US Unemployment Trends

Initial Model Selection

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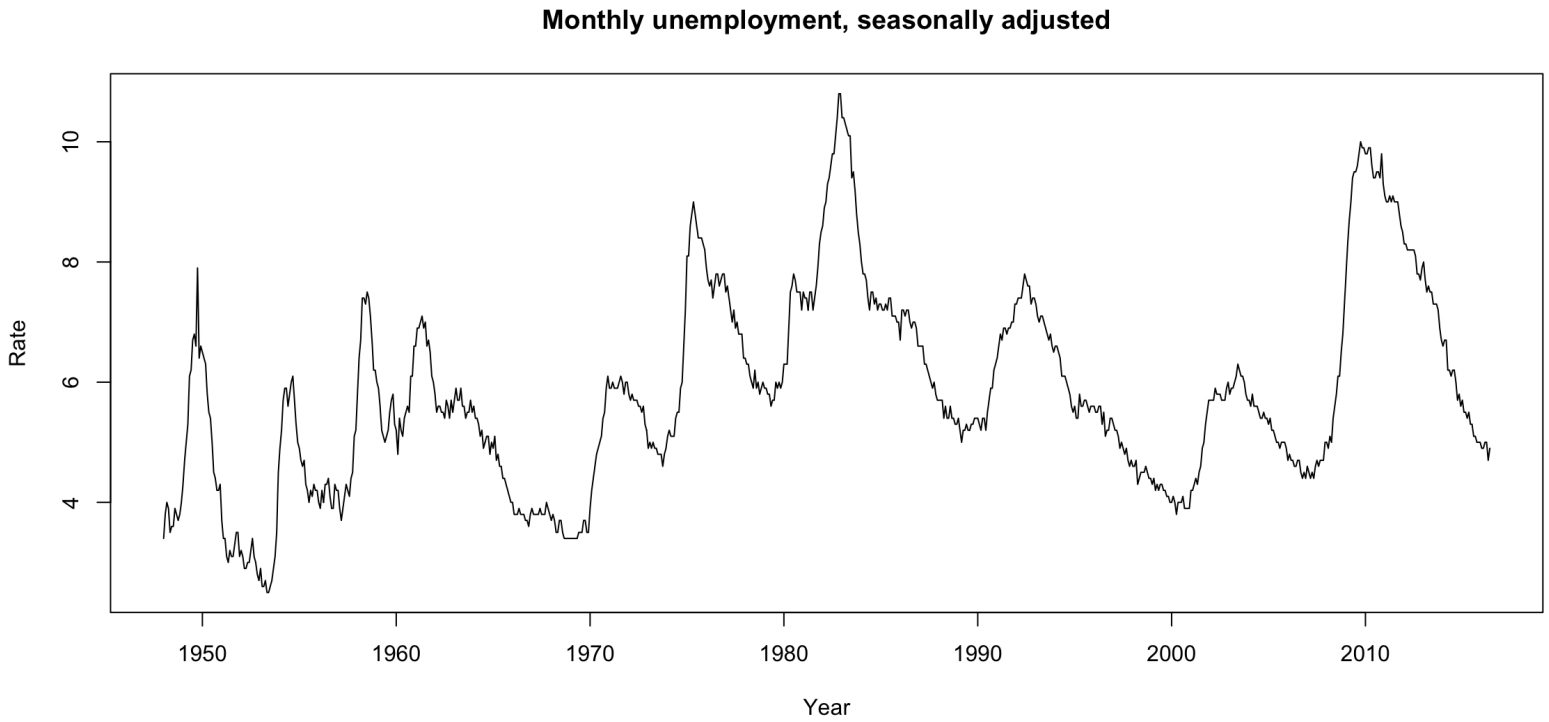
STAT 626: Time Series Analysis

