Problem Set 1

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CAP 4763 Time Series Modelling and Forecasting

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3 Static Model

3a

> Explain why the size of Florida’s labor force, the prime age employment to population ratio, and Florida building permits, might be closely related to the number of nonfarm jobs in Florida in a static long run sense. You might want to make some time series plots to give your data context. (Perhaps where one variable is employment and the other, on the other axis, is one of the other variables.)

The size of Florida's labor force can only increase for a few reasons. People either grow up and get a job or people move into the state for one reason or another. These would increase the prime age employment to population ratio but those people need places to work. They could either work in construction or any affiliated field which handles building permits or they could work in a building being constructed by the people handling those permits. In the meantime, as farming becomes more efficient and reliant on technology, not as many people are needed to farm the same parcels of land. This leads to more people employed in non-farm jobs.

3b

> Estimate the static model relating monthly nonfarm employment in Florida to the other three variables (all in logs) without controlling for seasonal impacts or a time trend.

3c

> Estimate the static model with month indicators and a time trend.

3d

> Compare your results from b and c and interpret any differences. What do the seasonal and time trend variables contribute?

Adding the seasonal and time trend variables transform the data into true time series data and give context to the changes. From both you can see that there is a general increase in nonfarm employment. However, by adding the month indicators, you can see that nonfarm employment decreases ever so slightly from March to November, presumably due to prime farming season.

3e

> Why should you be cautious using the results of these models for testing any hypotheses about the underlying relationships?

In time series data, the past affects the future and observations are not independent. Standard error and p-value assume that your data is independent which we just established time series data is not.

4 Finite Distributed Lag Model

4a

> Estimate the distributed lag model relating monthly nonfarm employment to lags 0 to 12 of the three predictor variables without month indicators and a time trend.

4b

> Estimate the model in (a) but add month indicators and a time trend.

4d

> Compare your results from a and c and interpret any differences. What do the seasonal and time trend variables contribute?

The model in 4a is accurate to the data it was given but does not make sense and has no practical application because the data is not organized in any way and does not account for the data being time series data.

4e

> Estimate two alternative models that contain month indicators and a time trend but that impose a more parsimonious lag structure for the predictor variables. Explain your choices.

Appendix A

```
clear
set more off

cd "/Users/guslipkin/Documents/Spring2020/CAP 4763 ~ Time Series/Problem Sets/Problem Set 1"

*2b Load the data
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

*2c Turn on a log file
log using "Problem Set 1", replace

*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

*2f
gen ln_us_epr=log(us_epr)
gen ln_fl_nonfarm=log(fl_nonfarm)
gen ln_fl_lf=log(fl_lf)
gen ln_fl_bp=log(fl_bp)

*3b Estimate the static model relating monthly nonfarm employment in Florida to the other three variables (all in logs) without controlling for seasonal impacts or a time trend.
regress ln_fl_nonfarm ln_fl_lf ln_us_epr ln_fl_bp

*3c Estimate the static model with month indicators and a time trend.
gen month=month(datec)
reg ln_fl_nonfarm ln_fl_lf ln_us_epr ln_fl_bp i.month date

*4a Estimate the distributed lag model relating monthly nonfarm employment to lags 0 to 12 of the three predictor variables without month indicators and a time trend.
regress ln_fl_nonfarm l(0/12).ln_fl_lf l(0/12).ln_us_epr l(0/12).ln_fl_bp

*4b Estimate the model in (a) but add month indicators and a time trend.
```

```
regress ln_fl_nonfarm l(0/12).ln_fl_lf l(0/12).ln_us_epr l(0/12).ln_fl_bp i.month
date

log close
```

