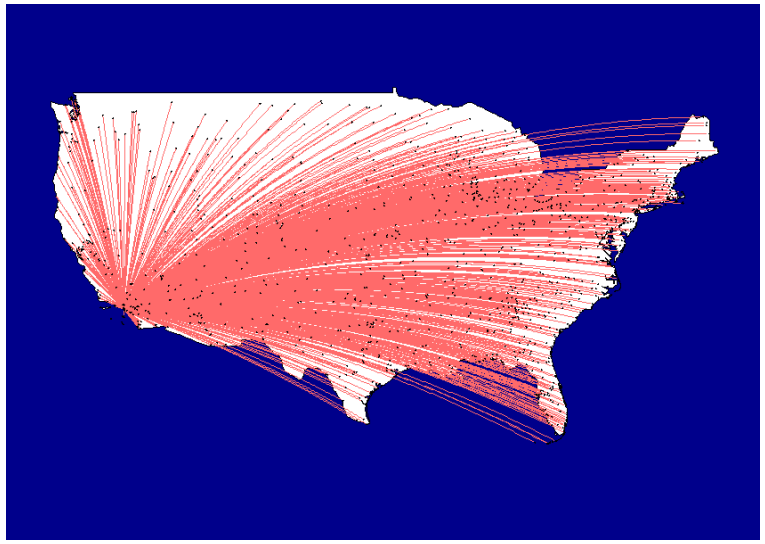
Time Series Analysis of Daily LAX Airport Delays



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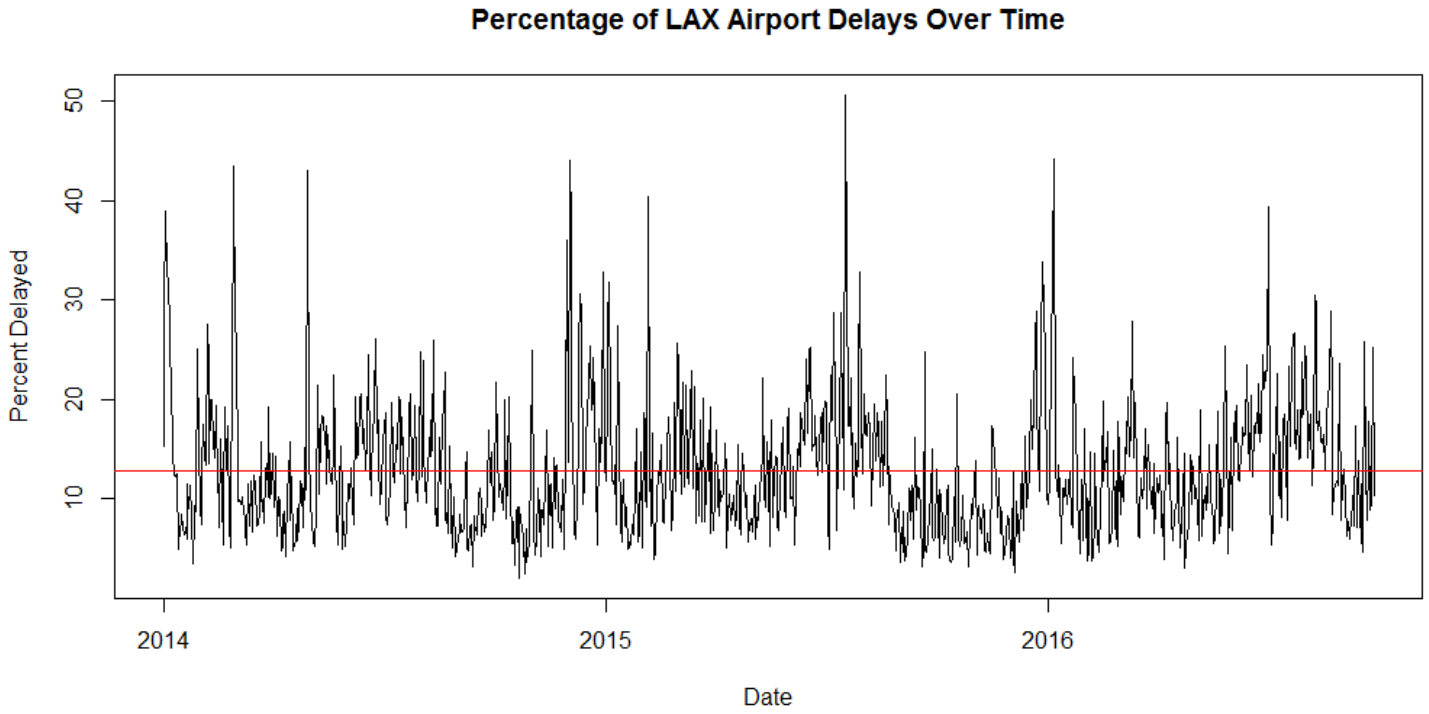
Background

