

Seasonality in Seoul: Multilinear Modeling with Kth Differences and Fixed Effects

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Abstract

In this analysis we explore which factors primarily drive short-run fluctuations as they depend on Seasonality. We examine the changes in temperature as well as the demand for bike rentals in Seoul, South Korea. We conducted multiple linear regression using weather predictors from 2018 hourly data. We found that the marginal effect of solar radiation on temperature change was most significant from 8:00 PM to 9:00 PM. Additionally, the marginal effects of solar radiation had a negative affect on bike demand; however, the interaction effects during peak demand times (rush hour times, for example), proved to be significantly positive.

1 Problem and Motivation

We are examining data from Seoul, Korea, to understand how weather and time influence bike sharing and temperature changes in the city. This data, which includes details about whether conditions and bike rentals over 8,456 days, is crucial for urban planning and environmental studies. Our goal is to identify which factors most affect bike usage and temperature fluctuations. This information is important because it helps city planners make better decisions about transportation and infrastructure, especially as cities around the world are focusing more on sustainable living and environment challenges. By understanding these patterns, we can help make cities like Seoul more efficient and responsive to both their climate and the needs of their residents.

1.1 Data Description

In this analysis we used data from UC Irvine's Machine Learning's Repository. We accessed [Seoul Bike Sharing Data](#), which contains 8,760 rows of hourly data pertaining to the corresponding amount of rented bikes (bike demand) in Seoul, Korea. 8,465 rows are considered "functioning days," where bikes are able to be rented. In order to consider our problem of interest, we will only consider these 8,465 rows to model the bike demand in Seoul. This data set also contains corresponding data for the respective temperature (celcius), humidity (%), wind speed (m/s), visibility (10m), dew point temperature (celcius), solar radiation (MJ/m^2), rainfall precipitation (mm), snowfall precipitation (cm), seasons (Winter, Spring, Summer, Autumn), and an indicator determining whether the corresponding day is a holiday.

We will use these variables along with a subset of interaction terms which will be determined by elastic net regression to include in our models.

1.2 Questions of Interest

1. Can we use factors in weather and time to determine the best predictors of short-run for fluctuations in temperature for the climate in Seoul, Korea?
2. Can we determine which weather and time factors affect the bike sharing demand the most in Seoul, Korea?

If there are significant predictive factors, which one has the largest influence?

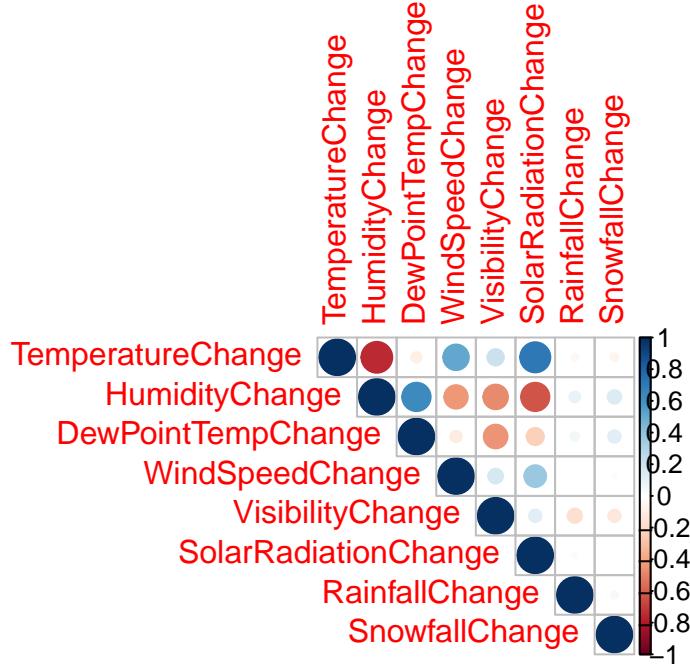
Regression Methods & Model Determination

We decided to run a first differences model to model the fluctuations in short-run temperature. where $\Delta \text{Temperature}_{st} = \text{Temperature}_{st} - \text{Temperature}_{t-5}$. We found that the optimal choice of k was 5 (see A.0 for optimal selection process on k).

Thus, we wish to estimate,

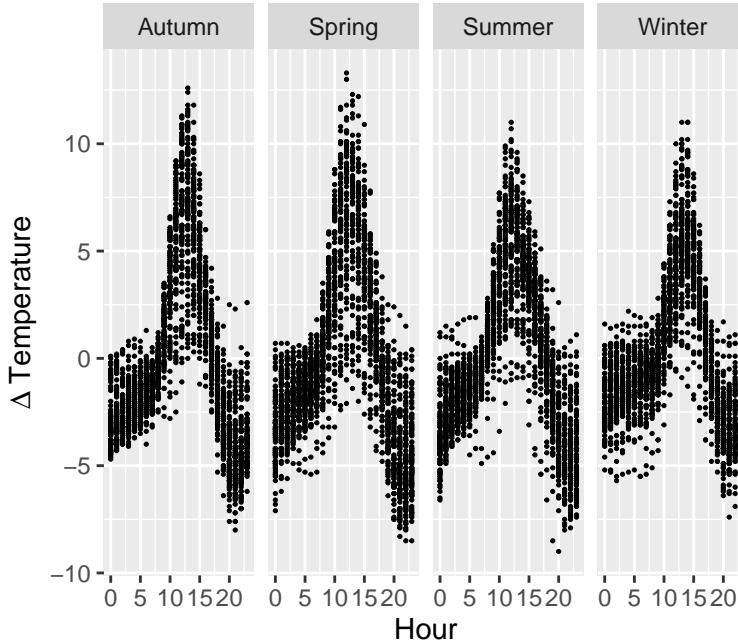
$$(1) \Delta \text{Temperature}_{st} = \beta_1 \Delta \text{Humidity}_{st} + \beta_2 \Delta \text{DewPointTemp}_{st} + \beta_3 \Delta \text{WindSpeed}_{st} + \beta_4 \Delta \text{SolarRadiation}_{st} + \beta_5 \Delta \text{Rainfall}_{st} + \beta_6 \Delta \text{Snowfall}_{st} + \Delta \beta_7 I(\text{Hour}_t = 1) + \dots + \Delta \beta_{29} I(\text{Hour}_t = 23) + \Delta \eta_{st}$$

Where $\Delta \text{Temperature}_{st} = \text{Temperature}_{st} - \text{Temperature}_{t-5}$



With our basic multilinear model (1) the correlation matrix indicates that there may be some potential multicollinearity between $\text{DewPointTempChange}_{st}$ and $\text{HumidityChange}_{st}$. For the most part, the indicators look good with changes in $\text{SolarRadiation}_{st}$ potentially affecting fluctuations in temperature the most.

Change in Temperature Across Hours of the Day by Season



According to our model, changes in temperature not only depend on temperature but also on season. While there are some general linear trends across some ranges of hours, the non-linearity of the hours in general with respect to temperature change led us to include indicators for each hour as specified in Model (1) using Hour 0 (12:00 a.m.) as our base year.

According to the model diagnostics [A.1.0](#), the linearity assumption seems to be met (see [A.1](#) for added variable plots). Additionally, though there were some points moving the model away from homoskedasticity the $\sqrt{|\text{Standardized residuals}|}$ vs. Fitted values Plot shows that homoskedasticity is roughly met. However, the normality assumption was blatantly violated so we considered adding interaction terms.

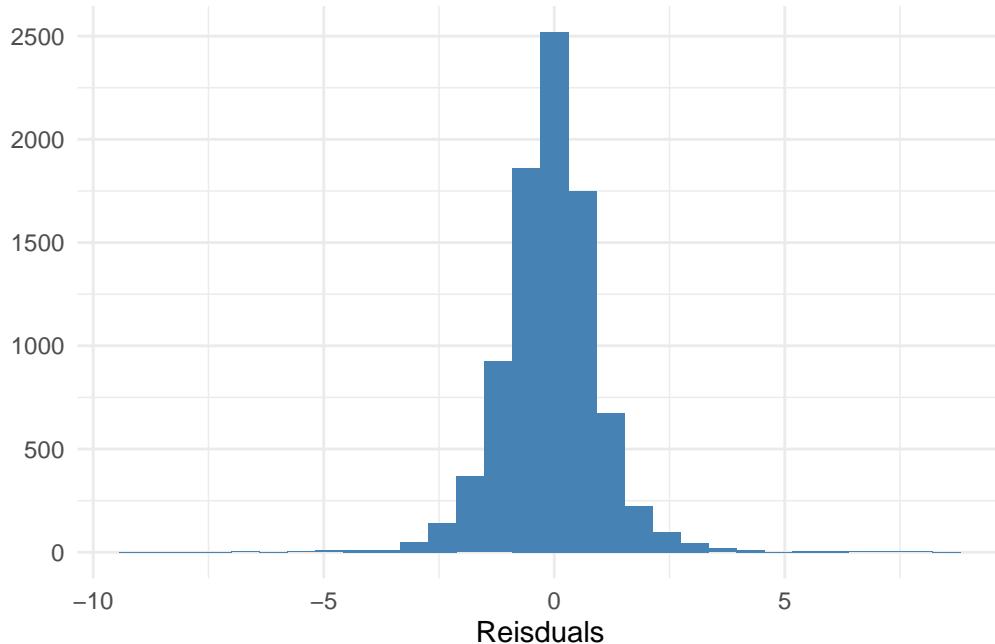
We used elastic net regression to select interaction terms to see if the influential points (and thus, Normality) could be remedied. We used elastic net regression over lasso regression due to the potential collinearity between $\text{HumidityChange}_{st}$ and other weather effects. (See [A.2.0](#) for model output)

However, even with selected interaction terms included, Normality did not drastically improve (see [A.2.1](#) for QQ-Plot).

We considered transforming the model (A.3) to better meet Normality and somewhat homoskedasticity. However, due to the nature of our X variable matrix—since each independent variable is a change in a variable, we thus had to shift the entire vector of that corresponding variable in order to derive optimal transformations. Hence, interpreting the any transformations we would make would prove difficult and impractical.

However, with large sample size ($n = 8740$), Normality could be appealed to. The residuals do appear to be Normal, though extreme values cause deviations from Normality at the tails as seen in the QQ-plot. We considered alternatives to meeting the assumptions such as linear robust regression to reduce the weights of outliers. One alternative is further discussed in A.4, where we considered estimating a model for each season.

Histogram of Residuals from Elastic Net Regression



Since the histogram of the residuals appears Normal, aside from the extreme values at the tails, we will appeal to Normality due to the large sample size.

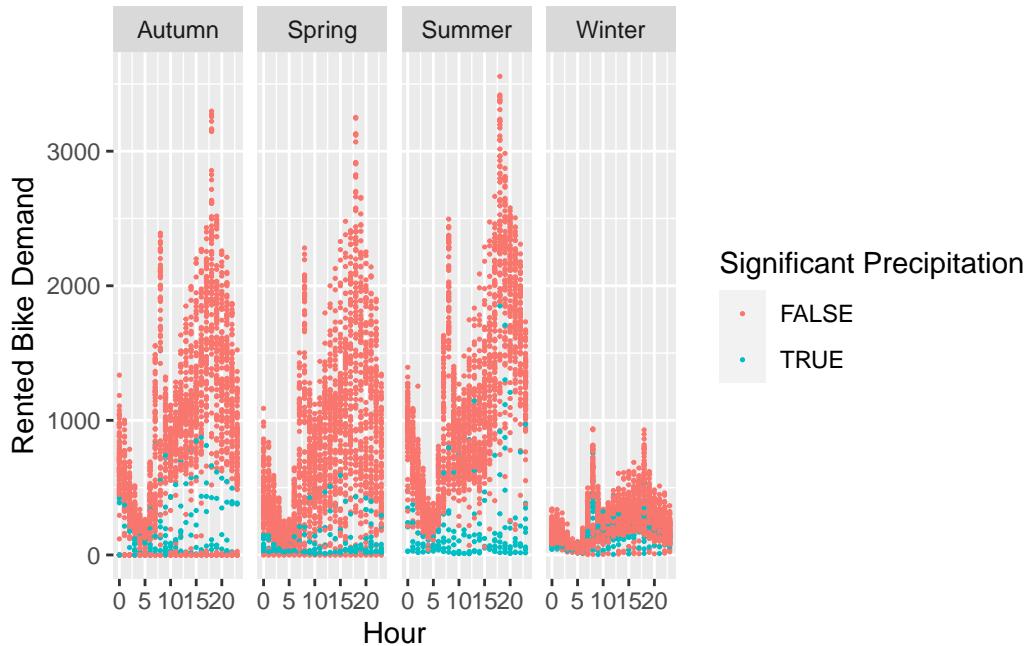
Additionally, diagnostics (A.2.1) show that there no unduly outliers, and linearity and homoskedasticity are met.

Thus, using our elastic regression results, we will modify Model (1) to include the following interaction terms. We made sure to include the lower-order regression coefficients for the coefficients that elastic net regression left out when elastic net included interaction terms involving a lower-order term. We are interested in estimating the most assailant factors (A.5). See A.6 for the full model.

$$(2) \Delta \text{Temperature}_{st} = \dots + \beta_5 \Delta \text{SolarRadiation}_{st} + \dots + \beta_{32} \Delta \text{Humidity}_{st} \Delta \text{SolarRadiation}_{st} + \dots + \beta_{39} \Delta \text{SolarRadiation}_{st} \Delta \text{Rainfall}_{st} + \dots + \sum_{n=1}^{23} \beta_{131+n} \Delta \text{SolarRadiation}_{st} \Delta I(\text{Hour}_t = n) + \dots + \Delta \eta_{st}$$

$$\Delta \eta_{st} \stackrel{iid}{\sim} N(0, \sigma^2)$$

Similar to our model for temperature, we have unobserved seasonal effects in ϵ . Instead of using a k th-difference approach, we will use a fixed effects models to include the seasonal effects for $s - 1$ (3) seasons to obtain unbiased estimates. We will use Spring as our base season. However, exploratory data analysis has shown that current bike demand is strongly dependent on the bike demand from previous hours. Hence, in order to include seasonal dummy variables, we also need to include a set of lagged effects (δ_p) conditional on Season on $\text{RentedBikeCount}_{st} \quad \forall s \in \text{Seasons}, s \neq \text{Spring}$ to adjust for the time dependency. (See A.7 to see how we chose our set of lagged effects).



Preliminary EDA shows that precipitation (rain and snow) will have a significant negative effect on rented bike demand.

Hence, we will first estimate the hourly demand for rented bikes in Seoul with the following model (see A.8.0 for full model description),

$$(3) \text{RentedBikeCount}_{st} = \beta_0 + \beta_1 \text{Humidity}_{st} + \beta_2 \text{Temperature}_{st} + \dots + \beta_{33} I(\text{Season}_s = \text{Winter}) + \beta_{34} I(\text{Season}_s = \text{Summer}) + \beta_{35} I(\text{Season}_s = \text{Autumn}) + \delta_1 \text{RentedBikeCount}_{st-1} + \delta_{23} \text{RentedBikeCount}_{st-23} + \sum_{p=1}^9 \delta_p + \eta_{st}$$

$$\eta_{st} \stackrel{iid}{\sim} N(0, \sigma^2)$$

Diagnostics for fitting this model to this data indicate that linearity is met A.8. Additionally, due to the large sample size, the leverage plot also indicates that there were not any influential points. However, since homoskedasticity was blatantly violated, especially for fitted values < 1000, we modified the model by including interaction terms.

We ran an elastic net regression model to control for collinearity. (See model A.9 for model output and diagnostics). Since $\text{RentedBikeCount}_{st}$ is likely poisson-distributed, we considered log-transforming the response, but diagnostics show that model assumptions did not improve A.10.0.

However, we noticed non-linear trends in Humidity_{st} against $\text{RentedBikeCount}_{st}$ and introduced categorical transformations A.10.1. Using an inverse response plot, we also found that we could optimally transform Visibility_{st} using a *log* transformation A.10.2. Lastly, we transformed WindSpeed_{st} since we noticed that extreme values were causing some non-linearity between the response. Hence, we introduced a categorical variable called ExtremeWind_{st} to capture this effect A.10.3.

Using an elastic net regression method to determine once again the appropriate coefficients to include A.11, we have determined our final model for measuring the demand for rented bikes in Seoul,

$$(4) \text{RentedBikeCount}_{st} = \beta_0 + \dots + \beta_{11} \text{Rainfall}_{st} + \dots + \beta_{17} \text{SolarRadiation}_{st} + \beta_{19} I(\text{Season}_s = \text{Winter}) + \beta_{20} I(\text{Season}_s = \text{Summer}) + \beta_{21} I(\text{Season}_s = \text{Autumn}) + \dots + \beta_{240} \text{SolarRadiation}_{st} I(\text{Hour}_t = 8) + \beta_{241} \text{SolarRadiation}_{st} I(\text{Hour}_t = 19) + \beta_{242} \text{Rainfall}_{st} I(\text{Hour}_t = 9) + \beta_{243} \text{Rainfall}_{st} I(\text{Hour}_t = 13) + \beta_{244} \text{Rainfall}_{st} I(\text{Hour}_t = 17) + \beta_{245} \text{Rainfall}_{st} I(\text{Hour}_t = 19) + \beta_{246} \text{Rainfall}_{st} I(\text{Hour}_t = 20) + \dots + \eta_{st}$$

$$\eta_{st} \stackrel{iid}{\sim} N(0, \sigma^2)$$

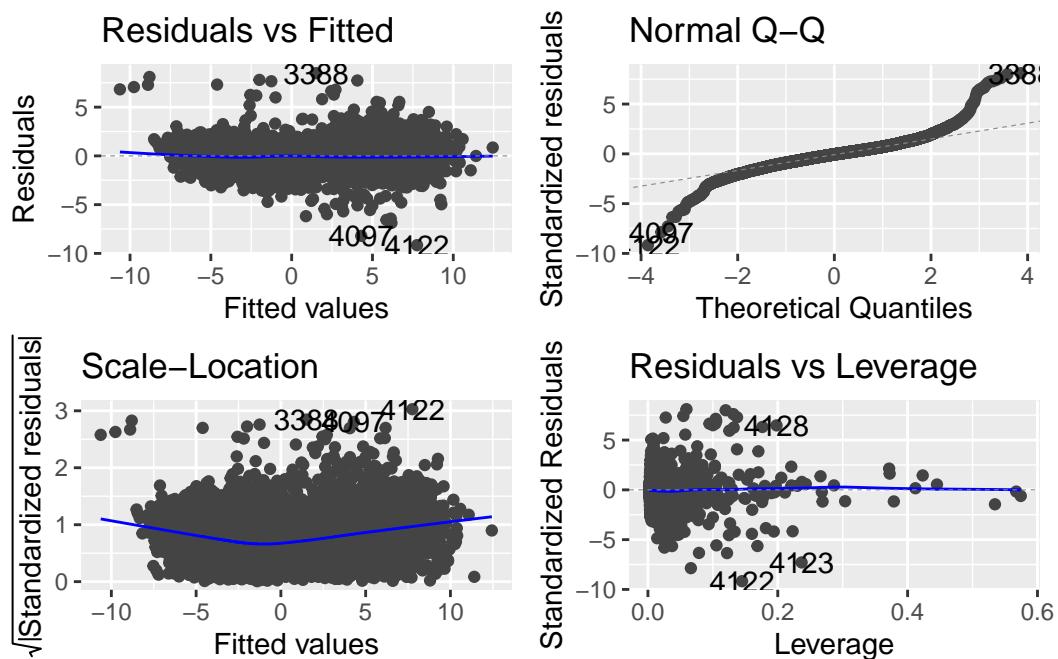
(The full model is referenced in A.13, only assaultant terms are included for simplicity.

Model 2 (Temperature Change) - Analyses, Results, and Interpretation

Analysis Details

Diagnostic Checks

```
autoplot(seoul.elastic)
```



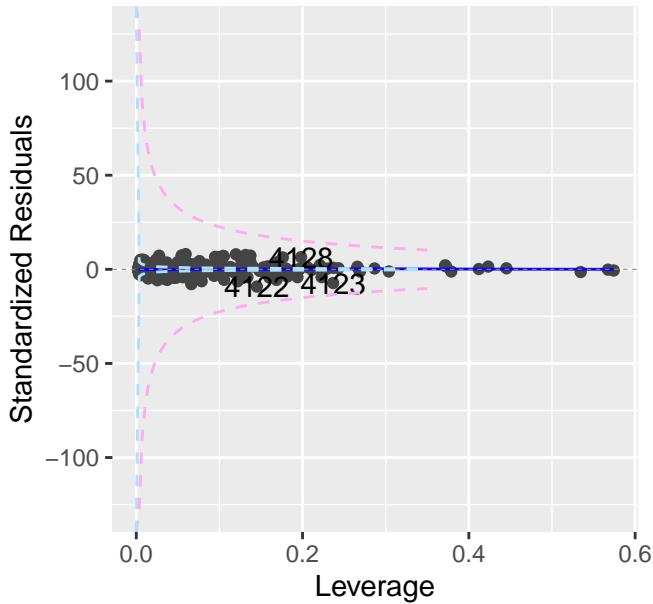
```
shapiro.test(sample(seoul.elastic$residuals, 5000))
```

Shapiro-Wilk normality test

```
data: sample(seoul.elastic$residuals, 5000)
W = 0.93786, p-value < 2.2e-16
```

```
show_leverage(seoul.elastic)
```

Residuals vs Leverage



In the residuals vs. fitted values plot, there is a straight blue curve for most of the fitted values with the vast majority of the residuals centered around the horizontal line at $y = 0$. Therefore, we think that the linearity assumption is met.

From the normal Q-Q plot and the Shapiro-Wilk normality test above, we are able to see that the standardized residuals on the tails do not fall on the dashed line, and with a p-value less than $2.2\text{e-}16$ which is extremely small and less than the significance level of $\alpha = 0.05$, we reject the null hypothesis, and there is sufficient evidence to conclude that the residuals are not normally distributed.

In the scale-location plot, we can see a straight and horizontal blue curve for most of the fitted values. Even though there is a slight curvature in the blue line shown in the plot, overall, I think that the homoscedasticity assumption is met.

From the residuals vs. leverage plots, we are able to see that none of the standardized residuals falls outside the 0.5 Cook's distance thresholds. Therefore, we can conclude that there is no unduly influential points.

Based on the plots above, we conclude that most of the assumptions are met, except that we observed that the assumption of normality in the residuals of our multiple linear regression model is not fully met. However, it is important to note that with large datasets, such as ours, the central limit theorem suggests that the sampling distribution of the regression coefficients will tend to be normally distributed, even if the residuals are not. This implies

that the violation of the normality assumption may not substantially affect the validity of our inferential statistics, like confidence intervals and hypothesis tests.

Inferential Statistics

Reduced Model Test - Elastic Net Model with Solar Radiation Factors vs. without Solar Radiation Factors

```
sr.factors = model.factors[model.factors %>% str_detect("SolarRadiation")]

seoul.elastic.reduced.factors = setdiff(model.factors, sr.factors)

seoul.elastic.reduced = lm(TemperatureChange ~ 0 + .,
                           seoul.temp[c(seoul.elastic.reduced.factors, "TemperatureChange")])

# anova(seoul.elastic.reduced, seoul.elastic)
```

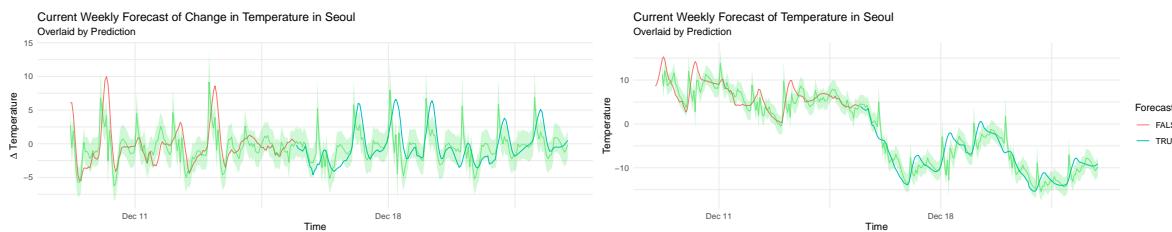
95% Confidence Interval of β_5 for Solar Radiation Change

```
conf_ints <- confint(seoul.elastic, level = 0.95)
conf_ints['SolarRadiationChange', ]
```

2.5 %	97.5 %
0.8726519	1.0023804

Holding all else constant, We are 95% confident that the true estimated average temperature change in Seoul will be between 0.8726519 and 1.0023804 Celsius when additional one MJ/m^2 increase in solar radiation change. The 95% confidence interval of β_5 for solar radiation change does not include zero. It suggests that the effect of solar radiation change on the average temperature change is statistically significant. In other words, there is a significant association between these variables.

95% Prediction Interval (see A.15 for API code/data retrieval)



Model 4 (Bike Sharing Demand) - Analyses, Results, and Interpretation

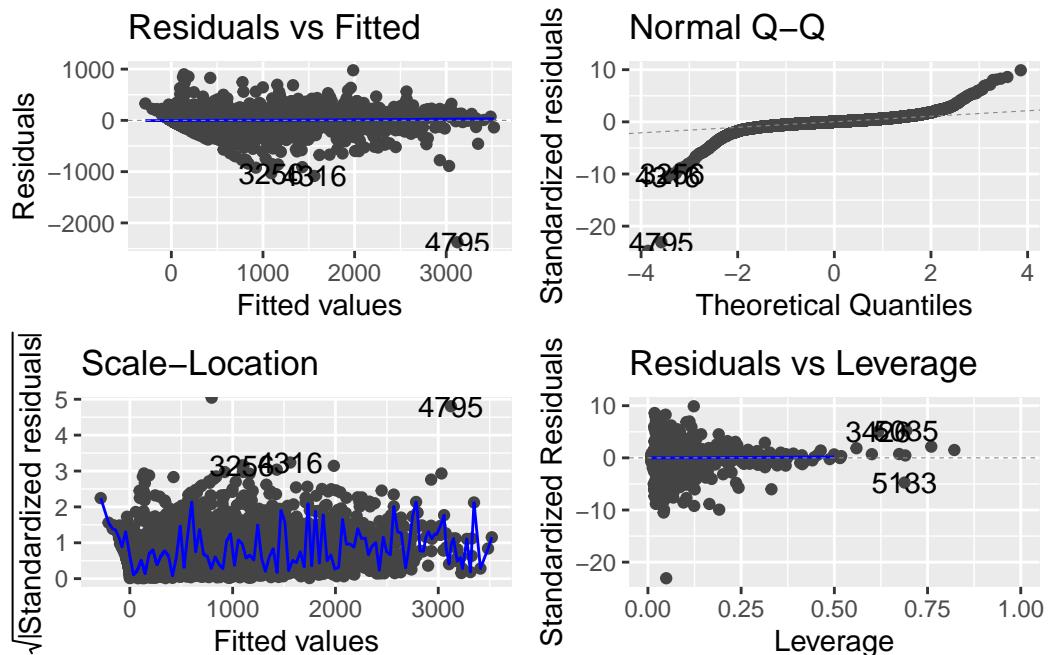
Analysis Details

Diagnostic Checks

```
autoplot(seoul.bike.elastic)
```

Warning: Removed 1 rows containing missing values (`geom_point()`).

Warning: Removed 13 rows containing missing values (`geom_line()`).



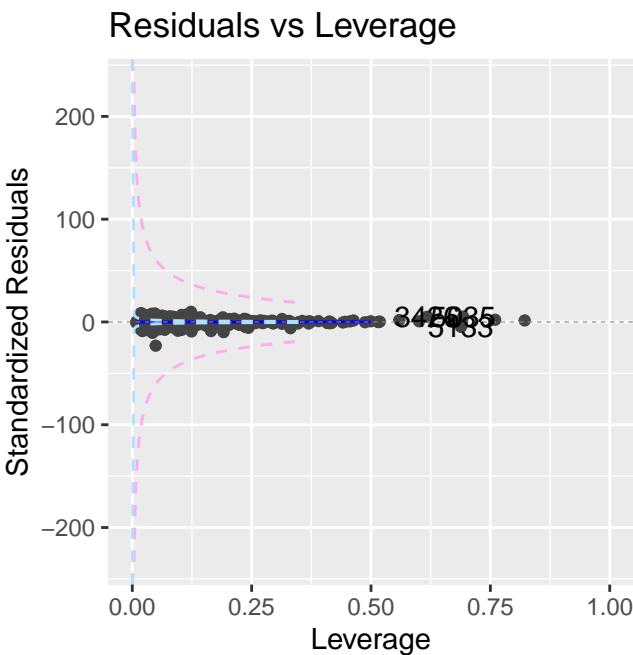
```
shapiro.test(sample(seoul.bike.elastic$residuals, 5000))
```

Shapiro-Wilk normality test

```
data: sample(seoul.bike.elastic$residuals, 5000)
W = 0.72604, p-value < 2.2e-16
```

```
show_leverage(seoul.bike.elastic)
```

Warning: Removed 1 rows containing missing values (`geom_point()`).
Removed 13 rows containing missing values (`geom_line()`).



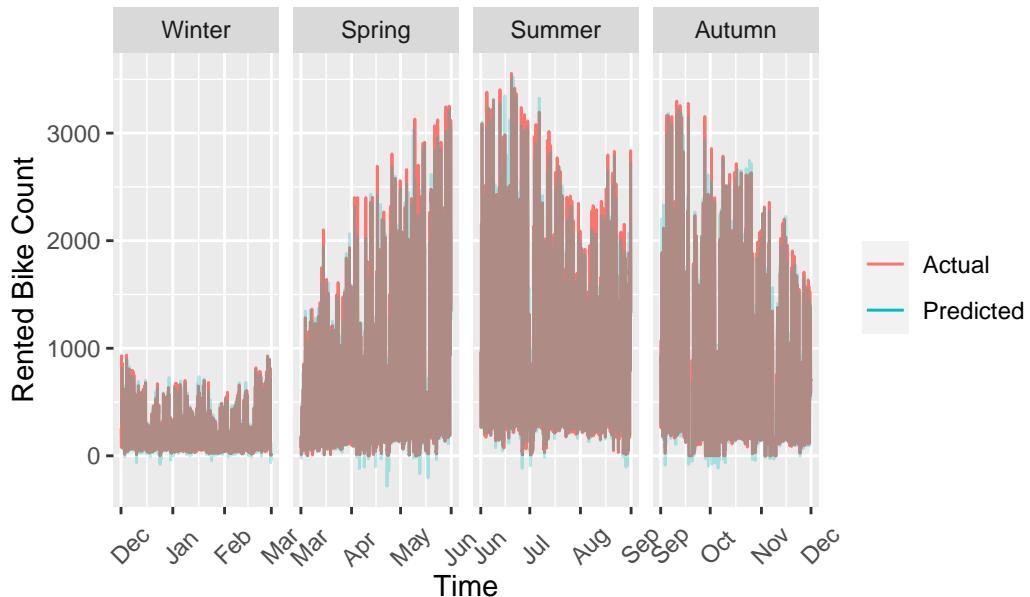
95% Confidence Interval of β_5 for Solar Radiation Change

```
conf_ints <- confint(seoul.bike.elastic, level = 0.95)

solar_radiation_ci <- conf_ints['SolarRadiationXHour19', ]
print(solar_radiation_ci)
```

2.5 % 97.5 %
598.5064 805.8327

Predicted Bike Demand in Seoul Over Time



APPENDIX

A.0

Selection Process for Optimal Choice of k

Temperature is highly dependent on the temperature from the hour before ($t - 1$):
 $\frac{\text{Cov}(\text{Temperature}_t, \text{Temperature}_{t-1})}{\text{Var}(\text{Temperature}_t)} = 0.9968$ (which is significant).

Since we have hourly data, running a first difference regression model will, though eliminate the dependency on the value from $t - 1$, may also leave the dependency from $t - 2, \dots, t - (k - 1)$ left over. If $\Delta \text{Temperature}_t = \text{Temperature}_t - \text{Temperature}_{t-k}$, We will find the k (the k th difference) such that there is no longer a direct dependency between $\Delta \text{Temperature}_t$ and $\Delta \text{Temperature}_{t-k}$. In other words, We want to find the smallest possible k such that $\text{cov}(\Delta \text{Temperature}_t, \Delta \text{Temperature}_{t-k}) = 0$.

We want k as small as possible because we want as much data for our model: Our belief is that short-run fluctuations in temperature can be determined by other short-run changes in other factors. Hence, the smaller k is, the better predictions we can make about the hour t . If we wanted to parse out a long-run effect, we would aggregate on a time period and regress over that interval. However, for the purposes of our research question, we need to be informed the most about what is happening in the short-run.

Running a k th difference regression model where $\Delta\text{Temperature}_t = \text{Temperature}_t - \text{Temperature}_{t-k}$ we can find a sufficient k by regressing $\Delta\text{Temperature}_{t-1}$ on $\Delta\text{Temperature}_{t-k^*}$, where k^* is the proposed value of k . We will choose $k = k^*$ when the regression coefficient becomes non-significant. This (non-coincidentally) happens as the regression coefficient approaches 0, or as $\Delta\text{Temperature}_t$ becomes less and less dependent of the $\Delta\text{Temperature}$ from k^* hours ago.

The optimal choice of k will lead us to run a k th difference regression model where $\Delta\text{Temperature}_t = \text{Temperature}_t - \text{Temperature}_{t-k}$.

Optimal choice of k :

```
ks = c()
alpha = 0.1
for(k in 1:100){
  k.change = seoul$Temperature - lag(seoul$Temperature, n = 1)
  k.lm = lm(k.change ~ lag(k.change, n = k))
  k.p = summary(k.lm)$coefficients[, "Pr(>|t|)"] [2]
  if(k.p > alpha){
    ks = c(ks, k)
  }
}

ks
```

```
[1] 5 19 29 43 53 67 77 91
```

Hence, we chose $k = 5$

We also hypothesized that since there are seasonal effects that are unobservable in our data set, the error term, ϵ is composed of a season-specific error term, α_s , and everything else that may affect fluctuations in temperature that varies by time period (t) and the season, which aren't possible to explicitly include in the model. Hence, $\epsilon_{st} = \alpha_s + \eta_{st}$. Let s denote the season and t denote time. For our data set-specific purposes, we will seek to understand how Temperature_{st} changes with respect to each season and hour (t).

