.21   0.830    -.0965832    .1202771
        L9D. |   .0950046   .0528395     1.80   0.073    -.0089728     .198982
       L10D. |  -.1667371   .0513332    -3.25   0.001    -.2677504   -.0657237
       L11D. |  -.0973744   .0527623    -1.85   0.066       -.2012    .0064512
       L12D. |   .3558615   .0529947     6.72   0.000     .2515787    .4601442
             |
      lnfllf |
         LD. |  -.2207878   .1039964    -2.12   0.035    -.4254316   -.0161439
        L2D. |  -.1729889   .1039895    -1.66   0.097    -.3776193    .0316415
             |
     lnusepr |
         LD. |   .2605882   .1366604     1.91   0.057    -.0083319    .5295083
        L2D. |   .1144682   .1376348     0.83   0.406    -.1563694    .3853057
             |
      lnflbp |
         LD. |   .0004482   .0015817     0.28   0.777    -.0026643    .0035607
        L2D. |   .0023902   .0015791     1.51   0.131    -.0007172    .0054976
             |
       month |
           2 |   .0095659    .002479     3.86   0.000     .0046877    .0144441
           3 |   .0074317   .0029681     2.50   0.013     .0015911    .0132722
           4 |   .0082161   .0029643     2.77   0.006     .0023829    .0140493
           5 |   .0014169   .0029168     0.49   0.627    -.0043227    .0071565
           6 |  -.0007554   .0026257    -0.29   0.774    -.0059222    .0044113
           7 |   .0004755    .002295     0.21   0.836    -.0040405    .0049916
           8 |   .0111367    .002636     4.22   0.000     .0059495    .0163238
           9 |   .0144071   .0027386     5.26   0.000     .0090182     .019796
          10 |   .0212425   .0027835     7.63   0.000      .015765    .0267199
          11 |   .0131857   .0026669     4.94   0.000     .0079378    .0184336
          12 |   .0122006   .0021503     5.67   0.000     .0079691     .016432
```

```
             |
        date |  -2.31e-06   2.07e-06    -1.11   0.266    -6.40e-06    1.77e-06
       _cons |  -.0058985   .0021464    -2.75   0.006    -.0101222   -.0016749
------------------------------------------------------------------------------

. scalar NVar2=e(df_m)

. predict res, residual
(14 missing values generated)

. predict pdln2
(option xb assumed; fitted values)
(13 missing values generated)

. predict stdf2, stdf
(13 missing values generated)

. gen ressq=res^2
(14 missing values generated)

. summ ressq if tin(2018q1,2018q4)

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
       ressq |          4    1.59e-06    1.08e-06   4.81e-07   3.02e-06

. scalar osrmse2=r(mean)^0.5

. drop res ressq

. gen ubdln2=pdln2+1.96*stdf2
(13 missing values generated)

. gen lbdln2=pdln2-1.96*stdf2
(13 missing values generated)

. twoway (tsline d.lnflnonfarm if tin(2018m1,2019m12)) ///
>         (tsline pdln2 ubdln2 lbdln2 if tin(2019m1,2019m12) ) , ///
>         saving(m2tslines, replace)
(file m2tslines.gph saved)

.
.
.
. *Model 3
. set seed 22045 // to  make sure the same folds are used for each model

. crossfold reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2,12)d.lnfllf ///
>         l(1/2,12)d.lnflbp i.month date , k(10)

             |      RMSE
-------------+-----------
        est1 |  .0044445
        est2 |  .0049586
        est3 |  .0035232
        est4 |  .0046603
        est5 |  .0033702
        est6 |  .0039719
        est7 |  .0026611
        est8 |  .0029074
        est9 |  .0025942
       est10 |  .0035816
```

```
. scalar define k=10

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

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

. matrix drop kSSE

. scalar drop k

. loocv reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2,12)d.lnfllf ///
>         l(1/2,12)d.lnflbp i.month date


 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   .00381403
Mean Absolute Errors     |   .00267812
Pseudo-R2                |   .85320103
-----------------------------------------

. scalar loormse3=r(rmse)

. reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2,12)d.lnfllf ///
>         l(1/2,12)d.lnflbp i.month date