- Moving through the airport already takes a long time.
  - TSA recommends arriving 2 hours early for domestic flights, 3 hours early for international flights
- Delays only exacerbate the problem
  - Cause stress
  - Miss out on vacation time
  - Decrease economic output

Data

- I gathered flight performance data on most recent data (January 2014 - October 2016) for all flights departing from LAX
  - Data obtained from RITA, a division of the US Bureau of Transportation Statistics (BTS)
  - https://www.transtats.bts.gov/DL_SelectFields.asp?Table_ID=236&DB_Short_Name=On-Time
- Data was cleaned (mostly removing missing data and canceled flights)
- Variable of interest – percentage of delays greater than 30 minutes from the 10 largest airline carriers at LAX

Initial Plot of Data



1,000 Observations (daily values)

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Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)       1.354e+00  1.199e+01   0.113    0.910
times_train$FL_DATE 6.901e-04  7.237e-04   0.954    0.341

Residual standard error: 6.606 on 998 degrees of freedom
Multiple R-squared:  0.0009104, Adjusted R-squared:  -9.071e-05
F-statistic: 0.9094 on 1 and 998 DF,  p-value: 0.3405
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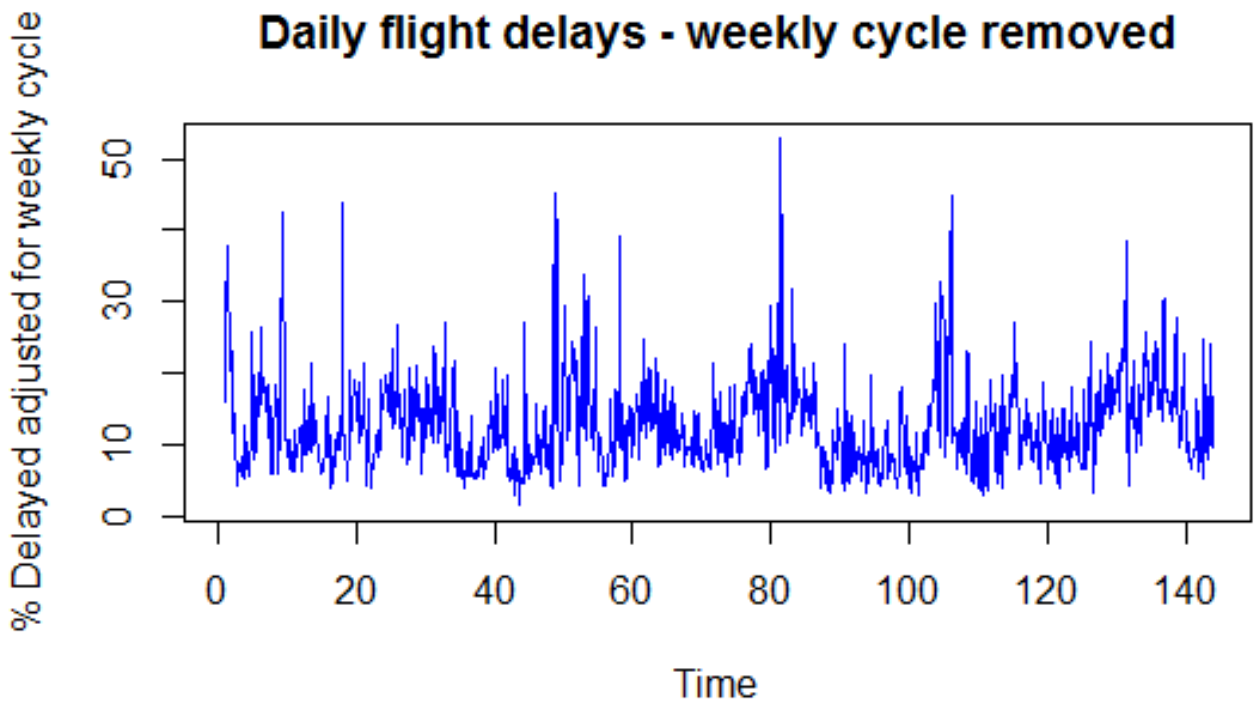
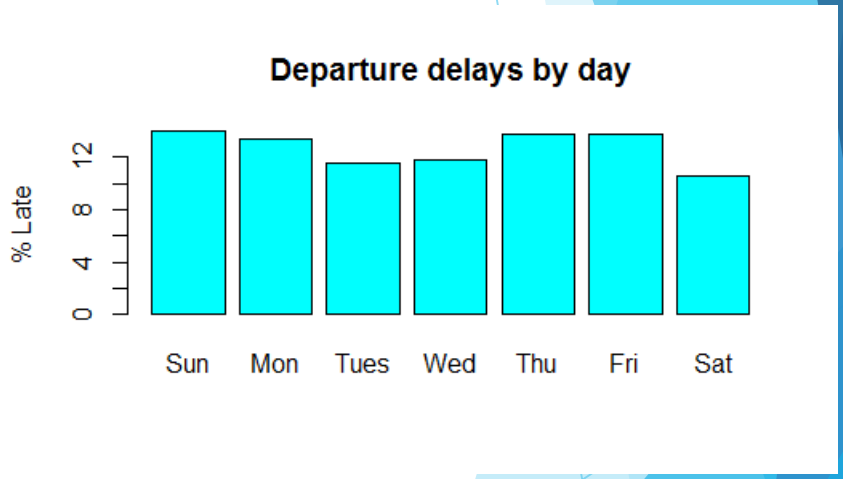
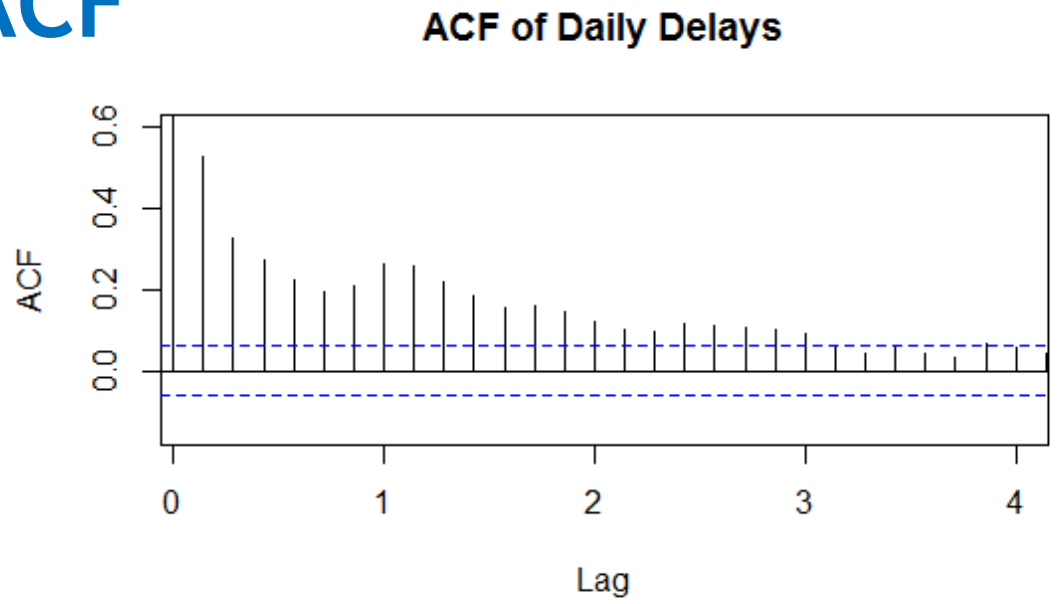
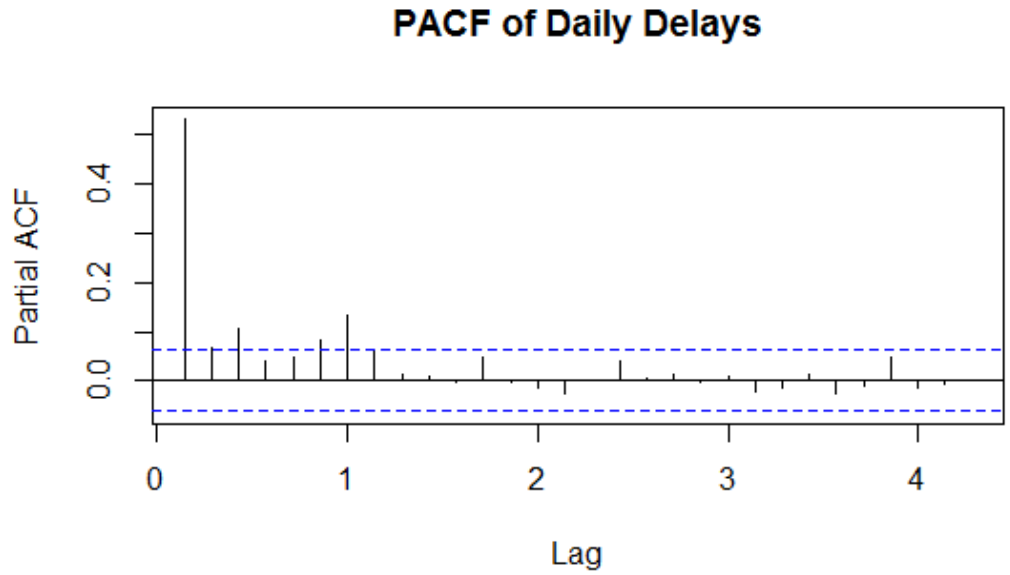
Weekly Cycle