Hence, with highly dependent time series data, we will resort to using a k th-differences regression model to model the short-run fluctuation in temperature where $k = 5$. In other words, we are going to try to see how temperature changes every five hours and see which factors affect those changes the most.

Hence, for our basic multivariate regression model (w/o interaction terms), if

$$\text{Temperature}_{st} = \beta_0 + \beta_1 \text{Humidity}_{st} + \beta_2 \text{DewPointTemp}_{st} + \beta_3 \text{WindSpeed}_{st} + \beta_4 \text{SolarRadiation}_{st} + \beta_5 \text{Rainfall}_{st} + \beta_6 \text{Snowfall}_{st} + \beta_7 I(\text{Hour}_t = 1) + \dots + \beta_{29} I(\text{Hour}_t = 23) + \alpha_s + \eta_{st}$$

Then,

$$\text{Temperature}_{st-5} = \beta_0 + \beta_1 \text{Humidity}_{st-5} + \beta_2 \text{DewPointTemp}_{st-5} + \beta_3 \text{WindSpeed}_{st-5} + \beta_4 \text{SolarRadiation}_{st-5} + \beta_5 \text{Rainfall}_{st-5} + \beta_6 \text{Snowfall}_{st-5} + \beta_7 I(\text{Hour}_{t-5} = 1) + \dots + \beta_{29} I(\text{Hour}_{t-5} = 23) + \alpha_s + \eta_{st-5}$$

Thus, we wish to estimate,

$$(1) \Delta \text{Temperature}_{st} = \beta_1 \Delta \text{Humidity}_{st} + \beta_2 \Delta \text{DewPointTemp}_{st} + \beta_3 \Delta \text{WindSpeed}_{st} + \beta_4 \Delta \text{SolarRadiation}_{st} + \beta_5 \Delta \text{Rainfall}_{st} + \beta_6 \Delta \text{Snowfall}_{st} + \Delta \beta_7 I(\text{Hour}_t = 1) + \dots + \Delta \beta_{29} I(\text{Hour}_t = 23) + \Delta \eta_{st}$$

A.1.0

Regression output and diagnostics for Model (1)

```
seoul.lm = lm(TemperatureChange ~ 0 + ., data=seoul.temp[unique(seoul.change)])
summary(seoul.lm)
```

Call:

```
lm(formula = TemperatureChange ~ 0 + ., data = seoul.temp[unique(seoul.change)])
```

Residuals:

Min	1Q	Median	3Q	Max
-9.9593	-0.5910	0.0285	0.6114	11.6173

Coefficients:

		Estimate	Std. Error	t value	Pr(> t)
HumidityChange		-1.439e-01	1.854e-03	-77.608	< 2e-16 ***
DewPointTempChange		5.144e-01	7.553e-03	68.099	< 2e-16 ***
WindSpeedChange		6.783e-02	1.375e-02	4.932	8.30e-07 ***
VisibilityChange		-3.087e-04	3.525e-05	-8.759	< 2e-16 ***
SolarRadiationChange		1.091e+00	2.495e-02	43.712	< 2e-16 ***
RainfallChange		6.186e-03	8.905e-03	0.695	0.48729
SnowfallChange		2.268e-01	4.329e-02	5.240	1.65e-07 ***
Hour1Change		-1.645e-01	1.256e-01	-1.310	0.19034
Hour2Change		-3.219e-01	1.526e-01	-2.110	0.03487 *
Hour3Change		-4.914e-01	1.499e-01	-3.279	0.00105 **
Hour4Change		-6.358e-01	1.156e-01	-5.501	3.89e-08 ***
Hour5Change		-7.538e-01	6.261e-02	-12.040	< 2e-16 ***
Hour6Change		-8.368e-01	1.344e-01	-6.224	5.06e-10 ***
Hour7Change		-9.824e-01	1.546e-01	-6.355	2.19e-10 ***

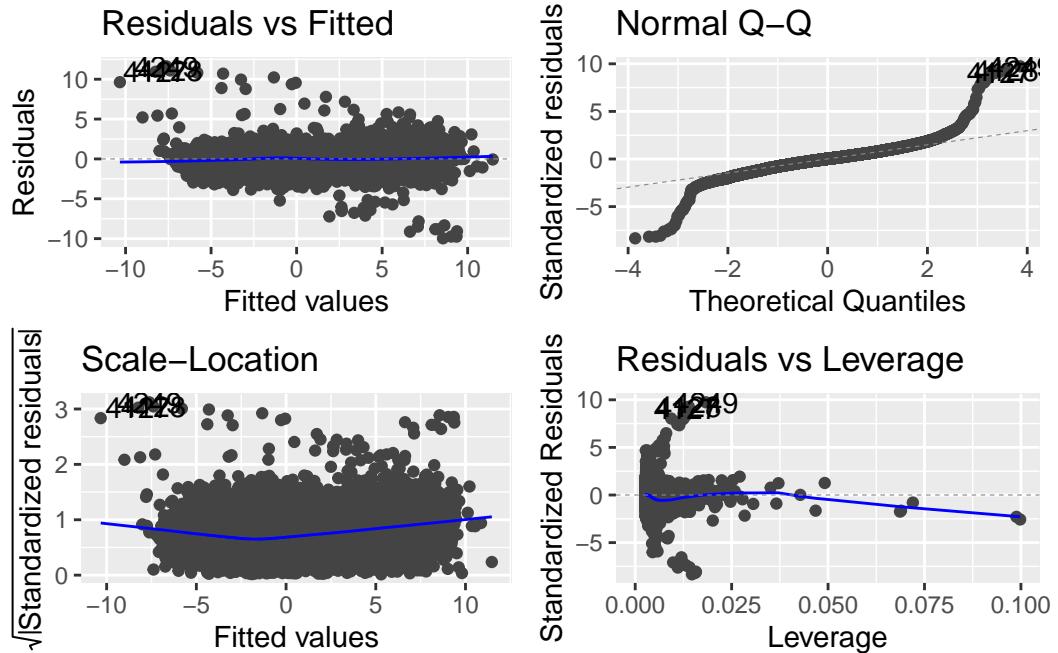
```

Hour8Change      -9.756e-01  1.464e-01  -6.662 2.87e-11 ***
Hour9Change      -9.226e-01  1.042e-01  -8.855 < 2e-16 ***
Hour10Change     -6.220e-01  9.017e-02  -6.898 5.64e-12 ***
Hour11Change     -2.461e-01  1.454e-01  -1.693  0.09054 .
Hour12Change     1.687e-01   1.605e-01   1.051  0.29338
Hour13Change     5.972e-01   1.478e-01   4.041  5.37e-05 ***
Hour14Change     1.084e+00   9.636e-02  11.245 < 2e-16 ***
Hour15Change     1.463e+00   1.101e-01  13.286 < 2e-16 ***
Hour16Change     1.743e+00   1.501e-01  11.612 < 2e-16 ***
Hour17Change     1.770e+00   1.570e-01  11.274 < 2e-16 ***
Hour18Change     1.627e+00   1.361e-01  11.958 < 2e-16 ***
Hour19Change     1.327e+00   6.489e-02  20.445 < 2e-16 ***
Hour20Change     9.682e-01   1.161e-01   8.341 < 2e-16 ***
Hour21Change     6.576e-01   1.500e-01   4.383 1.19e-05 ***
Hour22Change     3.900e-01   1.526e-01   2.555  0.01063 *
Hour23Change     1.628e-01   1.257e-01   1.295  0.19535
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

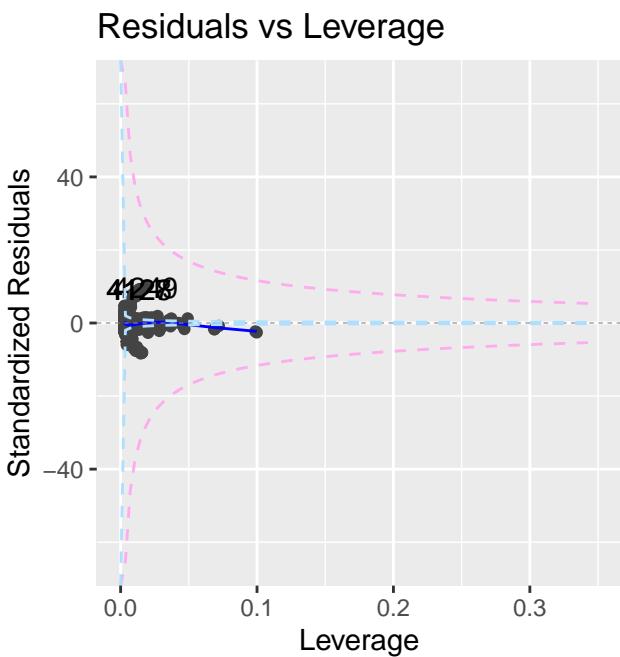
Residual standard error: 1.205 on 8710 degrees of freedom
Multiple R-squared:  0.8989,    Adjusted R-squared:  0.8985
F-statistic:  2581 on 30 and 8710 DF,  p-value: < 2.2e-16

```

```
 autoplot(seoul.lm)
```



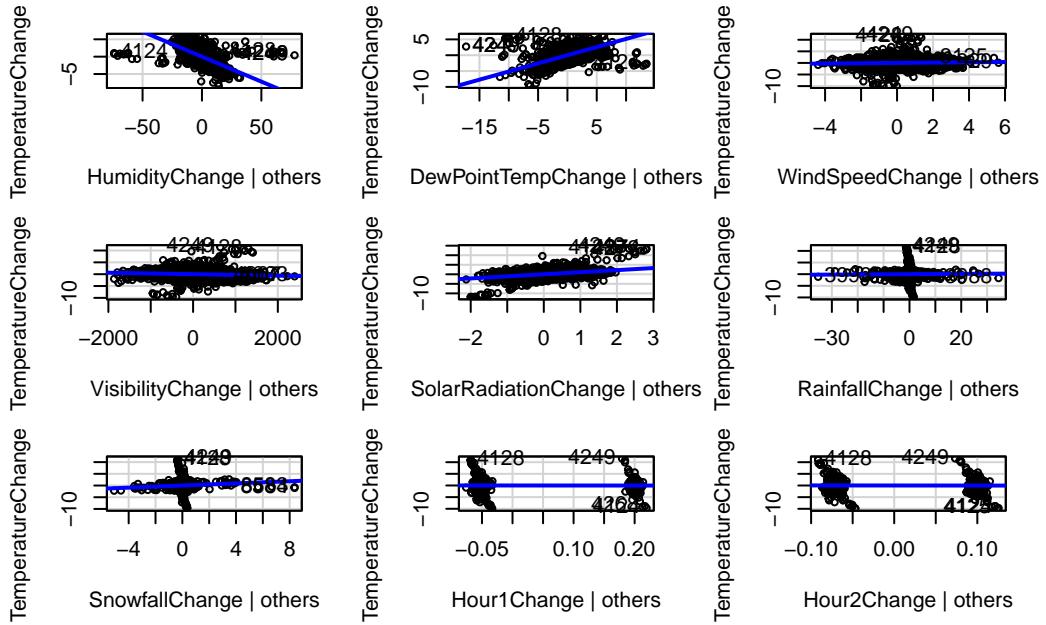
```
show_leverage(seoul.lm)
```

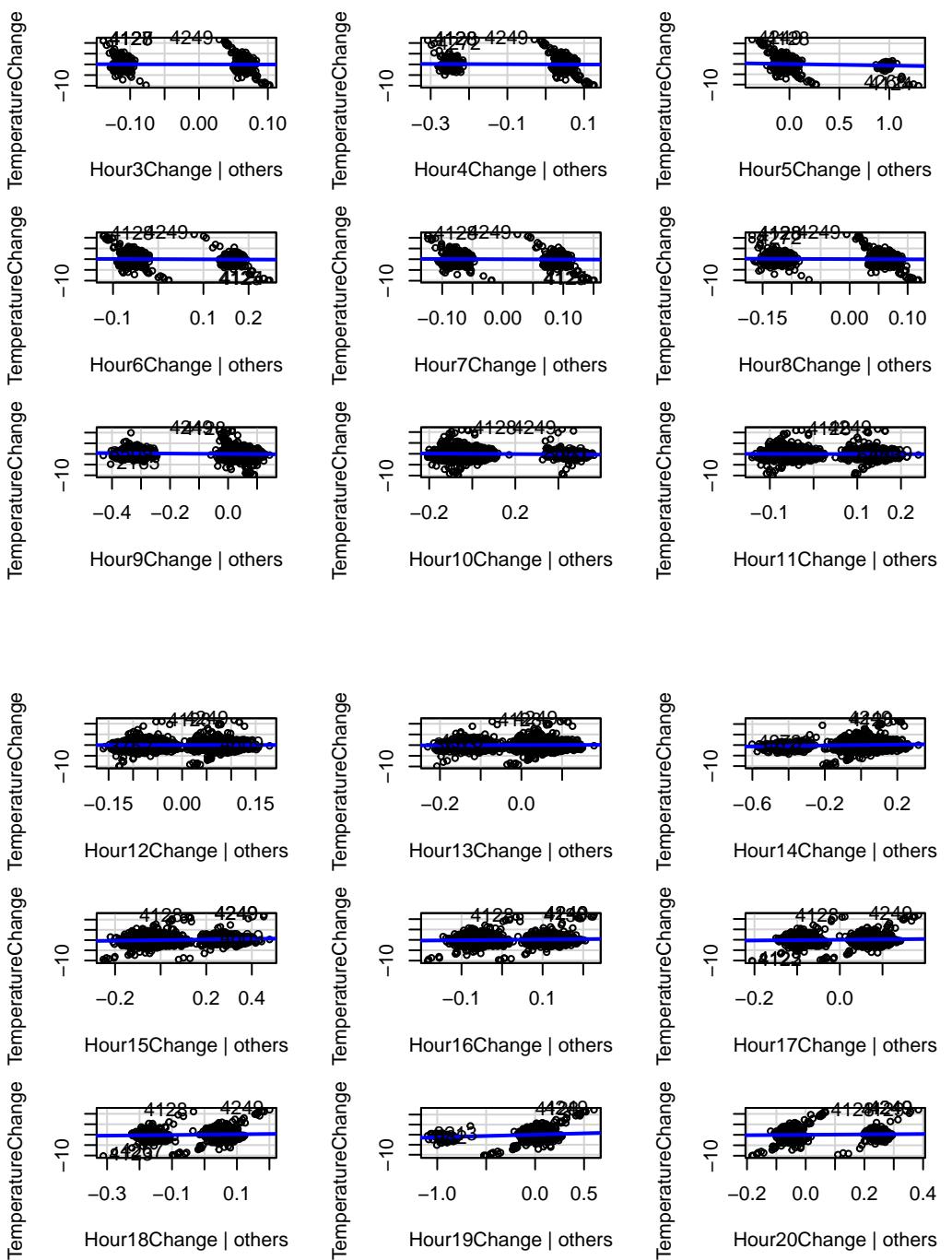


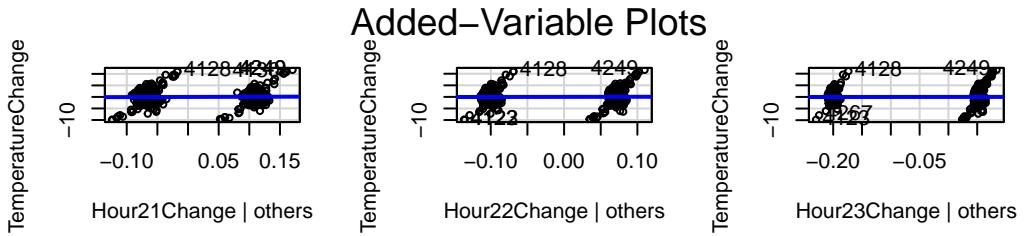
A.1.1

Added Variable Plots for Model (1). After considering the influential points, we determined that the linearity assumption was met.

```
avPlots(seoul.lm)
```







A.2.0

Elastic Net Regression on Model (1) w/ interaction terms

```

model.factors = setdiff(c(seoul.change, seoul.interaction),
                        c(seoul.base, "TemperatureChange"))

seoul.x = as.matrix(seoul.temp[model.factors])
seoul.y = as.matrix(seoul.temp["TemperatureChange"])

elastic_cv <- cv.glmnet(x = seoul.x,
                        y = seoul.y,
                        type.measure = "mse",
                        alpha = 0.5)

d = coef(elastic_cv, s = "lambda.1se")[2:(length(model.factors)-1)]
elastic.factors = c(model.factors[which(d != 0)])
elastic.factors = c(elastic.factors, setdiff(c(str_c(time.bike, "Change"), "RainfallChange",
seoul.elastic = lm(TemperatureChange ~ 0 + .,
                    seoul.temp[c("TemperatureChange",
elastic.factors]))
```

```
summary(seoul.elastic)
```

Call:

```
lm(formula = TemperatureChange ~ 0 + ., data = seoul.temp[c("TemperatureChange",  
elastic.factors)])
```

Residuals:

Min	1Q	Median	3Q	Max
-9.0698	-0.6618	-0.0573	0.4847	8.6140

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
HumidityChange	-1.516e-01	1.851e-03	-81.937	< 2e-16 ***
DewPointTempChange	5.570e-01	7.389e-03	75.376	< 2e-16 ***
WindSpeedChange	5.335e-02	1.266e-02	4.214	2.54e-05 ***
VisibilityChange	-3.308e-04	3.232e-05	-10.233	< 2e-16 ***
SolarRadiationChange	9.417e-01	3.311e-02	28.440	< 2e-16 ***
SnowfallChange	3.400e-01	4.776e-02	7.119	1.18e-12 ***
Hour3Change	-3.939e-01	2.466e-01	-1.597	0.110250
Hour4Change	-7.976e-01	2.071e-01	-3.852	0.000118 ***
Hour5Change	-8.101e-01	6.304e-02	-12.850	< 2e-16 ***
Hour6Change	-6.789e-01	2.054e-01	-3.305	0.000953 ***
Hour7Change	-4.791e-01	2.429e-01	-1.972	0.048592 *
Hour8Change	-7.504e-01	2.438e-01	-3.078	0.002091 **
Hour9Change	-1.009e+00	1.939e-01	-5.203	2.00e-07 ***
Hour10Change	-6.575e-01	1.264e-01	-5.200	2.04e-07 ***
Hour11Change	-1.464e-01	2.234e-01	-0.655	0.512244
Hour13Change	6.439e-02	2.266e-01	0.284	0.776329
Hour14Change	6.577e-01	1.327e-01	4.958	7.27e-07 ***
Hour15Change	7.897e-01	1.551e-01	5.092	3.61e-07 ***
Hour16Change	1.368e+00	2.328e-01	5.874	4.40e-09 ***
Hour17Change	1.081e+00	2.501e-01	4.323	1.56e-05 ***
Hour18Change	5.927e-01	2.204e-01	2.690	0.007168 **
Hour19Change	7.127e-01	9.551e-02	7.462	9.35e-14 ***
Hour20Change	6.468e-01	1.922e-01	3.366	0.000766 ***
Hour21Change	6.361e-01	2.388e-01	2.664	0.007732 **
HumidityChangeXDewPointTempChange	-1.194e-03	1.948e-04	-6.129	9.22e-10 ***
HumidityChangeXSolarRadiationChange	1.383e-02	1.334e-03	10.366	< 2e-16 ***
HumidityChangeXRainfallChange	-2.268e-03	1.053e-03	-2.153	0.031336 *
HumidityChangeXSnowfallChange	-3.160e-03	1.494e-03	-2.115	0.034481 *
DewPointTempChangeXWindSpeedChange	1.584e-02	3.704e-03	4.275	1.93e-05 ***

DewPointTempChangeXRainfallChange	-3.180e-03	5.383e-03	-0.591	0.554737
WindSpeedChangeXSolarRadiationChange	3.877e-02	1.290e-02	3.006	0.002654 **
SolarRadiationChangeXRainfallChange	1.001e-01	2.756e-02	3.634	0.000281 ***
HumidityChangeXHour1Change	-4.520e-02	8.009e-03	-5.643	1.72e-08 ***
HumidityChangeXHour2Change	-2.462e-02	6.994e-03	-3.520	0.000434 ***
HumidityChangeXHour5Change	5.228e-02	4.733e-03	11.047	< 2e-16 ***
HumidityChangeXHour6Change	3.376e-02	6.875e-03	4.910	9.27e-07 ***
HumidityChangeXHour7Change	2.422e-02	7.000e-03	3.460	0.000542 ***
HumidityChangeXHour8Change	4.255e-02	4.495e-03	9.465	< 2e-16 ***
HumidityChangeXHour9Change	5.649e-02	5.375e-03	10.509	< 2e-16 ***
HumidityChangeXHour10Change	1.087e-01	7.000e-03	15.522	< 2e-16 ***
HumidityChangeXHour11Change	4.001e-02	7.139e-03	5.604	2.16e-08 ***
HumidityChangeXHour12Change	2.432e-02	7.373e-03	3.299	0.000974 ***
HumidityChangeXHour14Change	1.801e-02	7.404e-03	2.432	0.015039 *
HumidityChangeXHour15Change	2.148e-02	6.139e-03	3.499	0.000470 ***
HumidityChangeXHour16Change	1.054e-03	6.581e-03	0.160	0.872752
HumidityChangeXHour17Change	-2.918e-03	7.108e-03	-0.410	0.681461
HumidityChangeXHour19Change	3.782e-02	7.257e-03	5.212	1.91e-07 ***
HumidityChangeXHour22Change	-2.235e-02	5.620e-03	-3.977	7.03e-05 ***
HumidityChangeXHour23Change	-4.092e-02	5.500e-03	-7.441	1.10e-13 ***
DewPointTempChangeXHour1Change	1.810e-01	3.070e-02	5.896	3.87e-09 ***
DewPointTempChangeXHour4Change	4.416e-02	2.388e-02	1.849	0.064441 .
DewPointTempChangeXHour10Change	-1.676e-01	2.168e-02	-7.728	1.21e-14 ***
DewPointTempChangeXHour13Change	-1.495e-02	2.020e-02	-0.740	0.459297
DewPointTempChangeXHour14Change	-1.452e-03	2.451e-02	-0.059	0.952753
DewPointTempChangeXHour18Change	-8.070e-02	2.054e-02	-3.928	8.61e-05 ***
DewPointTempChangeXHour19Change	-1.312e-01	2.768e-02	-4.740	2.18e-06 ***
DewPointTempChangeXHour20Change	4.572e-02	2.410e-02	1.897	0.057865 .
DewPointTempChangeXHour21Change	-5.933e-02	2.258e-02	-2.628	0.008610 **
WindSpeedChangeXHour3Change	7.364e-02	5.056e-02	1.457	0.145287
WindSpeedChangeXHour4Change	8.580e-02	4.843e-02	1.772	0.076495 .
WindSpeedChangeXHour5Change	1.382e-01	5.628e-02	2.455	0.014111 *
WindSpeedChangeXHour6Change	2.171e-01	5.614e-02	3.868	0.000111 ***
WindSpeedChangeXHour10Change	-2.168e-02	6.312e-02	-0.344	0.731207
WindSpeedChangeXHour11Change	8.066e-03	5.063e-02	0.159	0.873429
WindSpeedChangeXHour15Change	-6.852e-03	5.098e-02	-0.134	0.893084
WindSpeedChangeXHour17Change	-7.522e-02	3.955e-02	-1.902	0.057247 .
WindSpeedChangeXHour18Change	-3.379e-02	3.893e-02	-0.868	0.385450
WindSpeedChangeXHour19Change	-5.668e-02	4.140e-02	-1.369	0.171074
VisibilityChangeXHour1Change	-3.992e-04	1.311e-04	-3.044	0.002342 **
VisibilityChangeXHour2Change	-5.888e-04	1.199e-04	-4.909	9.30e-07 ***
VisibilityChangeXHour3Change	-1.184e-04	1.220e-04	-0.971	0.331726
VisibilityChangeXHour8Change	2.586e-04	1.191e-04	2.171	0.029926 *

VisibilityChangeXHour16Change	1.699e-04	1.153e-04	1.473	0.140739
VisibilityChangeXHour17Change	1.194e-04	1.159e-04	1.030	0.302953
VisibilityChangeXHour20Change	-1.258e-05	1.266e-04	-0.099	0.920862
VisibilityChangeXHour23Change	-5.012e-04	1.147e-04	-4.368	1.27e-05 ***
SolarRadiationChangeXHour1Change	5.579e+00	1.875e+00	2.975	0.002935 **
SolarRadiationChangeXHour2Change	1.012e+00	4.697e-01	2.155	0.031169 *
SolarRadiationChangeXHour3Change	-5.403e-01	1.638e-01	-3.299	0.000975 ***
SolarRadiationChangeXHour4Change	-9.865e-01	1.166e-01	-8.460	< 2e-16 ***
SolarRadiationChangeXHour5Change	-5.722e-01	1.543e-01	-3.709	0.000210 ***
SolarRadiationChangeXHour7Change	-3.108e-01	1.824e-01	-1.704	0.088469 .
SolarRadiationChangeXHour10Change	4.998e-01	1.185e-01	4.218	2.49e-05 ***
SolarRadiationChangeXHour11Change	7.054e-01	6.360e-02	11.091	< 2e-16 ***
SolarRadiationChangeXHour12Change	4.626e-01	1.536e-01	3.011	0.002612 **
SolarRadiationChangeXHour13Change	4.107e-01	5.677e-02	7.234	5.09e-13 ***
SolarRadiationChangeXHour14Change	1.826e-01	6.010e-02	3.038	0.002386 **
SolarRadiationChangeXHour17Change	-1.985e-01	1.114e-01	-1.782	0.074848 .
SolarRadiationChangeXHour20Change	-1.129e-01	7.850e-02	-1.438	0.150386
SolarRadiationChangeXHour23Change	4.748e-01	1.554e-01	3.055	0.002259 **
RainfallChangeXHour9Change	-9.933e-02	4.018e-02	-2.472	0.013441 *
RainfallChangeXHour10Change	-1.202e-01	4.549e-02	-2.641	0.008272 **
RainfallChangeXHour14Change	6.527e-02	5.265e-02	1.240	0.215115
RainfallChangeXHour20Change	5.139e-02	2.061e-02	2.493	0.012669 *
RainfallChangeXHour21Change	4.224e-02	2.215e-02	1.907	0.056523 .
SnowfallChangeXHour8Change	-1.903e-01	1.471e-01	-1.293	0.195906
SnowfallChangeXHour9Change	-1.038e-01	1.266e-01	-0.819	0.412620
SnowfallChangeXHour10Change	-2.124e-01	1.037e-01	-2.048	0.040625 *
SnowfallChangeXHour19Change	3.245e-01	2.394e-01	1.356	0.175180
Hour1Change	1.117e-01	2.034e-01	0.549	0.582810
Hour2Change	-5.688e-02	2.403e-01	-0.237	0.812862
Hour12Change	1.613e-01	2.490e-01	0.648	0.517250
Hour22Change	4.558e-01	2.485e-01	1.834	0.066639 .
Hour23Change	-1.584e-02	2.146e-01	-0.074	0.941144
RainfallChange	7.638e-03	8.610e-03	0.887	0.375022

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

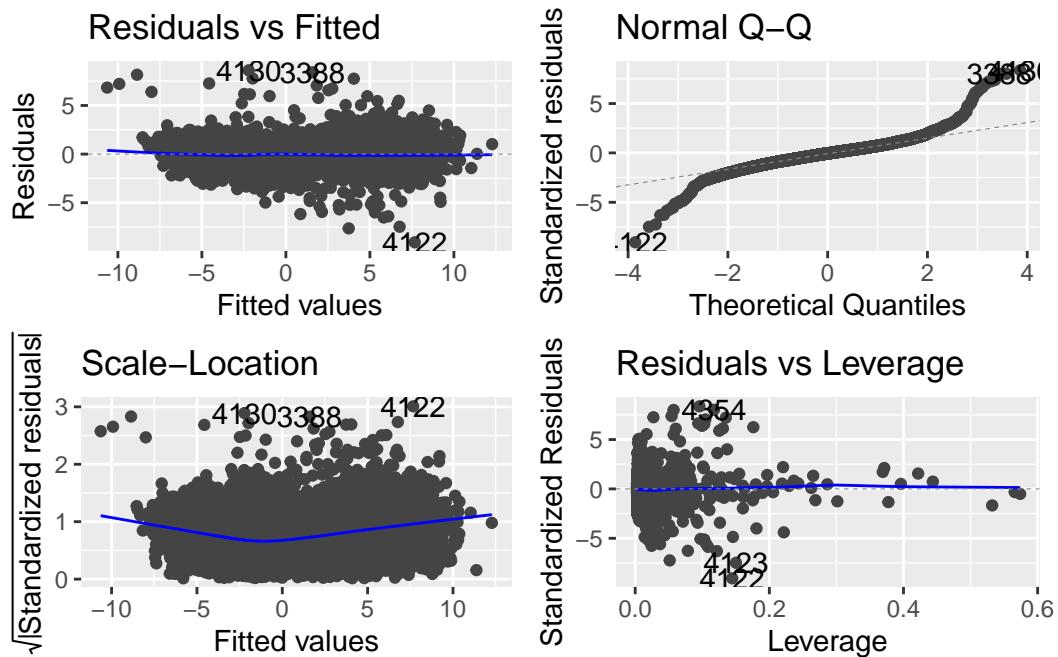
Residual standard error: 1.083 on 8635 degrees of freedom
 Multiple R-squared: 0.9189, Adjusted R-squared: 0.9179
 F-statistic: 932 on 105 and 8635 DF, p-value: < 2.2e-16

A.2.1

Model diagnostics for elastic net regression on Model (1) w/ interaction terms

Model assumptions did not drastically improve. QQ-plot indicates that normality assumption is still violated, and is confirmed by a Shapiro-Wilk normality test.

```
autoplot(seoul.elastic)
```



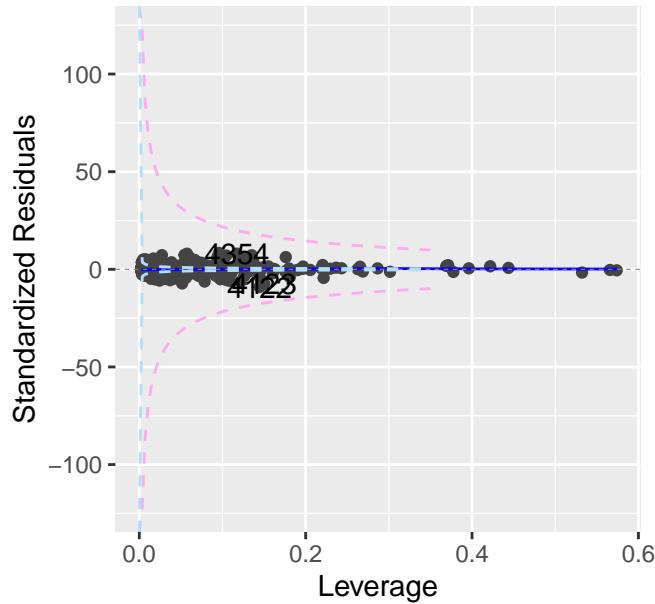
```
shapiro.test(sample(seoul.elastic$residuals, 5000))
```

Shapiro-Wilk normality test

```
data: sample(seoul.elastic$residuals, 5000)
W = 0.93861, p-value < 2.2e-16
```

```
show_leverage(seoul.elastic)
```

Residuals vs Leverage



A.3

Transformations we considered for Model (1)