Appendix B

```
------------------------------------------------------------------------------------------
      name:  <unnamed>
       log:  /Users/guslipkin/Documents/Spring2020/CAP 4763 ~ Time Series/Problem Sets/P
> roblem Set 1/Problem Set 1.smcl
  log type:  smcl
 opened on:   7 Feb 2021, 18:17:12

.
. *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

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

. gen ln_fl_nonfarm=log(fl_nonfarm)

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

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

.
. *3b Estimate the static model relating monthly nonfarm employment in Florida to the ot
> her three variables (all in logs) without controlling for seasonal impacts or a time t
> rend.
. regress ln_fl_nonfarm ln_fl_lf ln_us_epr ln_fl_bp

      Source |       SS           df       MS      Number of obs   =       396
-------------+----------------------------------   F(3, 392)       =   5972.65
       Model |  10.5356085         3  3.51186951   Prob > F        =    0.0000
    Residual |  .230492978       392  .000587992   R-squared       =    0.9786
-------------+----------------------------------   Adj R-squared   =    0.9784
       Total |  10.7661015       395  .027255953   Root MSE        =    .02425

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

ln_fl_nonf~m	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_fl_lf	1.110504	.0092305	120.31	0.000	1.092356	1.128651
ln_us_epr	.6006702	.047797	12.57	0.000	.5066997	.6946407
ln_fl_bp	.0516831	.0028713	18.00	0.000	.0460379	.0573282
_cons	-11.78364	.2925244	-40.28	0.000	-12.35875	-11.20852

```
.
. *3c Estimate the static model with month indicators and a time trend.
. gen month=month(datec)

. reg ln_fl_nonfarm ln_fl_lf ln_us_epr ln_fl_bp i.month date
```

Source	SS	df	MS
Model	10.6739911	15	.711599408
Residual	.092110398	380	.000242396
Total	10.7661015	395	.027255953

Number of obs	=	396
F(15, 380)	=	2935.69
Prob > F	=	0.0000
R-squared	=	0.9914
Adj R-squared	=	0.9911
Root MSE	=	.01557

ln_fl_nonf~m	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_fl_lf	.9282631	.0413265	22.46	0.000	.8470059	1.00952
ln_us_epr	.9105558	.0514333	17.70	0.000	.8094263	1.011685
ln_fl_bp	.0466812	.0021579	21.63	0.000	.0424382	.0509242
month						
2	.0045623	.0038378	1.19	0.235	-.0029837	.0121084
3	-.001379	.003839	-0.36	0.720	-.0089274	.0061694
4	-.0029373	.0038393	-0.77	0.445	-.0104863	.0046116
5	-.0142748	.0038468	-3.71	0.000	-.0218384	-.0067112
6	-.0356123	.0038709	-9.20	0.000	-.0432234	-.0280012
7	-.0519102	.0038917	-13.34	0.000	-.0595622	-.0442582
8	-.0380965	.0038668	-9.85	0.000	-.0456995	-.0304936
9	-.026004	.0038581	-6.74	0.000	-.0335899	-.0184181
10	-.0215894	.0038763	-5.57	0.000	-.029211	-.0139678
11	-.0014672	.0039082	-0.38	0.708	-.0091517	.0062173
12	.0054514	.0038735	1.41	0.160	-.0021648	.0130675
date	.0003124	.0000637	4.90	0.000	.000187	.0004377
_cons	-10.26323	.498888	-20.57	0.000	-11.24416	-9.282304