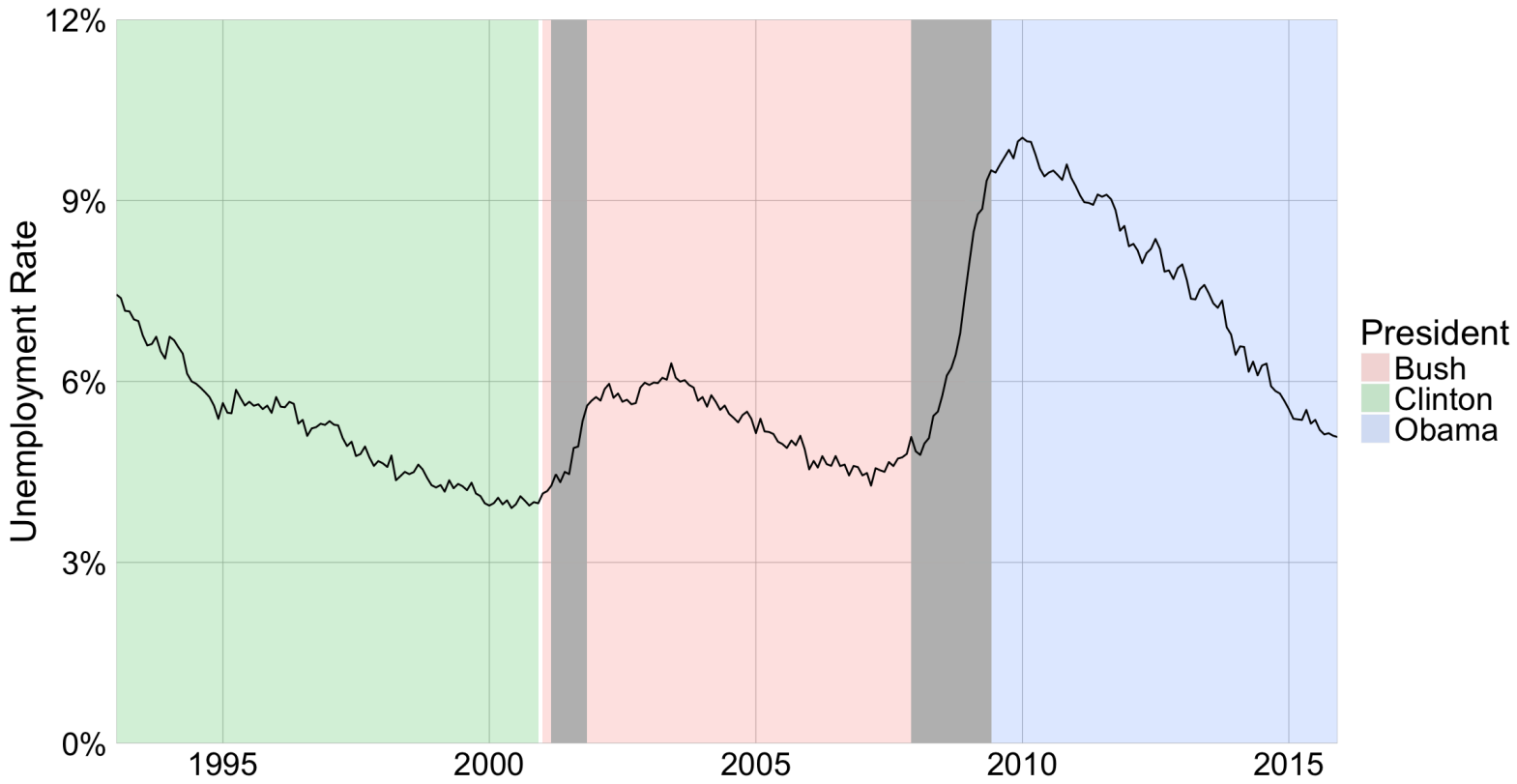
Outline

1. Description of data
2. Models Considered
3. Forecast comparisons

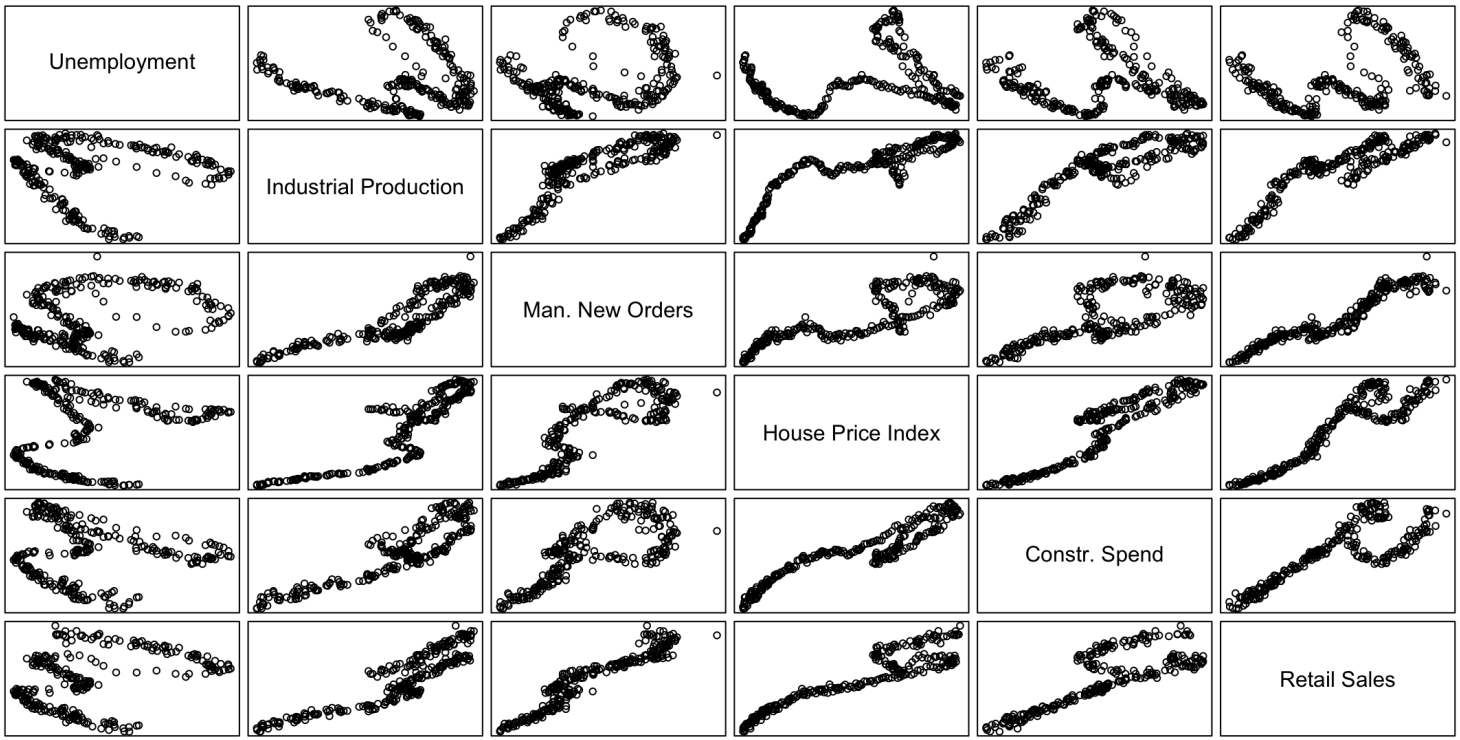