      Source |       SS           df       MS      Number of obs   =       347
-------------+----------------------------------   F(30, 316)      =     80.47
       Model |  .030160659        30  .001005355   Prob > F        =    0.0000
    Residual |  .003947723       316  .000012493   R-squared       =    0.8843
-------------+----------------------------------   Adj R-squared   =    0.8733
       Total |  .034108382       346  .000098579   Root MSE        =    .00353

------------------------------------------------------------------------------
D.           |
 lnflnonfarm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lnflnonfarm |
         LD. |  -.1179473   .0517143    -2.28   0.023    -.2196951   -.0161995
        L2D. |  -.0834614    .052317    -1.60   0.112    -.1863951    .0194723
        L3D. |   .2351664   .0515731     4.56   0.000     .1336964    .3366363
        L4D. |   .1596382   .0516095     3.09   0.002     .0580966    .2611797
        L5D. |   .1494304   .0522109     2.86   0.004     .0467055    .2521552
        L6D. |   .1590254   .0533389     2.98   0.003      .054081    .2639697
        L7D. |   .1012275   .0538178     1.88   0.061    -.0046589     .207114
        L8D. |   .0386844   .0531118     0.73   0.467     -.065813    .1431819
        L9D. |    .098232   .0511176     1.92   0.056    -.0023419    .1988058
       L10D. |  -.1775155   .0498607    -3.56   0.000    -.2756165   -.0794146
       L11D. |  -.0970244   .0510761    -1.90   0.058    -.1975166    .0034678
       L12D. |   .3567019   .0514544     6.93   0.000     .2554654    .4579385
             |
      lnfllf |
         LD. |   -.044002   .0540869    -0.81   0.417     -.150418    .0624139
        L2D. |  -.1081494    .053964    -2.00   0.046    -.2143235   -.0019754
       L12D. |   -.122442   .0525707    -2.33   0.020    -.2258747   -.0190092
             |
      lnflbp |
         LD. |   .0006484   .0015122     0.43   0.668    -.0023269    .0036237
        L2D. |   .0020716   .0015132     1.37   0.172    -.0009056    .0050488
       L12D. |   .0016323   .0013283     1.23   0.220    -.0009811    .0042457
             |
```

```
       month |
          2  |   .0087985   .0021525     4.09   0.000     .0045635    .0130335
          3  |   .0082388   .0025179     3.27   0.001     .0032848    .0131928
          4  |   .0091183   .0028339     3.22   0.001     .0035427     .014694
          5  |   .0038005   .0027832     1.37   0.173    -.0016755    .0092764
          6  |   .0003569   .0025185     0.14   0.887    -.0045984    .0053121
          7  |   .0033529   .0021834     1.54   0.126    -.0009428    .0076487
          8  |   .0123898   .0024816     4.99   0.000     .0075074    .0172723
          9  |   .0152734   .0026658     5.73   0.000     .0100285    .0205184
         10  |   .0202373   .0026631     7.60   0.000     .0149976     .025477
         11  |   .0138288   .0024088     5.74   0.000     .0090896    .0185681
         12  |   .0133178   .0020107     6.62   0.000     .0093618    .0172738
             |
        date |  -1.85e-06   1.91e-06    -0.97   0.333    -5.61e-06    1.90e-06
       _cons |  -.0073374   .0020026    -3.66   0.000    -.0112776   -.0033972
------------------------------------------------------------------------------

. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |        Obs  ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        347  1108.606   1482.742      31   -2903.484  -2784.155
-----------------------------------------------------------------------------
               Note: N=Obs used in calculating BIC; see [R] BIC note.

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

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

. reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2,12)d.lnfllf ///
>         l(1/2,12)d.lnflbp i.month date if tin(1991m1,2018m12)

      Source |       SS           df       MS      Number of obs   =       335
-------------+----------------------------------   F(30, 304)      =     76.84
       Model |  .029533325        30  .000984444   Prob > F        =    0.0000
    Residual |  .003894935       304  .000012812   R-squared       =    0.8835
-------------+----------------------------------   Adj R-squared   =    0.8720
       Total |   .03342826       334  .000100085   Root MSE        =    .00358

