주별 요인들 지연효과 확인

```
load('../../refinedata/analysis/analysis_total_Fixed.rda')
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 3.6.3
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(FinCal)
```

```
## Warning: package 'FinCal' was built under R version 3.6.3
```

```
library(car)
```

```
## Warning: package 'car' was built under R version 3.6.3
```

```
## Loading required package: carData
```

```
##
## Attaching package: 'car'
```

```
## The following object is masked from 'package:dplyr':
##
##     recode
```

```
library(gvlma)
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.6.3
```

```
library(tidyr)
library(forecast)
```

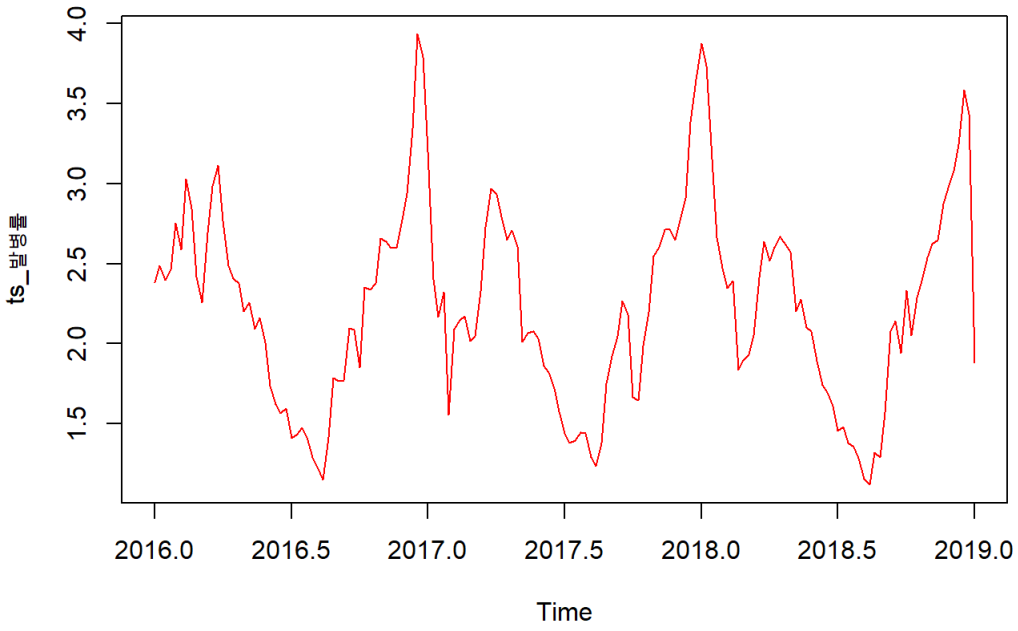
```
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```