US Unemployment



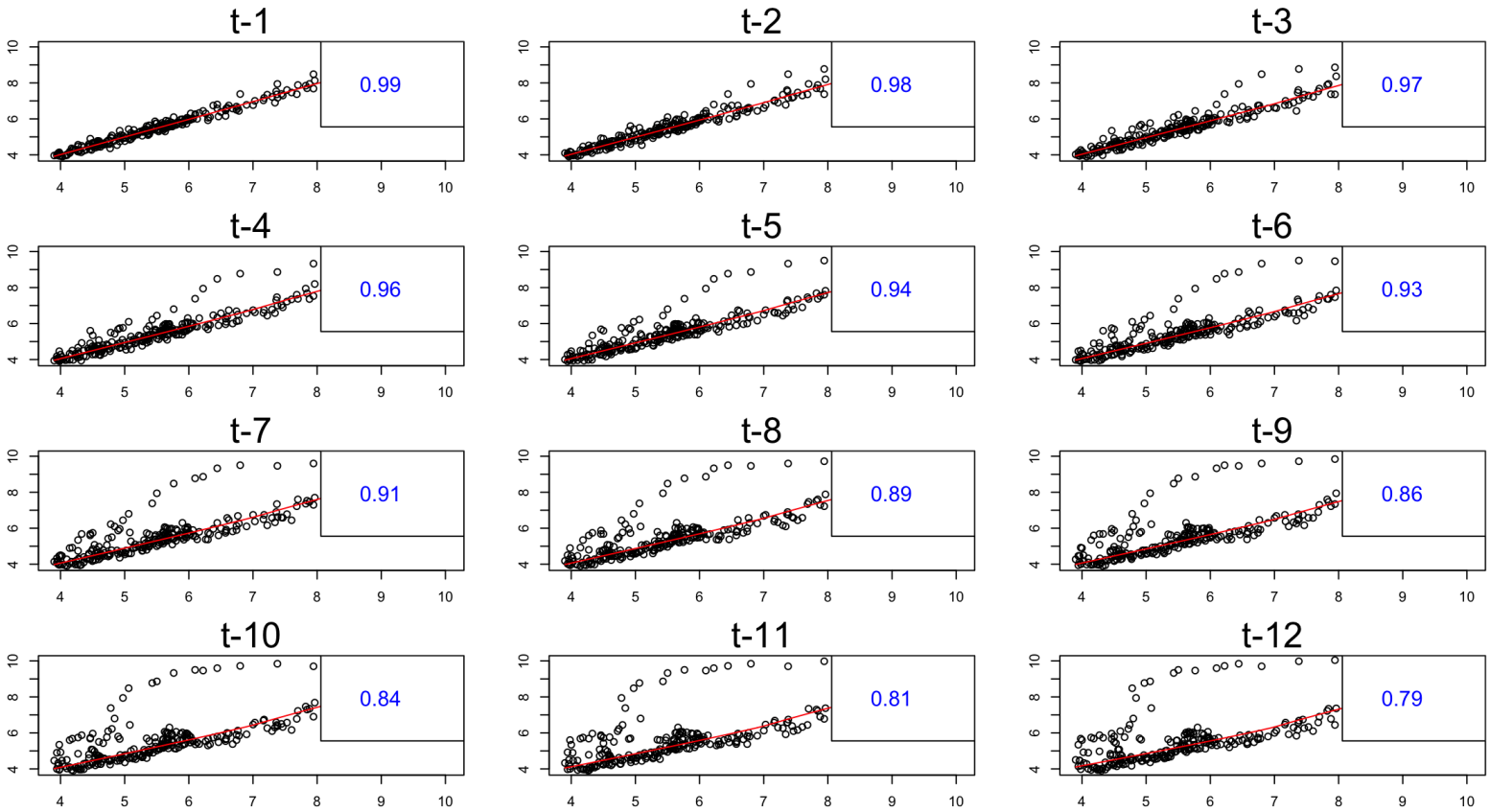
Seasonally Adjusted Unemployment with sitting president backdrop