------------------------------------------------------------------------------
D.           |
 lnflnonfarm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lnflnonfarm |
         LD. |  -.1293841   .0531129    -2.44   0.015    -.2338996   -.0248686
        L2D. |  -.0858645   .0535234    -1.60   0.110    -.1911877    .0194587
        L3D. |   .2384584   .0526225     4.53   0.000     .1349079    .3420088
        L4D. |   .1690107   .0528191     3.20   0.002     .0650734     .272948
        L5D. |   .1578785   .0536036     2.95   0.003     .0523975    .2633595
        L6D. |   .1622324   .0546873     2.97   0.003     .0546189    .2698459
        L7D. |   .1049544   .0553378     1.90   0.059    -.0039392    .2138479
        L8D. |   .0405085   .0545189     0.74   0.458    -.0667738    .1477908
        L9D. |   .0997632   .0524099     1.90   0.058    -.0033688    .2028952
       L10D. |  -.1781345   .0510472    -3.49   0.001    -.2785852   -.0776839
       L11D. |  -.1082445    .052337    -2.07   0.039    -.2112331   -.0052558
       L12D. |   .3445404   .0527947     6.53   0.000     .2406511    .4484296
             |
      lnfllf |
         LD. |  -.0509275   .0564462    -0.90   0.368    -.1620023    .0601473
        L2D. |  -.1055925   .0559263    -1.89   0.060    -.2156442    .0044592
```

```
       L12D. |  -.1157475   .0547446    -2.11   0.035    -.2234739   -.0080211
             |
      lnflbp |
         LD. |   .0008645   .0015703     0.55   0.582    -.0022255    .0039545
        L2D. |   .0023376   .0015671     1.49   0.137    -.0007462    .0054215
       L12D. |   .0017084   .0013632     1.25   0.211    -.0009741    .0043909
             |
       month |
          2  |   .0086588   .0022125     3.91   0.000      .004305    .0130125
          3  |   .0082427   .0026136     3.15   0.002     .0030996    .0133858
          4  |   .0091522   .0029301     3.12   0.002     .0033864    .0149179
          5  |   .0036547   .0028793     1.27   0.205    -.0020112    .0093205
          6  |   .0001017   .0025957     0.04   0.969    -.0050061    .0052094
          7  |    .002862   .0022433     1.28   0.203    -.0015523    .0072764
          8  |   .0124005   .0025404     4.88   0.000     .0074015    .0173995
          9  |   .0155017   .0027433     5.65   0.000     .0101034       .0209
         10  |   .0207081    .002745     7.54   0.000     .0153065    .0261098
         11  |   .0143846   .0024842     5.79   0.000     .0094963    .0192729
         12  |   .0134458   .0020583     6.53   0.000     .0093955     .017496
             |
        date |  -2.02e-06   2.04e-06    -0.99   0.325    -6.04e-06    2.01e-06
       _cons |  -.0072834   .0020777    -3.51   0.001    -.0113719   -.0031948
------------------------------------------------------------------------------

. scalar NVar3=e(df_m)

. predict res, residual
(14 missing values generated)

. predict pdln3
(option xb assumed; fitted values)
(13 missing values generated)

. predict stdf3, stdf
(13 missing values generated)

. gen ressq=res^2
(14 missing values generated)

. summ ressq if tin(2018q1,2018q4)

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
       ressq |          4    7.86e-07    1.38e-06   1.69e-08   2.85e-06

. scalar osrmse3=r(mean)^0.5

. drop res ressq

. gen ubdln3=pdln3+1.96*stdf3
(13 missing values generated)

. gen lbdln3=pdln3-1.96*stdf3
(13 missing values generated)

. twoway (tsline d.lnflnonfarm if tin(2018m1,2019m12)) ///
>         (tsline pdln3 ubdln3 lbdln3 if tin(2019m1,2019m12) ) , ///
>         saving(m3tslines, replace)
(file m3tslines.gph saved)

.
.
. *Model 4
```

```
. set seed 22045 // to  make sure the same folds are used for each model

. 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 , k(10)

             |      RMSE
-------------+----------
        est1 |  .0042473
        est2 |   .004756
        est3 |  .0035679
        est4 |  .0049788
        est5 |  .0033895
        est6 |  .0038525
        est7 |  .0026151
        est8 |  .0030183
        est9 |  .0025266
       est10 |  .0036381

. scalar define k=10

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

. scalar krmse4=(el(kSSE,1,1)/k)^.5

. matrix drop kSSE

. 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 |   .00370499
Mean Absolute Errors     |   .00265047
Pseudo-R2                |   .86035869
----------------------------------------