```
n <- rep(1:157,each = 7)
analysis_total_Fixed$주 <- rep(n[1:1096], 17)
analysis_total_Fixed <- as.data.frame(analysis_total_Fixed)
analysis_total_week <- analysis_total_Fixed %>%
  group_by(주) %>%
  summarise(`평균기온(°C)` = mean(`평균기온(°C)`),
            `평균 풍속(m/s)` = mean(`평균 풍속(m/s)`),
            `평균 현지기압(hPa)` = mean(`평균 현지기압(hPa)`),
            `일강수량(mm)` = mean(`일강수량(mm)`),
            SO2 = geometric.mean(SO2),
            CO = geometric.mean(CO),
            O3 = geometric.mean(O3),
            NO2 = geometric.mean(NO2),
            PM10 = geometric.mean(PM10),
            PM25 = geometric.mean(PM25),
            발병률 = sum(발병률)
            )
```

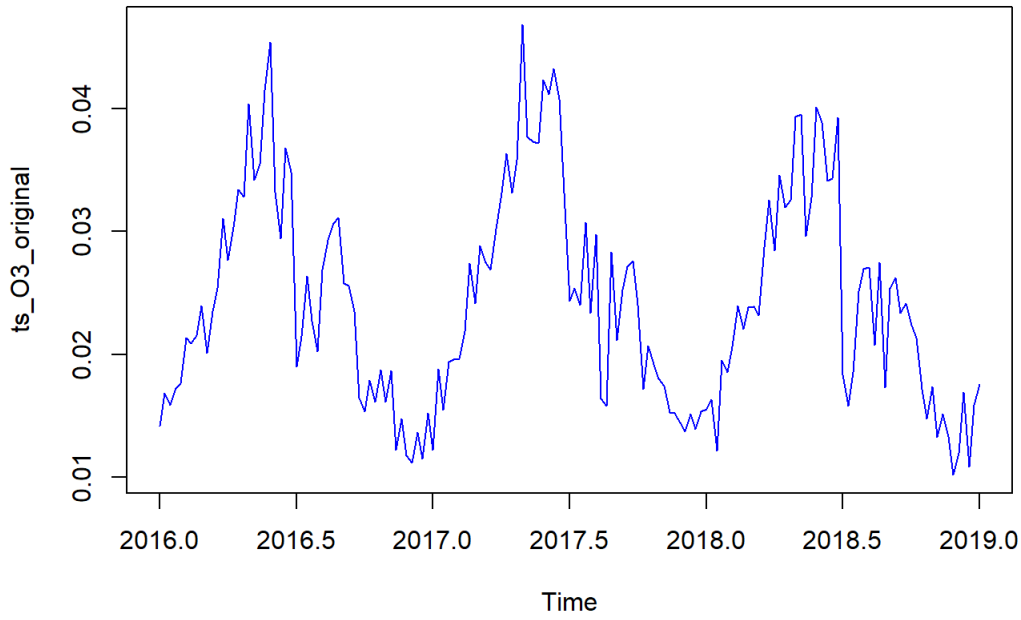
```
ts_발병률 <- ts(analysis_total_week$발병률, start = c(2016, 1), freq = 52)
```

```
ts_O3_original <- ts(lag(analysis_total_week$O3,0), start = c(2016, 1), freq = 52)#omnibus o
ts_O3 <- ts(lag(analysis_total_week$O3,30), start = c(2016, 1), freq = 52)#omnibus o
ts_NO2 <- ts(lag(analysis_total_week$NO2,0), start = c(2016, 1), freq = 52)#omnibus x
ts_CO <- ts(lag(analysis_total_week$CO,0), start = c(2016, 1), freq = 52)#omnibus o
ts_SO2 <- ts(lag(analysis_total_week$SO2,0), start = c(2016, 1), freq = 52)#omnibus x
ts_PM10 <- ts(lag(analysis_total_week$PM10,0), start = c(2016, 1), freq = 52)#omnibus x
ts_PM25 <- ts(lag(analysis_total_week$PM25,0), start = c(2016, 1), freq = 52)#omnibus x
ts_rain <- ts(lag(analysis_total_week$`일강수량(mm)`,25), start = c(2016, 1), freq = 52)#omnibus o
ts_temperature <- ts(lag(analysis_total_week$`평균기온(°C)`,0), start = c(2016, 1), freq = 52)#omnibus x
ts_air <- ts(lag(analysis_total_week$`평균 현지기압(hPa)`,1), start = c(2016, 1), freq = 52)#omnibus o
ts_wind <- ts(lag(analysis_total_week$`평균 풍속(m/s)`,36), start = c(2016, 1), freq = 52)#omnibus o
```

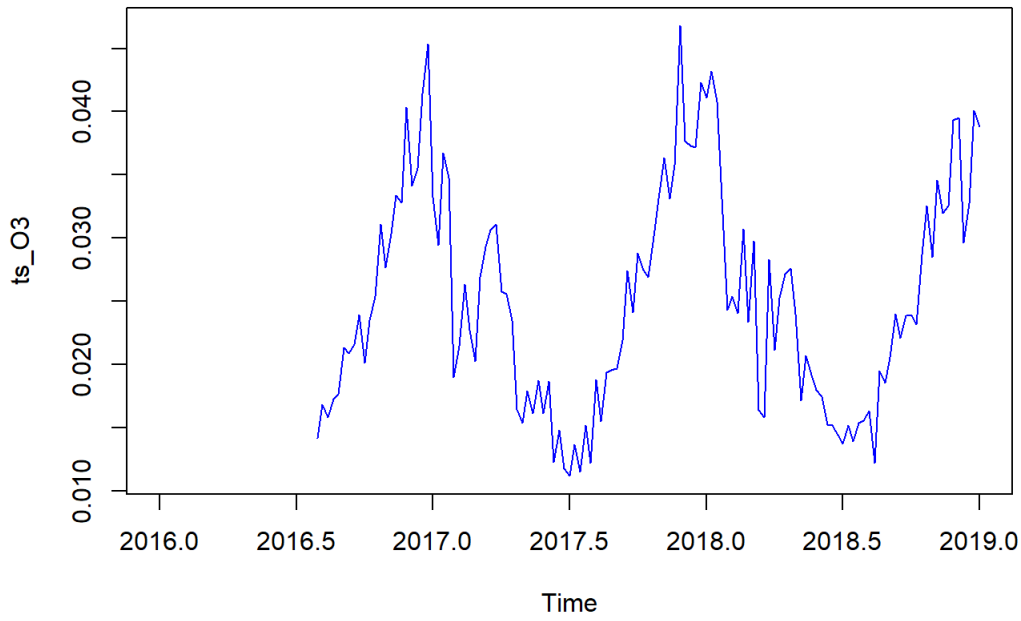
```
plot(ts_발병률,col='red')
```