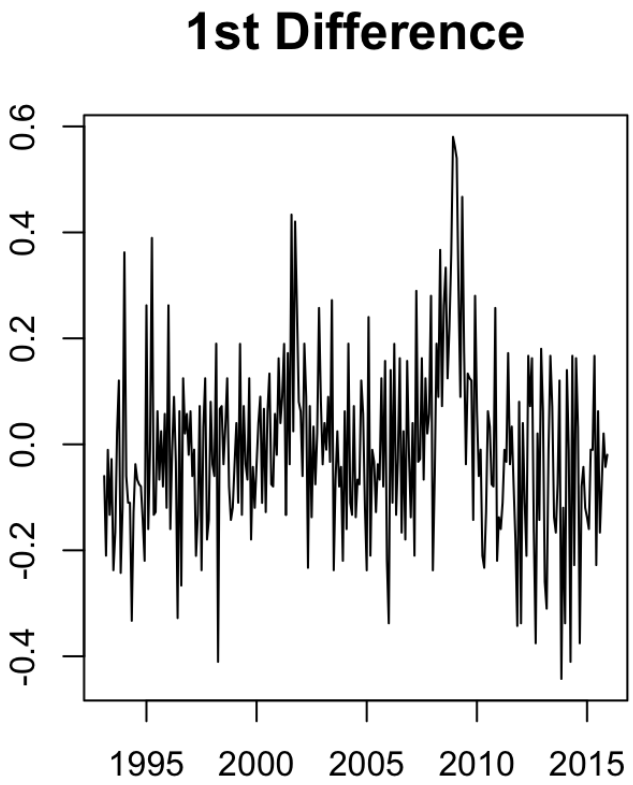
Scatterplot Matrix

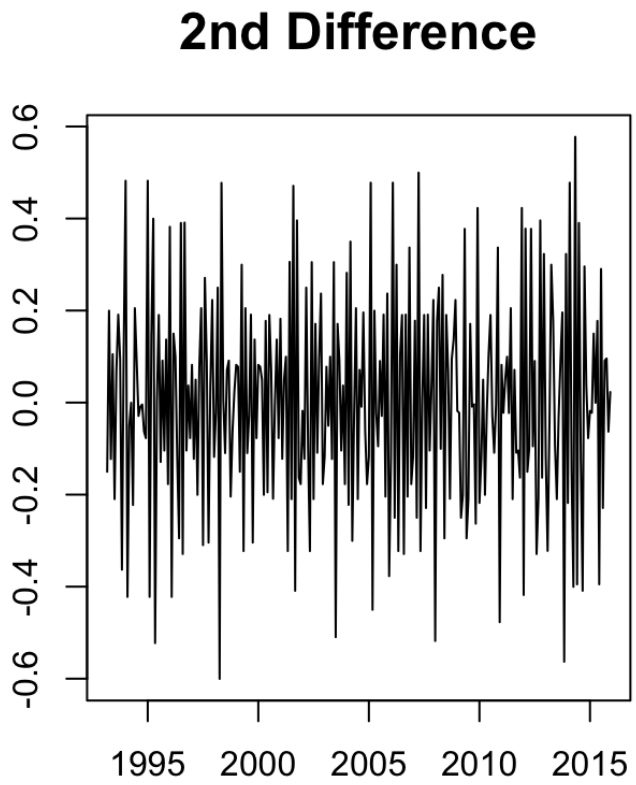


Autocorrelation of Unemployment



Differencing

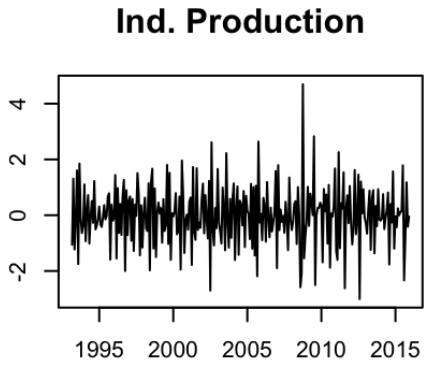


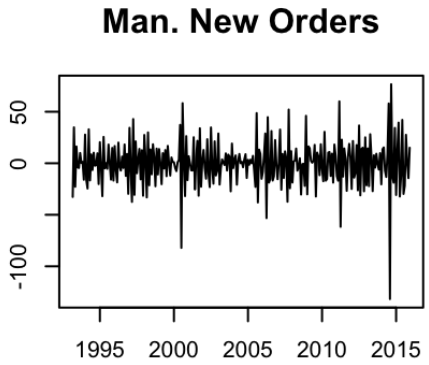


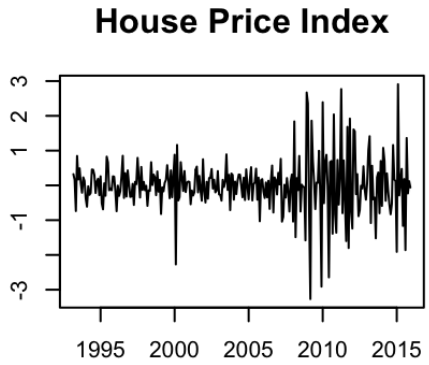
ADF Test

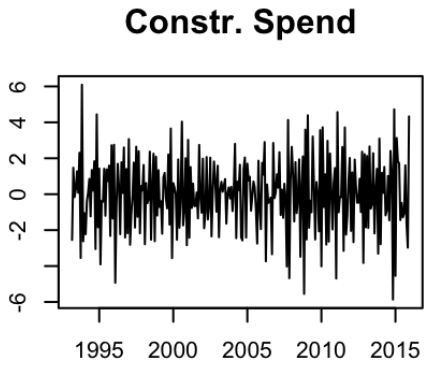
Model	Statistic	Lag order	p-value
1^{st} difference	-9.3595	6	< 0.01
2^{nd} difference	-9.3595	6	< 0.01
3^{rd} difference	-13.02	6	< 0.01