```
.
. *4a Estimate the distributed lag model relating monthly nonfarm employment to lags 0 t
> o 12 of the three predictor variables without month indicators and a time trend.
. regress ln_fl_nonfarm l(0/12).ln_fl_lf l(0/12).ln_us_epr l(0/12).ln_fl_bp
```

Source	SS	df	MS
Model	9.45063897	39	.242324076
Residual	.055338456	344	.000160868
Total	9.50597742	383	.024819784

Number of obs	=	384
F(39, 344)	=	1506.36
Prob > F	=	0.0000
R-squared	=	0.9942
Adj R-squared	=	0.9935
Root MSE	=	.01268

ln_fl_nonf~m	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_fl_lf						
--.	-.3180953	.2192272	-1.45	0.148	-.7492898	.1130992
L1.	-.4936055	.2780395	-1.78	0.077	-1.040477	.0532661
L2.	.3085466	.27846	1.11	0.269	-.239152	.8562452
L3.	1.173922	.2948363	3.98	0.000	.5940134	1.753831
L4.	-.2346487	.2905929	-0.81	0.420	-.8062113	.3369138
L5.	.2808166	.2958343	0.95	0.343	-.3010552	.8626884
L6.	-.2076341	.3372426	-0.62	0.539	-.8709511	.4556829
L7.	.428488	.3391507	1.26	0.207	-.2385821	1.095558
L8.	.4803611	.3332665	1.44	0.150	-.1751354	1.135858
L9.	.2977526	.3112925	0.96	0.339	-.3145235	.9100288
L10.	-.00028	.3217814	-0.00	0.999	-.6331867	.6326267
L11.	-.5860114	.3256137	-1.80	0.073	-1.226456	.0544331
L12.	.0176351	.2499574	0.07	0.944	-.4740021	.5092724
ln_us_epr						
--.	1.180441	.1573579	7.50	0.000	.8709364	1.489946
L1.	.2435207	.202013	1.21	0.229	-.1538155	.6408569
L2.	-.1519264	.2015081	-0.75	0.451	-.5482695	.2444166
L3.	-.719111	.2119425	-3.39	0.001	-1.135977	-.3022447
L4.	.1877102	.2014654	0.93	0.352	-.2085489	.5839692
L5.	-.1596306	.206881	-0.77	0.441	-.5665414	.2472803
L6.	.4937537	.2396216	2.06	0.040	.0224458	.9650615
L7.	-.3031484	.236988	-1.28	0.202	-.7692764	.1629796
L8.	-.2995254	.2312056	-1.30	0.196	-.7542801	.1552293
L9.	.5953076	.2915942	2.04	0.042	.0217756	1.16884
L10.	-.1656984	.352639	-0.47	0.639	-.8592984	.5279015
L11.	.5326939	.3523697	1.51	0.132	-.1603764	1.225764
L12.	-.4280274	.2543508	-1.68	0.093	-.928306	.0722511
ln_fl_bp						
--.	.0177815	.0051888	3.43	0.001	.0075758	.0279872
L1.	.0056999	.0054688	1.04	0.298	-.0050566	.0164565
L2.	.0123023	.0056879	2.16	0.031	.0011149	.0234898
L3.	-.0005041	.0058381	-0.09	0.931	-.0119871	.0109788
L4.	-.0040248	.0058282	-0.69	0.490	-.0154881	.0074385
L5.	.0053648	.0058106	0.92	0.357	-.006064	.0167937
L6.	.0122019	.0057914	2.11	0.036	.0008108	.0235929
L7.	.0146252	.0057698	2.53	0.012	.0032766	.0259737
L8.	.0114715	.0057663	1.99	0.047	.0001299	.0228131
L9.	.0100892	.0057895	1.74	0.082	-.0012981	.0214765
L10.	-.0077443	.0056515	-1.37	0.171	-.0188601	.0033715
L11.	-.0129284	.0055227	-2.34	0.020	-.0237908	-.002066
L12.	-.0156324	.0052843	-2.96	0.003	-.0260261	-.0052388
_cons	-14.00483	.220126	-63.62	0.000	-14.43779	-13.57187