. scalar loormse4=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   =       335
-------------+----------------------------------   F(32, 302)      =     74.38
       Model |  .029334712        32   .00091671   Prob > F        =    0.0000
    Residual |  .003721818       302  .000012324   R-squared       =    0.8874
-------------+----------------------------------   Adj R-squared   =    0.8755
       Total |  .033056529       334  .000098972   Root MSE        =    .00351

------------------------------------------------------------------------------
D.           |
 lnflnonfarm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lnflnonfarm |
         LD. |  -.0893296   .0527122    -1.69   0.091    -.1930593       .0144
        L2D. |  -.0665814   .0558162    -1.19   0.234    -.1764194    .0432566
        L3D. |   .2241205   .0541419     4.14   0.000     .1175775    .3306636
        L4D. |   .1514706   .0521838     2.90   0.004     .0487806    .2541605
        L5D. |   .1580576   .0532447     2.97   0.003     .0532801    .2628351
```

```
        L6D. |   .1598189    .055306     2.89   0.004      .050985    .2686528
        L7D. |   .0713947   .0554199     1.29   0.199    -.0376635    .1804528
        L8D. |   .0199339   .0547887     0.36   0.716    -.0878821      .12775
        L9D. |    .076253   .0525006     1.45   0.147    -.0270605    .1795664
       L10D. |  -.1636484   .0515785    -3.17   0.002    -.2651471   -.0621497
       L11D. |  -.0908334   .0531678    -1.71   0.089    -.1954596    .0137928
       L12D. |   .3044588   .0598043     5.09   0.000     .1867729    .4221446
       L24D. |   .1201683     .05152     2.33   0.020     .0187846    .2215519
             |
     lnfllf |
        LD. |  -.1225263   .0962344    -1.27   0.204    -.3119012    .0668486
       L2D. |  -.1611748   .0968689    -1.66   0.097    -.3517982    .0294486
       L12D. |  -.1592969   .1014979    -1.57   0.118    -.3590296    .0404358
       L24D. |   .1558841   .0998312     1.56   0.119    -.0405688     .352337
             |
    lnusepr |
        LD. |    .159602   .1313701     1.21   0.225    -.0989147    .4181187
       L2D. |   .0849591   .1315279     0.65   0.519    -.1738682    .3437864
       L12D. |   .1076075   .1327893     0.81   0.418    -.1537019     .368917
       L24D. |   -.330308   .1254379    -2.63   0.009     -.577151   -.0834651
             |
      month |
          2  |    .012446   .0031029     4.01   0.000       .00634     .018552
          3  |   .0108327   .0033014     3.28   0.001      .004336    .0173294
          4  |   .0111764   .0035758     3.13   0.002     .0041397     .018213
          5  |   .0053687   .0030705     1.75   0.081    -.0006736    .0114109
          6  |   .0041449   .0033227     1.25   0.213    -.0023936    .0106835
          7  |    .006134   .0027733     2.21   0.028     .0006765    .0115915
          8  |   .0129795   .0027654     4.69   0.000     .0075375    .0184214
          9  |   .0159311   .0027644     5.76   0.000     .0104912    .0213709
         10  |   .0227959   .0035244     6.47   0.000     .0158605    .0297313
         11  |   .0145436    .003114     4.67   0.000     .0084157    .0206715
         12  |   .0140586    .002605     5.40   0.000     .0089323     .019185
             |
       _cons |  -.0102486    .002402    -4.27   0.000    -.0149754   -.0055219
------------------------------------------------------------------------------

. estat ic

Akaike's information criterion and Bayesian information criterion

------------------------------------------------------------------------------
       Model |        Obs  ll(null)  ll(model)      df         AIC        BIC
-------------+----------------------------------------------------------------
           . |        335   1069.62   1435.441      33   -2804.882  -2679.016
------------------------------------------------------------------------------
               Note: N=Obs used in calculating BIC; see [R] BIC note.