Differenced Predictors





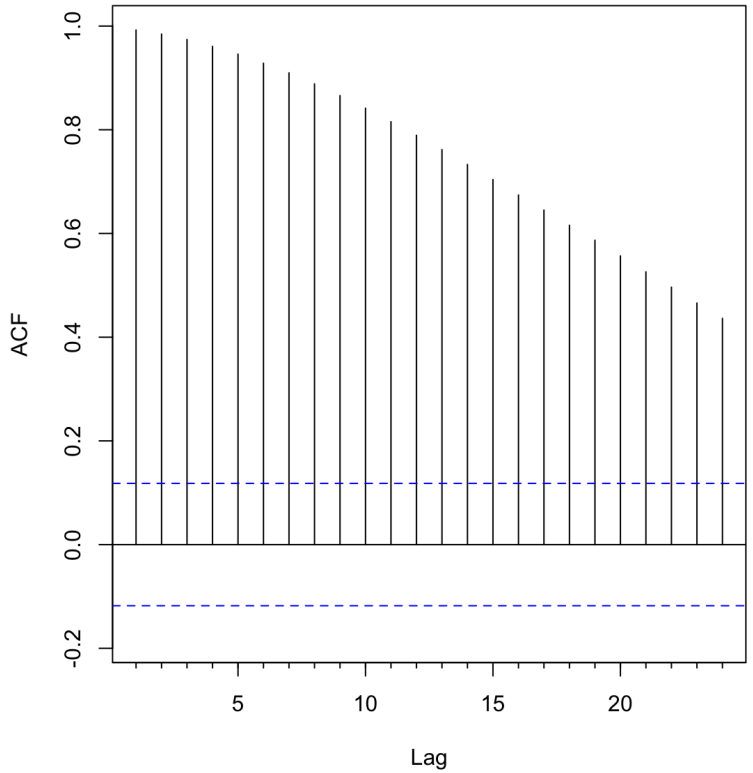


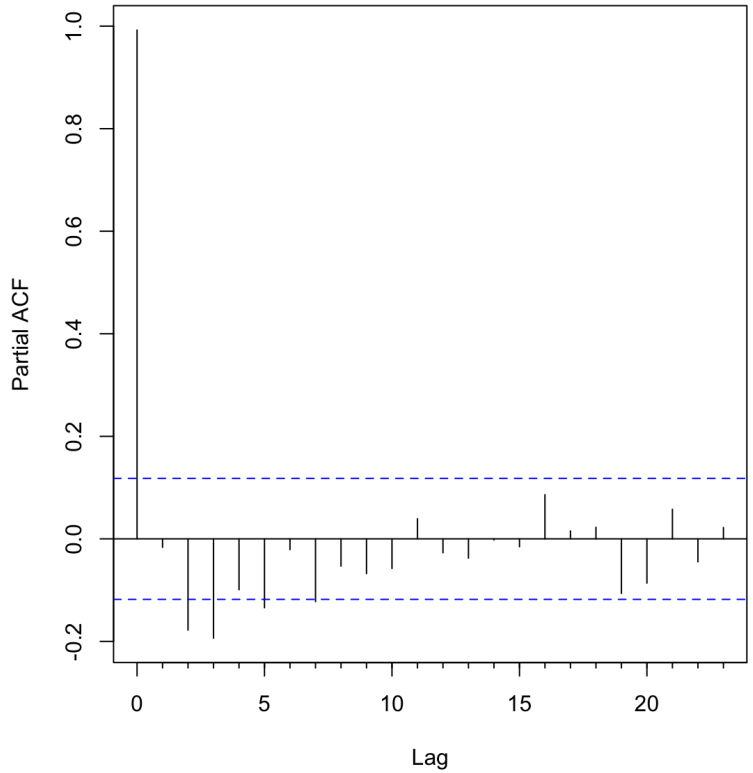


ADF Test for Predictors, $d = 2$

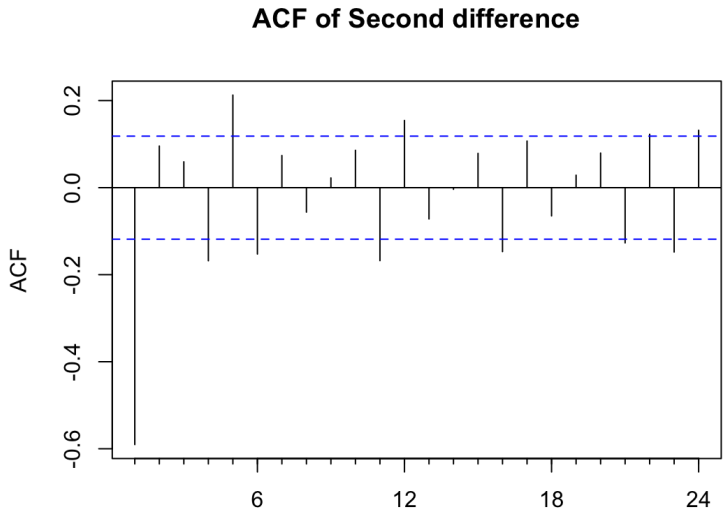
Variable	Statistic	p-value
Industrial Production	-9.2333	< 0.01
New Orders	-8.391	< 0.01
House Prices	-9.104	< 0.01
Construction Spending	-10.447	< 0.01
Retail Sales	-10.72	< 0.01