```
plot(ts_O3_original,col='blue')
```




```
plot(ts_O3,col='blue')
```




```
fit <- lm( ts_발병률~ts_O3)
summary(fit)
```

```
##
## Call:
## lm(formula = ts_발병률 ~ ts_O3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.16521 -0.21479  0.00349  0.22954  0.98999
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.7437     0.1053   7.064 9.96e-11 ***
## ts_O3        59.3144     3.9561  14.993  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3871 on 125 degrees of freedom
##   (30 observations deleted due to missingness)
## Multiple R-squared:  0.6426, Adjusted R-squared:  0.6398
## F-statistic: 224.8 on 1 and 125 DF,  p-value: < 2.2e-16
```

```
fit <- lm( ts_발병률~ts_CO )
summary(fit)
```

```
##
## Call:
## lm(formula = ts_발병률 ~ ts_CO)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.03671 -0.30055 -0.05285  0.31676  1.07111
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.06087    0.18296  -0.333     0.74
## ts_CO        5.34007    0.41732  12.796   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.434 on 155 degrees of freedom
## Multiple R-squared:  0.5137, Adjusted R-squared:  0.5106
## F-statistic: 163.7 on 1 and 155 DF,  p-value: < 2.2e-16
```

```
fit <- lm( ts_발병률~ts_rain)
summary(fit)
```

```
##
## Call:
## lm(formula = ts_발병률 ~ ts_rain)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.14205 -0.49799 -0.00987  0.44414  1.59152
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.98490    0.06283  31.590  < 2e-16 ***
## ts_rain      0.06735    0.01141   5.906 2.89e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.579 on 130 degrees of freedom
##   (25 observations deleted due to missingness)
## Multiple R-squared:  0.2115, Adjusted R-squared:  0.2055
## F-statistic: 34.88 on 1 and 130 DF,  p-value: 2.891e-08
```

```
fit <- lm( ts_발병률~ts_air)
summary(fit)
```

```
##
## Call:
## lm(formula = ts_발병률 ~ ts_air)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.45670 -0.28549  0.00246  0.25188  1.30850
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -67.028329   5.077702  -13.20   <2e-16 ***
## ts_air        0.068836   0.005046   13.64   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4201 on 154 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.5472, Adjusted R-squared:  0.5442
## F-statistic: 186.1 on 1 and 154 DF,  p-value: < 2.2e-16
```