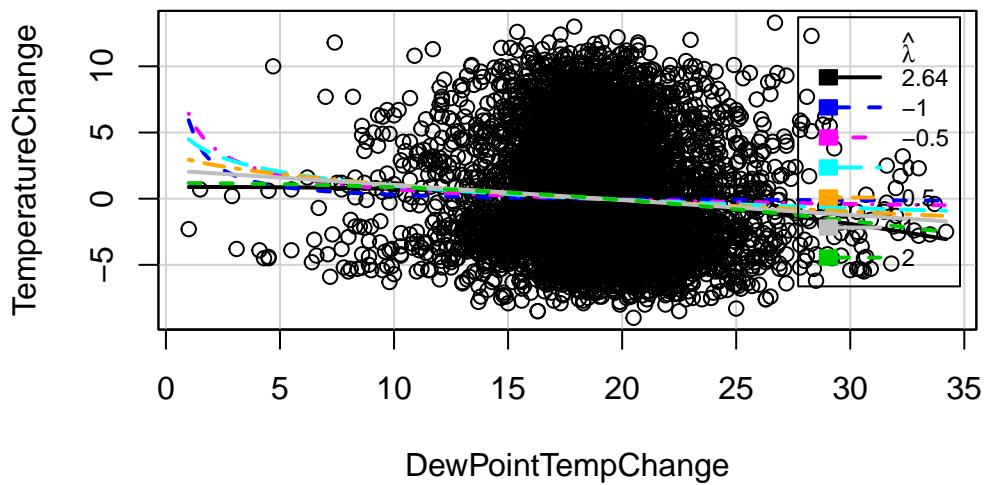
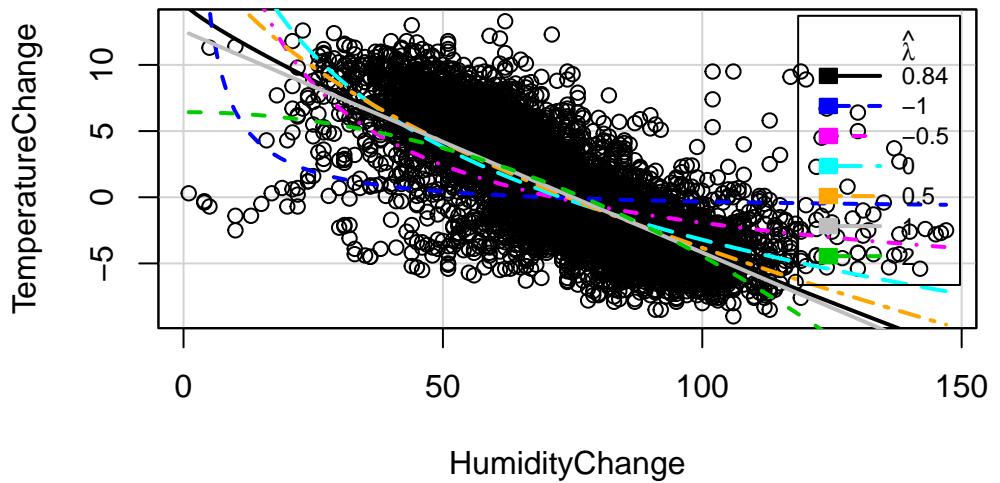
```

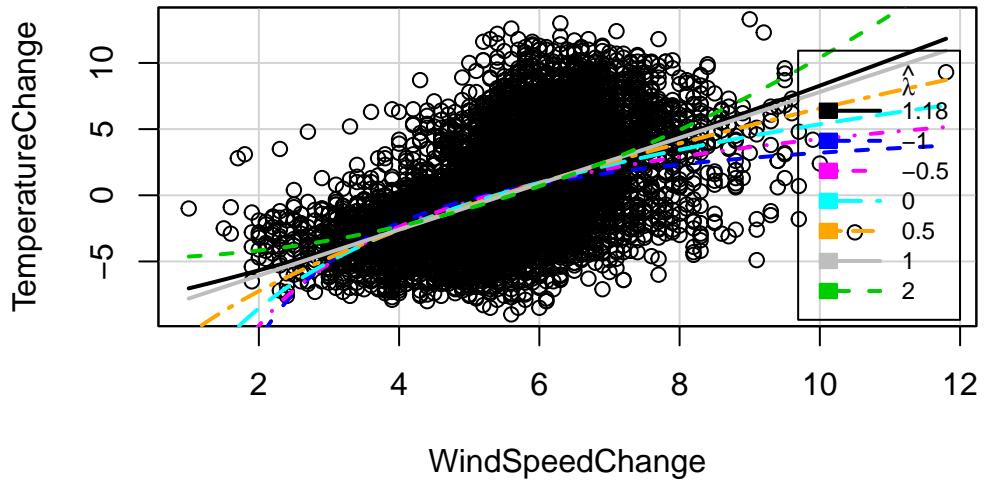
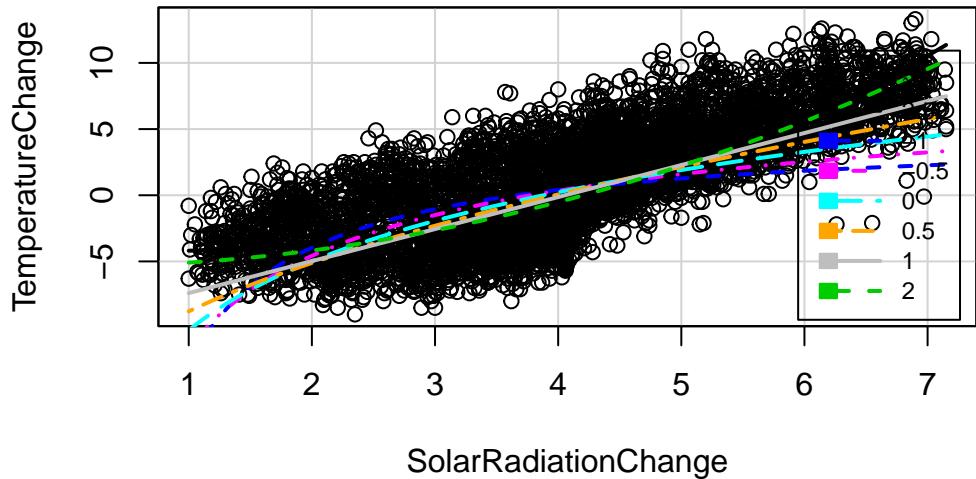
factors.transform = c("HumidityChange", "DewPointTempChange",
                     "SolarRadiationChange", "WindSpeedChange")

t = seoul.temp %>% mutate(
  HumidityChange = HumidityChange + abs(min(HumidityChange)) + 1,
  DewPointTempChange = DewPointTempChange + abs(min(DewPointTempChange)) + 1,
  SolarRadiationChange = SolarRadiationChange + abs(min(SolarRadiationChange)) + 1,
  WindSpeedChange = WindSpeedChange + abs(min(WindSpeedChange)) + 1
)

for(i in 1:length(factors.transform)){
  factor = factors.transform[i]
  invTranPlot(formula(str_c("TemperatureChange ~ ", factor)), data=t,
              lambda = c(-1, -0.5, 0, 0.5, 1, 2), optimal=T)
}

```





A.4

An alternative solution to meeting the assumptions for Model (1). In theory,

$$\text{Var}(\eta_{st}|s) = \sigma^2 \quad \forall s \in \text{Seasons}$$

However, if it's the case that

$$\exists \text{ at least one } s \text{ s.t. } \text{Var}(\eta_{st}|s) \neq \sigma^2$$

Then, we could use 4 separate models for each season to completely eliminate s out of the general η_{st} . Hence, each season will have its own population variance for η_t .

```
create_season_models = function(factors, response, base=F){
  factors = setdiff(factors, response)
  if(base == T){
    f = 0
  } else {
    f = paste(c(0, factors), collapse = " + ")
  }

  models <- map(unique(seoul$Seasons), function(x){
    lm(formula(paste(response, "~", f)),
      data = seoul[seoul$Seasons == x,] %>%
        select(all_of(c(factors, response))))
  })

  names(models) <- str_c("seoul.lm.", unique(seoul$Seasons))
  return(models)
}

models.lm = create_season_models(seoul.change, "TemperatureChange")

create_elastic = function(){
  models = list()
  seasons = seoul$Seasons %>% unique()
  for(s in seasons){
    #print(s)
    seoul.subset = seoul.temp %>% filter(Seasons == s)
    seoul.x = as.matrix(seoul.subset[model.factors])
    seoul.y = as.matrix(seoul.subset["TemperatureChange"])

    elastic_cv <- cv.glmnet(x = seoul.x,
                             y = seoul.y,
                             type.measure = "mse",
                             alpha = 0.5)
  }
}
```

```

d = coef(elastic_cv, s = "lambda.1se")[2:(length(model.factors)-1)]
elastic.factors = model.factors[which(d != 0)]
models[[str_c("seoul.lasso.",s)]] = lm(TemperatureChange ~ 0 + .,
                                         seoul.subset[c("TemperatureChange",
                                         elastic.factors)])
}
return(models)
}
seoul.elastic.models = create_elastic()
for(model in seoul.elastic.models){
  print(summary(model))
  print(autoplot(model))
}

```

Call:

```
lm(formula = TemperatureChange ~ 0 + ., data = seoul.subset[c("TemperatureChange",
  elastic.factors)])
```

Residuals:

Min	1Q	Median	3Q	Max
-3.5504	-0.4919	-0.0317	0.4088	3.8121

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
HumidityChange	-1.843e-01	3.755e-03	-49.082	< 2e-16
DewPointTempChange	7.027e-01	1.244e-02	56.489	< 2e-16
WindSpeedChange	2.637e-02	1.930e-02	1.367	0.171923
VisibilityChange	-6.297e-04	6.656e-05	-9.462	< 2e-16
SolarRadiationChange	9.505e-01	7.423e-02	12.805	< 2e-16
SnowfallChange	3.845e-01	5.567e-02	6.906	6.57e-12
Hour3Change	-3.000e-01	9.117e-02	-3.291	0.001016
Hour4Change	-2.515e-01	9.033e-02	-2.784	0.005414
Hour5Change	-2.728e-01	8.844e-02	-3.084	0.002067
Hour6Change	-2.564e-01	8.657e-02	-2.962	0.003087
Hour7Change	-3.386e-01	8.522e-02	-3.973	7.33e-05
Hour8Change	-5.652e-01	1.233e-01	-4.583	4.86e-06
Hour9Change	-3.492e-01	1.356e-01	-2.575	0.010105
Hour10Change	-3.537e-01	1.254e-01	-2.819	0.004858
Hour13Change	2.457e-01	1.756e-01	1.400	0.161768
Hour14Change	8.351e-01	1.428e-01	5.849	5.72e-09
Hour15Change	1.377e+00	1.376e-01	10.011	< 2e-16

Hour16Change	1.390e+00	1.101e-01	12.620	< 2e-16
Hour17Change	4.778e-01	1.203e-01	3.973	7.34e-05
Hour18Change	5.625e-01	1.100e-01	5.113	3.46e-07
Hour19Change	7.127e-01	9.357e-02	7.617	3.91e-14
Hour20Change	6.184e-01	9.100e-02	6.796	1.40e-11
Hour21Change	5.264e-01	8.931e-02	5.893	4.40e-09
HumidityChangeXDewPointTempChange	-1.076e-03	2.606e-04	-4.128	3.81e-05
DewPointTempChangeXWindSpeedChange	6.219e-03	4.402e-03	1.413	0.157930
DewPointTempChangeXSolarRadiationChange	5.477e-02	9.014e-03	6.076	1.46e-09
DewPointTempChangeXSnowfallChange	5.670e-03	1.374e-02	0.413	0.679887
SolarRadiationChangeXSnowfallChange	3.816e-01	8.368e-02	4.560	5.41e-06
HumidityChangeXHour6Change	-3.686e-03	9.650e-03	-0.382	0.702533
HumidityChangeXHour7Change	2.053e-02	5.858e-03	3.504	0.000468
HumidityChangeXHour8Change	2.522e-02	5.643e-03	4.469	8.27e-06
HumidityChangeXHour9Change	1.759e-02	6.527e-03	2.695	0.007101
HumidityChangeXHour14Change	-8.388e-03	5.501e-03	-1.525	0.127475
HumidityChangeXHour15Change	-1.280e-02	4.911e-03	-2.605	0.009249
HumidityChangeXHour16Change	-2.270e-02	5.907e-03	-3.843	0.000125
DewPointTempChangeXHour5Change	7.121e-02	2.505e-02	2.842	0.004523
DewPointTempChangeXHour6Change	1.061e-01	3.713e-02	2.858	0.004312
DewPointTempChangeXHour21Change	-6.513e-02	2.260e-02	-2.882	0.003992
DewPointTempChangeXHour22Change	-3.306e-02	2.234e-02	-1.480	0.139125
DewPointTempChangeXHour23Change	-4.234e-02	2.354e-02	-1.798	0.072269
WindSpeedChangeXHour1Change	1.247e-01	6.633e-02	1.880	0.060277
WindSpeedChangeXHour2Change	8.102e-02	7.063e-02	1.147	0.251423
WindSpeedChangeXHour10Change	-9.550e-02	6.450e-02	-1.481	0.138876
WindSpeedChangeXHour18Change	-9.628e-03	7.281e-02	-0.132	0.894802
WindSpeedChangeXHour19Change	-9.676e-02	5.785e-02	-1.673	0.094572
WindSpeedChangeXHour23Change	7.665e-02	8.350e-02	0.918	0.358720
VisibilityChangeXHour10Change	-7.376e-04	1.965e-04	-3.754	0.000179
VisibilityChangeXHour11Change	-5.868e-04	2.012e-04	-2.917	0.003575
SolarRadiationChangeXHour8Change	2.238e-01	2.664e-01	0.840	0.401069
SolarRadiationChangeXHour9Change	-5.215e-01	1.730e-01	-3.014	0.002612
SolarRadiationChangeXHour11Change	1.126e-01	1.565e-01	0.719	0.472058
SolarRadiationChangeXHour12Change	2.395e-01	1.467e-01	1.632	0.102742
SolarRadiationChangeXHour13Change	4.094e-01	1.551e-01	2.640	0.008352
SolarRadiationChangeXHour16Change	-7.140e-01	1.885e-01	-3.788	0.000156
SolarRadiationChangeXHour17Change	-7.705e-01	2.499e-01	-3.083	0.002078
SolarRadiationChangeXHour22Change	1.043e+00	3.842e-01	2.715	0.006673
SolarRadiationChangeXHour23Change	5.396e+00	1.109e+00	4.866	1.22e-06
RainfallChangeXHour10Change	3.479e-01	1.574e-01	2.210	0.027212
RainfallChangeXHour14Change	3.817e-01	1.232e-01	3.098	0.001974
RainfallChangeXHour16Change	-1.561e-01	9.658e-02	-1.617	0.106081

SnowfallChangeXHour16Change	-8.109e-02	1.311e-01	-0.618	0.536381
HumidityChange	***			
DewPointTempChange	***			
WindSpeedChange				
VisibilityChange	***			
SolarRadiationChange	***			
SnowfallChange	***			
Hour3Change	**			
Hour4Change	**			
Hour5Change	**			
Hour6Change	**			
Hour7Change	***			
Hour8Change	***			
Hour9Change	*			
Hour10Change	**			
Hour13Change				
Hour14Change	***			
Hour15Change	***			
Hour16Change	***			
Hour17Change	***			
Hour18Change	***			
Hour19Change	***			
Hour20Change	***			
Hour21Change	***			
HumidityChangeXDewPointTempChange	***			
DewPointTempChangeXWindSpeedChange				
DewPointTempChangeXSolarRadiationChange	***			
DewPointTempChangeXSnowfallChange				
SolarRadiationChangeXSnowfallChange	***			
HumidityChangeXHour6Change				
HumidityChangeXHour7Change	***			
HumidityChangeXHour8Change	***			
HumidityChangeXHour9Change	**			
HumidityChangeXHour14Change				
HumidityChangeXHour15Change	**			
HumidityChangeXHour16Change	***			
DewPointTempChangeXHour5Change	**			
DewPointTempChangeXHour6Change	**			
DewPointTempChangeXHour21Change	**			
DewPointTempChangeXHour22Change				
DewPointTempChangeXHour23Change	.			
WindSpeedChangeXHour1Change	.			

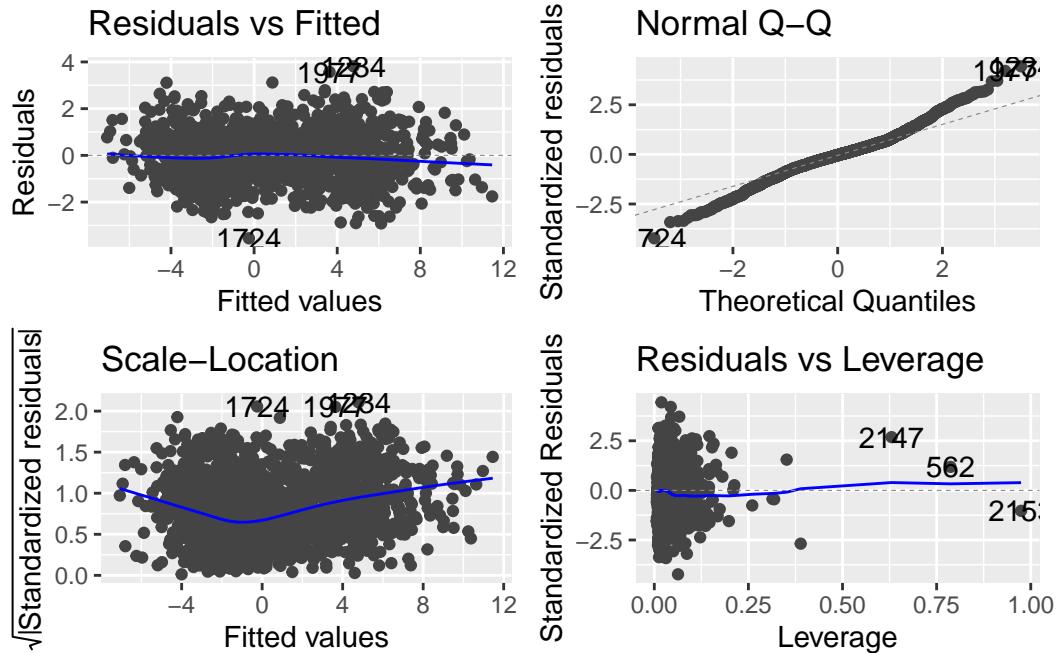
```

WindSpeedChangeXHour2Change
WindSpeedChangeXHour10Change
WindSpeedChangeXHour18Change
WindSpeedChangeXHour19Change
WindSpeedChangeXHour23Change
VisibilityChangeXHour10Change      ***
VisibilityChangeXHour11Change      **
SolarRadiationChangeXHour8Change
SolarRadiationChangeXHour9Change      **
SolarRadiationChangeXHour11Change
SolarRadiationChangeXHour12Change
SolarRadiationChangeXHour13Change      **
SolarRadiationChangeXHour16Change      ***
SolarRadiationChangeXHour17Change      **
SolarRadiationChangeXHour22Change      **
SolarRadiationChangeXHour23Change      ***
RainfallChangeXHour10Change          *
RainfallChangeXHour14Change          **
RainfallChangeXHour16Change
SnowfallChangeXHour16Change

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

Residual standard error: 0.8671 on 2094 degrees of freedom
Multiple R-squared: 0.9292, Adjusted R-squared: 0.9271
F-statistic: 450.6 on 61 and 2094 DF, p-value: < 2.2e-16



Call:

```
lm(formula = TemperatureChange ~ 0 + ., data = seoul.subset[c("TemperatureChange",
  elastic.factors)])
```

Residuals:

Min	1Q	Median	3Q	Max
-6.4208	-0.8507	-0.0578	0.7001	6.3699

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
HumidityChange	-9.606e-02	3.395e-03	-28.297	< 2e-16 ***
DewPointTempChange	3.512e-01	1.404e-02	25.014	< 2e-16 ***
WindSpeedChange	9.876e-02	3.085e-02	3.201	0.001388 **
SolarRadiationChange	1.421e+00	8.005e-02	17.750	< 2e-16 ***
Hour3Change	-1.332e+00	1.367e-01	-9.747	< 2e-16 ***
Hour4Change	-1.275e+00	1.374e-01	-9.283	< 2e-16 ***
Hour5Change	-1.206e+00	1.319e-01	-9.141	< 2e-16 ***
Hour6Change	-8.049e-01	1.428e-01	-5.636	1.98e-08 ***
Hour7Change	-3.888e-01	1.621e-01	-2.399	0.016529 *
Hour8Change	-1.409e+00	1.766e-01	-7.978	2.40e-15 ***
Hour9Change	-1.363e+00	2.465e-01	-5.528	3.64e-08 ***
Hour10Change	-1.145e+00	2.381e-01	-4.809	1.62e-06 ***

Hour11Change	-1.046e-01	2.678e-01	-0.391	0.696128
Hour14Change	5.763e-01	2.433e-01	2.368	0.017954 *
Hour15Change	5.829e-01	2.226e-01	2.618	0.008904 **
Hour16Change	1.676e+00	2.212e-01	7.579	5.15e-14 ***
Hour17Change	6.493e-01	1.962e-01	3.309	0.000953 ***
Hour18Change	4.187e-01	2.065e-01	2.027	0.042764 *
Hour19Change	1.212e+00	1.913e-01	6.337	2.85e-10 ***
Hour20Change	9.725e-01	1.543e-01	6.302	3.56e-10 ***
Hour21Change	1.072e+00	1.458e-01	7.350	2.82e-13 ***
HumidityChangeXDewPointTempChange	-1.618e-03	4.450e-04	-3.637	0.000282 ***
HumidityChangeXSolarRadiationChange	1.649e-02	2.345e-03	7.031	2.74e-12 ***
HumidityChangeXRainfallChange	-1.037e-02	2.768e-03	-3.747	0.000183 ***
DewPointTempChangeXWindSpeedChange	-2.497e-05	7.933e-03	-0.003	0.997489
DewPointTempChangeXRainfallChange	-3.093e-02	1.258e-02	-2.458	0.014058 *
WindSpeedChangeXSolarRadiationChange	5.258e-02	2.754e-02	1.909	0.056377 .
SolarRadiationChangeXRainfallChange	9.620e-02	7.144e-02	1.347	0.178283
HumidityChangeXHour1Change	-4.008e-02	7.963e-03	-5.032	5.25e-07 ***
HumidityChangeXHour2Change	-3.853e-02	8.820e-03	-4.369	1.31e-05 ***
HumidityChangeXHour5Change	4.327e-02	7.364e-03	5.875	4.89e-09 ***
HumidityChangeXHour8Change	2.569e-02	8.173e-03	3.144	0.001692 **
HumidityChangeXHour9Change	3.942e-02	7.417e-03	5.314	1.18e-07 ***
HumidityChangeXHour10Change	8.312e-02	9.686e-03	8.582	< 2e-16 ***
HumidityChangeXHour11Change	5.160e-02	1.069e-02	4.827	1.48e-06 ***
HumidityChangeXHour12Change	1.903e-02	7.992e-03	2.382	0.017325 *
HumidityChangeXHour16Change	-1.401e-02	9.276e-03	-1.510	0.131200
HumidityChangeXHour19Change	2.441e-02	9.028e-03	2.704	0.006915 **
HumidityChangeXHour22Change	-2.338e-02	8.299e-03	-2.817	0.004899 **
HumidityChangeXHour23Change	-3.020e-02	7.528e-03	-4.011	6.25e-05 ***
DewPointTempChangeXHour10Change	-2.113e-01	4.152e-02	-5.089	3.91e-07 ***
DewPointTempChangeXHour11Change	-1.859e-01	4.528e-02	-4.106	4.18e-05 ***
DewPointTempChangeXHour13Change	-5.650e-03	3.242e-02	-0.174	0.861664
DewPointTempChangeXHour14Change	9.114e-02	3.478e-02	2.621	0.008837 **
WindSpeedChangeXHour11Change	-2.031e-01	1.336e-01	-1.520	0.128692
WindSpeedChangeXHour14Change	-6.747e-02	1.188e-01	-0.568	0.570106
WindSpeedChangeXHour15Change	-3.019e-03	9.662e-02	-0.031	0.975075
WindSpeedChangeXHour16Change	-1.243e-01	1.104e-01	-1.126	0.260421
WindSpeedChangeXHour19Change	-2.895e-01	1.142e-01	-2.535	0.011329 *
VisibilityChangeXHour2Change	-7.938e-04	2.510e-04	-3.163	0.001584 **
VisibilityChangeXHour17Change	4.847e-04	2.076e-04	2.335	0.019648 *
SolarRadiationChangeXHour1Change	1.694e+01	6.179e+00	2.741	0.006169 **
SolarRadiationChangeXHour2Change	2.532e+00	9.657e-01	2.622	0.008803 **
SolarRadiationChangeXHour4Change	-1.119e+00	2.459e-01	-4.550	5.67e-06 ***
SolarRadiationChangeXHour5Change	-1.118e+00	1.752e-01	-6.379	2.17e-10 ***

```

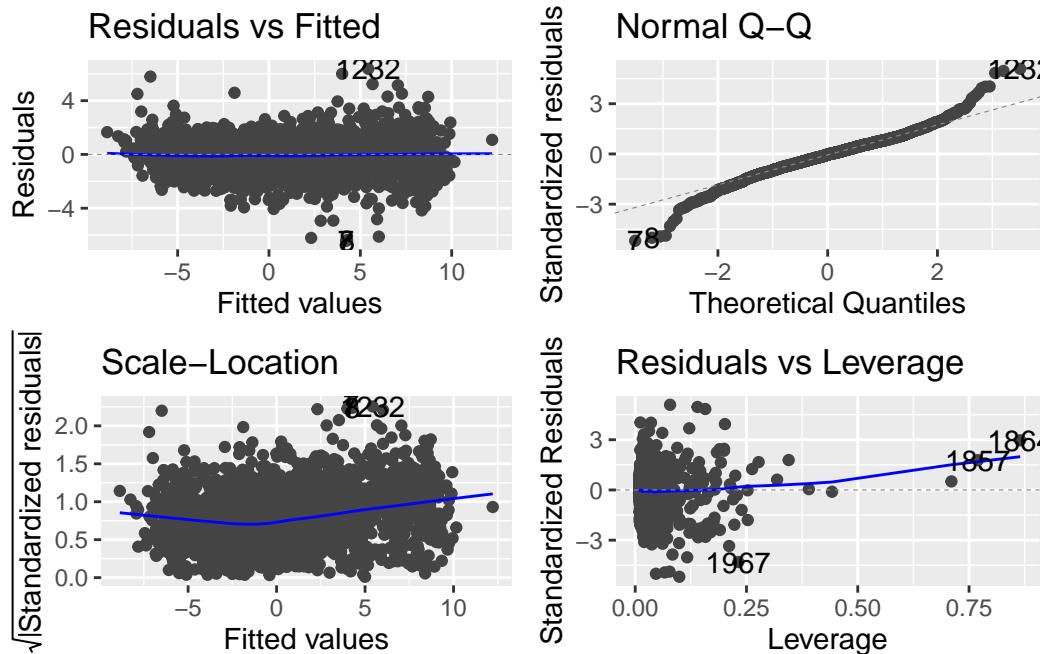
SolarRadiationChangeXHour6Change -4.865e-01 3.472e-01 -1.401 0.161311
SolarRadiationChangeXHour7Change -1.887e-01 3.144e-01 -0.600 0.548467
SolarRadiationChangeXHour11Change 8.345e-01 2.652e-01 3.146 0.001676 **
SolarRadiationChangeXHour12Change 1.102e+00 2.429e-01 4.536 6.06e-06 ***
SolarRadiationChangeXHour13Change 4.572e-01 1.778e-01 2.572 0.010185 *
SolarRadiationChangeXHour14Change 2.408e-01 1.115e-01 2.160 0.030858 *
SolarRadiationChangeXHour17Change -3.973e-01 2.240e-01 -1.773 0.076334 .
SolarRadiationChangeXHour18Change -5.142e-01 2.619e-01 -1.963 0.049729 *
SolarRadiationChangeXHour23Change 1.088e+00 4.082e-01 2.666 0.007735 **
RainfallChangeXHour11Change 1.603e-01 1.118e-01 1.434 0.151658
RainfallChangeXHour14Change 1.326e-01 6.778e-02 1.957 0.050479 .
RainfallChangeXHour15Change 2.272e-01 1.032e-01 2.202 0.027790 *
RainfallChangeXHour22Change -1.941e-01 1.165e-01 -1.666 0.095887 .

---

```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.305 on 2135 degrees of freedom
 Multiple R-squared: 0.9059, Adjusted R-squared: 0.9029
 F-statistic: 302.4 on 68 and 2135 DF, p-value: < 2.2e-16



Call:

```
lm(formula = TemperatureChange ~ 0 + ., data = seoul.subset[c("TemperatureChange",
elastic.factors)])
```

Residuals:

Min	1Q	Median	3Q	Max
-3.9689	-0.3744	0.0317	0.3874	4.6333

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
HumidityChange	-2.174e-01	3.098e-03	-70.174	< 2e-16
DewPointTempChange	7.262e-01	1.555e-02	46.704	< 2e-16
VisibilityChange	-3.679e-04	4.396e-05	-8.369	< 2e-16
SolarRadiationChange	5.672e-01	2.935e-02	19.326	< 2e-16
RainfallChange	1.876e-02	8.394e-03	2.235	0.025488
Hour4Change	-2.813e-01	7.395e-02	-3.803	0.000147
Hour5Change	-2.415e-01	7.557e-02	-3.195	0.001418
Hour6Change	-1.945e-01	8.152e-02	-2.386	0.017107
Hour8Change	-2.585e-01	1.084e-01	-2.385	0.017170
Hour9Change	-4.877e-01	1.124e-01	-4.338	1.50e-05
Hour10Change	-3.291e-01	1.323e-01	-2.487	0.012949
Hour11Change	-5.150e-01	1.336e-01	-3.854	0.000120
Hour14Change	2.871e-01	9.967e-02	2.880	0.004012
Hour15Change	5.470e-01	1.127e-01	4.856	1.29e-06
Hour16Change	3.044e-01	1.362e-01	2.235	0.025528
Hour17Change	3.303e-01	1.136e-01	2.907	0.003686
Hour18Change	3.042e-01	1.134e-01	2.683	0.007350
Hour19Change	6.019e-01	8.280e-02	7.269	5.06e-13
Hour20Change	4.404e-01	1.035e-01	4.253	2.20e-05
Hour21Change	2.142e-01	1.015e-01	2.111	0.034884
DewPointTempChangeXVisibilityChange	-7.527e-05	2.005e-05	-3.754	0.000178
VisibilityChangeXSolarRadiationChange	-7.165e-05	4.653e-05	-1.540	0.123702
SolarRadiationChangeXRainfallChange	8.602e-02	1.896e-02	4.537	6.02e-06
HumidityChangeXHour2Change	-2.117e-02	8.095e-03	-2.615	0.008976
HumidityChangeXHour3Change	-3.284e-02	5.895e-03	-5.571	2.86e-08
HumidityChangeXHour9Change	1.926e-02	5.006e-03	3.848	0.000123
HumidityChangeXHour10Change	2.200e-02	5.943e-03	3.702	0.000219
HumidityChangeXHour16Change	-2.867e-02	8.377e-03	-3.423	0.000632
DewPointTempChangeXHour5Change	2.583e-01	4.289e-02	6.023	2.01e-09
DewPointTempChangeXHour11Change	6.298e-02	4.408e-02	1.429	0.153233
DewPointTempChangeXHour12Change	1.039e-01	3.622e-02	2.868	0.004165
DewPointTempChangeXHour20Change	-5.878e-02	3.168e-02	-1.856	0.063657
DewPointTempChangeXHour21Change	-1.512e-01	3.995e-02	-3.785	0.000158
DewPointTempChangeXHour22Change	-7.280e-02	3.348e-02	-2.174	0.029802

WindSpeedChangeXHour10Change	-7.929e-02	8.947e-02	-0.886	0.375619
WindSpeedChangeXHour14Change	-2.948e-02	6.076e-02	-0.485	0.627654
WindSpeedChangeXHour15Change	-8.051e-02	8.297e-02	-0.970	0.331992
WindSpeedChangeXHour16Change	4.135e-02	5.783e-02	0.715	0.474653
WindSpeedChangeXHour19Change	-8.422e-02	6.443e-02	-1.307	0.191306
WindSpeedChangeXHour20Change	-1.117e-01	7.818e-02	-1.429	0.153142
VisibilityChangeXHour11Change	-1.587e-04	1.588e-04	-0.999	0.317889
VisibilityChangeXHour12Change	2.488e-05	1.641e-04	0.152	0.879458
VisibilityChangeXHour13Change	-4.583e-05	1.547e-04	-0.296	0.767124
VisibilityChangeXHour17Change	4.404e-04	1.780e-04	2.475	0.013415
VisibilityChangeXHour18Change	2.780e-04	1.507e-04	1.845	0.065204
SolarRadiationChangeXHour1Change	1.106e+00	1.760e+00	0.628	0.529748
SolarRadiationChangeXHour2Change	1.640e+00	2.962e-01	5.535	3.49e-08
SolarRadiationChangeXHour8Change	-8.955e-02	1.186e-01	-0.755	0.450448
SolarRadiationChangeXHour11Change	1.411e-01	5.941e-02	2.375	0.017658
SolarRadiationChangeXHour12Change	2.446e-01	3.896e-02	6.279	4.12e-10
SolarRadiationChangeXHour13Change	2.350e-01	7.433e-02	3.161	0.001594
SolarRadiationChangeXHour16Change	-4.123e-01	8.520e-02	-4.839	1.40e-06
SolarRadiationChangeXHour17Change	-3.302e-01	8.993e-02	-3.672	0.000246
SolarRadiationChangeXHour23Change	6.977e-01	1.543e-01	4.522	6.46e-06
RainfallChangeXHour5Change	-6.061e-02	4.711e-02	-1.287	0.198407
RainfallChangeXHour20Change	4.414e-02	1.537e-02	2.871	0.004128
HumidityChange	***			
DewPointTempChange	***			
VisibilityChange	***			
SolarRadiationChange	***			
RainfallChange	*			
Hour4Change	***			
Hour5Change	**			
Hour6Change	*			
Hour8Change	*			
Hour9Change	***			
Hour10Change	*			
Hour11Change	***			
Hour14Change	**			
Hour15Change	***			
Hour16Change	*			
Hour17Change	**			
Hour18Change	**			
Hour19Change	***			
Hour20Change	***			
Hour21Change	*			

```

DewPointTempChangeXVisibilityChange ***  

VisibilityChangeXSolarRadiationChange  

SolarRadiationChangeXRainfallChange ***  

HumidityChangeXHour2Change **  

HumidityChangeXHour3Change ***  

HumidityChangeXHour9Change ***  

HumidityChangeXHour10Change ***  

HumidityChangeXHour16Change ***  

DewPointTempChangeXHour5Change ***  

DewPointTempChangeXHour11Change  

DewPointTempChangeXHour12Change **  

DewPointTempChangeXHour20Change .  

DewPointTempChangeXHour21Change ***  

DewPointTempChangeXHour22Change *  

WindSpeedChangeXHour10Change  

WindSpeedChangeXHour14Change  

WindSpeedChangeXHour15Change  

WindSpeedChangeXHour16Change  

WindSpeedChangeXHour19Change  

WindSpeedChangeXHour20Change  

VisibilityChangeXHour11Change  

VisibilityChangeXHour12Change  

VisibilityChangeXHour13Change  

VisibilityChangeXHour17Change *  

VisibilityChangeXHour18Change .  