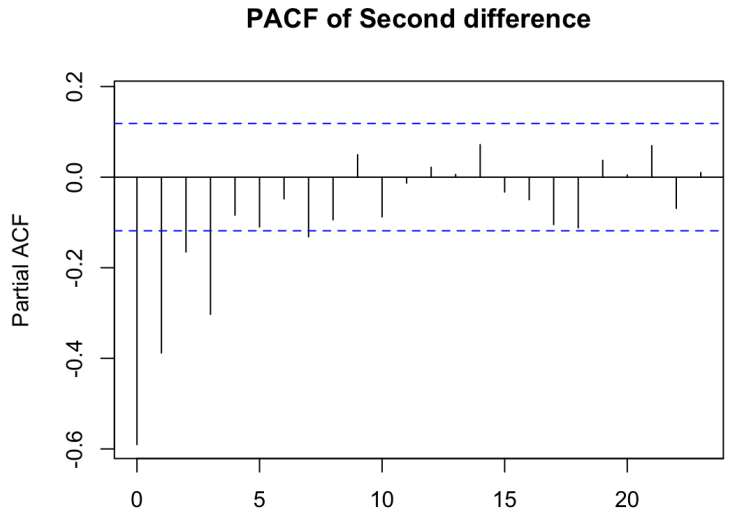
ACF & PACF Plots





ACF & PACF Plots of Second Differences





ARIMA

Model	Order	Reg	AIC	BIC	Best
1	1,2,1	NA	-212.30	-201.46	BIC
2	2,2,2	NA	-211.81	-193.74	
3	3,2,3	NA	-215.48	-190.19	
4	1,2,1	X	-211.56	-182.65	
5	2,2,2	X	-209.83	-177.32	
6	3,2,3	X	-215.10	-171.74	
7	1,2,1	LagX	-222.45	-193.69	AIC
8	2,2,2	LagX	-220.70	-188.35	
9	3,2,3	LagX	-217.89	-174.76	