```
fit <- lm( ts_발병률~ts_wind)
summary(fit)
```

```
##
## Call:
## lm(formula = ts_발병률 ~ ts_wind)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.11009 -0.42418 -0.07008  0.41400  1.65168
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.3520     0.3261   4.146 6.38e-05 ***
## ts_wind       0.4351     0.1515   2.873  0.00482 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.6146 on 119 degrees of freedom
##   (36 observations deleted due to missingness)
## Multiple R-squared:  0.06486,    Adjusted R-squared:  0.057
## F-statistic: 8.253 on 1 and 119 DF,  p-value: 0.004819
```

```
fit <- lm( ts_발병률~ts_O3*ts_NO2*ts_CO+ts_SO2*ts_PM10+ts_air)
summary(fit)
```

```
##
## Call:
## lm(formula = ts_발병률 ~ ts_O3 * ts_NO2 * ts_CO + ts_SO2 * ts_PM10 +
##     ts_air)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.98420 -0.15454 -0.01793  0.19535  0.77672
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)        -2.483e+01  8.701e+00  -2.854  0.00513 **
## ts_O3              -4.599e-01  8.142e+01  -0.006  0.99550
## ts_NO2              5.909e+02  1.448e+02   4.082 8.28e-05 ***
## ts_CO              -9.012e+00  6.450e+00  -1.397  0.16501
## ts_SO2             -6.029e+02  2.772e+02  -2.175  0.03168 *
## ts_PM10            -1.528e-02  2.085e-02  -0.733  0.46523
## ts_air              2.648e-02  8.496e-03   3.117  0.00231 **
## ts_O3:ts_NO2       -1.616e+04  4.812e+03  -3.359  0.00106 **
## ts_O3:ts_CO         4.199e+02  2.248e+02   1.868  0.06432 .
## ts_NO2:ts_CO       -6.173e+02  3.154e+02  -1.957  0.05274 .
## ts_SO2:ts_PM10      8.429e+00  6.155e+00   1.369  0.17353
## ts_O3:ts_NO2:ts_CO  1.468e+04  1.000e+04   1.468  0.14492
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3159 on 115 degrees of freedom
##   (30 observations deleted due to missingness)
## Multiple R-squared:  0.781,  Adjusted R-squared:  0.7601
## F-statistic: 37.29 on 11 and 115 DF,  p-value: < 2.2e-16
```

```
gvlma(fit)
```

```
##
## Call:
## lm(formula = ts_발병률 ~ ts_O3 * ts_NO2 * ts_CO + ts_SO2 * ts_PM10 +
##     ts_air)
##
## Coefficients:
##        (Intercept)               ts_O3              ts_NO2               ts_CO
##         -2.483e+01          -4.599e-01           5.909e+02          -9.012e+00
##             ts_SO2              ts_PM10              ts_air        ts_O3:ts_NO2
##         -6.029e+02          -1.528e-02           2.648e-02          -1.616e+04
##        ts_O3:ts_CO        ts_NO2:ts_CO      ts_SO2:ts_PM10  ts_O3:ts_NO2:ts_CO
##          4.199e+02          -6.173e+02           8.429e+00           1.468e+04
##
##
## ASSESSMENT OF THE LINEAR MODEL ASSUMPTIONS
## USING THE GLOBAL TEST ON 4 DEGREES-OF-FREEDOM:
## Level of Significance =  0.05
##
## Call:
##  gvlma(x = fit)
##
##                       Value p-value                Decision
## Global Stat        2.7805933  0.5952 Assumptions acceptable.
## Skewness           0.0452192  0.8316 Assumptions acceptable.
## Kurtosis           2.4276615  0.1192 Assumptions acceptable.
## Link Function      0.0009089  0.9759 Assumptions acceptable.
## Heteroscedasticity 0.3068037  0.5796 Assumptions acceptable.
```