SolarRadiationChangeXhour1Change  

SolarRadiationChangeXhour2Change ***  

SolarRadiationChangeXhour8Change  

SolarRadiationChangeXhour11Change *  

SolarRadiationChangeXhour12Change ***  

SolarRadiationChangeXhour13Change **  

SolarRadiationChangeXhour16Change ***  

SolarRadiationChangeXhour17Change ***  

SolarRadiationChangeXhour23Change ***  

RainfallChangeXHour5Change  

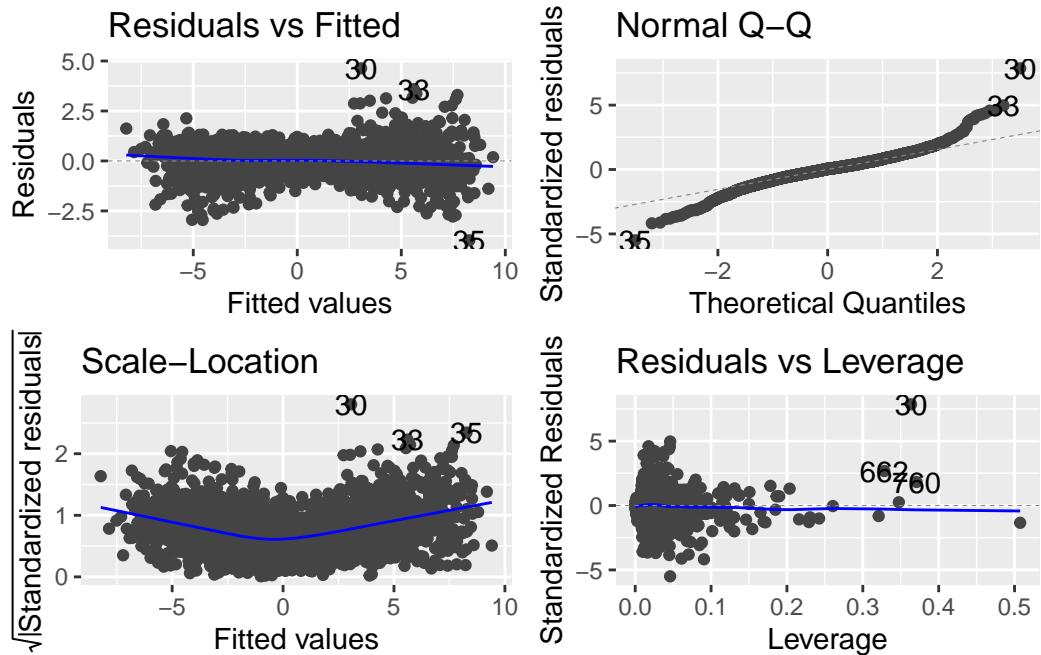
RainfallChangeXHour20Change **  

---  

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

Residual standard error: 0.7394 on 2147 degrees of freedom
Multiple R-squared: 0.9597, Adjusted R-squared: 0.9586
F-statistic: 912.3 on 56 and 2147 DF, p-value: < 2.2e-16



Call:

```
lm(formula = TemperatureChange ~ 0 + ., data = seoul.subset[c("TemperatureChange",
  elastic.factors)])
```

Residuals:

Min	1Q	Median	3Q	Max
-6.1285	-0.4940	-0.0988	0.3265	5.5903

Coefficients:

HumidityChange
DewPointTempChange
WindSpeedChange
VisibilityChange
SolarRadiationChange
RainfallChange
Hour5Change
Hour14Change
Hour15Change
Hour16Change
Hour17Change
Hour18Change

	Estimate	Std. Error	t value	Pr(> t)
-2.144e-01	2.894e-03	-74.097	< 2e-16	
7.525e-01	1.207e-02	62.356	< 2e-16	
7.905e-03	2.016e-02	0.392	0.694974	
-3.982e-04	5.732e-05	-6.948	4.92e-12	
5.719e-01	4.075e-02	14.035	< 2e-16	
4.997e-02	1.522e-02	3.282	0.001046	
-1.092e-01	8.384e-02	-1.303	0.192783	
7.987e-01	1.160e-01	6.886	7.50e-12	
1.293e+00	1.088e-01	11.886	< 2e-16	
8.967e-01	1.261e-01	7.112	1.55e-12	
5.262e-01	1.044e-01	5.040	5.05e-07	
3.929e-01	1.171e-01	3.355	0.000806	

Hour19Change	5.959e-01	9.148e-02	6.514	9.11e-11
Hour20Change	4.248e-01	9.096e-02	4.670	3.20e-06
Hour21Change	3.242e-01	8.689e-02	3.732	0.000195
DewPointTempChangeXSolarRadiationChange	4.035e-02	8.889e-03	4.539	5.96e-06
VisibilityChangeXSolarRadiationChange	-1.757e-04	6.020e-05	-2.919	0.003554
SolarRadiationChangeXRainfallChange	1.500e-01	3.781e-02	3.966	7.54e-05
SolarRadiationChangeXSnowfallChange	6.025e-01	1.221e-01	4.936	8.61e-07
HumidityChangeXHour8Change	1.712e-02	5.679e-03	3.014	0.002606
HumidityChangeXHour9Change	5.218e-02	9.119e-03	5.722	1.20e-08
HumidityChangeXHour10Change	2.795e-02	1.002e-02	2.790	0.005322
HumidityChangeXHour14Change	-3.710e-03	6.718e-03	-0.552	0.580800
HumidityChangeXHour15Change	-1.221e-02	6.472e-03	-1.887	0.059283
HumidityChangeXHour16Change	-2.185e-02	6.566e-03	-3.329	0.000888
HumidityChangeXHour23Change	-8.744e-03	6.558e-03	-1.333	0.182571
DewPointTempChangeXHour4Change	9.340e-02	3.990e-02	2.341	0.019342
DewPointTempChangeXHour10Change	2.111e-02	3.919e-02	0.539	0.590216
DewPointTempChangeXHour11Change	3.105e-02	2.668e-02	1.164	0.244672
DewPointTempChangeXHour18Change	-1.316e-01	2.811e-02	-4.684	2.99e-06
DewPointTempChangeXHour19Change	-9.718e-02	2.952e-02	-3.292	0.001011
DewPointTempChangeXHour20Change	-1.183e-01	2.798e-02	-4.230	2.44e-05
DewPointTempChangeXHour21Change	-1.127e-01	2.804e-02	-4.020	6.01e-05
DewPointTempChangeXHour22Change	-5.369e-02	2.856e-02	-1.880	0.060259
WindSpeedChangeXHour14Change	2.529e-02	6.813e-02	0.371	0.710509
WindSpeedChangeXHour15Change	8.328e-02	5.959e-02	1.398	0.162387
VisibilityChangeXHour10Change	4.444e-05	1.614e-04	0.275	0.783047
VisibilityChangeXHour11Change	-1.585e-04	1.687e-04	-0.939	0.347771
VisibilityChangeXHour22Change	1.648e-04	2.140e-04	0.770	0.441429
SolarRadiationChangeXHour5Change	-1.465e-01	1.501e-01	-0.976	0.329364
SolarRadiationChangeXHour8Change	-5.757e-01	1.332e-01	-4.322	1.62e-05
SolarRadiationChangeXHour9Change	-5.358e-02	1.238e-01	-0.433	0.665286
SolarRadiationChangeXHour11Change	1.338e-01	6.010e-02	2.225	0.026160
SolarRadiationChangeXHour12Change	3.630e-01	4.991e-02	7.273	4.93e-13
SolarRadiationChangeXHour13Change	1.019e-02	8.146e-02	0.125	0.900502
SolarRadiationChangeXHour16Change	-6.820e-01	1.376e-01	-4.958	7.67e-07
SolarRadiationChangeXHour22Change	8.806e-01	2.008e-01	4.386	1.21e-05
SolarRadiationChangeXHour23Change	1.421e+00	4.376e-01	3.247	0.001183
RainfallChangeXHour9Change	-1.421e-01	5.962e-02	-2.384	0.017213
RainfallChangeXHour20Change	-2.360e-01	8.713e-02	-2.709	0.006797
HumidityChange	***			
DewPointTempChange	***			
WindSpeedChange				
VisibilityChange	***			

SolarRadiationChange	***
RainfallChange	**
Hour5Change	
Hour14Change	***
Hour15Change	***
Hour16Change	***
Hour17Change	***
Hour18Change	***
Hour19Change	***
Hour20Change	***
Hour21Change	***
DewPointTempChangeXSolarRadiationChange	***
VisibilityChangeXSolarRadiationChange	**
SolarRadiationChangeXRainfallChange	***
SolarRadiationChangeXSnowfallChange	***
HumidityChangeXHour8Change	**
HumidityChangeXHour9Change	***
HumidityChangeXHour10Change	**
HumidityChangeXHour14Change	
HumidityChangeXHour15Change	.
HumidityChangeXHour16Change	***
HumidityChangeXHour23Change	
DewPointTempChangeXHour4Change	*
DewPointTempChangeXHour10Change	
DewPointTempChangeXHour11Change	
DewPointTempChangeXHour18Change	***
DewPointTempChangeXHour19Change	**
DewPointTempChangeXHour20Change	***
DewPointTempChangeXHour21Change	***
DewPointTempChangeXHour22Change	.
WindSpeedChangeXHour14Change	
WindSpeedChangeXHour15Change	
VisibilityChangeXHour10Change	
VisibilityChangeXHour11Change	
VisibilityChangeXHour22Change	
SolarRadiationChangeXHour5Change	
SolarRadiationChangeXHour8Change	***
SolarRadiationChangeXHour9Change	
SolarRadiationChangeXHour11Change	*
SolarRadiationChangeXHour12Change	***
SolarRadiationChangeXHour13Change	
SolarRadiationChangeXHour16Change	***
SolarRadiationChangeXHour22Change	***

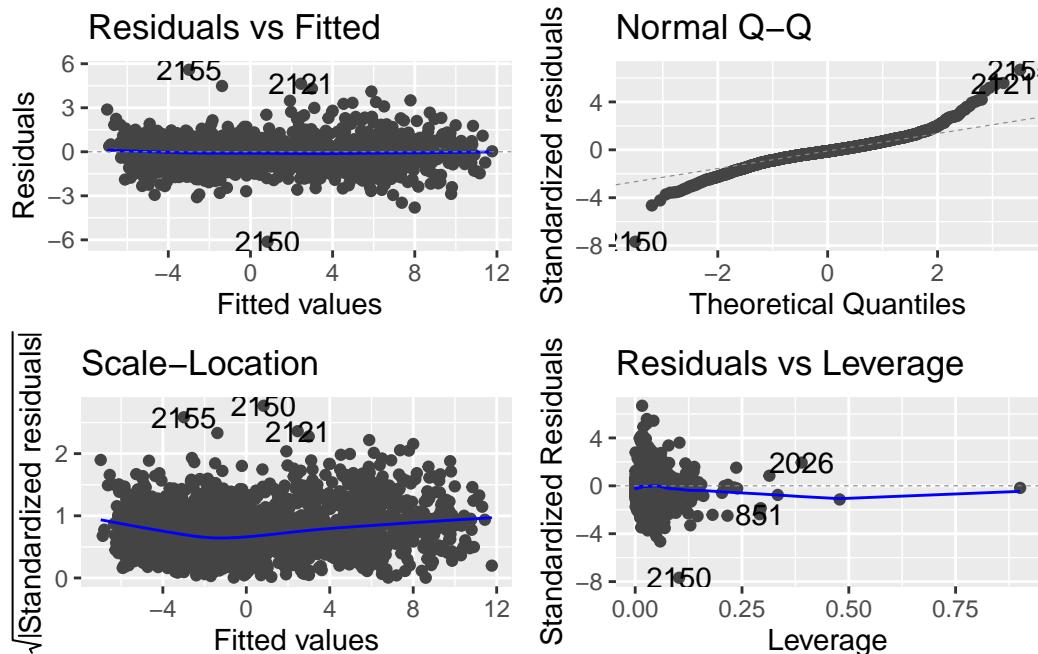
```

SolarRadiationChangeXHour23Change      **
RainfallChangeXHour9Change             *
RainfallChangeXHour20Change           **

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

Residual standard error: 0.843 on 2129 degrees of freedom
 Multiple R-squared: 0.9568, Adjusted R-squared: 0.9558
 F-statistic: 943.3 on 50 and 2129 DF, p-value: < 2.2e-16



A.5

Most assailant factors in Model (2) (hour changes excluded)

```

elastic.coef = tibble(
  Factor = names(seoul.elastic$coefficients),
  Coefficient = seoul.elastic$coefficients,
  P.Value = summary(seoul.elastic)$coefficients[, "Pr(>|t|)"] %>% round(5) %>%
    format(scientific=F)
) %>% arrange(abs(Coefficient)) %>% desc()

elastic.coef$Rank = 1:nrow(elastic.coef)

```

```

elastic.coef %>%
  filter(!(Factor %in% str_c(time.bike, "Change"))) %>%
  knitr::kable()

```

Factor	Coefficient	P.Value	Rank
SolarRadiationChangeXHour1Change	5.5787472	0.00294	1
SolarRadiationChangeXHour2Change	1.0122516	0.03117	4
SolarRadiationChangeXHour4Change	-0.9865170	0.00000	6
SolarRadiationChange	0.9417236	0.00000	7
SolarRadiationChangeXHour11Change	0.7053653	0.00000	13
SolarRadiationChangeXHour5Change	-0.5721647	0.00021	20
DewPointTempChange	0.5569784	0.00000	21
SolarRadiationChangeXHour3Change	-0.5403304	0.00097	22
SolarRadiationChangeXHour10Change	0.4998107	0.00002	23
SolarRadiationChangeXHour23Change	0.4748375	0.00226	25
SolarRadiationChangeXHour12Change	0.4625892	0.00261	26
SolarRadiationChangeXHour13Change	0.4106958	0.00000	28
SnowfallChange	0.3399878	0.00000	30
SnowfallChangeXHour19Change	0.3245405	0.17518	31
SolarRadiationChangeXHour7Change	-0.3107854	0.08847	32
WindSpeedChangeXHour6Change	0.2171378	0.00011	33
SnowfallChangeXHour10Change	-0.2124133	0.04062	34
SolarRadiationChangeXHour17Change	-0.1984743	0.07485	35
SnowfallChangeXHour8Change	-0.1903064	0.19591	36
SolarRadiationChangeXHour14Change	0.1826105	0.00239	37
DewPointTempChangeXHour1Change	0.1809766	0.00000	38
DewPointTempChangeXHour10Change	-0.1675868	0.00000	39
HumidityChange	-0.1516280	0.00000	41
WindSpeedChangeXHour5Change	0.1381607	0.01411	43
DewPointTempChangeXHour19Change	-0.1311686	0.00000	44
RainfallChangeXHour10Change	-0.1201618	0.00827	45
SolarRadiationChangeXHour20Change	-0.1129054	0.15039	46
HumidityChangeXHour10Change	0.1086546	0.00000	48
SnowfallChangeXHour9Change	-0.1037536	0.41262	49
SolarRadiationChangeXRainfallChange	0.1001328	0.00028	50
RainfallChangeXHour9Change	-0.0993346	0.01344	51
WindSpeedChangeXHour4Change	0.0858013	0.07650	52
DewPointTempChangeXHour18Change	-0.0807023	0.00009	53
WindSpeedChangeXHour17Change	-0.0752170	0.05725	54
WindSpeedChangeXHour3Change	0.0736372	0.14529	55
RainfallChangeXHour14Change	0.0652716	0.21511	56

Factor	Coefficient	P.Value	Rank
DewPointTempChangeXHour21Change	-0.0593261	0.00861	58
WindSpeedChangeXHour19Change	-0.0566760	0.17107	60
HumidityChangeXHour9Change	0.0564867	0.00000	61
WindSpeedChange	0.0533535	0.00003	62
HumidityChangeXHour5Change	0.0522806	0.00000	63
RainfallChangeXHour20Change	0.0513882	0.01267	64
DewPointTempChangeXHour20Change	0.0457215	0.05787	65
HumidityChangeXHour1Change	-0.0451956	0.00000	66
DewPointTempChangeXHour4Change	0.0441639	0.06444	67
HumidityChangeXHour8Change	0.0425455	0.00000	68
RainfallChangeXHour21Change	0.0422417	0.05652	69
HumidityChangeXHour23Change	-0.0409225	0.00000	70
HumidityChangeXHour11Change	0.0400053	0.00000	71
WindSpeedChangeXSolarRadiationChange	0.0387651	0.00265	72
HumidityChangeXHour19Change	0.0378249	0.00000	73
WindSpeedChangeXHour18Change	-0.0337908	0.38545	74
HumidityChangeXHour6Change	0.0337572	0.00000	75
HumidityChangeXHour2Change	-0.0246159	0.00043	76
HumidityChangeXHour12Change	0.0243231	0.00097	77
HumidityChangeXHour7Change	0.0242233	0.00054	78
HumidityChangeXHour22Change	-0.0223507	0.00007	79
WindSpeedChangeXHour10Change	-0.0216839	0.73121	80
HumidityChangeXHour15Change	0.0214781	0.00047	81
HumidityChangeXHour14Change	0.0180054	0.01504	82
DewPointTempChangeXWindSpeedChange	0.0158359	0.00002	84
DewPointTempChangeXHour13Change	-0.0149466	0.45930	85
HumidityChangeXSolarRadiationChange	0.0138289	0.00000	86
WindSpeedChangeXHour11Change	0.0080658	0.87343	87
RainfallChange	0.0076382	0.37502	88
WindSpeedChangeXHour15Change	-0.0068516	0.89308	89
DewPointTempChangeXRainfallChange	-0.0031795	0.55474	90
HumidityChangeXSnowfallChange	-0.0031603	0.03448	91
HumidityChangeXHour17Change	-0.0029178	0.68146	92
HumidityChangeXRainfallChange	-0.0022681	0.03134	93
DewPointTempChangeXHour14Change	-0.0014523	0.95275	94
HumidityChangeXDewPointTempChange	-0.0011938	0.00000	95
HumidityChangeXHour16Change	0.0010542	0.87275	96
VisibilityChangeXHour2Change	-0.0005888	0.00000	97
VisibilityChangeXHour23Change	-0.0005012	0.00001	98
VisibilityChangeXHour1Change	-0.0003992	0.00234	99
VisibilityChange	-0.0003308	0.00000	100

Factor	Coefficient	P.Value	Rank
VisibilityChangeXHour8Change	0.0002586	0.02993	101
VisibilityChangeXHour16Change	0.0001699	0.14074	102
VisibilityChangeXHour17Change	0.0001194	0.30295	103
VisibilityChangeXHour3Change	-0.0001184	0.33173	104
VisibilityChangeXHour20Change	-0.0000126	0.92086	105

A.6

The theoretical model for Model (2) can be fully written as,

$$(2) \Delta \text{Temperature}_{st} = \beta_1 \Delta \text{Humidity}_{st} + \beta_2 \Delta \text{DewPointTemp}_{st} + \beta_3 \Delta \text{Visibility}_{st} + \beta_4 \Delta \text{WindSpeed}_{st} + \beta_5 \Delta \text{SolarRadiation}_{st} + \beta_6 \Delta \text{Rainfall}_{st} + \beta_7 \Delta \text{Snowfall}_{st} + \beta_8 \Delta I(\text{Hour}_t = 1) + \dots + \beta_{30} \Delta I(\text{Hour}_t = 23) + \beta_{31} \Delta \text{Humidity}_{st} \text{DewPointTemp}_{st} + \beta_{32} \Delta \text{Humidity}_{st} \text{SolarRadiation}_{st} + \beta_{33} \Delta \text{Humidity}_{st} \text{Rainfall}_{st} + \beta_{34} \Delta \text{Humidity}_{st} \text{Snowfall}_{st} + \beta_{35} \Delta \text{DewPointTemp}_{st} \text{WindSpeed}_{st} + \beta_{36} \Delta \text{DewPointTemp}_{st} \text{Rainfall}_{st} + \beta_{37} \Delta \text{WindSpeed}_{st} \text{Visibility}_{st} + \beta_{38} \Delta \text{WindSpeed}_{st} \text{solarRadiation}_{st} + \beta_{39} \Delta \text{SolarRadiation}_{st} \text{Rainfall}_{st} + \sum_{j=1}^{23} \beta_{39+j} \Delta \text{Humidity}_{st} \Delta I(\text{Hour}_t = j) + \sum_{k=1}^{23} \beta_{62+k} \Delta \text{DewPointTemp}_{st} \Delta I(\text{Hour}_t = k) + \sum_{l=1}^{23} \beta_{85+l} \Delta \text{WindSpeed}_{st} \Delta I(\text{Hour}_t = l) + \sum_{m=1}^{23} \beta_{108+m} \Delta \text{Visibility}_{st} \Delta I(\text{Hour}_t = m) + \sum_{n=1}^{23} \beta_{131+n} \Delta \text{SolarRadiation}_{st} \Delta I(\text{Hour}_t = n) + \sum_{o=1}^{23} \beta_{154+o} \Delta \text{Rainfall}_{st} \Delta I(\text{Hour}_t = o) + \sum_{p=1}^{23} \beta_{177+p} \Delta \text{Snowfall}_{st} \Delta I(\text{Hour}_t = p) + \Delta \eta_{st}$$

$$\Delta \eta_{st} \stackrel{iid}{\sim} N(0, \sigma^2)$$

Due to the nature of elastic net regression, some of the coefficients for j, k, l, m, n, o , and p are 0:

$$\beta_{39+j} = 0 \quad \forall j \in \{3, 13, 15, 18, 20\}$$

$$\beta_{62+k} = 0 \quad \forall k \in \{3, 5, 6, 7, 8, 12, 15, 22, 23\}$$

$$\beta_{85+l} = 0 \quad \forall l \in \{1, 2, 3, 7, 8, 9, 12, 13, 14, 16, 20, 21, 22, 23\}$$

$$\beta_{108+m} = 0 \quad \forall m \in \{5, 6, 7, 10, 12, 13, 14, 15, 18, 21, 22\}$$

$$\beta_{131+n} = 0 \quad \forall n \in \{8, 9, 15, 16, 18, 21, 22\}$$

$$\beta_{154+o} = 0 \quad \forall o \in \{1, \dots, 8, 11, 12, 13, 15, 16, 17, 18, 19, 23\}$$

$$\beta_{177+p} = 0 \quad \forall p \in \{1, \dots, 7, 11, \dots, 15, 17, 18, 20, 21, 22, 23\}$$

A.7

Choosing the optimal set of lagged effects, $\delta_p \quad \forall p \in P$

Similar to choosing k in our k th-difference model such that $\Delta\text{Temperature}_{st}$ was no longer dependent on $\Delta\text{Temperature}_{st-k}$, we need to find the optimal set P such that $\text{RentedBikeCount}_{st}$ is no longer dependent on $\text{RentedBikeCount}_{st-p} \quad \forall p \in P$. To do this, we need to find the maximum lags ($\max(P)$) that makes it so there is no longer a significant marginal effect on $\text{RentedBikeCount}_{st}$.

```

find_local_max = function(v){
  if(v[2] <= v[1]){
    maxes = v[1]
  } else {
    maxes = c()
  }

  for(i in 1:length(v)){
    if(i-1 >= 1 && i+1 <= length(v)){
      if(v[i-1] <= v[i] &&
         v[i+1] <= v[i]){
        maxes = c(maxes, v[i])
      }
    }
  }

  if(v[length(v)] >= v[(length(v)-1)]){
    maxes = c(maxes, v[length(v)])
  }

  return(maxes)
}

graphs = list()

for(season in seoul$Seasons %>% unique()){
  l = 1
  alpha = 0.05
  seoul.subset = seoul %>% filter(Seasons == season)
  deltas = cov(seoul.subset$RentedBikeCount[(l+1):length(seoul.subset$RentedBikeCount)],
               lag(seoul.subset$RentedBikeCount, n=1)[(l+1):length(seoul.subset$RentedBikeCount)])
  var(seoul.subset$RentedBikeCount[(l+1):length(seoul.subset$RentedBikeCount)])
  p.value = 0
}

```

```

while(p.value < alpha){
  l = l+1

  deltas = c(deltas, cov(seoul.subset$RentedBikeCount[(l+1):length(seoul.subset$RentedBikeCount),
    lag(seoul.subset$RentedBikeCount, n=1)[(l+1):length(seoul.subset$RentedBikeCount)])/
    var(seoul.subset$RentedBikeCount[(l+1):length(seoul.subset$RentedBikeCount)]))

  l.lm = lm(seoul.subset$RentedBikeCount[(l+1):length(seoul.subset$RentedBikeCount)] ~
    lag(seoul.subset$RentedBikeCount, n=1)[(l+1):length(seoul.subset$RentedBikeCount)])
  summary()
  p.value = l.lm$coefficients[, "Pr(>|t|)"][2]
}

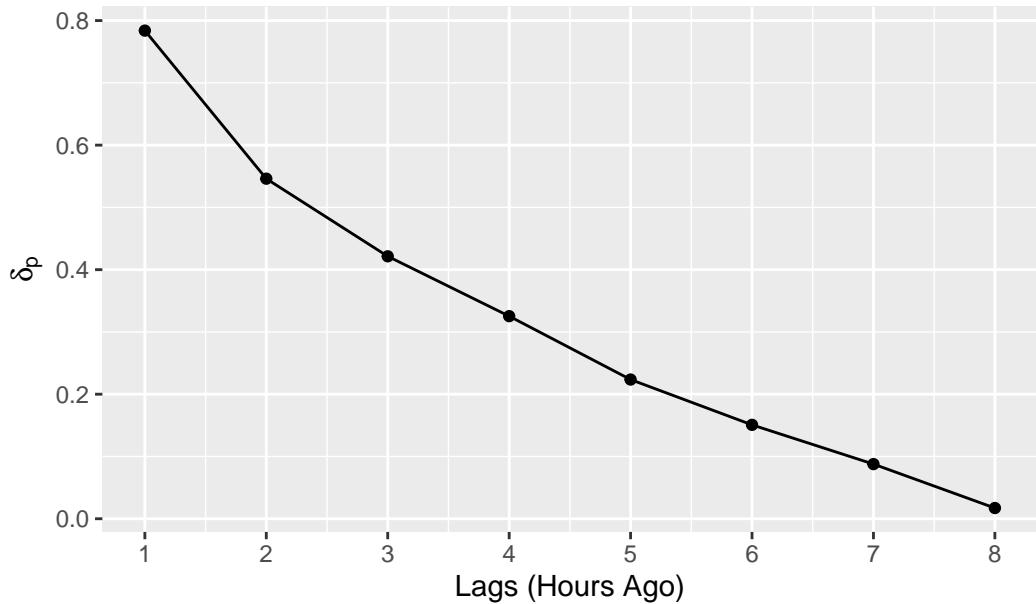
local.max = find_local_max(deltas)
deltas.max = which(deltas %in% local.max)

p = ggplot(mapping=aes(x=1:l, y=deltas))+
  geom_point()+
  geom_line()+
  xlab("Lags (Hours Ago)")+
  ylab(expression(delta[p]))+
  scale_x_continuous(breaks=1:l)+
  labs(title=str_c("Pth Lagged Effects on Rented Bike Count During ", season))

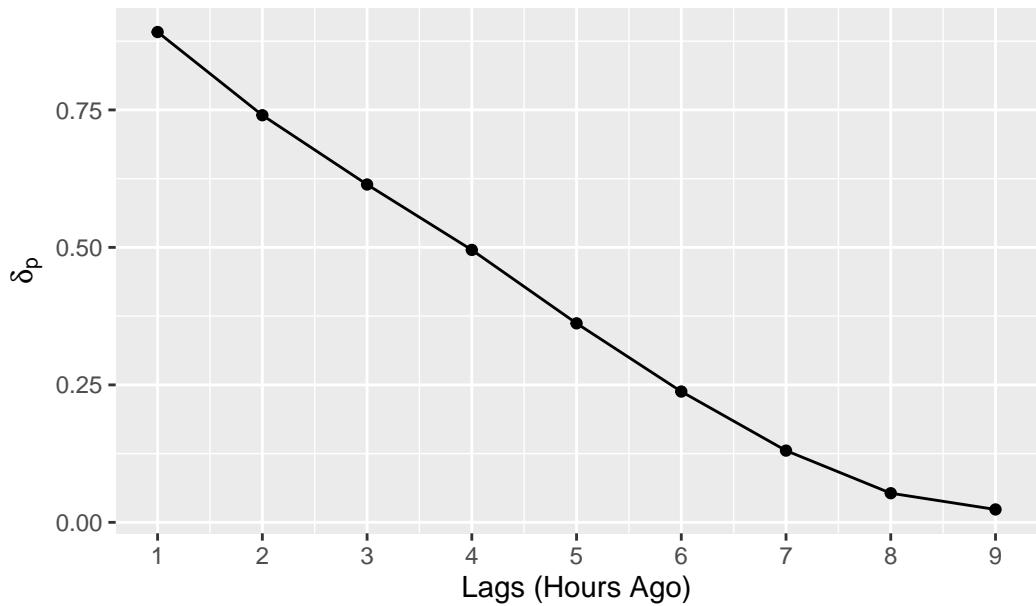
print(p)
}

```

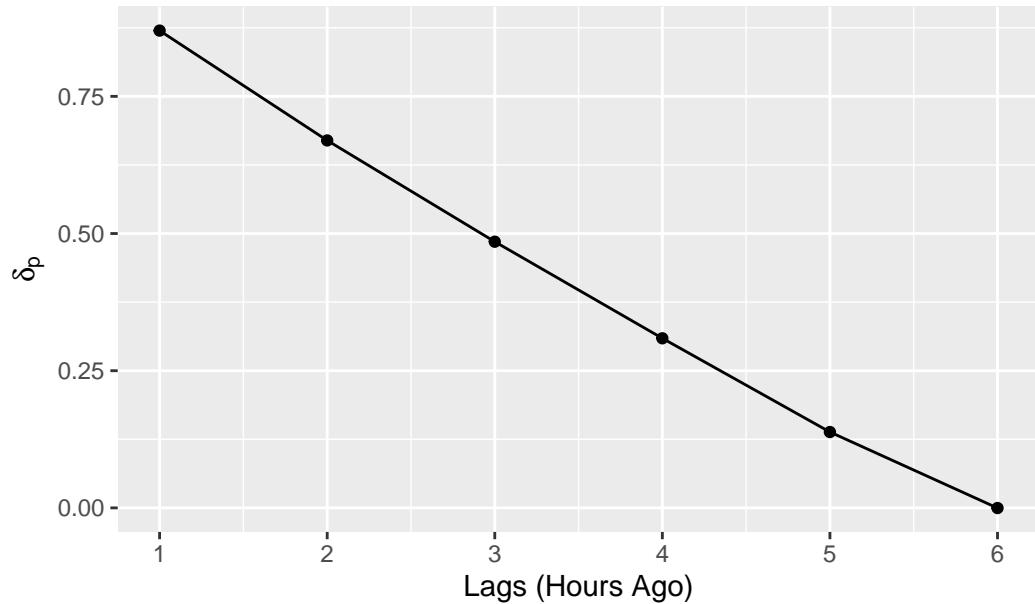
Pth Lagged Effects on Rented Bike Count During Winter



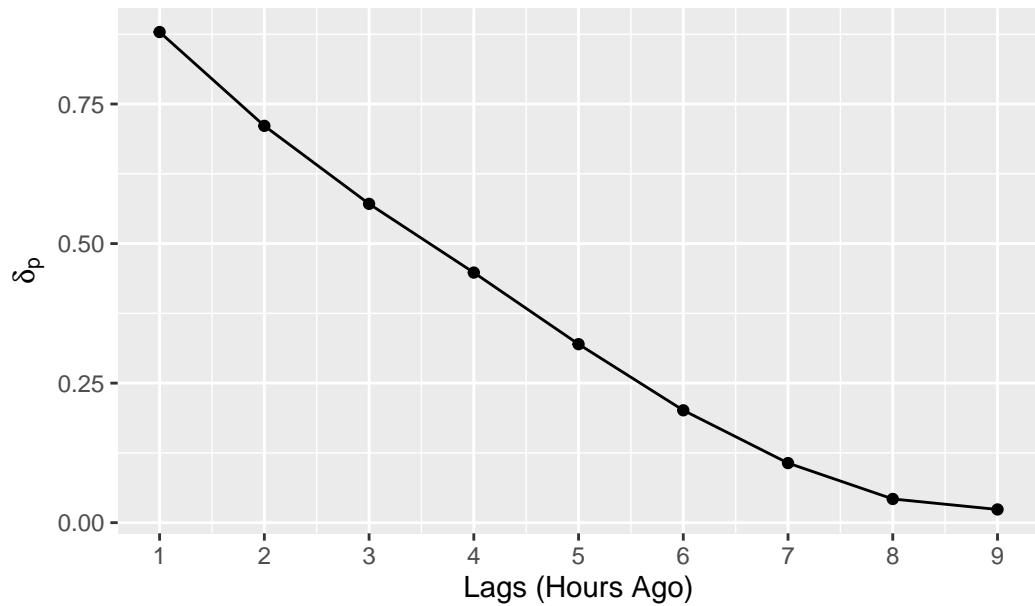
Pth Lagged Effects on Rented Bike Count During Spring



Pth Lagged Effects on Rented Bike Count During Summer



Pth Lagged Effects on Rented Bike Count During Autumn



Since Spring is our base season, we will include $p = 9$ lagged effects for $\text{RentedBikeCount}_{st}$ in the base model, and since no other season has $p > 9$, we do not need any other lagged effects

dependent on season.

A.8.0

Model 3 can be fully written as,

$$(3) \text{RentedBikeCount}_{st} = \beta_0 + \beta_1 \text{Humidity}_{st} + \beta_2 \text{Temperature}_{st} + \beta_3 \text{WindSpeed}_{st} + \beta_4 \text{Visibility}_{st} + \beta_5 \text{DewPointTemp}_{st} + \beta_6 \text{SolarRadiation}_{st} + \beta_7 \text{Rainfall}_{st} + \beta_8 \text{Snowfall}_{st} + \beta_9 I(\text{Day}_t = \text{Holiday}) + \beta_{10} I(\text{Hour}_t = 1) + \dots + \beta_{32} I(\text{Hour}_t = 23) + \beta_{33} I(\text{Season}_s = \text{Winter}) + \beta_{34} I(\text{Season}_s = \text{Summer}) + \beta_{35} I(\text{Season}_s = \text{Autumn}) + \delta_1 \text{RentedBikeCount}_{st-1} + \delta_{23} \text{RentedBikeCount}_{st-23} + \sum_{p=1}^9 \delta_p + \eta_{st}$$

A.8

Fitting a linear model to estimate parameters for Model (3)

```
model.3.factors = c(seoul.bike.factors,
                     bike.deltas) %>% setdiff(c(
                     time.h humidities, seoul.bike.transformed))

seoul.bike.lm = lm(RentedBikeCount ~ .,
                     data=seoul[model.3.factors])
summary(seoul.bike.lm)
```

Call:

```
lm(formula = RentedBikeCount ~ ., data = seoul[model.3.factors])
```

Residuals:

Min	1Q	Median	3Q	Max
-1775.17	-78.47	2.31	74.81	1378.45

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	2.945e+01	4.417e+01	0.667	0.505004
Humidity	-2.860e-01	4.603e-01	-0.621	0.534463
Temperature	1.091e+00	1.641e+00	0.665	0.506128
WindSpeed	-1.608e+00	2.307e+00	-0.697	0.485657
Visibility	9.769e-03	4.352e-03	2.245	0.024800 *
DewPointTemp	7.310e-01	1.704e+00	0.429	0.667946
SolarRadiation	5.752e+01	5.084e+00	11.313	< 2e-16 ***
Rainfall	-5.164e+00	1.903e+00	-2.714	0.006661 **

Snowfall	6.191e+00	4.890e+00	1.266	0.205530
IsHoliday	-2.126e+01	9.436e+00	-2.253	0.024281 *
Hour1	-5.452e+01	1.616e+01	-3.373	0.000747 ***
Hour2	-5.063e+01	1.608e+01	-3.149	0.001643 **
Hour3	-1.206e+02	1.567e+01	-7.696	1.56e-14 ***
Hour4	-9.982e+01	1.515e+01	-6.589	4.68e-11 ***
Hour5	-2.709e+01	1.583e+01	-1.712	0.086953 .
Hour6	9.300e+01	1.573e+01	5.911	3.52e-09 ***
Hour7	2.335e+02	1.591e+01	14.673	< 2e-16 ***
Hour8	3.394e+02	1.627e+01	20.861	< 2e-16 ***
Hour9	-4.198e+02	1.693e+01	-24.794	< 2e-16 ***
Hour10	-5.868e+01	1.751e+01	-3.350	0.000811 ***
Hour11	-3.354e+01	1.815e+01	-1.848	0.064682 .
Hour12	-1.776e-01	1.861e+01	-0.010	0.992384
Hour13	1.706e+01	1.862e+01	0.916	0.359597
Hour14	1.000e+01	1.652e+01	0.606	0.544820
Hour15	5.536e+01	1.827e+01	3.030	0.002454 **
Hour16	1.121e+02	1.769e+01	6.338	2.45e-10 ***
Hour17	1.661e+02	1.648e+01	10.079	< 2e-16 ***
Hour18	3.936e+02	1.582e+01	24.883	< 2e-16 ***
Hour19	-2.202e+02	1.640e+01	-13.430	< 2e-16 ***
Hour20	1.038e+02	1.608e+01	6.455	1.14e-10 ***
Hour21	5.696e+01	1.600e+01	3.561	0.000371 ***
Hour22	-8.296e+00	1.610e+01	-0.515	0.606336
Hour23	-8.919e+01	1.613e+01	-5.530	3.30e-08 ***
IsWinter	-1.927e+01	8.511e+00	-2.264	0.023619 *
IsSummer	7.420e+00	7.886e+00	0.941	0.346733
IsAutumn	1.417e+01	6.028e+00	2.350	0.018777 *
RentedBikeCount_Lag1	1.107e+00	1.065e-02	103.917	< 2e-16 ***
RentedBikeCount_Lag2	-3.318e-01	1.589e-02	-20.888	< 2e-16 ***
RentedBikeCount_Lag3	1.165e-01	1.628e-02	7.160	8.70e-13 ***
RentedBikeCount_Lag4	2.701e-02	1.632e-02	1.655	0.097899 .
RentedBikeCount_Lag5	-9.975e-02	1.629e-02	-6.124	9.50e-10 ***
RentedBikeCount_Lag6	-1.915e-03	1.632e-02	-0.117	0.906606
RentedBikeCount_Lag7	1.799e-02	1.627e-02	1.105	0.268987
RentedBikeCount_Lag8	-1.067e-01	1.587e-02	-6.723	1.89e-11 ***
RentedBikeCount_Lag9	1.447e-01	1.049e-02	13.793	< 2e-16 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

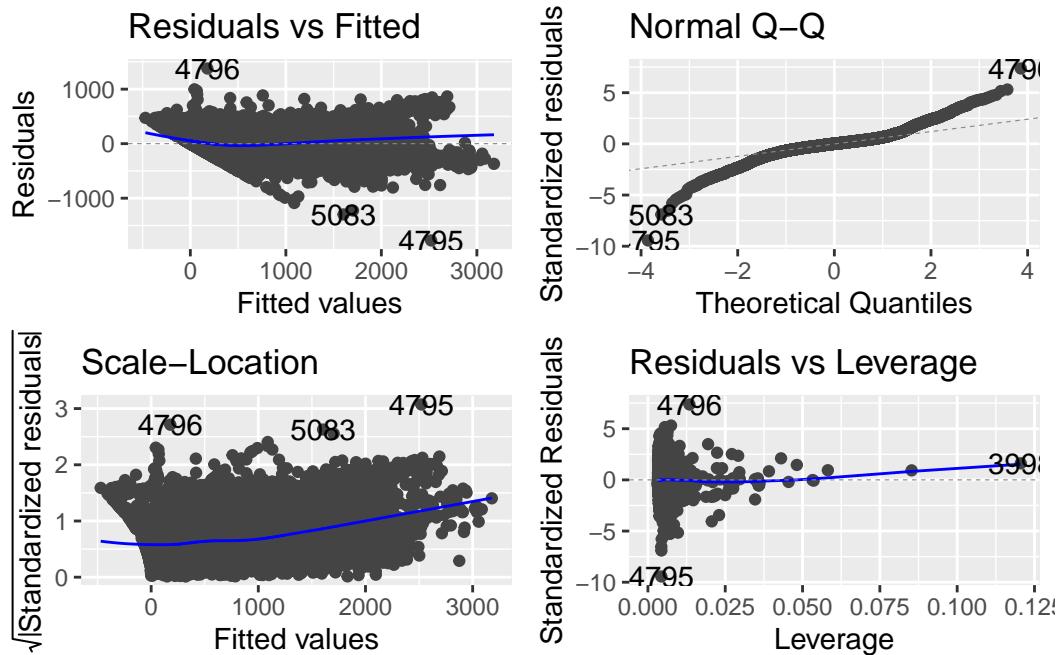
Residual standard error: 188.5 on 8706 degrees of freedom

(9 observations deleted due to missingness)

Multiple R-squared: 0.9151, Adjusted R-squared: 0.9146

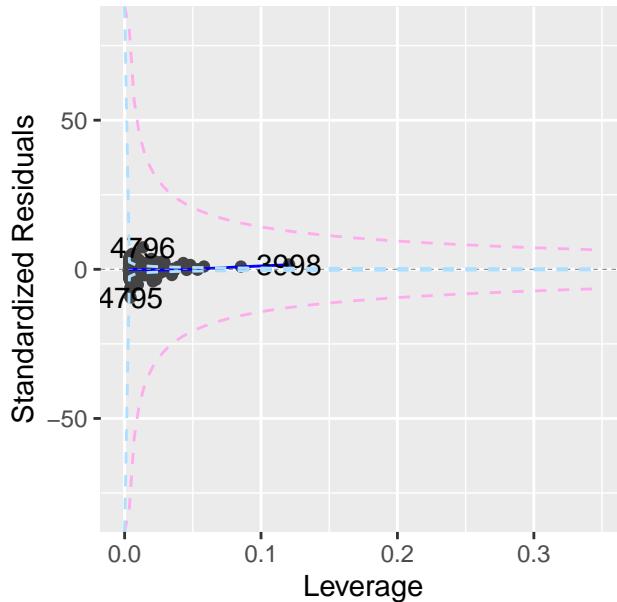
F-statistic: 2132 on 44 and 8706 DF, p-value: < 2.2e-16

```
autoplot(seoul.bike.lm)
```



```
show_leverage(seoul.bike.lm)
```

Residuals vs Leverage



Linearity seems to be roughly met and even Normality can be appealed to. However, in the $\sqrt{|\text{Standardized residuals}|}$ vs. Fitted values Plot, homoskedasticity appears to be violated, with some interesting trends happening with fitted values < 1000 .

A.9

Including all necessary interaction terms, we ran an elastic net regression to see if we could better meet the model assumptions.

```

singularities = c("SolarRadiationXHour1", "SolarRadiationXHour2", "SolarRadiationXHour3",
                 "SnowfallXIIsFunctioningDay", "SolarRadiationXHour4",
                 "SolarRadiationXHour5", "SolarRadiationXHour20", "SolarRadiationXHour21",
                 "SolarRadiationXHour22", "SolarRadiationXHour23", "SnowfallXIIsSummer",
                 "SnowfallXIIsAutumn")

seoul = create_interaction_terms(seoul)

model.bike.factors = setdiff(c(seoul.bike.factors, seoul.bike.interaction),
                             c(seoul.bike.base, "RentedBikeCount", singularities,
                               humidity.interactions))

seoul.bike.x = as.matrix(seoul[(length(bike.deltas)+1):nrow(seoul),model.bike.factors])

```

```

seoul.bike.y = as.matrix(seoul[(length(bike.deltas)+1):nrow(seoul),"RentedBikeCount"])

elastic_cv <- cv.glmnet(x = seoul.bike.x,
                        y = seoul.bike.y,
                        type.measure = "mse",
                        alpha = 1)

d = coef(elastic_cv, s = "lambda.1se")[2:(length(model.bike.factors)-1)]
elastic.bike.factors = model.bike.factors[which(d != 0)]
seoul.bike.elastic = lm(RentedBikeCount ~ .,
                        seoul[c("RentedBikeCount",
                                elastic.bike.factors)])

print(summary(seoul.bike.elastic))

```

Call:

```
lm(formula = RentedBikeCount ~ ., data = seoul[c("RentedBikeCount",
                                                elastic.bike.factors)])
```

Residuals:

Min	1Q	Median	3Q	Max
-2428.95	-35.94	-0.36	37.13	1020.47

Coefficients:

	Estimate	Std. Error	t value
(Intercept)	3.703e+01	6.878e+00	5.384
WindSpeed	-6.264e+00	2.162e+00	-2.897
Rainfall	-1.505e+00	2.268e+00	-0.664
Hour2	1.054e+01	1.609e+01	0.656
Hour3	1.644e+01	3.983e+01	0.413
Hour4	1.274e+01	3.821e+01	0.333
Hour11	3.283e+00	1.718e+01	0.191
IsWinter	-4.666e+00	1.922e+01	-0.243
RentedBikeCount_Lag1	7.548e-01	1.581e-02	47.757
RentedBikeCount_Lag5	-9.042e-03	6.939e-03	-1.303
HumidityXVisibility	2.260e-04	4.265e-05	5.300
HumidityXSolarRadiation	1.916e-01	9.240e-02	2.073
HumidityXRentedBikeCount_Lag1	2.105e-03	2.062e-04	10.210
HumidityXRentedBikeCount_Lag2	-1.990e-03	1.705e-04	-11.669
TemperatureXDewPointTemp	-4.012e-02	1.247e-02	-3.218
TemperatureXRentedBikeCount_Lag1	1.974e-03	4.050e-04	4.874

WindSpeedXDewPointTemp	-2.694e-02	1.108e-01	-0.243
WindSpeedXRentedBikeCount_Lag5	-4.816e-03	2.591e-03	-1.858
WindSpeedXRentedBikeCount_Lag9	4.217e-03	2.395e-03	1.761
DewPointTempXSolarRadiation	-2.441e-01	2.260e-01	-1.080
SolarRadiationXRainfall	4.186e+01	1.415e+01	2.959
SolarRadiationXIsHoliday	4.195e+00	5.987e+00	0.701
SolarRadiationXRentedBikeCount_Lag1	2.709e-02	5.474e-03	4.949
SolarRadiationXRentedBikeCount_Lag6	-7.336e-04	4.768e-03	-0.154
SolarRadiationXRentedBikeCount_Lag9	3.303e-02	6.641e-03	4.974
RainfallXSnowfall	-5.265e-01	2.100e+00	-0.251
RainfallXRentedBikeCount_Lag1	-8.107e-02	1.095e-02	-7.407
RainfallXRentedBikeCount_Lag3	3.336e-02	4.678e-03	7.131
RainfallXRentedBikeCount_Lag8	-3.720e-03	3.369e-03	-1.104
RentedBikeCount_Lag2XRentedBikeCount_Lag5	-4.076e-05	7.023e-06	-5.804
RentedBikeCount_Lag2XRentedBikeCount_Lag6	1.863e-05	6.268e-06	2.973
HumidityXHour3	-2.486e-01	4.205e-01	-0.591
HumidityXHour4	-2.282e-01	4.009e-01	-0.569
HumidityXHour7	1.281e+00	2.026e-01	6.323
HumidityXHour8	8.609e-01	1.466e-01	5.873
HumidityXHour13	1.851e-01	2.115e-01	0.875
HumidityXHour19	-1.072e+00	2.546e-01	-4.212
HumidityXHour20	-3.191e-01	1.741e-01	-1.832
HumidityXHour23	-1.712e-01	1.524e-01	-1.123
TemperatureXHour1	-4.446e-01	9.085e-01	-0.489
TemperatureXHour7	-6.664e+00	1.173e+00	-5.681
TemperatureXHour18	3.174e+00	1.905e+00	1.666
WindSpeedXHour1	-6.742e+00	6.589e+00	-1.023
WindSpeedXHour18	1.273e+01	5.469e+00	2.328
WindSpeedXHour19	-3.578e+00	6.075e+00	-0.589
VisibilityXHour1	-2.239e-02	9.184e-03	-2.438
VisibilityXHour2	-1.848e-02	9.422e-03	-1.961
VisibilityXHour3	-1.436e-02	1.149e-02	-1.249
VisibilityXHour4	-1.186e-02	1.120e-02	-1.059
VisibilityXHour17	8.966e-03	8.278e-03	1.083
VisibilityXHour18	7.180e-03	1.161e-02	0.618
DewPointTempXHour5	2.856e-01	6.355e-01	0.449
DewPointTempXHour8	-3.806e+00	5.467e-01	-6.963
DewPointTempXHour9	-1.286e+00	6.513e-01	-1.975
DewPointTempXHour11	-1.347e+00	6.832e-01	-1.971
DewPointTempXHour16	1.233e+00	6.205e-01	1.988
DewPointTempXHour17	2.374e+00	7.841e-01	3.028
DewPointTempXHour18	8.282e-01	1.579e+00	0.525
DewPointTempXHour19	3.474e-01	7.800e-01	0.445

DewPointTempXHour20	2.801e+00	6.562e-01	4.268
DewPointTempXHour21	1.732e+00	6.656e-01	2.602
SolarRadiationXHour8	-1.523e+02	2.075e+01	-7.342
SolarRadiationXHour18	-5.225e+00	2.356e+01	-0.222
SolarRadiationXHour19	6.107e+02	5.304e+01	11.514
RainfallXHour7	1.090e+01	6.616e+00	1.648
RainfallXHour9	-4.909e+00	4.753e+00	-1.033
RainfallXHour13	3.029e+00	3.492e+00	0.867
RainfallXHour16	-2.431e+01	1.447e+01	-1.680
RainfallXHour17	-5.210e+01	7.710e+00	-6.758
RainfallXHour18	-2.797e+00	4.388e+00	-0.637
RainfallXHour19	-2.308e+01	1.024e+01	-2.254
RainfallXHour20	-1.390e+01	3.826e+00	-3.633
SnowfallXHour9	-1.773e+01	1.217e+01	-1.457
IsHolidayXHour5	-3.986e+01	2.608e+01	-1.528
IsHolidayXHour6	-2.714e+00	2.696e+01	-0.101
IsHolidayXHour7	-2.781e+01	2.711e+01	-1.026
IsHolidayXHour8	-4.842e+01	2.688e+01	-1.801
IsHolidayXHour10	2.038e+01	2.795e+01	0.729
IsHolidayXHour15	-4.653e+01	2.769e+01	-1.680
IsHolidayXHour17	-4.071e+01	2.708e+01	-1.503
IsHolidayXHour18	-6.531e+01	2.728e+01	-2.394
IsHolidayXHour19	5.091e+01	2.693e+01	1.891
IsHolidayXHour20	2.791e+01	2.654e+01	1.051
RentedBikeCount_Lag1XHour1	-1.173e-01	2.827e-02	-4.148
RentedBikeCount_Lag1XHour2	-6.260e-02	2.198e-02	-2.848
RentedBikeCount_Lag1XHour3	-9.836e-02	2.974e-02	-3.307
RentedBikeCount_Lag1XHour4	-1.650e-01	4.298e-02	-3.840
RentedBikeCount_Lag1XHour6	1.888e+00	9.276e-02	20.355
RentedBikeCount_Lag1XHour7	1.482e+00	3.778e-02	39.233
RentedBikeCount_Lag1XHour8	7.369e-01	1.848e-02	39.867
RentedBikeCount_Lag1XHour9	-2.961e-01	4.810e-02	-6.156
RentedBikeCount_Lag1XHour11	2.207e-01	2.614e-02	8.444
RentedBikeCount_Lag1XHour12	3.014e-01	1.837e-02	16.405
RentedBikeCount_Lag1XHour13	7.810e-02	5.014e-02	1.558
RentedBikeCount_Lag1XHour14	1.964e-01	1.773e-02	11.074
RentedBikeCount_Lag1XHour15	1.929e-01	1.303e-02	14.806
RentedBikeCount_Lag1XHour16	1.963e-01	1.440e-02	13.633
RentedBikeCount_Lag1XHour17	1.665e-01	1.497e-02	11.119
RentedBikeCount_Lag1XHour18	7.858e-01	3.577e-02	21.970
RentedBikeCount_Lag1XHour19	-2.675e-01	1.446e-02	-18.491
RentedBikeCount_Lag2XHour9	-2.930e-01	7.836e-02	-3.739
RentedBikeCount_Lag2XHour10	-6.918e-02	5.045e-02	-1.371

RentedBikeCount_Lag2XHour23	-1.479e-02	1.105e-02	-1.339
RentedBikeCount_Lag3XHour6	-6.361e-01	6.370e-02	-9.985
RentedBikeCount_Lag3XHour7	-5.376e-01	2.746e-01	-1.958
RentedBikeCount_Lag3XHour10	1.046e-01	1.180e-01	0.887
RentedBikeCount_Lag3XHour13	2.491e-01	8.326e-02	2.991
RentedBikeCount_Lag3XHour18	-8.778e-01	6.687e-02	-13.127
RentedBikeCount_Lag3XHour21	9.925e-02	9.548e-03	10.394
RentedBikeCount_Lag4XHour7	-1.094e-01	1.644e-01	-0.665
RentedBikeCount_Lag4XHour10	-3.313e-01	1.394e-01	-2.376
RentedBikeCount_Lag4XHour18	2.272e-01	6.622e-02	3.431
RentedBikeCount_Lag4XHour19	2.784e-01	3.243e-02	8.585
RentedBikeCount_Lag4XHour22	6.022e-02	1.520e-02	3.962
RentedBikeCount_Lag5XHour9	9.621e-01	2.725e-01	3.530
RentedBikeCount_Lag5XHour20	1.552e-01	1.263e-02	12.289
RentedBikeCount_Lag5XHour22	1.692e-02	1.947e-02	0.869
RentedBikeCount_Lag6XHour9	4.014e-01	1.650e-01	2.433
RentedBikeCount_Lag6XHour10	5.910e-01	2.760e-01	2.141
RentedBikeCount_Lag6XHour13	-1.027e-01	2.323e-02	-4.423
RentedBikeCount_Lag6XHour19	3.980e-02	3.656e-02	1.089
RentedBikeCount_Lag7XHour1	6.103e-02	8.272e-03	7.378
RentedBikeCount_Lag7XHour10	3.006e-02	1.649e-01	0.182
RentedBikeCount_Lag7XHour21	4.144e-02	6.336e-02	0.654
RentedBikeCount_Lag8XHour14	-1.315e-01	4.276e-02	-3.077
RentedBikeCount_Lag8XHour16	2.566e-02	9.946e-03	2.580
RentedBikeCount_Lag8XHour18	-1.085e+00	8.701e-02	-12.470
RentedBikeCount_Lag8XHour21	1.459e-02	6.726e-02	0.217
RentedBikeCount_Lag9XHour5	3.905e-03	6.994e-03	0.558
RentedBikeCount_Lag9XHour13	-8.116e-02	1.106e-01	-0.734
RentedBikeCount_Lag9XHour17	1.411e-01	1.168e-02	12.079
RentedBikeCount_Lag9XHour18	1.093e+00	5.422e-02	20.159
HumidityXIIsWinter	-1.434e-01	2.187e-01	-0.655
WindSpeedXIIsSummer	1.056e+01	3.930e+00	2.687
VisibilityXIIsWinter	-3.245e-03	6.594e-03	-0.492
SolarRadiationXIIsSummer	-3.359e+01	5.089e+00	-6.601
RainfallXIIsWinter	-6.982e+00	6.030e+00	-1.158
RainfallXIIsSummer	-2.039e+00	2.578e+00	-0.791
Hour1XIIsWinter	4.731e+01	1.846e+01	2.563
Hour1XIIsAutumn	-2.574e+00	1.467e+01	-0.175
Hour2XIIsAutumn	-1.423e+01	1.378e+01	-1.033
Hour5XIIsSummer	2.226e+01	1.816e+01	1.225
Hour6XIIsWinter	-1.347e+01	1.269e+01	-1.062
Hour6XIIsAutumn	2.889e+01	1.314e+01	2.199
Hour7XIIsWinter	-9.788e+01	1.984e+01	-4.933

Hour7XIIsSummer	-8.580e+01	2.087e+01	-4.111
Hour8XIIsAutumn	5.614e+00	1.430e+01	0.393
Hour9XIIsSummer	-6.067e+01	1.948e+01	-3.115
Hour10XIIsWinter	-2.026e+01	1.307e+01	-1.550
Hour10XIIsSummer	-3.433e+01	1.934e+01	-1.775
Hour11XIIsWinter	-4.865e+00	2.206e+01	-0.221
Hour12XIIsSummer	-5.586e+01	1.746e+01	-3.199
Hour12XIIsAutumn	-4.804e+01	1.492e+01	-3.221
Hour13XIIsAutumn	8.225e+00	1.431e+01	0.575
Hour15XIIsSummer	3.474e+01	1.562e+01	2.224
Hour16XIIsSummer	-1.396e+01	1.867e+01	-0.747
Hour17XIIsSummer	-1.536e+00	2.307e+01	-0.067
Hour17XIIsAutumn	1.889e+01	1.710e+01	1.104
Hour18XIIsSummer	-9.904e+01	2.131e+01	-4.648
Hour19XIIsSummer	1.444e+02	2.231e+01	6.471
Hour19XIIsAutumn	9.161e+01	1.787e+01	5.127
Hour20XIIsSummer	8.666e+01	1.923e+01	4.507
Hour21XIIsSummer	-3.264e+01	2.131e+01	-1.531
Hour21XIIsAutumn	-3.506e+01	1.547e+01	-2.267
RentedBikeCount_Lag1XIIsAutumn	1.642e-02	4.046e-03	4.058
RentedBikeCount_Lag3XIIsSummer	3.044e-02	5.057e-03	6.019
Pr(> t)			
(Intercept)	7.47e-08	***	
WindSpeed	0.003772	**	
Rainfall	0.506972		
Hour2	0.512153		
Hour3	0.679813		
Hour4	0.738864		
Hour11	0.848439		
IsWinter	0.808138		
RentedBikeCount_Lag1	< 2e-16	***	
RentedBikeCount_Lag5	0.192556		
HumidityXVisibility	1.19e-07	***	
HumidityXSolarRadiation	0.038157	*	
HumidityXRentedBikeCount_Lag1	< 2e-16	***	
HumidityXRentedBikeCount_Lag2	< 2e-16	***	
TemperatureXDewPointTemp	0.001293	**	
TemperatureXRentedBikeCount_Lag1	1.11e-06	***	
WindSpeedXDewPointTemp	0.807914		
WindSpeedXRentedBikeCount_Lag5	0.063137	.	
WindSpeedXRentedBikeCount_Lag9	0.078307	.	
DewPointTempXSolarRadiation	0.280167		
SolarRadiationXRainfall	0.003090	**	

SolarRadiationXIsHoliday	0.483553
SolarRadiationXRentedBikeCount_Lag1	7.61e-07 ***
SolarRadiationXRentedBikeCount_Lag6	0.877715
SolarRadiationXRentedBikeCount_Lag9	6.69e-07 ***
Rainfall1XSnowfall	0.802028
Rainfall1XRentedBikeCount_Lag1	1.42e-13 ***
Rainfall1XRentedBikeCount_Lag3	1.08e-12 ***
Rainfall1XRentedBikeCount_Lag8	0.269477
RentedBikeCount_Lag2XRentedBikeCount_Lag5	6.72e-09 ***
RentedBikeCount_Lag2XRentedBikeCount_Lag6	0.002957 **
HumidityXHour3	0.554411
HumidityXHour4	0.569150
HumidityXHour7	2.69e-10 ***
HumidityXHour8	4.44e-09 ***
HumidityXHour13	0.381618
HumidityXHour19	2.55e-05 ***
HumidityXHour20	0.066921 .
HumidityXHour23	0.261360
TemperatureXHour1	0.624579
TemperatureXHour7	1.38e-08 ***
TemperatureXHour18	0.095690 .
WindSpeedXHour1	0.306224
WindSpeedXHour18	0.019961 *
WindSpeedXHour19	0.555930
VisibilityXHour1	0.014777 *
VisibilityXHour2	0.049875 *
VisibilityXHour3	0.211598
VisibilityXHour4	0.289784
VisibilityXHour17	0.278779
VisibilityXHour18	0.536483
DewPointTempXHour5	0.653102
DewPointTempXHour8	3.59e-12 ***
DewPointTempXHour9	0.048353 *
DewPointTempXHour11	0.048752 *
DewPointTempXHour16	0.046868 *
DewPointTempXHour17	0.002472 **
DewPointTempXHour18	0.599813
DewPointTempXHour19	0.656085
DewPointTempXHour20	1.99e-05 ***
DewPointTempXHour21	0.009284 **
SolarRadiationXHour8	2.30e-13 ***
SolarRadiationXHour18	0.824517
SolarRadiationXHour19	< 2e-16 ***

RainfallXHour7	0.099332 .
RainfallXHour9	0.301697
RainfallXHour13	0.385698
RainfallXHour16	0.093034 .
RainfallXHour17	1.49e-11 ***
RainfallXHour18	0.523966
RainfallXHour19	0.024241 *
RainfallXHour20	0.000281 ***
SnowfallXHour9	0.145031
IsHolidayXHour5	0.126536
IsHolidayXHour6	0.919828
IsHolidayXHour7	0.304994
IsHolidayXHour8	0.071694 .
IsHolidayXHour10	0.465856
IsHolidayXHour15	0.092921 .
IsHolidayXHour17	0.132861
IsHolidayXHour18	0.016687 *
IsHolidayXHour19	0.058722 .
IsHolidayXHour20	0.293110
RentedBikeCount_Lag1XHour1	3.38e-05 ***
RentedBikeCount_Lag1XHour2	0.004406 **
RentedBikeCount_Lag1XHour3	0.000947 ***
RentedBikeCount_Lag1XHour4	0.000124 ***
RentedBikeCount_Lag1XHour6	< 2e-16 ***
RentedBikeCount_Lag1XHour7	< 2e-16 ***
RentedBikeCount_Lag1XHour8	< 2e-16 ***
RentedBikeCount_Lag1XHour9	7.79e-10 ***
RentedBikeCount_Lag1XHour11	< 2e-16 ***
RentedBikeCount_Lag1XHour12	< 2e-16 ***
RentedBikeCount_Lag1XHour13	0.119307
RentedBikeCount_Lag1XHour14	< 2e-16 ***
RentedBikeCount_Lag1XHour15	< 2e-16 ***
RentedBikeCount_Lag1XHour16	< 2e-16 ***
RentedBikeCount_Lag1XHour17	< 2e-16 ***
RentedBikeCount_Lag1XHour18	< 2e-16 ***
RentedBikeCount_Lag1XHour19	< 2e-16 ***
RentedBikeCount_Lag2XHour9	0.000186 ***
RentedBikeCount_Lag2XHour10	0.170356
RentedBikeCount_Lag2XHour23	0.180535
RentedBikeCount_Lag3XHour6	< 2e-16 ***
RentedBikeCount_Lag3XHour7	0.050319 .
RentedBikeCount_Lag3XHour10	0.375210
RentedBikeCount_Lag3XHour13	0.002785 **

RentedBikeCount_Lag3XHour18	< 2e-16 ***
RentedBikeCount_Lag3XHour21	< 2e-16 ***
RentedBikeCount_Lag4XHour7	0.505754
RentedBikeCount_Lag4XHour10	0.017505 *
RentedBikeCount_Lag4XHour18	0.000604 ***
RentedBikeCount_Lag4XHour19	< 2e-16 ***
RentedBikeCount_Lag4XHour22	7.48e-05 ***
RentedBikeCount_Lag5XHour9	0.000417 ***
RentedBikeCount_Lag5XHour20	< 2e-16 ***
RentedBikeCount_Lag5XHour22	0.384779
RentedBikeCount_Lag6XHour9	0.015000 *
RentedBikeCount_Lag6XHour10	0.032264 *
RentedBikeCount_Lag6XHour13	9.86e-06 ***
RentedBikeCount_Lag6XHour19	0.276383
RentedBikeCount_Lag7XHour1	1.76e-13 ***
RentedBikeCount_Lag7XHour10	0.855392
RentedBikeCount_Lag7XHour21	0.513144
RentedBikeCount_Lag8XHour14	0.002101 **
RentedBikeCount_Lag8XHour16	0.009911 **
RentedBikeCount_Lag8XHour18	< 2e-16 ***
RentedBikeCount_Lag8XHour21	0.828246
RentedBikeCount_Lag9XHour5	0.576670
RentedBikeCount_Lag9XHour13	0.462994
RentedBikeCount_Lag9XHour17	< 2e-16 ***
RentedBikeCount_Lag9XHour18	< 2e-16 ***
HumidityXIIsWinter	0.512191
WindSpeedXIIsSummer	0.007226 **
VisibilityXIIsWinter	0.622649
SolarRadiationXIIsSummer	4.33e-11 ***
RainfallXIIsWinter	0.246950
RainfallXIIsSummer	0.429005
Hour1XIIsWinter	0.010387 *
Hour1XIIsAutumn	0.860778
Hour2XIIsAutumn	0.301697
Hour5XIIsSummer	0.220434
Hour6XIIsWinter	0.288352
Hour6XIIsAutumn	0.027885 *
Hour7XIIsWinter	8.25e-07 ***
Hour7XIIsSummer	3.98e-05 ***
Hour8XIIsAutumn	0.694557
Hour9XIIsSummer	0.001843 **
Hour10XIIsWinter	0.121143
Hour10XIIsSummer	0.076010 .

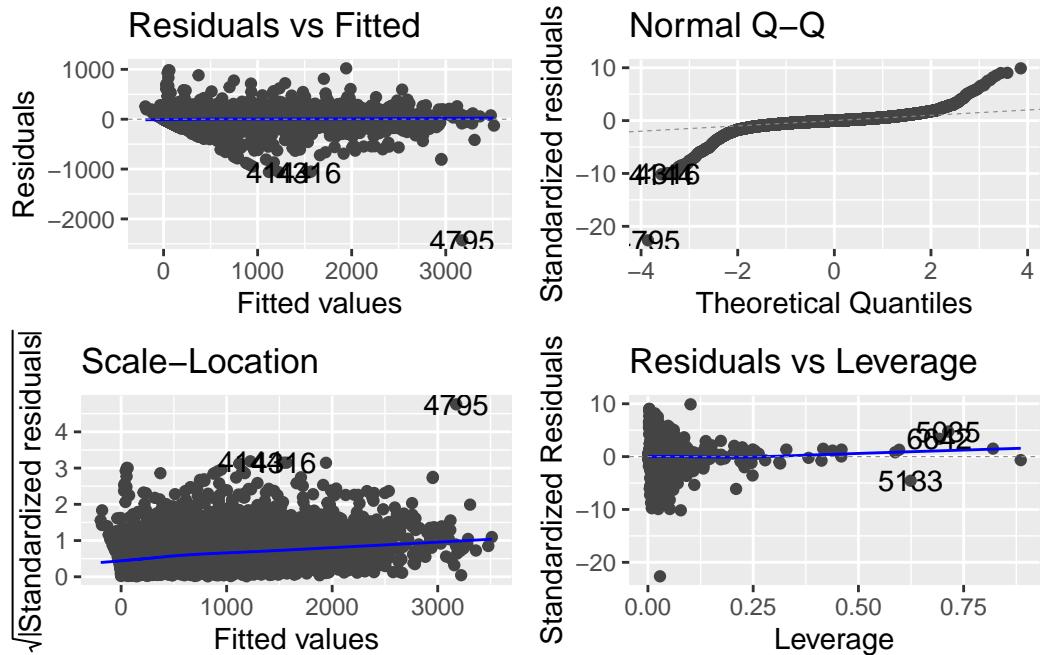
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Hour11XIIsWinter          0.825440
Hour12XIIsSummer          0.001385  **
Hour12XIIsAutumn          0.001284  **
Hour13XIIsAutumn          0.565466
Hour15XIIsSummer          0.026190  *
Hour16XIIsSummer          0.454809
Hour17XIIsSummer          0.946929
Hour17XIIsAutumn          0.269468
Hour18XIIsSummer          3.41e-06  ***
Hour19XIIsSummer          1.03e-10  ***
Hour19XIIsAutumn          3.01e-07  ***
Hour20XIIsSummer          6.67e-06  ***
Hour21XIIsSummer          0.125683
Hour21XIIsAutumn          0.023432  *
RentedBikeCount_Lag1XIIsAutumn  4.99e-05  ***
RentedBikeCount_Lag3XIIsSummer  1.82e-09  ***
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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

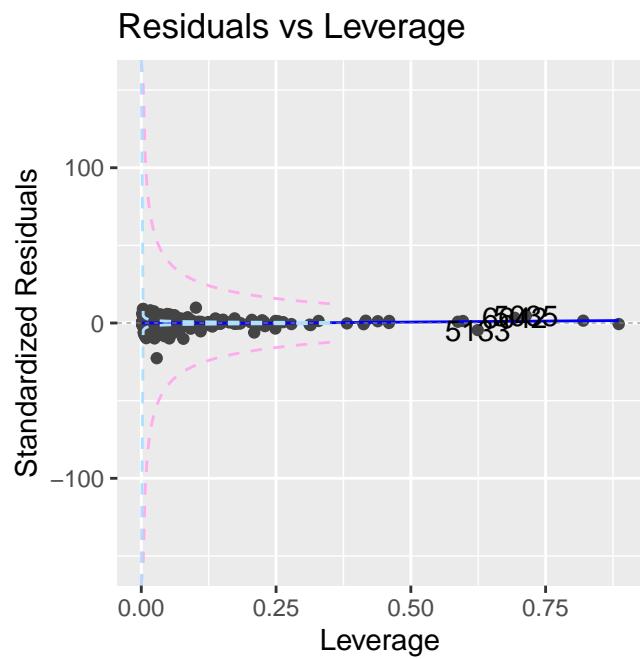
Residual standard error: 108.8 on 8585 degrees of freedom
(9 observations deleted due to missingness)
Multiple R-squared:  0.9721,    Adjusted R-squared:  0.9715
F-statistic:  1812 on 165 and 8585 DF,  p-value: < 2.2e-16

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 autoplot(seoul.bike.elastic)
```



```
show_leverage(seoul.bike.elastic)
```