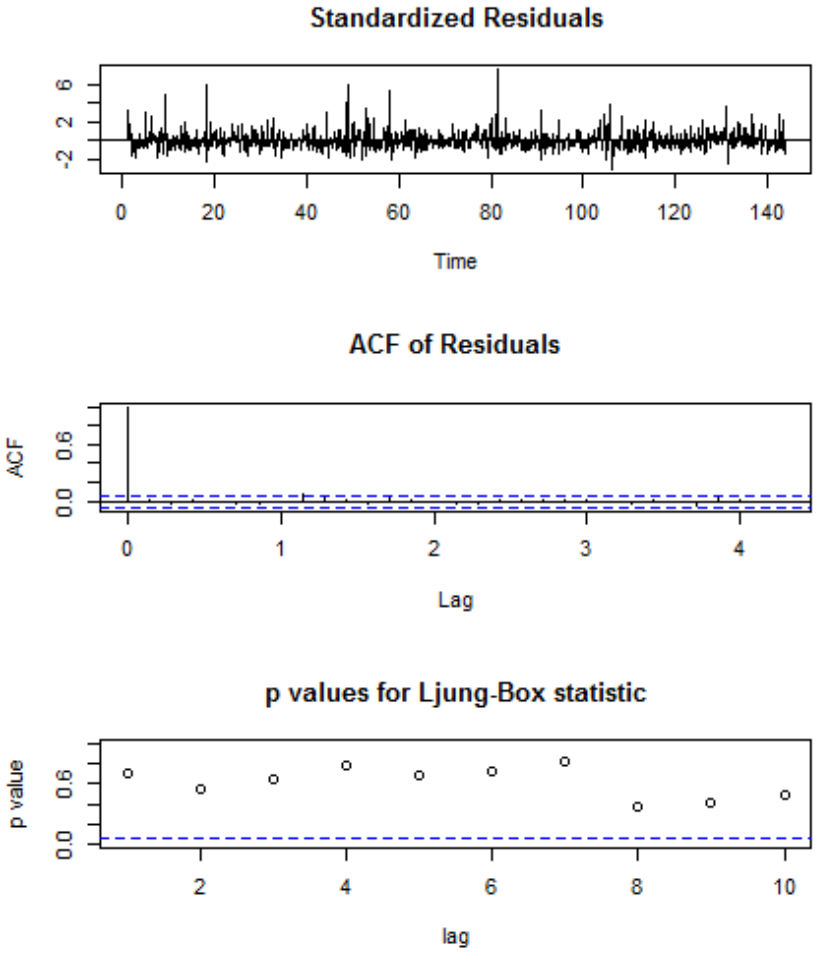
ACF/PACF

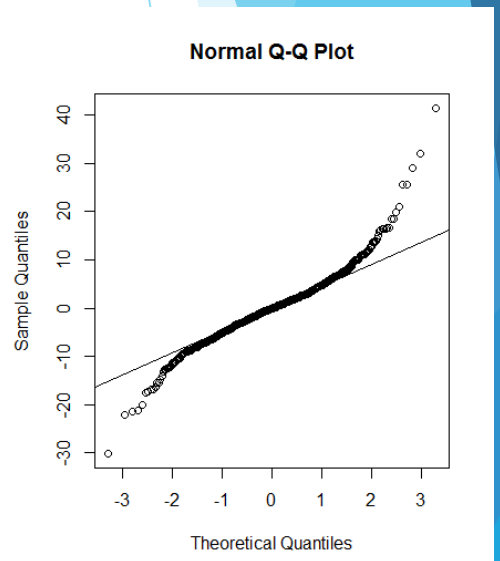

ACF of Daily Delays
ACF
0.0
0.2
0.4
0.6
0
1
2
3
4
Lag


PACF of Daily Delays
Partial ACF
0.0
0.2
0.4
0
1
2
3
4
Lag

Model Fitting

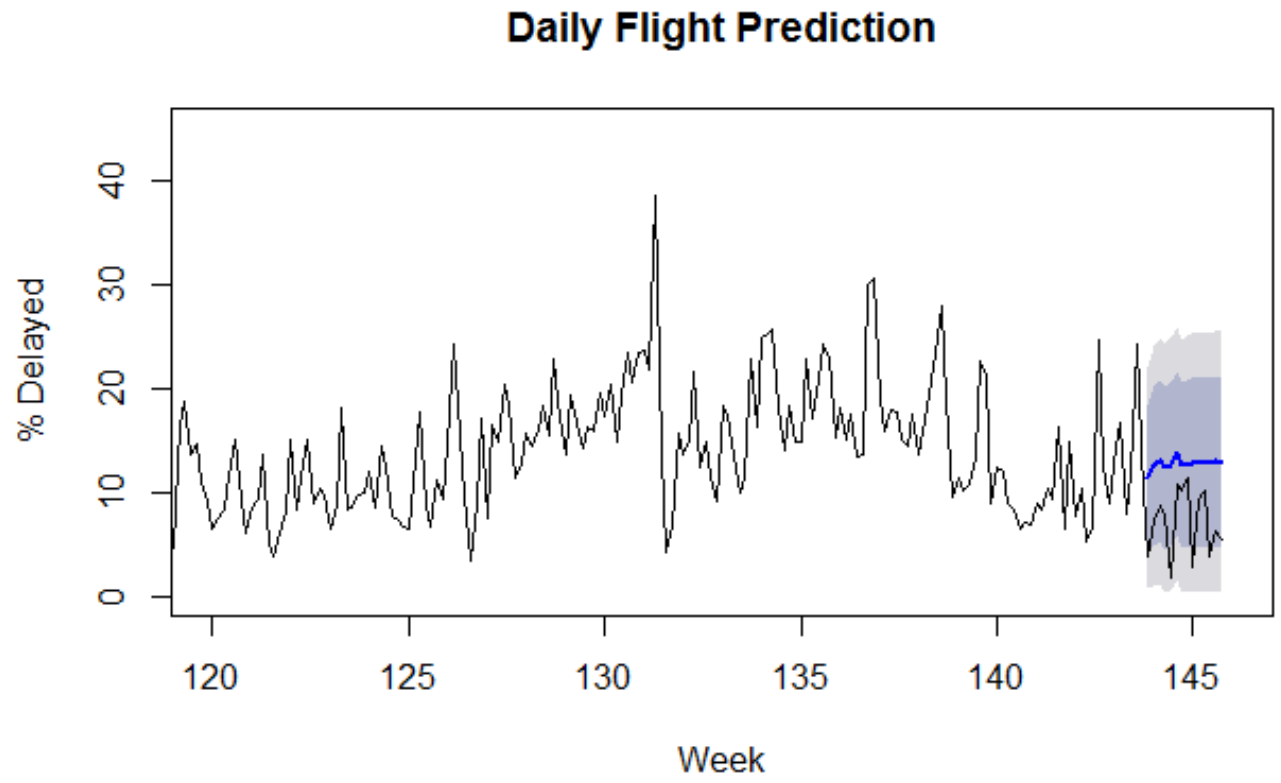
ARIMA Model	AIC	BIC
(2,0,1)(1,0,0)[7]	6,219.45	6,248.90
(1,0,1)(1,0,0)[7]	6,222.31	6,253.01
(2,0,2)(0,0,0)[7]	6,223.30	6,252.75
(1,1,1)(0,0,0)[7]	6,231.28	6,246.00
(1,0,0)(0,0,0)[7]	6,255.69	6,270.41
(1,1,0)(0,0,0)[7]	6,429.38	6,439.19