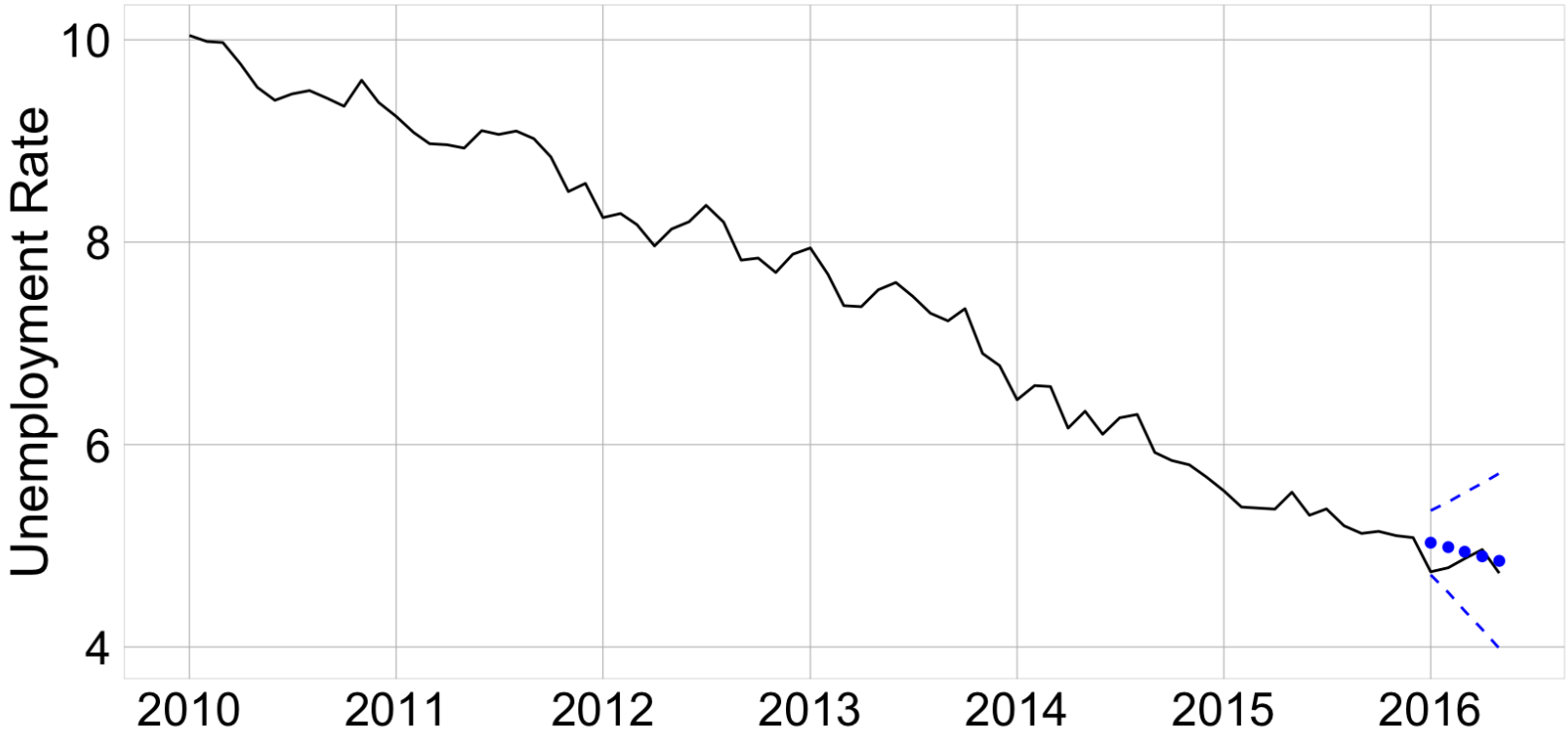
VAR

Model	P	Type	AIC	BIC	Best
1	1	NA	-223.67	-201.97	
2	2	NA	-217.83	-185.31	
3	1	Ind	-256.77	-231.45	BIC/AIC
4	1	LagX	-216.65	-195.06	
5	2	LagX	-212.53	-180.17	
6	1	Both	-245.72	-220.53	