. scalar aic4=(el(r(S),1,5))

. scalar bic4=(el(r(S),1,6))

. 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 if tin(1991m1,2018m12)

      Source |       SS           df       MS      Number of obs   =       323
-------------+----------------------------------   F(32, 290)      =     72.13
       Model |  .028763234        32  .000898851   Prob > F        =    0.0000
    Residual |  .003613751       290  .000012461   R-squared       =    0.8884
-------------+----------------------------------   Adj R-squared   =    0.8761
       Total |  .032376985       322   .00010055   Root MSE        =    .00353

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

```
D.           |
 lnflnonfarm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lnflnonfarm |
         LD. |  -.0948899   .0538787    -1.76   0.079    -.2009328     .011153
        L2D. |  -.0699134   .0566996    -1.23   0.219    -.1815084    .0416815
        L3D. |   .2254863   .0548686     4.11   0.000     .1174951    .3334775
        L4D. |   .1605308   .0530143     3.03   0.003     .0561892    .2648724
        L5D. |   .1707254   .0543612     3.14   0.002     .0637329    .2777179
        L6D. |   .1686264   .0562834     3.00   0.003     .0578507     .279402
        L7D. |   .0701475   .0563324     1.25   0.214    -.0407247    .1810198
        L8D. |     .01683   .0556574     0.30   0.763    -.0927136    .1263736
        L9D. |   .0730854   .0535314     1.37   0.173     -.032274    .1784448
       L10D. |  -.1617793   .0523278    -3.09   0.002    -.2647697   -.0587889
       L11D. |  -.1031841   .0538404    -1.92   0.056    -.2091516    .0027834
       L12D. |   .2633745   .0622896     4.23   0.000     .1407774    .3859716
       L24D. |   .1726133   .0585465     2.95   0.003     .0573833    .2878433
             |
      lnfllf |
         LD. |  -.1634339   .1031209    -1.58   0.114    -.3663941    .0395263
        L2D. |  -.1805075    .102243    -1.77   0.079      -.38174    .0207249
       L12D. |  -.1331463   .1039788    -1.28   0.201    -.3377951    .0715024
       L24D. |   .1745973   .1017924     1.72   0.087    -.0257484    .3749429
             |
     lnusepr |
         LD. |   .2178432    .138245     1.58   0.116    -.0542475    .4899338
        L2D. |   .1240292   .1373462     0.90   0.367    -.1462925    .3943509
       L12D. |   .0737005   .1362179     0.54   0.589    -.1944007    .3418016
       L24D. |  -.3825953   .1298244    -2.95   0.003    -.6381128   -.1270778
             |
       month |
          2  |   .0133682   .0032032     4.17   0.000     .0070638    .0196727
          3  |   .0114276   .0034255     3.34   0.001     .0046855    .0181696
          4  |   .0118775   .0036738     3.23   0.001     .0046468    .0191082
          5  |   .0054937   .0031766     1.73   0.085    -.0007585    .0117459
          6  |   .0048945   .0034447     1.42   0.156    -.0018852    .0116742
          7  |   .0065019   .0028725     2.26   0.024     .0008484    .0121554
          8  |   .0128559   .0028172     4.56   0.000     .0073111    .0184006
          9  |   .0159705   .0028304     5.64   0.000     .0103998    .0215413
         10  |   .0243941   .0036365     6.71   0.000     .0172369    .0315513
         11  |   .0153289   .0032299     4.75   0.000     .0089718     .021686
         12  |   .0141916   .0026701     5.32   0.000     .0089364    .0194469
             |
       _cons |  -.0107474   .0024715    -4.35   0.000    -.0156118   -.0058831
------------------------------------------------------------------------------

. scalar NVar4=e(df_m)

. predict res, residual
(26 missing values generated)

. predict pdln4
(option xb assumed; fitted values)
(25 missing values generated)

. predict stdf4, stdf
(25 missing values generated)

. gen ressq=res^2
(26 missing values generated)

. summ ressq if tin(2018q1,2018q4)
```

```
    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