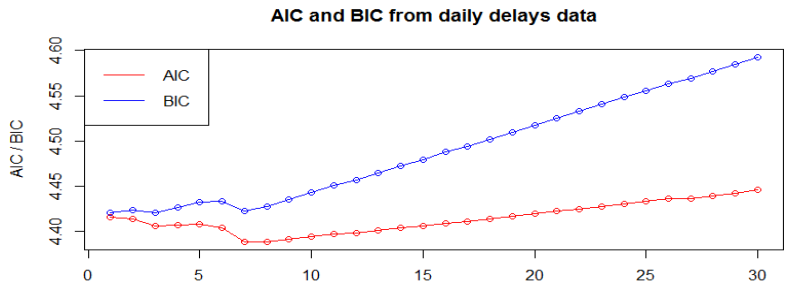


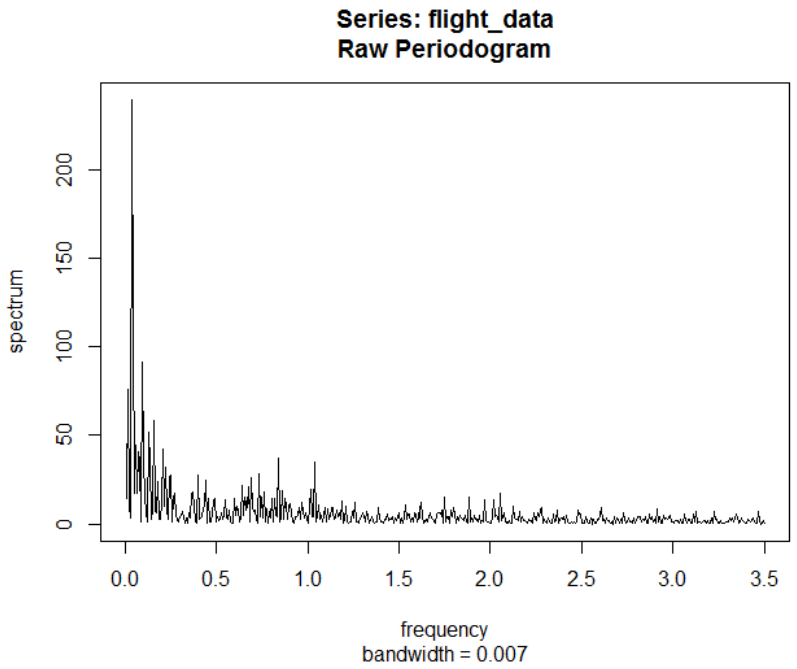
Prediction

Two-week forecast

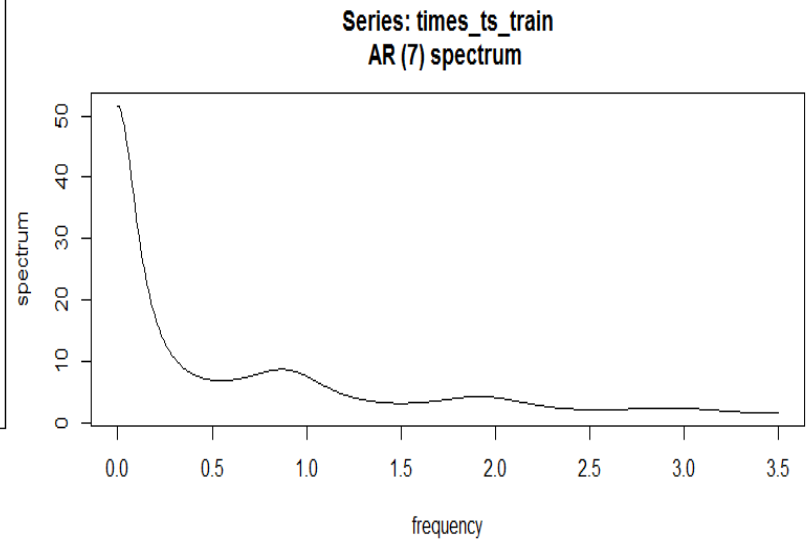


Frequency Analysis

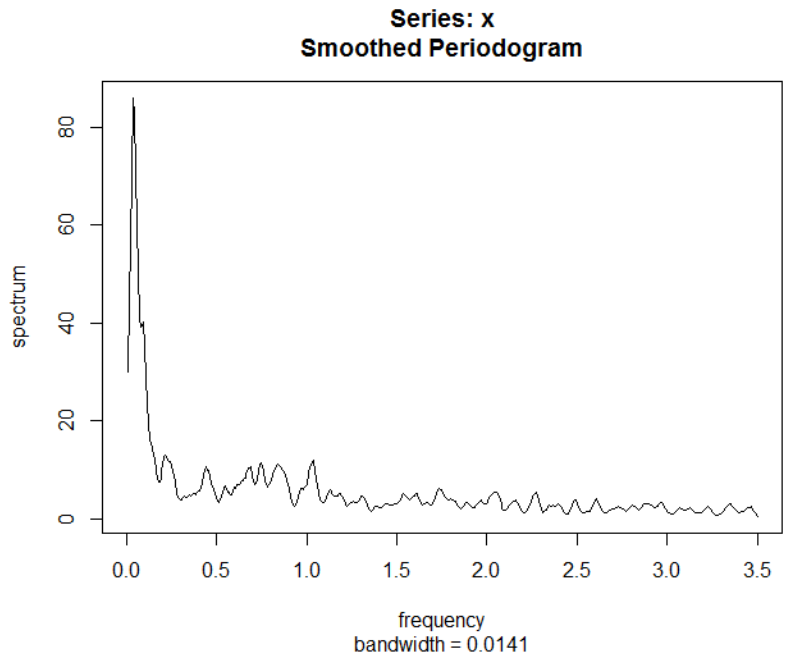




Original Periodogram



Smoothed AR(7) Periodogram



Smoothed with (2,0,2) Daniell Kernel

Next Steps

- Look at other potential covariates
  - Weather data
  - Total number of flights per day
- Analyze delays for other airports
- Pursue cut-point analysis
  - Target significant policy change dates