```
.
. *4b Estimate the model in (a) but add month indicators and a time trend.
. regress ln_fl_nonfarm l(0/12).ln_fl_lf l(0/12).ln_us_epr l(0/12).ln_fl_bp i.month date
```

Source	SS	df	MS			
				Number of obs	=	384
				F(51, 332)	=	1880.48
Model	9.47318331	51	.185748693	Prob > F	=	0.0000

Source	SS	df	MS			
Model	9.47318331	51	.185748692	Prob > F	=	0.0000
Residual	.03279411	332	.000098777	R-squared	=	0.9966
				Adj R-squared	=	0.9960
Total	9.50597742	383	.024819784	Root MSE	=	.00994

ln_fl_nonf~m	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_fl_lf						
--.	.1395258	.2167149	0.64	0.520	-.2867817	.5658333
L1.	-.0728475	.2909974	-0.25	0.802	-.6452787	.4995837
L2.	-.0401378	.2914261	-0.14	0.891	-.6134123	.5331367
L3.	.4941867	.3004728	1.64	0.101	-.096884	1.085257
L4.	.0243743	.3032608	0.08	0.936	-.5721806	.6209291
L5.	-.0515457	.3007867	-0.17	0.864	-.6432337	.5401424
L6.	.2645611	.3042172	0.87	0.385	-.3338753	.8629975
L7.	.3032209	.3064496	0.99	0.323	-.2996069	.9060486
L8.	.0945934	.3058001	0.31	0.757	-.5069567	.6961435
L9.	-.1097755	.3559336	-0.31	0.758	-.8099451	.590394
L10.	.1539543	.375505	0.41	0.682	-.5847148	.8926234
L11.	-.2776778	.3787638	-0.73	0.464	-1.022757	.4674017
L12.	-.0112724	.279864	-0.04	0.968	-.5618026	.5392579
ln_us_epr						
--.	.8902343	.1499136	5.94	0.000	.595334	1.185135
L1.	.0725186	.1976025	0.37	0.714	-.3161923	.4612294
L2.	.0146862	.1973291	0.07	0.941	-.3734868	.4028593
L3.	-.3099001	.2109421	-1.47	0.143	-.7248517	.1050514
L4.	.137028	.215249	0.64	0.525	-.2863958	.5604519
L5.	-.0073661	.2142714	-0.03	0.973	-.4288668	.4141346
L6.	.0293898	.2200462	0.13	0.894	-.4034709	.4622504
L7.	-.1397223	.2227059	-0.63	0.531	-.5778149	.2983702
L8.	-.0598893	.2228997	-0.27	0.788	-.4983631	.3785844
L9.	.4823653	.4060878	1.19	0.236	-.3164642	1.281195
L10.	.0335197	.4684115	0.07	0.943	-.887909	.9549485
L11.	.4443457	.4733678	0.94	0.349	-.4868327	1.375524
L12.	-.3652099	.3457533	-1.06	0.292	-1.045353	.3149335
ln_fl_bp						
--.	.0174185	.0043812	3.98	0.000	.0088	.0260369
L1.	.0097915	.0047176	2.08	0.039	.0005113	.0190717
L2.	.005989	.0048174	1.24	0.215	-.0034873	.0154654
L3.	.0067099	.0049382	1.36	0.175	-.0030042	.016424
L4.	.0015463	.0049663	0.31	0.756	-.0082232	.0113157
L5.	.0025978	.0049914	0.52	0.603	-.007221	.0124166
L6.	.006001	.0049798	1.21	0.229	-.0037949	.0157968
L7.	.0066017	.0049157	1.34	0.180	-.003068	.0162715
L8.	-.0015491	.0049371	-0.31	0.754	-.011261	.0081628
L9.	.0010036	.0048898	0.21	0.838	-.0086153	.0106225
L10.	-.0004773	.0047767	-0.10	0.920	-.0098737	.008919
L11.	-.0083937	.0046846	-1.79	0.074	-.017609	.0008216
L12.	-.0041455	.0044702	-0.93	0.354	-.0129391	.004648
month						
2	.0077995	.0048077	1.62	0.106	-.001658	.017257
3	.0052085	.0041637	1.25	0.212	-.0029821	.0133991
4	-.0010198	.0053356	-0.19	0.849	-.0115156	.009476
5	-.0012298	.0047478	-0.26	0.796	-.0105694	.0081098

```
           5  |  -.0012298   .0047478    -0.26   0.796    -.0105694    .0081098
           6  |  -.0122415   .0055844    -2.19   0.029    -.0232267   -.0012563
           7  |  -.0240128   .0047031    -5.11   0.000    -.0332644   -.0147612
           8  |  -.0152756   .0052483    -2.91   0.004    -.0255997   -.0049514
           9  |  -.0111308   .0045365    -2.45   0.015    -.0200548   -.0022068
          10  |  -.0046899    .006722    -0.70   0.486    -.0179129    .0085332
          11  |   .0076979   .0057763     1.33   0.184    -.0036649    .0190607
          12  |   .0151789   .0059337     2.56   0.011     .0035065    .0268514
              |
         date |   .0003695    .000047     7.86   0.000      .000277    .0004619
        _cons |  -11.28083    .391293   -28.83   0.000    -12.05055    -10.5111
------------------------------------------------------------------------------

. 
. log close
      name:  <unnamed>
       log:  /Users/guslipkin/Documents/Spring2020/CAP 4763 ~ Time Series/Problem Sets/P
> roblem Set 1/Problem Set 1.smcl
  log type:  smcl
 closed on:   7 Feb 2021, 18:17:12
----------------------------------------------------------------------------------------
```