       ressq |          4    4.65e-06    7.94e-06   3.50e-08   .0000165

. scalar osrmse4=r(mean)^0.5

. drop res ressq

. gen ubdln4=pdln4+1.96*stdf4
(25 missing values generated)

. gen lbdln4=pdln4-1.96*stdf4
(25 missing values generated)

. twoway (tsline d.lnflnonfarm if tin(2018m1,2019m12)) ///
>         (tsline pdln4 ubdln4 lbdln4 if tin(2019m1,2019m12) ) ///
>         , saving(m4tslines, replace)
(file m4tslines.gph saved)

.
.
. matrix M1=(NVar1,aic1,bic1,krmse1,loormse1,osrmse1)

. matrix M2=(NVar2,aic2,bic2,krmse2,loormse2,osrmse2)

. matrix M3=(NVar3,aic3,bic3,krmse3,loormse3,osrmse3)

. matrix M4=(NVar4,aic4,bic4,krmse4,loormse4,osrmse4)

. matrix MStats=(M1\M2\M3\M4)

. matrix colnames MStats=NVar AIC BIC RMSE10F RMSENF RMSEOS

. matrix rownames MStats=Model1 Model2 Model3 Model4

. matrix list MStats

MStats[4,6]
              NVar         AIC         BIC     RMSE10F      RMSENF      RMSEOS
Model1          60  -2896.7087  -2661.8999   .00379661    .0039009   .00195263
Model2          30  -2898.5286  -2779.1995   .00375628   .00382463   .00126116
Model3          30  -2903.4842  -2784.1552   .00375098   .00381403   .00088639
Model4          32  -2804.8818  -2679.0155   .00374267   .00370499   .00215691

.
. graph combine m1tslines.gph m2tslines.gph m3tslines.gph m4tslines.gph , ///
>         saving(mtslines, replace)
(file mtslines.gph saved)

.
. STOP
command STOP is unrecognized
r(199);

end of do-file

r(199);

. do "C:\Users\jdewey\AppData\Local\Temp\STD3380_000000.tmp"

. *Going to go with model 3
.
. drop pdl* ub* lb* stdf*
```

```
. scalar drop _all

.
. reg d.lnflnonfarm l(1/12)d.lnflnonfarm l(1/2,12)d.lnfllf ///
>         l(1/2,12)d.lnflbp i.month date

      Source |       SS           df       MS      Number of obs   =       347
-------------+----------------------------------   F(30, 316)      =     80.47
       Model |  .030160659        30  .001005355   Prob > F        =    0.0000
    Residual |  .003947723       316  .000012493   R-squared       =    0.8843
-------------+----------------------------------   Adj R-squared   =    0.8733
       Total |  .034108382       346  .000098579   Root MSE        =    .00353

------------------------------------------------------------------------------
D.           |
 lnflnonfarm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lnflnonfarm |
         LD. |  -.1179473   .0517143    -2.28   0.023    -.2196951   -.0161995
        L2D. |  -.0834614    .052317    -1.60   0.112    -.1863951    .0194723
        L3D. |   .2351664   .0515731     4.56   0.000     .1336964    .3366363
        L4D. |   .1596382   .0516095     3.09   0.002     .0580966    .2611797
        L5D. |   .1494304   .0522109     2.86   0.004     .0467055    .2521552
        L6D. |   .1590254   .0533389     2.98   0.003      .054081    .2639697
        L7D. |   .1012275   .0538178     1.88   0.061    -.0046589     .207114
        L8D. |   .0386844   .0531118     0.73   0.467     -.065813    .1431819
        L9D. |    .098232   .0511176     1.92   0.056    -.0023419    .1988058
       L10D. |  -.1775155   .0498607    -3.56   0.000    -.2756165   -.0794146
       L11D. |  -.0970244   .0510761    -1.90   0.058    -.1975166    .0034678
       L12D. |   .3567019   .0514544     6.93   0.000     .2554654    .4579385
             |
      lnfllf |
         LD. |   -.044002   .0540869    -0.81   0.417     -.150418    .0624139
        L2D. |  -.1081494    .053964    -2.00   0.046    -.2143235   -.0019754
       L12D. |   -.122442   .0525707    -2.33   0.020    -.2258747   -.0190092
             |
      lnflbp |
         LD. |   .0006484   .0015122     0.43   0.668    -.0023269    .0036237
        L2D. |   .0020716   .0015132     1.37   0.172    -.0009056    .0050488
       L12D. |   .0016323   .0013283     1.23   0.220    -.0009811    .0042457
             |
       month |