A.10.0

Transformations of Model (3)

We first considered a log transformation of $\text{RentedBikeCount}_{st}$

```
seoul$RentedBikeCount = log(seoul$RentedBikeCount + 1)
calculate_deltas()
seoul = create_interaction_terms(seoul)

seoul.bike.x = as.matrix(seoul[(length(bike.deltas)+1):nrow(seoul),model.bike.factors])
seoul.bike.y = as.matrix(seoul[(length(bike.deltas)+1):nrow(seoul),"RentedBikeCount"])

elastic_cv <- cv.glmnet(x = seoul.bike.x,
                        y = seoul.bike.y,
                        type.measure = "mse",
                        alpha = 1)

d = coef(elastic_cv, s = "lambda.1se")[2:(length(model.bike.factors)-1)]
elastic.bike.factors.log = model.bike.factors[which(d != 0)]
seoul.bike.elastic.log = lm(RentedBikeCount ~ .,
                            seoul[c("RentedBikeCount",
                                    elastic.bike.factors.log)])

print(summary(seoul.bike.elastic.log))
```

Call:

```
lm(formula = RentedBikeCount ~ ., data = seoul[c("RentedBikeCount",
                                                 elastic.bike.factors.log)])
```

Residuals:

Min	1Q	Median	3Q	Max
-6.2976	-0.0752	0.0080	0.0970	2.0034

Coefficients:

	Estimate	Std. Error	t value
(Intercept)	5.183e+00	2.060e-01	25.158
Humidity	-3.596e-03	2.289e-03	-1.571
Visibility	1.389e-04	5.292e-05	2.624
SolarRadiation	-1.568e-01	6.604e-02	-2.374
Rainfall	-3.320e-01	3.787e-02	-8.766
Hour1	-4.986e+00	2.529e-01	-19.714

Hour2	-5.062e+00	2.813e-01	-17.992
Hour3	-4.979e+00	2.609e-01	-19.082
Hour4	-5.104e+00	2.684e-01	-19.014
Hour5	-4.418e+00	2.258e-01	-19.566
Hour6	-4.579e+00	2.323e-01	-19.713
Hour7	-4.666e+00	2.682e-01	-17.399
Hour8	-5.084e+00	2.770e-01	-18.350
Hour9	-4.707e+00	2.383e-01	-19.752
Hour10	-4.836e+00	2.286e-01	-21.154
Hour11	-4.474e+00	2.327e-01	-19.226
Hour12	-4.346e+00	2.208e-01	-19.682
Hour13	-5.250e+00	4.754e-01	-11.045
Hour14	-4.368e+00	2.259e-01	-19.341
Hour15	-4.220e+00	2.054e-01	-20.551
Hour16	-4.519e+00	2.406e-01	-18.783
Hour17	-5.302e+00	4.924e-01	-10.767
Hour18	-3.794e+00	4.447e-01	-8.532
Hour19	-5.079e+00	2.188e-01	-23.211
Hour20	-4.982e+00	2.112e-01	-23.588
Hour21	-5.052e+00	2.140e-01	-23.612
Hour22	-4.996e+00	2.067e-01	-24.175
Hour23	-5.230e+00	1.757e-01	-29.764
IsAutumn	-2.585e-02	6.889e-02	-0.375
RentedBikeCount_Lag1	6.899e-01	4.284e-02	16.104
RentedBikeCount_Lag5	-8.311e-02	5.086e-02	-1.634
RentedBikeCount_Lag6	-6.095e-02	4.682e-02	-1.302
RentedBikeCount_Lag7	-2.040e-01	4.973e-02	-4.102
RentedBikeCount_Lag8	-2.215e-01	4.569e-02	-4.848
RentedBikeCount_Lag9	6.515e-02	4.608e-02	1.414
HumidityXVisibility	4.390e-07	5.370e-07	0.818
HumidityXSolarRadiation	1.533e-03	6.502e-04	2.357
HumidityXRentedBikeCount_Lag1	1.641e-03	5.218e-04	3.145
HumidityXRentedBikeCount_Lag2	-1.268e-03	4.336e-04	-2.925
HumidityXRentedBikeCount_Lag6	4.143e-05	4.098e-04	0.101
HumidityXRentedBikeCount_Lag9	-1.081e-03	3.660e-04	-2.952
TemperatureXDewPointTemp	1.588e-05	9.383e-05	0.169
TemperatureXSolarRadiation	-7.073e-04	1.494e-03	-0.474
TemperatureXRentedBikeCount_Lag1	4.851e-03	9.856e-04	4.922
TemperatureXRentedBikeCount_Lag3	3.484e-04	1.198e-03	0.291
WindSpeedXDewPointTemp	-3.131e-04	4.243e-04	-0.738
WindSpeedXRainfall	6.440e-03	5.476e-03	1.176
WindSpeedXSnowfall	2.562e-03	1.325e-02	0.193
WindSpeedXIsholiday	-1.579e-03	1.837e-02	-0.086

WindSpeedXRentedBikeCount_Lag1	1.769e-04	1.653e-03	0.107
VisibilityXDewPointTemp	2.915e-07	9.625e-07	0.303
VisibilityXRainfall	5.287e-05	9.663e-06	5.471
VisibilityXSnowfall	-1.687e-05	2.221e-05	-0.759
VisibilityXIsHoliday	1.487e-05	4.113e-05	0.362
VisibilityXRentedBikeCount_Lag7	-2.243e-05	5.409e-06	-4.147
DewPointTempXRainfall	2.767e-03	1.425e-03	1.941
DewPointTempXSnowfall	8.376e-05	2.258e-03	0.037
DewPointTempXIsHoliday	5.528e-03	3.562e-03	1.552
DewPointTempXRentedBikeCount_Lag3	-2.367e-04	7.845e-04	-0.302
SolarRadiationXRainfall	1.537e-01	6.498e-02	2.366
SolarRadiationXIsHoliday	6.134e-02	4.478e-02	1.370
SolarRadiationXRentedBikeCount_Lag1	-8.425e-02	3.052e-02	-2.761
SolarRadiationXRentedBikeCount_Lag2	5.321e-02	3.331e-02	1.597
SolarRadiationXRentedBikeCount_Lag4	-1.614e-02	2.273e-02	-0.710
SolarRadiationXRentedBikeCount_Lag5	5.329e-02	1.763e-02	3.023
SolarRadiationXRentedBikeCount_Lag9	2.367e-02	1.131e-02	2.094
RainfallXSnowfall	6.829e-04	8.893e-03	0.077
RainfallXIsHoliday	-5.760e-02	4.026e-02	-1.431
RainfallXRentedBikeCount_Lag1	-6.525e-02	7.384e-03	-8.837
RainfallXRentedBikeCount_Lag2	1.354e-02	7.139e-03	1.896
RainfallXRentedBikeCount_Lag4	3.983e-03	6.531e-03	0.610
RainfallXRentedBikeCount_Lag8	1.749e-02	4.509e-03	3.879
SnowfallXIsHoliday	8.865e-02	9.278e-02	0.955
SnowfallXRentedBikeCount_Lag2	-1.611e-02	9.201e-03	-1.751
SnowfallXRentedBikeCount_Lag9	1.150e-02	8.145e-03	1.412
IsHolidayXRentedBikeCount_Lag1	6.045e-03	1.879e-02	0.322
IsHolidayXRentedBikeCount_Lag4	-3.077e-02	1.800e-02	-1.709
RentedBikeCount_Lag1XRentedBikeCount_Lag2	-1.679e-02	4.087e-03	-4.109
RentedBikeCount_Lag1XRentedBikeCount_Lag7	2.456e-02	6.450e-03	3.808
RentedBikeCount_Lag1XRentedBikeCount_Lag8	7.387e-03	1.052e-02	0.702
RentedBikeCount_Lag1XRentedBikeCount_Lag9	-1.493e-02	8.921e-03	-1.674
RentedBikeCount_Lag2XRentedBikeCount_Lag3	-1.552e-02	3.679e-03	-4.220
RentedBikeCount_Lag3XRentedBikeCount_Lag4	-1.585e-03	4.462e-03	-0.355
RentedBikeCount_Lag3XRentedBikeCount_Lag5	-5.954e-03	5.250e-03	-1.134
RentedBikeCount_Lag4XRentedBikeCount_Lag5	-2.397e-03	5.859e-03	-0.409
RentedBikeCount_Lag4XRentedBikeCount_Lag9	-4.393e-04	5.627e-03	-0.078
RentedBikeCount_Lag5XRentedBikeCount_Lag9	5.076e-03	5.748e-03	0.883
RentedBikeCount_Lag6XRentedBikeCount_Lag8	-5.303e-04	1.001e-02	-0.053
RentedBikeCount_Lag6XRentedBikeCount_Lag9	3.786e-03	9.832e-03	0.385
RentedBikeCount_Lag7XRentedBikeCount_Lag8	1.515e-02	4.638e-03	3.266
HumidityXHour1	8.718e-03	2.047e-03	4.258
HumidityXHour2	7.979e-03	2.089e-03	3.820

HumidityXHour3	8.431e-03	2.090e-03	4.033
HumidityXHour4	8.510e-03	2.029e-03	4.194
HumidityXHour5	7.768e-03	1.761e-03	4.411
HumidityXHour6	8.718e-03	1.805e-03	4.831
HumidityXHour7	9.991e-03	2.088e-03	4.784
HumidityXHour8	6.812e-03	2.236e-03	3.046
HumidityXHour9	6.389e-03	2.351e-03	2.718
HumidityXHour10	7.486e-03	2.131e-03	3.513
HumidityXHour11	5.899e-03	2.147e-03	2.747
HumidityXHour12	2.254e-03	2.181e-03	1.033
HumidityXHour13	1.569e-02	5.075e-03	3.092
HumidityXHour14	2.577e-03	2.255e-03	1.143
HumidityXHour15	1.060e-03	1.885e-03	0.562
HumidityXHour16	3.346e-03	2.155e-03	1.553
HumidityXHour17	1.250e-02	5.317e-03	2.351
HumidityXHour18	-5.711e-03	5.071e-03	-1.126
HumidityXHour19	6.119e-03	1.947e-03	3.142
HumidityXHour20	5.473e-03	1.911e-03	2.863
HumidityXHour21	9.449e-03	1.962e-03	4.816
HumidityXHour22	7.543e-03	2.006e-03	3.759
HumidityXHour23	7.323e-03	1.746e-03	4.194
TemperatureXHour1	-3.436e-02	3.570e-03	-9.627
TemperatureXHour2	-3.539e-02	3.643e-03	-9.714
TemperatureXHour3	-2.669e-02	3.597e-03	-7.419
TemperatureXHour4	-2.667e-02	4.177e-03	-6.387
TemperatureXHour5	-2.389e-02	3.390e-03	-7.046
TemperatureXHour6	-2.937e-02	4.091e-03	-7.178
TemperatureXHour7	-3.621e-02	4.145e-03	-8.736
TemperatureXHour8	-3.574e-02	4.470e-03	-7.996
TemperatureXHour9	-3.880e-02	4.653e-03	-8.337
TemperatureXHour10	-3.184e-02	4.484e-03	-7.101
TemperatureXHour11	-2.888e-02	4.752e-03	-6.076
TemperatureXHour12	-2.703e-02	4.041e-03	-6.689
TemperatureXHour13	-2.467e-03	1.571e-02	-0.157
TemperatureXHour14	-3.202e-02	4.145e-03	-7.723
TemperatureXHour15	-3.601e-02	4.600e-03	-7.828
TemperatureXHour16	-2.689e-02	4.609e-03	-5.835
TemperatureXHour17	-1.209e-02	1.591e-02	-0.760
TemperatureXHour18	-6.290e-02	1.561e-02	-4.028
TemperatureXHour19	-2.923e-02	4.398e-03	-6.646
TemperatureXHour20	-2.566e-02	4.187e-03	-6.129
TemperatureXHour21	-3.397e-02	4.269e-03	-7.959
TemperatureXHour22	-3.519e-02	3.496e-03	-10.065

TemperatureXHour23	-2.434e-02	4.258e-03	-5.718
WindSpeedXHour1	-2.042e-02	2.492e-02	-0.819
WindSpeedXHour2	-2.813e-02	2.568e-02	-1.095
WindSpeedXHour3	-1.767e-02	2.598e-02	-0.680
WindSpeedXHour4	-2.923e-02	2.488e-02	-1.175
WindSpeedXHour5	-5.086e-02	2.625e-02	-1.937
WindSpeedXHour6	-8.650e-03	2.612e-02	-0.331
WindSpeedXHour7	-1.316e-02	2.647e-02	-0.497
WindSpeedXHour9	-1.360e-02	2.552e-02	-0.533
WindSpeedXHour10	-2.094e-02	2.294e-02	-0.913
WindSpeedXHour11	-3.253e-02	2.234e-02	-1.456
WindSpeedXHour12	-2.927e-02	2.160e-02	-1.355
WindSpeedXHour13	-3.194e-02	2.121e-02	-1.506
WindSpeedXHour14	-2.212e-02	2.124e-02	-1.041
WindSpeedXHour15	-2.254e-02	2.062e-02	-1.093
WindSpeedXHour16	-1.881e-03	2.209e-02	-0.085
WindSpeedXHour17	1.643e-03	2.163e-02	0.076
WindSpeedXHour19	-2.164e-02	2.337e-02	-0.926
WindSpeedXHour20	-1.904e-02	2.188e-02	-0.870
WindSpeedXHour21	-3.155e-02	2.196e-02	-1.437
WindSpeedXHour22	-1.611e-02	2.278e-02	-0.707
VisibilityXHour1	-1.921e-05	4.066e-05	-0.472
VisibilityXHour2	-1.707e-05	4.164e-05	-0.410
VisibilityXHour3	-8.039e-06	4.250e-05	-0.189
VisibilityXHour4	3.183e-05	4.057e-05	0.785
VisibilityXHour7	-8.284e-06	4.019e-05	-0.206
VisibilityXHour8	-2.480e-05	4.158e-05	-0.596
VisibilityXHour9	-1.121e-05	4.341e-05	-0.258
VisibilityXHour10	1.677e-05	4.545e-05	0.369
VisibilityXHour11	-1.831e-05	4.697e-05	-0.390
VisibilityXHour12	-3.733e-05	4.603e-05	-0.811
VisibilityXHour14	-7.524e-06	4.460e-05	-0.169
VisibilityXHour16	1.180e-05	4.470e-05	0.264
VisibilityXHour17	-6.617e-06	4.453e-05	-0.149
VisibilityXHour19	2.664e-05	4.378e-05	0.609
VisibilityXHour20	-4.126e-05	4.213e-05	-0.979
VisibilityXHour21	1.439e-05	4.382e-05	0.328
VisibilityXHour22	-1.236e-05	4.277e-05	-0.289
DewPointTempXHour13	-3.320e-02	1.588e-02	-2.091
DewPointTempXHour17	-1.760e-02	1.670e-02	-1.054
DewPointTempXHour18	3.807e-02	1.692e-02	2.251
SolarRadiationXHour6	-1.822e+00	1.498e+00	-1.216
SolarRadiationXHour7	-1.314e-01	1.991e-01	-0.660

SolarRadiationXHour8	-1.132e-01	8.976e-02	-1.261
SolarRadiationXHour9	1.524e-01	6.434e-02	2.368
SolarRadiationXHour14	1.147e-02	3.898e-02	0.294
SolarRadiationXHour16	-3.605e-02	4.885e-02	-0.738
SolarRadiationXHour17	9.676e-03	6.369e-02	0.152
SolarRadiationXHour18	-9.726e-02	8.505e-02	-1.144
SolarRadiationXHour19	4.255e-01	1.729e-01	2.461
Rainfall1XHour1	3.493e-01	4.586e-02	7.616
Rainfall1XHour2	3.525e-01	4.132e-02	8.530
Rainfall1XHour3	3.356e-01	4.203e-02	7.985
Rainfall1XHour4	2.616e-01	2.695e-02	9.706
Rainfall1XHour5	1.974e-01	4.506e-02	4.381
Rainfall1XHour6	2.376e-01	3.571e-02	6.654
Rainfall1XHour7	3.617e-01	2.982e-02	12.131
Rainfall1XHour8	3.262e-01	2.814e-02	11.592
Rainfall1XHour9	3.082e-01	2.953e-02	10.437
Rainfall1XHour10	2.372e-01	3.587e-02	6.611
Rainfall1XHour11	2.825e-01	3.094e-02	9.130
Rainfall1XHour12	3.873e-01	3.714e-02	10.428
Rainfall1XHour13	3.491e-01	2.927e-02	11.927
Rainfall1XHour14	5.602e-01	5.509e-02	10.169
Rainfall1XHour15	3.871e-01	3.410e-02	11.353
Rainfall1XHour16	3.595e-01	5.779e-02	6.222
Rainfall1XHour17	1.863e-01	3.835e-02	4.858
Rainfall1XHour18	3.789e-01	2.924e-02	12.958
Rainfall1XHour19	3.038e-01	4.257e-02	7.136
Rainfall1XHour20	2.619e-01	2.712e-02	9.657
Rainfall1XHour21	3.215e-01	2.632e-02	12.216
Rainfall1XHour22	3.663e-01	5.466e-02	6.701
Rainfall1XHour23	4.030e-01	4.952e-02	8.138
Snowfall1XHour1	6.701e-02	5.146e-02	1.302
Snowfall1XHour2	2.037e-02	5.075e-02	0.401
Snowfall1XHour4	3.663e-02	5.191e-02	0.706
Snowfall1XHour5	2.963e-02	5.276e-02	0.562
Snowfall1XHour6	-3.804e-02	5.074e-02	-0.750
Snowfall1XHour7	1.591e-02	4.731e-02	0.336
Snowfall1XHour9	-6.954e-02	4.581e-02	-1.518
Snowfall1XHour11	5.530e-02	3.485e-02	1.587
Snowfall1XHour12	8.362e-02	3.920e-02	2.133
Snowfall1XHour14	7.813e-02	5.006e-02	1.561
Snowfall1XHour16	8.749e-02	6.705e-02	1.305
Snowfall1XHour17	-2.577e-02	6.710e-02	-0.384
Snowfall1XHour18	2.127e-01	6.443e-02	3.301

SnowfallXHour19	2.657e-02	6.024e-02	0.441
SnowfallXHour20	5.618e-02	5.843e-02	0.961
SnowfallXHour21	6.540e-03	5.758e-02	0.114
SnowfallXHour22	3.143e-02	5.721e-02	0.549
SnowfallXHour23	2.031e-02	5.851e-02	0.347
IsHolidayXHour1	2.118e-01	9.736e-02	2.175
IsHolidayXHour2	2.288e-01	9.706e-02	2.358
IsHolidayXHour3	1.679e-01	9.773e-02	1.718
IsHolidayXHour4	5.249e-02	9.782e-02	0.537
IsHolidayXHour5	-1.736e-01	9.825e-02	-1.766
IsHolidayXHour6	6.559e-02	1.001e-01	0.655
IsHolidayXHour7	-1.019e-01	9.686e-02	-1.052
IsHolidayXHour8	7.351e-02	9.719e-02	0.756
IsHolidayXHour10	1.261e-01	1.081e-01	1.166
IsHolidayXHour11	6.385e-02	1.165e-01	0.548
IsHolidayXHour12	1.157e-02	1.223e-01	0.095
IsHolidayXHour13	-5.178e-02	1.225e-01	-0.423
IsHolidayXHour14	1.061e-01	1.207e-01	0.880
IsHolidayXHour15	-3.307e-02	1.147e-01	-0.288
IsHolidayXHour16	1.014e-02	1.081e-01	0.094
IsHolidayXHour17	2.554e-02	1.046e-01	0.244
IsHolidayXHour18	-3.894e-02	9.971e-02	-0.391
IsHolidayXHour19	2.215e-01	1.003e-01	2.208
IsHolidayXHour20	1.390e-01	9.943e-02	1.398
IsHolidayXHour21	1.500e-01	1.012e-01	1.481
IsHolidayXHour23	1.521e-01	9.972e-02	1.525
RentedBikeCount_Lag1XHour3	1.748e-01	7.965e-02	2.194
RentedBikeCount_Lag1XHour4	7.622e-02	9.763e-02	0.781
RentedBikeCount_Lag1XHour6	6.389e-01	5.084e-02	12.566
RentedBikeCount_Lag1XHour7	4.716e-01	3.144e-02	14.999
RentedBikeCount_Lag1XHour8	4.328e-01	2.848e-02	15.194
RentedBikeCount_Lag1XHour9	1.862e-01	2.793e-02	6.668
RentedBikeCount_Lag1XHour10	1.674e-01	7.202e-02	2.325
RentedBikeCount_Lag1XHour12	2.351e-01	8.407e-02	2.796
RentedBikeCount_Lag1XHour13	1.979e-01	8.118e-02	2.438
RentedBikeCount_Lag1XHour14	2.505e-01	8.600e-02	2.913
RentedBikeCount_Lag1XHour15	4.933e-01	4.415e-02	11.173
RentedBikeCount_Lag1XHour16	2.255e-01	7.239e-02	3.115
RentedBikeCount_Lag1XHour17	1.729e-01	8.637e-02	2.002
RentedBikeCount_Lag1XHour18	4.083e-01	3.914e-02	10.433
RentedBikeCount_Lag1XHour20	3.324e-01	5.890e-02	5.644
RentedBikeCount_Lag1XHour21	3.033e-01	5.591e-02	5.425
RentedBikeCount_Lag1XHour23	3.495e-01	7.313e-02	4.779

RentedBikeCount_Lag2XHour1	3.364e-01	9.122e-02	3.688
RentedBikeCount_Lag2XHour2	2.136e-01	3.204e-02	6.669
RentedBikeCount_Lag2XHour3	1.892e-01	8.714e-02	2.172
RentedBikeCount_Lag2XHour4	7.784e-02	1.218e-01	0.639
RentedBikeCount_Lag2XHour5	-3.095e-02	5.462e-02	-0.567
RentedBikeCount_Lag2XHour6	-3.522e-02	5.316e-02	-0.663
RentedBikeCount_Lag2XHour10	1.396e-01	7.067e-02	1.976
RentedBikeCount_Lag2XHour11	4.064e-01	6.017e-02	6.754
RentedBikeCount_Lag2XHour12	2.819e-01	9.812e-02	2.873
RentedBikeCount_Lag2XHour13	1.768e-01	1.210e-01	1.461
RentedBikeCount_Lag2XHour14	-1.983e-02	1.140e-01	-0.174
RentedBikeCount_Lag2XHour16	2.343e-01	1.289e-01	1.818
RentedBikeCount_Lag2XHour17	2.965e-01	1.145e-01	2.591
RentedBikeCount_Lag2XHour19	1.485e-01	8.207e-02	1.809
RentedBikeCount_Lag2XHour22	3.885e-01	8.308e-02	4.676
RentedBikeCount_Lag3XHour1	1.239e-01	1.059e-01	1.171
RentedBikeCount_Lag3XHour2	2.254e-01	9.323e-02	2.418
RentedBikeCount_Lag3XHour3	-8.238e-02	7.106e-02	-1.159
RentedBikeCount_Lag3XHour4	1.152e-01	7.083e-02	1.627
RentedBikeCount_Lag3XHour12	2.023e-01	7.708e-02	2.624
RentedBikeCount_Lag3XHour13	2.473e-01	8.117e-02	3.047
RentedBikeCount_Lag3XHour14	3.093e-01	1.098e-01	2.816
RentedBikeCount_Lag3XHour16	4.817e-02	9.747e-02	0.494
RentedBikeCount_Lag3XHour17	-8.476e-02	1.304e-01	-0.650
RentedBikeCount_Lag3XHour19	3.517e-01	1.224e-01	2.873
RentedBikeCount_Lag3XHour20	1.152e-01	9.537e-02	1.208
RentedBikeCount_Lag3XHour21	2.131e-01	6.852e-02	3.110
RentedBikeCount_Lag3XHour22	-2.308e-03	1.159e-01	-0.020
RentedBikeCount_Lag3XHour23	-3.638e-03	1.036e-01	-0.035
RentedBikeCount_Lag4XHour2	-1.768e-01	1.573e-01	-1.124
RentedBikeCount_Lag4XHour3	1.096e-01	9.241e-02	1.186
RentedBikeCount_Lag4XHour11	1.498e-01	5.196e-02	2.883
RentedBikeCount_Lag4XHour14	-3.799e-02	9.728e-02	-0.391
RentedBikeCount_Lag4XHour17	1.546e-01	1.372e-01	1.128
RentedBikeCount_Lag4XHour19	2.178e-03	1.164e-01	0.019
RentedBikeCount_Lag4XHour20	-6.869e-02	1.246e-01	-0.551
RentedBikeCount_Lag4XHour21	8.155e-02	7.016e-02	1.162
RentedBikeCount_Lag4XHour22	1.714e-01	8.170e-02	2.098
RentedBikeCount_Lag4XHour23	2.524e-02	1.104e-01	0.229
RentedBikeCount_Lag5XHour2	3.598e-01	1.323e-01	2.719
RentedBikeCount_Lag5XHour3	2.538e-01	1.564e-01	1.623
RentedBikeCount_Lag5XHour4	1.311e-01	9.002e-02	1.457
RentedBikeCount_Lag5XHour5	3.348e-01	5.300e-02	6.316

RentedBikeCount_Lag5XHour9	2.010e-01	9.527e-02	2.110
RentedBikeCount_Lag5XHour10	1.908e-01	8.586e-02	2.222
RentedBikeCount_Lag5XHour14	2.142e-01	7.556e-02	2.835
RentedBikeCount_Lag5XHour15	1.336e-01	5.758e-02	2.320
RentedBikeCount_Lag5XHour17	-1.337e-02	1.149e-01	-0.116
RentedBikeCount_Lag5XHour18	4.305e-02	9.716e-02	0.443
RentedBikeCount_Lag5XHour19	-1.875e-02	1.322e-01	-0.142
RentedBikeCount_Lag5XHour20	2.279e-01	1.156e-01	1.971
RentedBikeCount_Lag5XHour23	9.106e-02	8.680e-02	1.049
RentedBikeCount_Lag6XHour1	-8.795e-04	8.721e-02	-0.010
RentedBikeCount_Lag6XHour2	-2.349e-03	9.869e-02	-0.024
RentedBikeCount_Lag6XHour3	-2.541e-04	1.335e-01	-0.002
RentedBikeCount_Lag6XHour4	1.254e-01	1.217e-01	1.031
RentedBikeCount_Lag6XHour7	2.082e-01	3.524e-02	5.908
RentedBikeCount_Lag6XHour9	3.860e-01	8.488e-02	4.548
RentedBikeCount_Lag6XHour10	7.975e-02	8.580e-02	0.929
RentedBikeCount_Lag6XHour16	6.787e-02	8.296e-02	0.818
RentedBikeCount_Lag6XHour17	7.040e-02	1.050e-01	0.670
RentedBikeCount_Lag6XHour18	1.401e-01	1.014e-01	1.382
RentedBikeCount_Lag6XHour19	8.412e-02	1.363e-01	0.617
RentedBikeCount_Lag6XHour20	2.001e-01	7.286e-02	2.746
RentedBikeCount_Lag6XHour22	3.464e-02	9.860e-02	0.351
RentedBikeCount_Lag6XHour23	6.448e-02	1.038e-01	0.621
RentedBikeCount_Lag7XHour1	2.577e-01	6.738e-02	3.825
RentedBikeCount_Lag7XHour3	6.320e-02	9.001e-02	0.702
RentedBikeCount_Lag7XHour8	3.780e-01	3.450e-02	10.956
RentedBikeCount_Lag7XHour11	2.108e-01	3.938e-02	5.351
RentedBikeCount_Lag7XHour15	-5.109e-02	8.399e-02	-0.608
RentedBikeCount_Lag7XHour16	1.071e-01	1.060e-01	1.010
RentedBikeCount_Lag7XHour19	2.099e-02	1.180e-01	0.178
RentedBikeCount_Lag7XHour21	-8.317e-02	1.153e-01	-0.722
RentedBikeCount_Lag7XHour22	7.057e-02	1.164e-01	0.606
RentedBikeCount_Lag7XHour23	-8.180e-02	1.235e-01	-0.662
RentedBikeCount_Lag8XHour4	9.449e-02	1.019e-01	0.927
RentedBikeCount_Lag8XHour5	3.439e-01	9.364e-02	3.672
RentedBikeCount_Lag8XHour6	3.006e-01	1.077e-01	2.791
RentedBikeCount_Lag8XHour10	7.497e-02	9.770e-02	0.767
RentedBikeCount_Lag8XHour15	1.506e-01	8.178e-02	1.841
RentedBikeCount_Lag8XHour16	6.405e-02	5.348e-02	1.198
RentedBikeCount_Lag8XHour17	2.632e-02	9.737e-02	0.270
RentedBikeCount_Lag8XHour19	5.489e-02	1.100e-01	0.499
RentedBikeCount_Lag8XHour21	2.875e-01	9.709e-02	2.961
RentedBikeCount_Lag8XHour22	1.240e-01	1.289e-01	0.962

RentedBikeCount_Lag8XHour23	3.308e-01	8.409e-02	3.934
RentedBikeCount_Lag9XHour2	1.152e-01	4.532e-02	2.543
RentedBikeCount_Lag9XHour4	5.159e-02	8.168e-02	0.632
RentedBikeCount_Lag9XHour5	-6.118e-02	8.878e-02	-0.689
RentedBikeCount_Lag9XHour6	-7.286e-02	1.029e-01	-0.708
RentedBikeCount_Lag9XHour7	1.130e-01	2.453e-02	4.606
RentedBikeCount_Lag9XHour8	3.334e-02	2.438e-02	1.367
RentedBikeCount_Lag9XHour10	1.401e-01	7.604e-02	1.842
RentedBikeCount_Lag9XHour13	1.093e-01	3.913e-02	2.792
RentedBikeCount_Lag9XHour17	1.542e-01	5.461e-02	2.824
RentedBikeCount_Lag9XHour18	2.162e-01	4.289e-02	5.041
RentedBikeCount_Lag9XHour19	1.318e-01	7.457e-02	1.767
RentedBikeCount_Lag9XHour22	7.377e-03	9.448e-02	0.078
TemperatureXIIsWinter	1.332e-02	4.429e-03	3.008
TemperatureXIIsSummer	-6.229e-03	4.521e-03	-1.378
TemperatureXIIsAutumn	-7.044e-03	4.231e-03	-1.665
WindSpeedXIIsSummer	2.403e-02	1.464e-02	1.641
VisibilityXIIsAutumn	-6.875e-06	1.951e-05	-0.352
DewPointTempXIIsWinter	1.103e-03	3.235e-03	0.341
DewPointTempXIIsSummer	3.045e-03	3.383e-03	0.900
DewPointTempXIIsAutumn	3.211e-03	3.225e-03	0.996
SolarRadiationXIIsWinter	1.667e-02	3.516e-02	0.474
SolarRadiationXIIsSummer	-4.159e-02	3.168e-02	-1.313
SolarRadiationXIIsAutumn	4.314e-02	2.509e-02	1.719
RainfallXIIsWinter	-6.954e-02	3.398e-02	-2.047
RainfallXIIsSummer	8.131e-03	1.446e-02	0.562
RainfallXIIsAutumn	2.271e-02	1.576e-02	1.441
IsHolidayXIIsWinter	2.721e-03	7.009e-02	0.039
IsHolidayXIIsSummer	-6.918e-02	9.149e-02	-0.756
IsHolidayXIIsAutumn	-7.995e-02	7.443e-02	-1.074
Hour1XIIsWinter	2.654e-01	8.069e-02	3.289
Hour1XIIsAutumn	1.251e-01	5.844e-02	2.141
Hour2XIIsWinter	8.506e-02	8.125e-02	1.047
Hour2XIIsAutumn	5.643e-02	6.066e-02	0.930
Hour3XIIsSummer	-1.851e-01	8.018e-02	-2.309
Hour3XIIsAutumn	5.130e-02	6.367e-02	0.806
Hour4XIIsWinter	1.198e-01	8.155e-02	1.469
Hour4XIIsSummer	-7.861e-02	8.001e-02	-0.983
Hour4XIIsAutumn	1.162e-01	6.592e-02	1.763
Hour5XIIsWinter	5.126e-02	7.982e-02	0.642
Hour5XIIsAutumn	2.476e-02	6.067e-02	0.408
Hour6XIIsWinter	-6.426e-02	8.249e-02	-0.779
Hour6XIIsSummer	-2.287e-01	8.032e-02	-2.848