ARIMA vs VAR

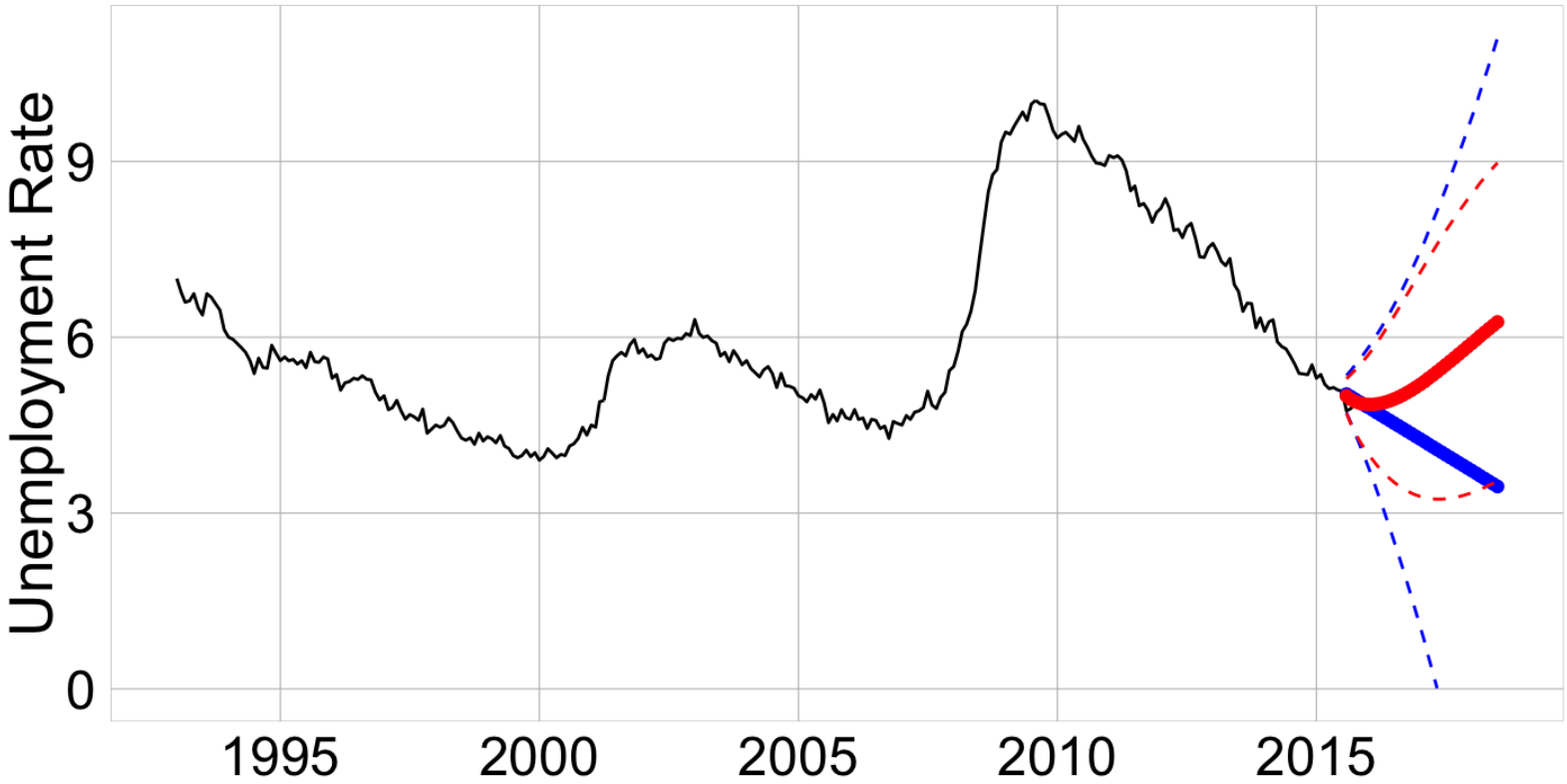
Model	Type	AIC	BIC
ARIMA #1	Univariate ARIMA(1,2,1)	-212.29	-201.45
ARIMA #7	Multivariate ARIMA(1,2,1)	-222.45	-193.69
VAR #3	VAR(1)	-256.76	-231.45

ARIMA(1,2,1)



VAR(1)

ARIMA(1,2,1) vs VAR(1)



VAR(1) Estimates


```
-------------------------------------------------
unem = unem.l1 + constr.l1 + retail.l1 + recession.l1
+ const + trend
-------------------------------------------------
-------------------------------------------------
             Estimate Std. Error t value Pr(>|t|)
unem.l1       0.975191   0.009984  97.677  < 2e-16 ***
constr.l1     0.004262   0.001249   3.412 0.000744 ***
retail.l1    -0.005873   0.001121  -5.241 3.24e-07 ***
recession.l1  0.192394   0.031793   6.051 4.80e-09 ***
const         0.843825   0.201499   4.188 3.82e-05 ***
trend         0.004488   0.000943   4.759 3.17e-06 ***
-------------------------------------------------
```

Final Model: VAR(1)

The final model chose was the VAR(1) with construction spending, retail sales, and the recession indicator as predictors:

$$\begin{aligned}\widehat{\text{Unemployment}} = {} & 0.8438_{(0.2015)} + 0.0045_{(0.0009)}(t) \\ & + 0.9752_{(0.0010)}(\text{Unemployment}_{t-1}) \\ & + 0.0043_{(0.0012)}(\text{ConstructionSpend}_{t-1}) \\ & - 0.0059_{(0.0012)}(\text{RetailSales}_{t-1}) \\ & + 0.1924_{(0.0012)}(\text{Recession}_{t-1})\end{aligned}$$

VAR(1) Predictions