          2  |   .0087985   .0021525     4.09   0.000     .0045635    .0130335
          3  |   .0082388   .0025179     3.27   0.001     .0032848    .0131928
          4  |   .0091183   .0028339     3.22   0.001     .0035427     .014694
          5  |   .0038005   .0027832     1.37   0.173    -.0016755    .0092764
          6  |   .0003569   .0025185     0.14   0.887    -.0045984    .0053121
          7  |   .0033529   .0021834     1.54   0.126    -.0009428    .0076487
          8  |   .0123898   .0024816     4.99   0.000     .0075074    .0172723
          9  |   .0152734   .0026658     5.73   0.000     .0100285    .0205184
         10  |   .0202373   .0026631     7.60   0.000     .0149976     .025477
         11  |   .0138288   .0024088     5.74   0.000     .0090896    .0185681
         12  |   .0133178   .0020107     6.62   0.000     .0093618    .0172738
             |
        date |  -1.85e-06   1.91e-06    -0.97   0.333    -5.61e-06    1.90e-06
       _cons |  -.0073374   .0020026    -3.66   0.000    -.0112776   -.0033972
------------------------------------------------------------------------------

. predict pdln
(option xb assumed; fitted values)
(13 missing values generated)
```

```
. predict stdf
(option xb assumed; fitted values)
(13 missing values generated)

. scalar rmse=e(rmse)

. gen corrnorm=exp((rmse^2)/2)

. predict res
(option xb assumed; fitted values)
(13 missing values generated)

. gen expres=exp(res)
(13 missing values generated)

. summ expres

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
      expres |        348    1.001602    .0093405    .978271   1.017811

. gen corremp=r(mean)

.
.
. gen pyn=corrnorm*exp(l.lnflnon+pdln)
(13 missing values generated)

. gen ubyn=corrnorm*exp(l.lnflnon+pdln+1.96*rmse)
(13 missing values generated)

. gen lbyn=corrnorm*exp(l.lnflnon+pdln-1.96*rmse)
(13 missing values generated)

. twoway (tsline fl_nonfarm if tin(2018m1,2019m12)) ///
>         (tsline pyn ubyn lbyn if tin(2019m1,2019m12) ) ///
>         , saving(m3ynorm, replace)
(file m3ynorm.gph saved)

.
.
. _pctile res, percentiles(2.5,97.5)

. gen pye=corremp*exp(l.lnflnon+pdln)
(13 missing values generated)

. gen ubye=corremp*exp(l.lnflnon+pdln+r(r2))
(13 missing values generated)

. gen lbye=corremp*exp(l.lnflnon+pdln+r(r1))
(13 missing values generated)

. twoway (tsline fl_nonfarm if tin(2018m1,2019m12)) ///
>         (tsline pye ubye lbye if tin(2019m1,2019m12) ) ///
>         , saving(m3yemp, replace)
(file m3yemp.gph saved)

.
. graph combine m3ynorm.gph m3yemp.gph , ///
>         saving(m3yen, replace)
(file m3yen.gph saved)

.
```

```
.
. gen fub=ubye if tin(2020m1,)
(360 missing values generated)

. gen flb=lbye if tin(2020m1,)
(360 missing values generated)

. gen fcst=pye if tin(2020m1,)
(360 missing values generated)

. replace fcst=fl_non if tin(2019m12,2019m12)
(1 real change made)

. replace fub=fl_non if tin(2019m12,2019m12)
(1 real change made)

. replace flb=fl_non if tin(2019m12,2019m12)
(1 real change made)

.
. tsline fl_nonfarm fub flb fcst if tin(2019m1,2020m1) , saving(fcst, replace)
(file fcst.gph saved)

.
. list fcst fup flb if date=tm(2020m1)
variable fup not found
r(111);

end of do-file

r(111);

. do "C:\Users\jdewey\AppData\Local\Temp\STD3380_000000.tmp"

. list fcst fub flb if date=tm(2020m1)
=exp not allowed
r(101);

end of do-file

r(101);

. do "C:\Users\jdewey\AppData\Local\Temp\STD3380_000000.tmp"

. list fcst fub flb if date==tm(2020m1)

     +---------------------------------+
     |     fcst        fub        flb |
     |---------------------------------|
361. | 9093.688   9219.636   8923.498 |
     +---------------------------------+

.
. log close
      name:  <unnamed>
       log:  C:\Users\jdewey\Documents\A S20 Time Series\Problem Sets\Problem Set 4
Work.smcl
  log type:  smcl
 closed on:   5 Apr 2020, 21:42:04
-------------------------------------------------------------------------------
```