Hour6XIIsAutumn	2.779e-02	6.569e-02	0.423
Hour7XIIsWinter	-6.817e-02	8.453e-02	-0.806
Hour7XIIsSummer	-2.868e-01	8.097e-02	-3.542
Hour7XIIsAutumn	-9.317e-02	6.819e-02	-1.366
Hour8XIIsWinter	1.852e-01	8.316e-02	2.227
Hour8XIIsSummer	-8.812e-02	7.932e-02	-1.111
Hour8XIIsAutumn	-9.650e-02	6.695e-02	-1.441
Hour9XIIsWinter	-7.544e-02	8.539e-02	-0.883
Hour9XIIsSummer	-2.935e-01	8.550e-02	-3.432
Hour9XIIsAutumn	-1.844e-01	6.495e-02	-2.840
Hour10XIIsWinter	-1.466e-01	8.609e-02	-1.703
Hour10XIIsSummer	-3.951e-01	9.434e-02	-4.188
Hour10XIIsAutumn	-1.473e-01	6.583e-02	-2.238
Hour11XIIsWinter	7.525e-02	8.850e-02	0.850
Hour11XIIsSummer	-3.418e-01	1.008e-01	-3.391
Hour11XIIsAutumn	-1.657e-01	6.543e-02	-2.532
Hour12XIIsSummer	-2.451e-01	9.955e-02	-2.462
Hour12XIIsAutumn	-5.194e-02	6.346e-02	-0.818
Hour13XIIsWinter	1.983e-02	9.244e-02	0.214
Hour13XIIsSummer	-1.384e-01	1.017e-01	-1.362
Hour13XIIsAutumn	6.728e-03	6.576e-02	0.102
Hour14XIIsSummer	-1.752e-01	8.972e-02	-1.953
Hour15XIIsWinter	2.317e-02	8.336e-02	0.278
Hour15XIIsSummer	5.763e-02	8.790e-02	0.656
Hour16XIIsWinter	1.491e-02	8.705e-02	0.171
Hour16XIIsSummer	-2.284e-01	9.442e-02	-2.419
Hour16XIIsAutumn	-6.917e-02	6.601e-02	-1.048
Hour17XIIsWinter	1.111e-01	8.636e-02	1.286
Hour17XIIsSummer	-1.893e-01	9.088e-02	-2.083
Hour17XIIsAutumn	1.043e-01	7.054e-02	1.478
Hour18XIIsSummer	-3.302e-01	8.311e-02	-3.973
Hour18XIIsAutumn	-8.931e-02	6.629e-02	-1.347
Hour19XIIsWinter	1.653e-01	8.478e-02	1.950
Hour19XIIsSummer	-1.896e-01	8.652e-02	-2.191
Hour19XIIsAutumn	1.462e-01	6.886e-02	2.124
Hour20XIIsWinter	1.233e-01	7.971e-02	1.547
Hour20XIIsSummer	-2.244e-01	7.832e-02	-2.865
Hour21XIIsWinter	5.056e-02	8.326e-02	0.607
Hour21XIIsSummer	-2.767e-01	8.429e-02	-3.283
Hour21XIIsAutumn	-4.494e-02	6.215e-02	-0.723
Hour22XIIsSummer	-1.598e-01	8.129e-02	-1.966
Hour22XIIsAutumn	2.963e-02	5.969e-02	0.496
Hour23XIIsWinter	1.875e-01	8.148e-02	2.301

Hour23XIIsSummer	-2.001e-01	8.001e-02	-2.500
Hour23XIIsAutumn	5.270e-02	6.013e-02	0.876
RentedBikeCount_Lag1XIIsAutumn	3.216e-02	1.091e-02	2.947
RentedBikeCount_Lag3XIIsWinter	-5.341e-02	1.692e-02	-3.156
RentedBikeCount_Lag3XIIsSummer	6.452e-02	2.396e-02	2.693
RentedBikeCount_Lag5XIIsSummer	-1.077e-02	3.970e-02	-0.271
RentedBikeCount_Lag6XIIsSummer	-1.254e-02	3.277e-02	-0.383
RentedBikeCount_Lag6XIIsAutumn	-3.893e-02	1.634e-02	-2.382
RentedBikeCount_Lag8XIIsAutumn	2.423e-02	1.450e-02	1.671
RentedBikeCount_Lag9XIIsWinter	2.739e-02	1.617e-02	1.693
Pr(> t)			
(Intercept)	< 2e-16	***	
Humidity	0.116195		
Visibility	0.008707	**	
SolarRadiation	0.017615	*	
Rainfall	< 2e-16	***	
Hour1	< 2e-16	***	
Hour2	< 2e-16	***	
Hour3	< 2e-16	***	
Hour4	< 2e-16	***	
Hour5	< 2e-16	***	
Hour6	< 2e-16	***	
Hour7	< 2e-16	***	
Hour8	< 2e-16	***	
Hour9	< 2e-16	***	
Hour10	< 2e-16	***	
Hour11	< 2e-16	***	
Hour12	< 2e-16	***	
Hour13	< 2e-16	***	
Hour14	< 2e-16	***	
Hour15	< 2e-16	***	
Hour16	< 2e-16	***	
Hour17	< 2e-16	***	
Hour18	< 2e-16	***	
Hour19	< 2e-16	***	
Hour20	< 2e-16	***	
Hour21	< 2e-16	***	
Hour22	< 2e-16	***	
Hour23	< 2e-16	***	
IsAutumn	0.707461		
RentedBikeCount_Lag1	< 2e-16	***	
RentedBikeCount_Lag5	0.102241		
RentedBikeCount_Lag6	0.193036		

RentedBikeCount_Lag7	4.14e-05 ***
RentedBikeCount_Lag8	1.27e-06 ***
RentedBikeCount_Lag9	0.157434
HumidityXVisibility	0.413640
HumidityXSolarRadiation	0.018427 *
HumidityXRentedBikeCount_Lag1	0.001669 **
HumidityXRentedBikeCount_Lag2	0.003451 **
HumidityXRentedBikeCount_Lag6	0.919479
HumidityXRentedBikeCount_Lag9	0.003166 **
TemperatureXDewPointTemp	0.865579
TemperatureXSolarRadiation	0.635832
TemperatureXRentedBikeCount_Lag1	8.74e-07 ***
TemperatureXRentedBikeCount_Lag3	0.771263
WindSpeedXDewPointTemp	0.460516
WindSpeedXRainfall	0.239580
WindSpeedXSnowfall	0.846755
WindSpeedXIsHoliday	0.931512
WindSpeedXRentedBikeCount_Lag1	0.914745
VisibilityXDewPointTemp	0.761999
VisibilityXRainfall	4.60e-08 ***
VisibilityXSnowfall	0.447605
VisibilityXIsHoliday	0.717725
VisibilityXRentedBikeCount_Lag7	3.40e-05 ***
DewPointTempXRainfall	0.052249 .
DewPointTempXSnowfall	0.970403
DewPointTempXIsHoliday	0.120769
DewPointTempXRentedBikeCount_Lag3	0.762838
SolarRadiationXRainfall	0.018025 *
SolarRadiationXIsHoliday	0.170795
SolarRadiationXRentedBikeCount_Lag1	0.005778 **
SolarRadiationXRentedBikeCount_Lag2	0.110288
SolarRadiationXRentedBikeCount_Lag4	0.477536
SolarRadiationXRentedBikeCount_Lag5	0.002507 **
SolarRadiationXRentedBikeCount_Lag9	0.036334 *
RainfallXSnowfall	0.938787
RainfallXIsHoliday	0.152566
RainfallXRentedBikeCount_Lag1	< 2e-16 ***
RainfallXRentedBikeCount_Lag2	0.057935 .
RainfallXRentedBikeCount_Lag4	0.542023
RainfallXRentedBikeCount_Lag8	0.000106 ***
SnowfallXIsHoliday	0.339375
SnowfallXRentedBikeCount_Lag2	0.080066 .
SnowfallXRentedBikeCount_Lag9	0.158075

IsHolidayXRentedBikeCount_Lag1	0.747623
IsHolidayXRentedBikeCount_Lag4	0.087402 .
RentedBikeCount_Lag1XRentedBikeCount_Lag2	4.01e-05 ***
RentedBikeCount_Lag1XRentedBikeCount_Lag7	0.000141 ***
RentedBikeCount_Lag1XRentedBikeCount_Lag8	0.482396
RentedBikeCount_Lag1XRentedBikeCount_Lag9	0.094173 .
RentedBikeCount_Lag2XRentedBikeCount_Lag3	2.47e-05 ***
RentedBikeCount_Lag3XRentedBikeCount_Lag4	0.722528
RentedBikeCount_Lag3XRentedBikeCount_Lag5	0.256751
RentedBikeCount_Lag4XRentedBikeCount_Lag5	0.682483
RentedBikeCount_Lag4XRentedBikeCount_Lag9	0.937771
RentedBikeCount_Lag5XRentedBikeCount_Lag9	0.377181
RentedBikeCount_Lag6XRentedBikeCount_Lag8	0.957730
RentedBikeCount_Lag6XRentedBikeCount_Lag9	0.700220
RentedBikeCount_Lag7XRentedBikeCount_Lag8	0.001094 **
HumidityXHour1	2.08e-05 ***
HumidityXHour2	0.000135 ***
HumidityXHour3	5.56e-05 ***
HumidityXHour4	2.77e-05 ***
HumidityXHour5	1.04e-05 ***
HumidityXHour6	1.39e-06 ***
HumidityXHour7	1.75e-06 ***
HumidityXHour8	0.002325 **
HumidityXHour9	0.006581 **
HumidityXHour10	0.000445 ***
HumidityXHour11	0.006024 **
HumidityXHour12	0.301505
HumidityXHour13	0.001998 **
HumidityXHour14	0.253194
HumidityXHour15	0.573924
HumidityXHour16	0.120473
HumidityXHour17	0.018767 *
HumidityXHour18	0.260158
HumidityXHour19	0.001682 **
HumidityXHour20	0.004201 **
HumidityXHour21	1.49e-06 ***
HumidityXHour22	0.000172 ***
HumidityXHour23	2.77e-05 ***
TemperatureXHour1	< 2e-16 ***
TemperatureXHour2	< 2e-16 ***
TemperatureXHour3	1.30e-13 ***
TemperatureXHour4	1.79e-10 ***
TemperatureXHour5	1.99e-12 ***

TemperatureXHour6	7.66e-13 ***
TemperatureXHour7	< 2e-16 ***
TemperatureXHour8	1.46e-15 ***
TemperatureXHour9	< 2e-16 ***
TemperatureXHour10	1.35e-12 ***
TemperatureXHour11	1.29e-09 ***
TemperatureXHour12	2.39e-11 ***
TemperatureXHour13	0.875201
TemperatureXHour14	1.27e-14 ***
TemperatureXHour15	5.58e-15 ***
TemperatureXHour16	5.59e-09 ***
TemperatureXHour17	0.447455
TemperatureXHour18	5.67e-05 ***
TemperatureXHour19	3.21e-11 ***
TemperatureXHour20	9.25e-10 ***
TemperatureXHour21	1.97e-15 ***
TemperatureXHour22	< 2e-16 ***
TemperatureXHour23	1.12e-08 ***
WindSpeedXHour1	0.412601
WindSpeedXHour2	0.273401
WindSpeedXHour3	0.496516
WindSpeedXHour4	0.240151
WindSpeedXHour5	0.052744 .
WindSpeedXHour6	0.740532
WindSpeedXHour7	0.619057
WindSpeedXHour9	0.594112
WindSpeedXHour10	0.361360
WindSpeedXHour11	0.145457
WindSpeedXHour12	0.175380
WindSpeedXHour13	0.132162
WindSpeedXHour14	0.297687
WindSpeedXHour15	0.274397
WindSpeedXHour16	0.932167
WindSpeedXHour17	0.939458
WindSpeedXHour19	0.354584
WindSpeedXHour20	0.384325
WindSpeedXHour21	0.150734
WindSpeedXHour22	0.479480
VisibilityXHour1	0.636699
VisibilityXHour2	0.681787
VisibilityXHour3	0.849955
VisibilityXHour4	0.432689
VisibilityXHour7	0.836689

VisibilityXHour8	0.550876
VisibilityXHour9	0.796199
VisibilityXHour10	0.712212
VisibilityXHour11	0.696764
VisibilityXHour12	0.417439
VisibilityXHour14	0.866032
VisibilityXHour16	0.791810
VisibilityXHour17	0.881867
VisibilityXHour19	0.542823
VisibilityXHour20	0.327447
VisibilityXHour21	0.742625
VisibilityXHour22	0.772537
DewPointTempXHour13	0.036565 *
DewPointTempXHour17	0.292138
DewPointTempXHour18	0.024442 *
SolarRadiationXHour6	0.223966
SolarRadiationXHour7	0.509164
SolarRadiationXHour8	0.207464
SolarRadiationXHour9	0.017895 *
SolarRadiationXHour14	0.768644
SolarRadiationXHour16	0.460561
SolarRadiationXHour17	0.879255
SolarRadiationXHour18	0.252856
SolarRadiationXHour19	0.013862 *
RainfallXHour1	2.90e-14 ***
RainfallXHour2	< 2e-16 ***
RainfallXHour3	1.60e-15 ***
RainfallXHour4	< 2e-16 ***
RainfallXHour5	1.20e-05 ***
RainfallXHour6	3.03e-11 ***
RainfallXHour7	< 2e-16 ***
RainfallXHour8	< 2e-16 ***
RainfallXHour9	< 2e-16 ***
RainfallXHour10	4.05e-11 ***
RainfallXHour11	< 2e-16 ***
RainfallXHour12	< 2e-16 ***
RainfallXHour13	< 2e-16 ***
RainfallXHour14	< 2e-16 ***
RainfallXHour15	< 2e-16 ***
RainfallXHour16	5.16e-10 ***
RainfallXHour17	1.21e-06 ***
RainfallXHour18	< 2e-16 ***
RainfallXHour19	1.04e-12 ***

RainfallXHour20	< 2e-16 ***
RainfallXHour21	< 2e-16 ***
RainfallXHour22	2.21e-11 ***
RainfallXHour23	4.59e-16 ***
SnowfallXHour1	0.192934
SnowfallXHour2	0.688143
SnowfallXHour4	0.480420
SnowfallXHour5	0.574409
SnowfallXHour6	0.453444
SnowfallXHour7	0.736573
SnowfallXHour9	0.129056
SnowfallXHour11	0.112619
SnowfallXHour12	0.032933 *
SnowfallXHour14	0.118610
SnowfallXHour16	0.191966
SnowfallXHour17	0.700954
SnowfallXHour18	0.000966 ***
SnowfallXHour19	0.659195
SnowfallXHour20	0.336365
SnowfallXHour21	0.909584
SnowfallXHour22	0.582777
SnowfallXHour23	0.728554
IsHolidayXHour1	0.029670 *
IsHolidayXHour2	0.018419 *
IsHolidayXHour3	0.085832 .
IsHolidayXHour4	0.591568
IsHolidayXHour5	0.077360 .
IsHolidayXHour6	0.512392
IsHolidayXHour7	0.292832
IsHolidayXHour8	0.449418
IsHolidayXHour10	0.243564
IsHolidayXHour11	0.583787
IsHolidayXHour12	0.924628
IsHolidayXHour13	0.672648
IsHolidayXHour14	0.379079
IsHolidayXHour15	0.773027
IsHolidayXHour16	0.925278
IsHolidayXHour17	0.807002
IsHolidayXHour18	0.696174
IsHolidayXHour19	0.027257 *
IsHolidayXHour20	0.162263
IsHolidayXHour21	0.138564
IsHolidayXHour23	0.127257

RentedBikeCount_Lag1XHour3	0.028253 *
RentedBikeCount_Lag1XHour4	0.434954
RentedBikeCount_Lag1XHour6	< 2e-16 ***
RentedBikeCount_Lag1XHour7	< 2e-16 ***
RentedBikeCount_Lag1XHour8	< 2e-16 ***
RentedBikeCount_Lag1XHour9	2.75e-11 ***
RentedBikeCount_Lag1XHour10	0.020087 *
RentedBikeCount_Lag1XHour12	0.005185 **
RentedBikeCount_Lag1XHour13	0.014774 *
RentedBikeCount_Lag1XHour14	0.003586 **
RentedBikeCount_Lag1XHour15	< 2e-16 ***
RentedBikeCount_Lag1XHour16	0.001846 **
RentedBikeCount_Lag1XHour17	0.045292 *
RentedBikeCount_Lag1XHour18	< 2e-16 ***
RentedBikeCount_Lag1XHour20	1.72e-08 ***
RentedBikeCount_Lag1XHour21	5.95e-08 ***
RentedBikeCount_Lag1XHour23	1.80e-06 ***
RentedBikeCount_Lag2XHour1	0.000228 ***
RentedBikeCount_Lag2XHour2	2.75e-11 ***
RentedBikeCount_Lag2XHour3	0.029914 *
RentedBikeCount_Lag2XHour4	0.522813
RentedBikeCount_Lag2XHour5	0.570929
RentedBikeCount_Lag2XHour6	0.507586
RentedBikeCount_Lag2XHour10	0.048182 *
RentedBikeCount_Lag2XHour11	1.53e-11 ***
RentedBikeCount_Lag2XHour12	0.004076 **
RentedBikeCount_Lag2XHour13	0.143979
RentedBikeCount_Lag2XHour14	0.861865
RentedBikeCount_Lag2XHour16	0.069117 .
RentedBikeCount_Lag2XHour17	0.009594 **
RentedBikeCount_Lag2XHour19	0.070522 .
RentedBikeCount_Lag2XHour22	2.98e-06 ***
RentedBikeCount_Lag3XHour1	0.241823
RentedBikeCount_Lag3XHour2	0.015626 *
RentedBikeCount_Lag3XHour3	0.246323
RentedBikeCount_Lag3XHour4	0.103834
RentedBikeCount_Lag3XHour12	0.008713 **
RentedBikeCount_Lag3XHour13	0.002321 **
RentedBikeCount_Lag3XHour14	0.004868 **
RentedBikeCount_Lag3XHour16	0.621210
RentedBikeCount_Lag3XHour17	0.515663
RentedBikeCount_Lag3XHour19	0.004079 **
RentedBikeCount_Lag3XHour20	0.227117

RentedBikeCount_Lag3XHour21	0.001878 **
RentedBikeCount_Lag3XHour22	0.984110
RentedBikeCount_Lag3XHour23	0.971997
RentedBikeCount_Lag4XHour2	0.261141
RentedBikeCount_Lag4XHour3	0.235791
RentedBikeCount_Lag4XHour11	0.003949 **
RentedBikeCount_Lag4XHour14	0.696158
RentedBikeCount_Lag4XHour17	0.259553
RentedBikeCount_Lag4XHour19	0.985073
RentedBikeCount_Lag4XHour20	0.581551
RentedBikeCount_Lag4XHour21	0.245116
RentedBikeCount_Lag4XHour22	0.035917 *
RentedBikeCount_Lag4XHour23	0.819191
RentedBikeCount_Lag5XHour2	0.006562 **
RentedBikeCount_Lag5XHour3	0.104584
RentedBikeCount_Lag5XHour4	0.145246
RentedBikeCount_Lag5XHour5	2.82e-10 ***
RentedBikeCount_Lag5XHour9	0.034910 *
RentedBikeCount_Lag5XHour10	0.026280 *
RentedBikeCount_Lag5XHour14	0.004595 **
RentedBikeCount_Lag5XHour15	0.020347 *
RentedBikeCount_Lag5XHour17	0.907303
RentedBikeCount_Lag5XHour18	0.657732
RentedBikeCount_Lag5XHour19	0.887261
RentedBikeCount_Lag5XHour20	0.048705 *
RentedBikeCount_Lag5Xhour23	0.294132
RentedBikeCount_Lag6XHour1	0.991954
RentedBikeCount_Lag6XHour2	0.981014
RentedBikeCount_Lag6XHour3	0.998481
RentedBikeCount_Lag6XHour4	0.302667
RentedBikeCount_Lag6XHour7	3.61e-09 ***
RentedBikeCount_Lag6XHour9	5.49e-06 ***
RentedBikeCount_Lag6XHour10	0.352681
RentedBikeCount_Lag6XHour16	0.413331
RentedBikeCount_Lag6XHour17	0.502717
RentedBikeCount_Lag6XHour18	0.167041
RentedBikeCount_Lag6XHour19	0.537118
RentedBikeCount_Lag6XHour20	0.006044 **
RentedBikeCount_Lag6XHour22	0.725359
RentedBikeCount_Lag6XHour23	0.534637
RentedBikeCount_Lag7XHour1	0.000132 ***
RentedBikeCount_Lag7XHour3	0.482646
RentedBikeCount_Lag7XHour8	< 2e-16 ***

RentedBikeCount_Lag7XHour11	8.96e-08 ***
RentedBikeCount_Lag7XHour15	0.543024
RentedBikeCount_Lag7XHour16	0.312543
RentedBikeCount_Lag7XHour19	0.858819
RentedBikeCount_Lag7XHour21	0.470619
RentedBikeCount_Lag7XHour22	0.544226
RentedBikeCount_Lag7XHour23	0.507690
RentedBikeCount_Lag8XHour4	0.353787
RentedBikeCount_Lag8XHour5	0.000242 ***
RentedBikeCount_Lag8XHour6	0.005268 **
RentedBikeCount_Lag8XHour10	0.442893
RentedBikeCount_Lag8XHour15	0.065638 .
RentedBikeCount_Lag8XHour16	0.231075
RentedBikeCount_Lag8XHour17	0.786906
RentedBikeCount_Lag8XHour19	0.617799
RentedBikeCount_Lag8XHour21	0.003074 **
RentedBikeCount_Lag8XHour22	0.336150
RentedBikeCount_Lag8XHour23	8.43e-05 ***
RentedBikeCount_Lag9XHour2	0.011022 *
RentedBikeCount_Lag9XHour4	0.527671
RentedBikeCount_Lag9XHour5	0.490759
RentedBikeCount_Lag9XHour6	0.478905
RentedBikeCount_Lag9XHour7	4.17e-06 ***
RentedBikeCount_Lag9XHour8	0.171574
RentedBikeCount_Lag9XHour10	0.065455 .
RentedBikeCount_Lag9XHour13	0.005244 **
RentedBikeCount_Lag9XHour17	0.004749 **
RentedBikeCount_Lag9XHour18	4.73e-07 ***
RentedBikeCount_Lag9XHour19	0.077271 .
RentedBikeCount_Lag9XHour22	0.937770
TemperatureXIsWinter	0.002634 **
TemperatureXIsSummer	0.168304
TemperatureXIsAutumn	0.095952 .
WindSpeedXIsSummer	0.100768
VisibilityXIsAutumn	0.724541
DewPointTempXIsWinter	0.733097
DewPointTempXIsSummer	0.368112
DewPointTempXIsAutumn	0.319332
SolarRadiationXIsWinter	0.635474
SolarRadiationXIsSummer	0.189353
SolarRadiationXIsAutumn	0.085637 .
RainfallXIsWinter	0.040723 *
RainfallXIsSummer	0.573893

RainfallXIIsAutumn	0.149629
IsHolidayXIIsWinter	0.969031
IsHolidayXIIsSummer	0.449595
IsHolidayXIIsAutumn	0.282814
Hour1XIIsWinter	0.001009 **
Hour1XIIsAutumn	0.032338 *
Hour2XIIsWinter	0.295181
Hour2XIIsAutumn	0.352264
Hour3XIIsSummer	0.020955 *
Hour3XIIsAutumn	0.420441
Hour4XIIsWinter	0.141884
Hour4XIIsSummer	0.325859
Hour4XIIsAutumn	0.077950 .
Hour5XIIsWinter	0.520716
Hour5XIIsAutumn	0.683191
Hour6XIIsWinter	0.435966
Hour6XIIsSummer	0.004411 **
Hour6XIIsAutumn	0.672324
Hour7XIIsWinter	0.420029
Hour7XIIsSummer	0.000400 ***
Hour7XIIsAutumn	0.171883
Hour8XIIsWinter	0.025967 *
Hour8XIIsSummer	0.266637
Hour8XIIsAutumn	0.149533
Hour9XIIsWinter	0.377037
Hour9XIIsSummer	0.000601 ***
Hour9XIIsAutumn	0.004525 **
Hour10XIIsWinter	0.088615 .
Hour10XIIsSummer	2.84e-05 ***
Hour10XIIsAutumn	0.025228 *
Hour11XIIsWinter	0.395224
Hour11XIIsSummer	0.000700 ***
Hour11XIIsAutumn	0.011345 *
Hour12XIIsSummer	0.013840 *
Hour12XIIsAutumn	0.413145
Hour13XIIsWinter	0.830181
Hour13XIIsSummer	0.173376
Hour13XIIsAutumn	0.918505
Hour14XIIsSummer	0.050873 .
Hour15XIIsWinter	0.781101
Hour15XIIsSummer	0.512121
Hour16XIIsWinter	0.864025
Hour16XIIsSummer	0.015602 *

```

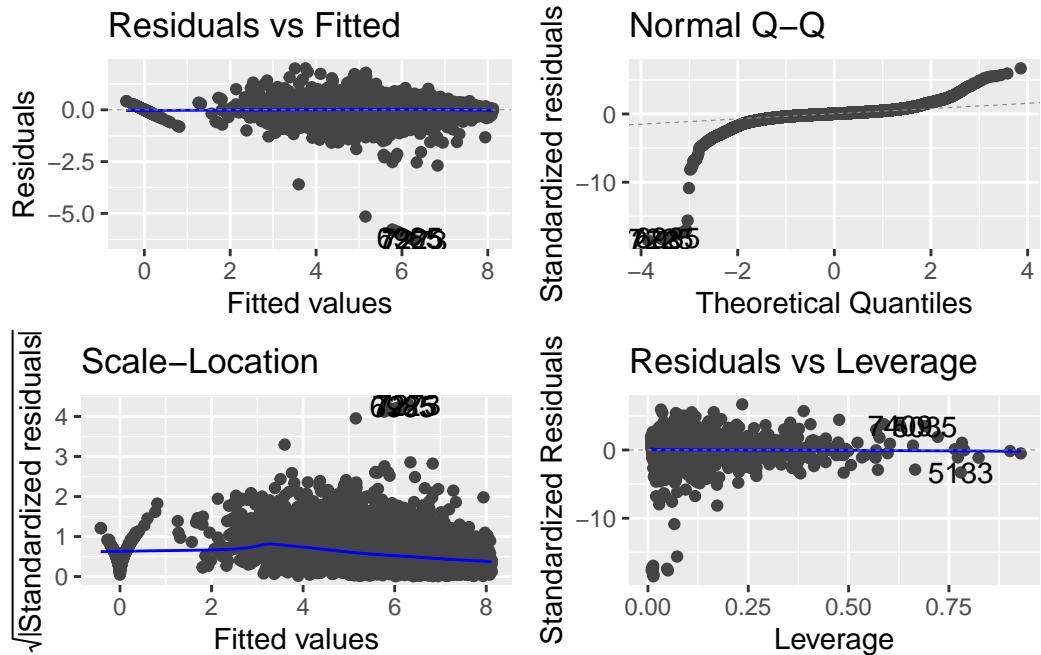
Hour16XIIsAutumn          0.294736
Hour17XIIsWinter          0.198319
Hour17XIIsSummer          0.037281 *
Hour17XIIsAutumn          0.139369
Hour18XIIsSummer          7.17e-05 ***
Hour18XIIsAutumn          0.177935
Hour19XIIsWinter          0.051170 .
Hour19XIIsSummer          0.028448 *
Hour19XIIsAutumn          0.033736 *
Hour20XIIsWinter          0.121979
Hour20XIIsSummer          0.004175 **
Hour21XIIsWinter          0.543689
Hour21XIIsSummer          0.001031 **
Hour21XIIsAutumn          0.469648
Hour22XIIsSummer          0.049302 *
Hour22XIIsAutumn          0.619597
Hour23XIIsWinter          0.021412 *
Hour23XIIsSummer          0.012424 *
Hour23XIIsAutumn          0.380842
RentedBikeCount_Lag1XIIsAutumn 0.003220 **
RentedBikeCount_Lag3XIIsWinter 0.001606 **
RentedBikeCount_Lag3XIIsSummer 0.007097 **
RentedBikeCount_Lag5XIIsSummer 0.786183
RentedBikeCount_Lag6XIIsSummer 0.702030
RentedBikeCount_Lag6XIIsAutumn 0.017253 *
RentedBikeCount_Lag8XIIsAutumn 0.094779 .
RentedBikeCount_Lag9XIIsWinter 0.090409 .

---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

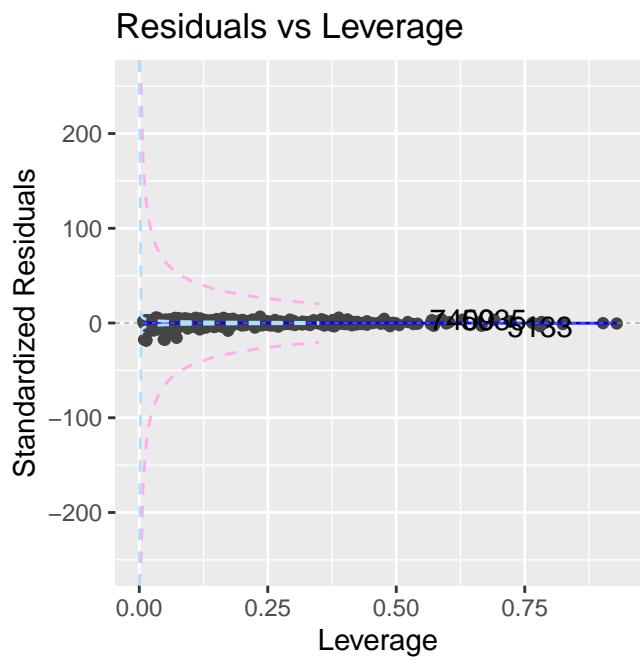
Residual standard error: 0.3424 on 8305 degrees of freedom
(9 observations deleted due to missingness)
Multiple R-squared: 0.9554, Adjusted R-squared: 0.953
F-statistic: 399.9 on 445 and 8305 DF, p-value: < 2.2e-16

```

```
autoplot(seoul.bike.elastic.log)
```



```
show_leverage(seoul.bike.elastic.log)
```

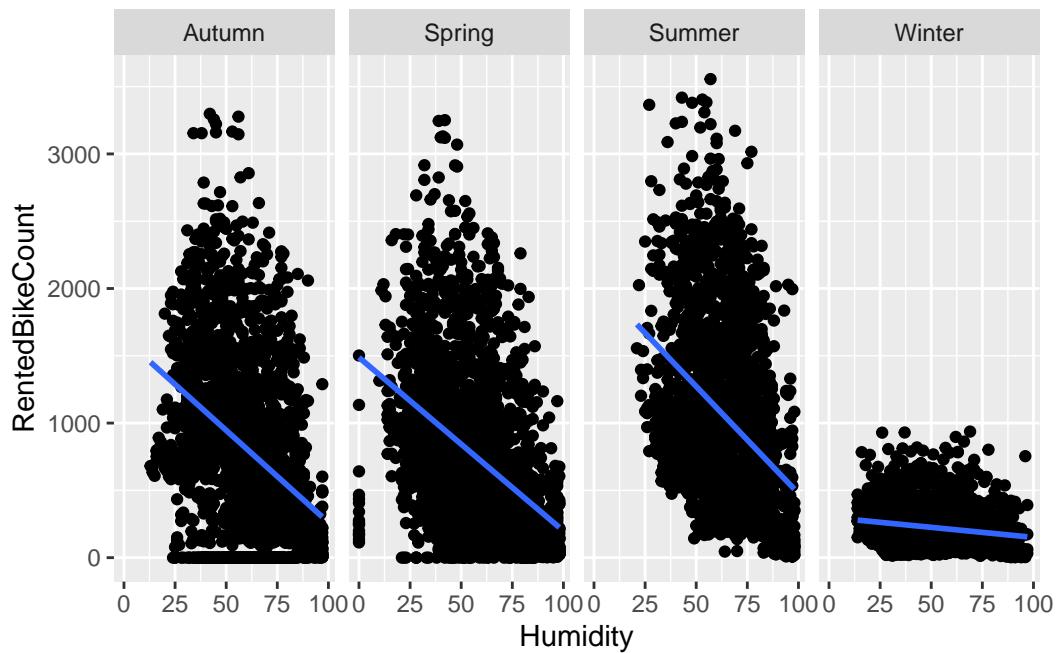


Strange trends happen in homoskedasticity when fitted values approach zero, which may be exacerbating the strange trends seen in the Residuals vs. Fitted values plot. Overall, the model assumptions did not approve with a log transformation.

A.10.1

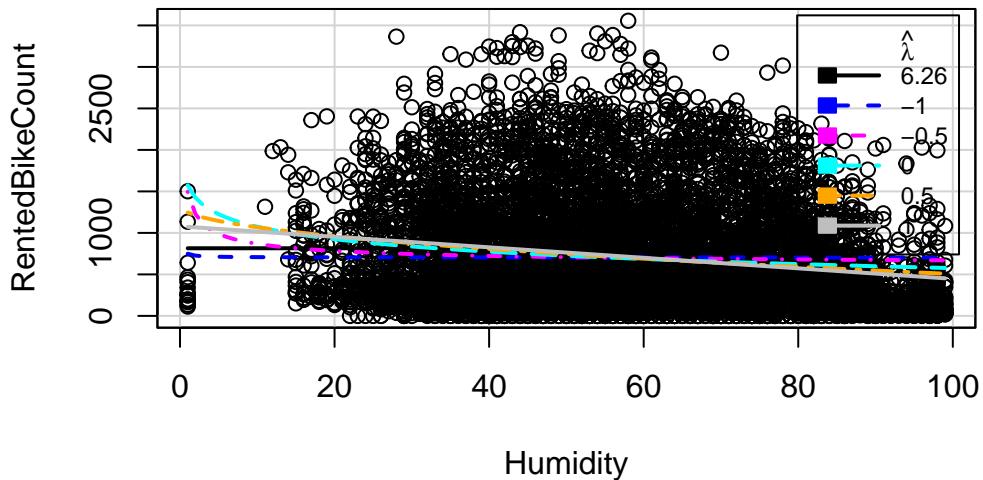
Non-linearity in the Humidity vs. # of Rented Bikes

```
seoul %>% ggplot(aes(x=Humidity, y=RentedBikeCount))+  
  geom_point() +  
  geom_smooth(method="lm", se=F) +  
  facet_grid(~Seasons)
```



```
t = seoul %>%  
  mutate(  
    Humidity = Humidity + 1,  
    Visibility = Visibility + 1,  
    WindSpeed = WindSpeed + 1,  
  )  
  
invTranPlot(RentedBikeCount ~ Humidity, data=t,
```

```
lambda = c(-1, -0.5, 0, 0.5, 1), optimal=T)
```



	lambda	RSS
1	6.257958	3376420282
2	-1.000000	3643900037
3	-0.500000	3627599076
4	0.000000	3572181770
5	0.500000	3529713040
6	1.000000	3498497235

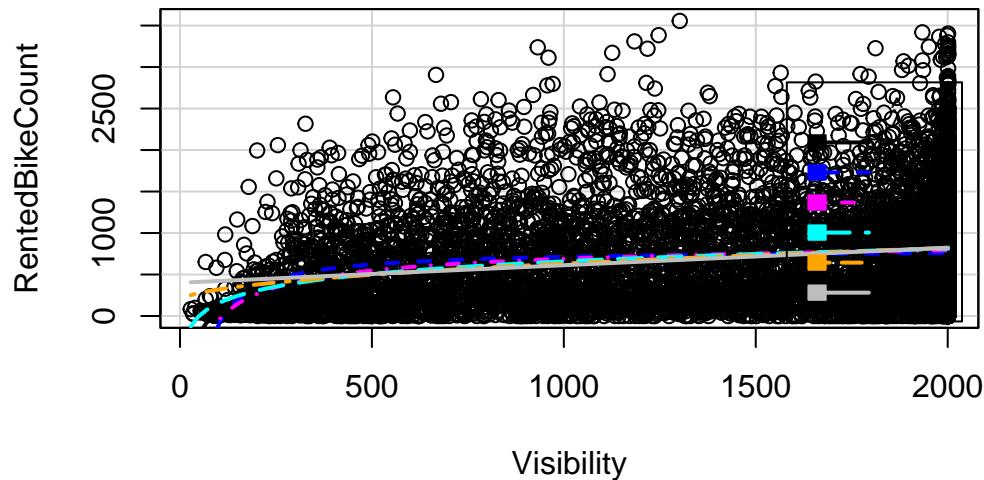
Due to the non-linearity in Humidity_{st} , and the impracticality of transforming it (a $\lambda = 6$ is not ideally interpretable), we decided to include 9 (ommitting a first level to preserve the full rank of $X'X$) levels of humidity as dummy variables to isolate non-linear effects.

Hence, we included $\sum_{i=1}^9 \beta_i I(10i \leq \text{Humidity}_{st} < 10(i+1))$ as categorical variables.

A.10.2

An ideal transformation for Visibility_{st}

```
invTranPlot(RentedBikeCount ~ Visibility, data=t,
            lambda = c(-1, -0.5, 0, 0.5, 1), optimal=T)
```



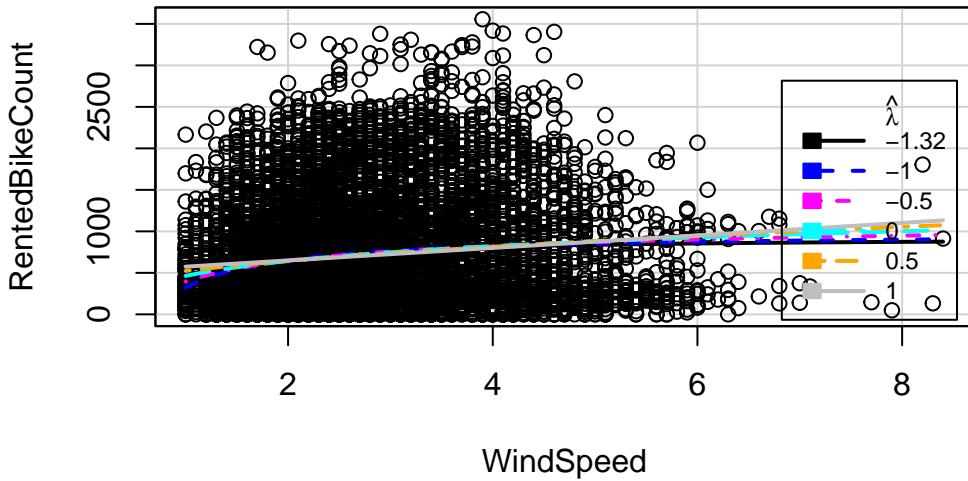
	lambda	RSS
1	-0.2416886	3464971093
2	-1.0000000	3510030146
3	-0.5000000	3469179906
4	0.0000000	3467575822
5	0.5000000	3482113896
6	1.0000000	3499224121

Based on the Inverse Response Plot, the best transformation for Visibility_{st} for interpretable results is a *log* transformation ($\lambda = 0$).

A.10.3

Transforming WindSpeed_{st}

```
invTranPlot(RentedBikeCount ~ WindSpeed, data=t,
            lambda = c(-1, -0.5, 0, 0.5, 1), optimal=T)
```

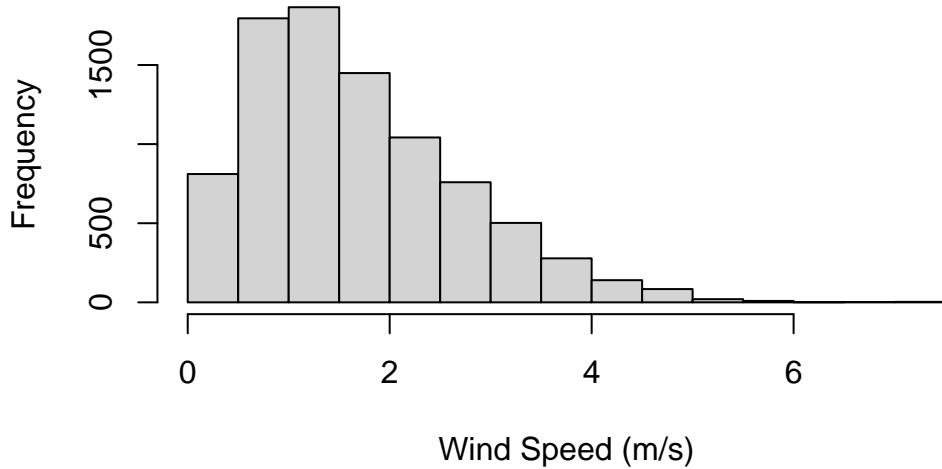


	lambda	RSS
1	-1.319359	3545185375
2	-1.000000	3546213510
3	-0.500000	3551962580
4	0.000000	3562228807
5	0.500000	3575668783
6	1.000000	3590487844

An ideal transformation for WindSpeed_{st} could be an inverse transformation. However, upon further analysis of the sample distribution of WindSpeed_{st} , there are extreme values of wind that may be skewing the results:

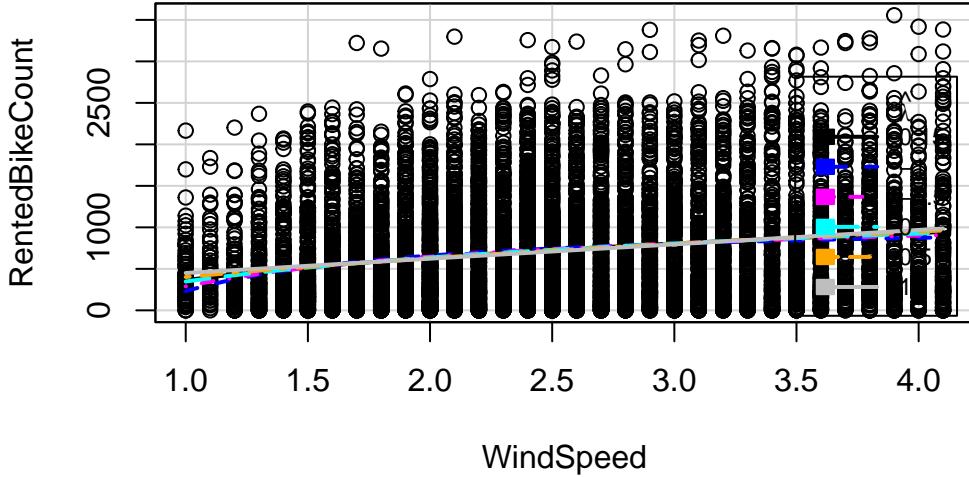
```
hist(seoul$WindSpeed, main="Histogram of Wind Speed (m/s)",
     xlab="Wind Speed (m/s)")
```

Histogram of Wind Speed (m/s)



Hence, filtering out extreme values of wind,

```
t %>% filter(WindSpeed < quantile(WindSpeed, 0.9)) -> t  
  
invTranPlot(RentedBikeCount ~ WindSpeed, data=t,  
lambda = c(-1, -0.5, 0, 0.5, 1), optimal=T)
```



	lambda	RSS
1	0.1487667	3124846145
2	-1.0000000	3133415490
3	-0.5000000	3127536986
4	0.0000000	3124982517
5	0.5000000	3125565109
6	1.0000000	3128778666

We will apply two transformations as follows:

- (1) Define a new categorical variable called ExtremeWind_{st} that will be either 1 or 0 depending if $\text{WindSpeed}_{st} \geq \phi(0.9|\text{Season} = s)$, where ϕ is the inverse CDF of $F(\text{WindSpeed}_{st} \leq c)$
- (2) Transform WindSpeed_{st} such that values that classify as ExtremeWind_{st} are 0, and all other values follow a \log transformation as denoted by the inverse response plot.

This isolates the linear trend in the “non-extreme” wind-speeds, and gives the extreme wind categorical variable its own marginal effect that we can distinguish.

A.11

Elastic net regression and output on Model (4)

```

elastic_cv <- cv.glmnet(x = seoul.bike.x,
                        y = seoul.bike.y,
                        type.measure = "mse",
                        alpha = 1)

d = coef(elastic_cv, s = "lambda.1se") [2:(length(model.bike.factors)-1)]

elastic.bike.factors = c(model.bike.factors[which(d != 0)])

#Add lower level terms
elastic.bike.factors = c(elastic.bike.factors,
                         setdiff(seoul.bike.factors.alt,
                                  c("RentedBikeCount", elastic.bike.factors)))

seoul.bike.elastic = lm(RentedBikeCount ~ .,
                        seoul.bike[c("RentedBikeCount",
                                    elastic.bike.factors)])

print(summary(seoul.bike.elastic))

```

Call:

```
lm(formula = RentedBikeCount ~ ., data = seoul.bike[c("RentedBikeCount",
                                                       elastic.bike.factors)])
```

Residuals:

Min	1Q	Median	3Q	Max
-2394.93	-35.89	1.38	38.94	1250.22

Coefficients:

	Estimate	Std. Error	t value
(Intercept)	2.469e+02	9.784e+01	2.524
Humidity	-1.626e+00	1.056e+00	-1.541
Visibility	1.113e+01	9.556e+00	1.164
SolarRadiation	-1.367e+02	6.585e+01	-2.076
Rainfall	-4.921e+01	1.582e+01	-3.112
Hour1	-3.061e+02	1.159e+02	-2.641
Hour2	-1.426e+02	1.185e+02	-1.203
Hour3	-2.392e+02	1.193e+02	-2.004
Hour4	-2.423e+02	1.088e+02	-2.228
Hour5	-3.131e+02	5.031e+01	-6.223

Hour6	-3.308e+02	5.159e+01	-6.412
Hour7	-2.238e+02	1.120e+02	-1.999
Hour8	6.126e+01	1.195e+02	0.512
Hour9	-2.439e+01	1.268e+02	-0.192
Hour10	-2.591e+02	1.280e+02	-2.025
Hour11	-1.388e+02	1.362e+02	-1.019
Hour12	-1.052e+02	1.313e+02	-0.801
Hour13	-4.886e+02	1.465e+02	-3.336
Hour14	8.937e+00	1.260e+02	0.071
Hour15	-2.507e+02	4.776e+01	-5.250
Hour16	-3.501e+02	5.558e+01	-6.299
Hour17	-5.381e+02	1.973e+02	-2.727
Hour18	-2.284e+02	3.885e+01	-5.878
Hour19	-2.396e+02	1.248e+02	-1.920
Hour20	-2.206e+01	1.218e+02	-0.181
Hour21	-2.388e+02	1.255e+02	-1.902
Hour22	-8.659e+01	1.200e+02	-0.721
Hour23	-2.481e+02	4.466e+01	-5.556
IsAutumn	7.774e+01	4.180e+01	1.860
RentedBikeCount_Lag1	7.524e-01	2.962e-02	25.403
RentedBikeCount_Lag6	-3.295e-02	2.858e-02	-1.153
RentedBikeCount_Lag8	-2.683e-02	2.609e-02	-1.028
RentedBikeCount_Lag9	8.907e-02	2.939e-02	3.030
HumidityXWindSpeed	-1.044e-01	6.362e-02	-1.642
HumidityXVisibility	2.643e-04	1.322e-04	1.999
HumidityXSolarRadiation	2.097e+00	6.926e-01	3.027
HumidityXRentedBikeCount_Lag1	7.582e-04	3.171e-04	2.391
HumidityXRentedBikeCount_Lag6	6.629e-04	2.815e-04	2.355
HumidityXRentedBikeCount_Lag9	-9.725e-04	2.626e-04	-3.703
TemperatureXDewPointTemp	-8.929e-02	3.386e-02	-2.637
TemperatureXSolarRadiation	2.566e+00	1.687e+00	1.521
TemperatureXRentedBikeCount_Lag1	3.787e-03	7.368e-04	5.140
TemperatureXRentedBikeCount_Lag3	2.230e-03	1.443e-03	1.546
WindSpeedXDewPointTemp	-1.133e-01	3.195e-01	-0.355
WindSpeedXSolarRadiation	-3.129e+00	5.626e+00	-0.556
WindSpeedXRainfall	-4.128e-01	3.769e+00	-0.110
WindSpeedXSnowfall	6.648e+00	1.072e+01	0.620
WindSpeedXIsholiday	-1.932e+01	1.416e+01	-1.364
WindSpeedXRentedBikeCount_Lag1	1.809e-03	6.646e-03	0.272
VisibilityXDewPointTemp	-2.805e-01	3.188e-01	-0.880
VisibilityXSolarRadiation	4.625e+00	4.718e+00	0.980
VisibilityXRainfall	2.165e+00	2.062e+00	1.050
VisibilityXSnowfall	-4.855e+00	4.654e+00	-1.043

VisibilityXRentedBikeCount_Lag7	-9.799e-03	4.858e-03	-2.017
DewPointTempXSolarRadiation	-3.760e+00	1.808e+00	-2.079
DewPointTempXRainfall	4.614e-01	4.078e-01	1.132
DewPointTempXSnowfall	-4.279e-01	6.257e-01	-0.684
DewPointTempXIsHoliday	9.404e-01	9.457e-01	0.994
DewPointTempXRentedBikeCount_Lag3	-4.864e-04	1.136e-03	-0.428
SolarRadiationXRainfall	6.760e+01	2.139e+01	3.161
SolarRadiationXIsHoliday	2.233e+01	1.206e+01	1.851
SolarRadiationXRentedBikeCount_Lag1	1.320e-02	1.480e-02	0.892
SolarRadiationXRentedBikeCount_Lag2	1.885e-03	1.359e-02	0.139
SolarRadiationXRentedBikeCount_Lag4	7.229e-03	9.755e-03	0.741
SolarRadiationXRentedBikeCount_Lag5	-9.928e-03	8.141e-03	-1.219
SolarRadiationXRentedBikeCount_Lag9	3.564e-02	9.882e-03	3.607
RainfallXSnowfall	3.890e-01	2.849e+00	0.137
RainfallXIsHoliday	1.214e+01	1.273e+01	0.954
RainfallXRentedBikeCount_Lag1	-8.525e-02	1.440e-02	-5.922
RainfallXRentedBikeCount_Lag2	-3.649e-04	1.172e-02	-0.031
RainfallXRentedBikeCount_Lag4	2.059e-02	9.380e-03	2.195
RainfallXRentedBikeCount_Lag8	-5.230e-03	5.412e-03	-0.966
SnowfallXIsHoliday	-2.968e+00	2.792e+01	-0.106
SnowfallXRentedBikeCount_Lag2	5.260e-03	2.836e-02	0.186
SnowfallXRentedBikeCount_Lag9	-1.328e-02	2.463e-02	-0.539
IsHolidayXRentedBikeCount_Lag4	-9.188e-03	1.319e-02	-0.696
RentedBikeCount_Lag1XRentedBikeCount_Lag2	-8.857e-05	1.079e-05	-8.207
RentedBikeCount_Lag1XRentedBikeCount_Lag7	3.733e-05	1.845e-05	2.023
RentedBikeCount_Lag1XRentedBikeCount_Lag8	-9.645e-05	2.579e-05	-3.741
RentedBikeCount_Lag1XRentedBikeCount_Lag9	3.718e-05	1.870e-05	1.989
RentedBikeCount_Lag2XRentedBikeCount_Lag3	5.882e-05	1.552e-05	3.789
RentedBikeCount_Lag3XRentedBikeCount_Lag4	-3.487e-06	1.718e-05	-0.203
RentedBikeCount_Lag3XRentedBikeCount_Lag5	-2.541e-05	2.022e-05	-1.257
RentedBikeCount_Lag4XRentedBikeCount_Lag5	8.432e-06	1.727e-05	0.488
RentedBikeCount_Lag4XRentedBikeCount_Lag9	6.997e-06	1.822e-05	0.384
RentedBikeCount_Lag5XRentedBikeCount_Lag6	1.435e-05	1.255e-05	1.143
RentedBikeCount_Lag5XRentedBikeCount_Lag9	1.855e-05	2.147e-05	0.864
RentedBikeCount_Lag6XRentedBikeCount_Lag8	5.527e-05	2.159e-05	2.560
RentedBikeCount_Lag6XRentedBikeCount_Lag9	-4.366e-05	1.857e-05	-2.351
RentedBikeCount_Lag7XRentedBikeCount_Lag8	-3.298e-05	1.316e-05	-2.506
HumidityXHour1	2.396e+00	6.578e-01	3.642
HumidityXHour2	1.791e+00	6.726e-01	2.663
HumidityXHour3	1.273e+00	6.764e-01	1.882
HumidityXHour4	1.841e+00	6.614e-01	2.783
HumidityXHour5	2.125e+00	5.860e-01	3.626
HumidityXHour6	2.480e+00	6.097e-01	4.067

HumidityXHour7	3.480e+00	6.961e-01	4.999
HumidityXHour8	9.266e-01	7.415e-01	1.250
HumidityXHour9	1.048e+00	8.027e-01	1.306
HumidityXHour10	1.771e+00	7.152e-01	2.477
HumidityXHour11	4.826e-01	7.273e-01	0.664
HumidityXHour12	5.815e-01	7.290e-01	0.798
HumidityXHour13	3.663e+00	1.699e+00	2.156
HumidityXHour14	-4.680e-01	6.819e-01	-0.686
HumidityXHour15	-1.841e-02	6.185e-01	-0.030
HumidityXHour16	1.667e+00	6.651e-01	2.507
HumidityXHour17	3.082e+00	1.700e+00	1.813
HumidityXHour18	1.077e+00	6.009e-01	1.792
HumidityXHour19	6.800e-01	6.717e-01	1.012
HumidityXHour20	9.405e-01	6.547e-01	1.437
HumidityXHour21	1.915e+00	6.713e-01	2.853
HumidityXHour22	1.289e+00	6.645e-01	1.939
HumidityXHour23	7.823e-01	5.734e-01	1.364
TemperatureXHour1	-1.026e+01	1.338e+00	-7.666
TemperatureXHour2	-1.042e+01	1.355e+00	-7.688
TemperatureXHour4	-7.774e+00	1.338e+00	-5.809
TemperatureXHour5	-6.131e+00	1.316e+00	-4.658
TemperatureXHour6	-6.685e+00	1.496e+00	-4.469
TemperatureXHour7	-1.527e+01	1.472e+00	-10.372
TemperatureXHour8	-1.234e+01	1.534e+00	-8.041
TemperatureXHour9	-1.087e+01	1.612e+00	-6.743
TemperatureXHour10	-9.851e+00	1.559e+00	-6.320
TemperatureXHour11	-7.541e+00	1.650e+00	-4.569
TemperatureXHour12	-8.501e+00	1.472e+00	-5.774
TemperatureXHour13	2.617e-01	5.197e+00	0.050
TemperatureXHour14	-9.868e+00	1.437e+00	-6.866
TemperatureXHour15	-7.554e+00	1.531e+00	-4.934
TemperatureXHour16	-6.455e+00	1.550e+00	-4.164
TemperatureXHour17	-3.013e+00	5.023e+00	-0.600
TemperatureXHour18	-1.948e+00	1.380e+00	-1.411
TemperatureXHour19	-1.069e+01	1.336e+00	-8.005
TemperatureXHour20	-7.455e+00	1.474e+00	-5.059
TemperatureXHour21	-7.871e+00	1.492e+00	-5.275
TemperatureXHour22	-9.341e+00	1.295e+00	-7.212
TemperatureXHour23	-6.279e+00	1.461e+00	-4.298
WindSpeedXHour1	-1.282e+01	1.902e+01	-0.674
WindSpeedXHour2	4.148e+00	1.969e+01	0.211
WindSpeedXHour3	2.580e+00	2.015e+01	0.128
WindSpeedXHour4	1.082e+01	2.028e+01	0.533

WindSpeedXHour5	4.616e+00	2.101e+01	0.220
WindSpeedXHour6	6.733e+00	2.057e+01	0.327
WindSpeedXHour7	-6.108e+00	2.152e+01	-0.284
WindSpeedXHour9	1.439e+00	2.012e+01	0.072
WindSpeedXHour10	9.097e+00	1.883e+01	0.483
WindSpeedXHour11	1.730e+01	1.838e+01	0.941
WindSpeedXHour12	2.255e+01	1.741e+01	1.295
WindSpeedXHour13	1.513e+01	1.695e+01	0.892
WindSpeedXHour14	1.172e+01	1.597e+01	0.734
WindSpeedXHour15	1.871e+01	1.477e+01	1.267
WindSpeedXHour16	1.427e+01	1.395e+01	1.023
WindSpeedXHour19	8.143e+00	1.551e+01	0.525
WindSpeedXHour20	1.376e+01	1.647e+01	0.836
WindSpeedXHour21	-2.188e+01	1.750e+01	-1.250
WindSpeedXHour22	4.088e+00	1.749e+01	0.234
VisibilityXHour1	-4.278e+00	1.233e+01	-0.347
VisibilityXHour2	-1.997e+01	1.231e+01	-1.621
VisibilityXHour3	-1.019e+01	1.226e+01	-0.831
VisibilityXHour4	-9.720e+00	1.110e+01	-0.876
VisibilityXHour7	-1.226e+01	1.128e+01	-1.087
VisibilityXHour8	-2.234e+01	1.214e+01	-1.840
VisibilityXHour9	-2.330e+01	1.323e+01	-1.761
VisibilityXHour10	-2.038e+00	1.415e+01	-0.144
VisibilityXHour11	-7.798e+00	1.535e+01	-0.508
VisibilityXHour12	-1.791e+01	1.539e+01	-1.164
VisibilityXHour14	-2.599e+01	1.482e+01	-1.753
VisibilityXHour17	1.355e+01	1.453e+01	0.932
VisibilityXHour19	-1.112e+01	1.420e+01	-0.783
VisibilityXHour20	-3.877e+01	1.335e+01	-2.904
VisibilityXHour21	-4.664e+00	1.383e+01	-0.337
VisibilityXHour22	-2.130e+01	1.338e+01	-1.592
DewPointTempXHour13	-8.479e+00	5.294e+00	-1.602
DewPointTempXHour17	-3.047e+00	5.314e+00	-0.573
SolarRadiationXHour6	-3.122e+02	5.224e+02	-0.598
SolarRadiationXHour7	-1.295e+02	6.997e+01	-1.850
SolarRadiationXHour8	-1.890e+02	3.002e+01	-6.295
SolarRadiationXHour9	1.230e+01	2.169e+01	0.567
SolarRadiationXHour16	5.828e+00	1.536e+01	0.379
SolarRadiationXHour17	2.510e+01	2.137e+01	1.174
SolarRadiationXHour18	-1.126e+01	2.872e+01	-0.392
SolarRadiationXHour19	6.421e+02	5.755e+01	11.157
RainfallXHour1	3.801e+01	1.373e+01	2.769
RainfallXHour2	3.812e+01	1.208e+01	3.155

RainfallXHour3	2.499e+01	1.192e+01	2.097
RainfallXHour4	2.749e+01	7.918e+00	3.472
RainfallXHour5	1.944e+01	1.321e+01	1.471
RainfallXHour6	2.983e+01	9.568e+00	3.117
RainfallXHour7	4.667e+01	8.557e+00	5.454
RainfallXHour8	2.402e+01	7.680e+00	3.128
RainfallXHour9	2.246e+01	7.781e+00	2.887
RainfallXHour10	2.406e+01	9.845e+00	2.444
RainfallXHour11	3.047e+01	8.807e+00	3.459
RainfallXHour12	2.270e+01	1.091e+01	2.080
RainfallXHour13	2.800e+01	7.656e+00	3.657
RainfallXHour14	3.763e+01	1.572e+01	2.394
RainfallXHour15	4.176e+01	9.961e+00	4.192
RainfallXHour16	6.842e+00	1.700e+01	0.402
RainfallXHour18	1.638e+01	7.507e+00	2.182
RainfallXHour19	2.204e+01	1.223e+01	1.803
RainfallXHour20	2.700e+01	7.600e+00	3.553
RainfallXHour21	3.068e+01	6.659e+00	4.607
RainfallXHour22	1.158e+01	1.427e+01	0.812
RainfallXHour23	4.081e+01	1.516e+01	2.693
SnowfallXHour1	4.633e+00	1.642e+01	0.282
SnowfallXHour3	1.346e+01	1.696e+01	0.794
SnowfallXHour4	4.152e+00	1.655e+01	0.251
SnowfallXHour6	-3.190e+00	1.620e+01	-0.197
SnowfallXHour7	-1.507e+01	1.512e+01	-0.997
SnowfallXHour9	-1.028e+01	1.499e+01	-0.686
SnowfallXHour11	1.067e+01	1.136e+01	0.940
SnowfallXHour12	9.064e+00	1.324e+01	0.685
SnowfallXHour13	-6.272e+00	1.435e+01	-0.437
SnowfallXHour14	2.555e+00	1.611e+01	0.159
SnowfallXHour16	1.156e+01	2.120e+01	0.545
SnowfallXHour17	-3.090e+00	2.105e+01	-0.147
SnowfallXHour18	3.147e+01	2.042e+01	1.541
SnowfallXHour20	5.671e+00	1.911e+01	0.297
SnowfallXHour21	4.709e+00	1.857e+01	0.254
SnowfallXHour22	3.159e+00	1.842e+01	0.171
SnowfallXHour23	1.772e+01	1.861e+01	0.952
IsHolidayXHour1	3.614e+01	3.118e+01	1.159
IsHolidayXHour2	4.611e+01	3.130e+01	1.473
IsHolidayXHour3	-2.216e+00	3.142e+01	-0.071
IsHolidayXHour4	2.078e+00	3.137e+01	0.066
IsHolidayXHour5	-2.010e+01	3.134e+01	-0.641
IsHolidayXHour6	7.319e+00	3.208e+01	0.228

IsHolidayXHour7	-2.379e+01	3.190e+01	-0.746
IsHolidayXHour8	-3.365e+01	3.158e+01	-1.066
IsHolidayXHour10	1.129e+01	3.240e+01	0.348
IsHolidayXHour12	-1.458e+01	3.448e+01	-0.423
IsHolidayXHour13	-2.887e+01	3.436e+01	-0.840
IsHolidayXHour14	-4.129e+01	3.377e+01	-1.222
IsHolidayXHour15	-6.429e+01	3.261e+01	-1.972
IsHolidayXHour16	-1.765e+01	3.186e+01	-0.554
IsHolidayXHour17	-2.382e+01	3.127e+01	-0.762
IsHolidayXHour18	-7.105e+01	3.118e+01	-2.279
IsHolidayXHour19	9.408e+01	3.141e+01	2.996
IsHolidayXHour20	4.699e+01	3.166e+01	1.484
IsHolidayXHour21	1.853e+01	3.191e+01	0.581
IsHolidayXHour23	2.067e+00	3.161e+01	0.065
RentedBikeCount_Lag1XHour3	-2.039e-01	9.799e-02	-2.081
RentedBikeCount_Lag1XHour6	2.311e+00	1.390e-01	16.631
RentedBikeCount_Lag1XHour7	1.627e+00	4.541e-02	35.839
RentedBikeCount_Lag1XHour8	9.001e-01	2.284e-02	39.413
RentedBikeCount_Lag1XHour9	-2.261e-01	1.899e-02	-11.907
RentedBikeCount_Lag1XHour10	1.835e-01	6.503e-02	2.822
RentedBikeCount_Lag1XHour12	2.750e-01	8.701e-02	3.161
RentedBikeCount_Lag1XHour13	2.917e-01	5.772e-02	5.053
RentedBikeCount_Lag1XHour14	5.540e-01	5.698e-02	9.723
RentedBikeCount_Lag1XHour15	5.017e-01	2.596e-02	19.325
RentedBikeCount_Lag1XHour16	3.219e-01	5.946e-02	5.414
RentedBikeCount_Lag1XHour17	3.513e-01	5.956e-02	5.899
RentedBikeCount_Lag1XHour18	5.840e-01	2.485e-02	23.501
RentedBikeCount_Lag1XHour20	3.361e-01	3.125e-02	10.757
RentedBikeCount_Lag1XHour21	2.118e-01	3.191e-02	6.639
RentedBikeCount_Lag1XHour23	1.467e-01	3.607e-02	4.067
RentedBikeCount_Lag2XHour1	2.604e-01	6.287e-02	4.142
RentedBikeCount_Lag2XHour2	1.599e-01	4.186e-02	3.819
RentedBikeCount_Lag2XHour3	2.294e-01	9.925e-02	2.312
RentedBikeCount_Lag2XHour4	-1.426e-02	9.694e-02	-0.147
RentedBikeCount_Lag2XHour6	-8.401e-01	1.398e-01	-6.008
RentedBikeCount_Lag2XHour10	7.024e-02	3.904e-02	1.799
RentedBikeCount_Lag2XHour11	5.070e-01	5.476e-02	9.259
RentedBikeCount_Lag2XHour12	3.184e-01	1.198e-01	2.657
RentedBikeCount_Lag2XHour16	2.898e-01	1.236e-01	2.345
RentedBikeCount_Lag2XHour17	1.844e-01	8.834e-02	2.088
RentedBikeCount_Lag2XHour22	8.826e-02	5.281e-02	1.671
RentedBikeCount_Lag3XHour1	-7.623e-02	5.633e-02	-1.353
RentedBikeCount_Lag3XHour2	7.700e-02	7.331e-02	1.050

RentedBikeCount_Lag3XHour3	5.933e-02	7.456e-02	0.796
RentedBikeCount_Lag3XHour4	1.012e-01	7.831e-02	1.292
RentedBikeCount_Lag3XHour12	3.414e-02	7.209e-02	0.474
RentedBikeCount_Lag3XHour13	2.814e-01	8.322e-02	3.381
RentedBikeCount_Lag3XHour14	-4.396e-02	1.011e-01	-0.435
RentedBikeCount_Lag3XHour16	-9.416e-02	1.387e-01	-0.679
RentedBikeCount_Lag3XHour17	-1.060e-01	1.231e-01	-0.861
RentedBikeCount_Lag3XHour19	1.603e-01	6.476e-02	2.475
RentedBikeCount_Lag3XHour20	3.035e-01	6.083e-02	4.990
RentedBikeCount_Lag3XHour21	1.858e-01	3.155e-02	5.889
RentedBikeCount_Lag3XHour22	2.168e-01	6.733e-02	3.220
RentedBikeCount_Lag4XHour2	-4.648e-02	9.892e-02	-0.470
RentedBikeCount_Lag4XHour3	-6.336e-02	6.985e-02	-0.907
RentedBikeCount_Lag4XHour11	-8.825e-02	4.627e-02	-1.907
RentedBikeCount_Lag4XHour14	-6.969e-02	9.019e-02	-0.773
RentedBikeCount_Lag4XHour16	-1.315e-02	9.474e-02	-0.139
RentedBikeCount_Lag4XHour17	1.828e-02	1.371e-01	0.133
RentedBikeCount_Lag4XHour19	3.521e-01	8.884e-02	3.964
RentedBikeCount_Lag4XHour20	-2.822e-01	8.798e-02	-3.207
RentedBikeCount_Lag4XHour21	-4.851e-02	4.662e-02	-1.041
RentedBikeCount_Lag4XHour22	2.314e-02	3.625e-02	0.638
RentedBikeCount_Lag5XHour2	1.318e-01	9.996e-02	1.319
RentedBikeCount_Lag5XHour3	1.807e-01	9.453e-02	1.912
RentedBikeCount_Lag5XHour5	1.073e-01	3.383e-02	3.172
RentedBikeCount_Lag5XHour9	9.255e-01	2.793e-01	3.313
RentedBikeCount_Lag5XHour10	-3.067e-01	2.340e-01	-1.310
RentedBikeCount_Lag5XHour17	2.316e-02	1.196e-01	0.194
RentedBikeCount_Lag5XHour19	-4.345e-01	1.237e-01	-3.512
RentedBikeCount_Lag5XHour20	1.263e-01	8.471e-02	1.491
RentedBikeCount_Lag6XHour2	-6.588e-02	5.929e-02	-1.111
RentedBikeCount_Lag6XHour3	-1.167e-01	6.592e-02	-1.770
RentedBikeCount_Lag6XHour4	-1.998e-02	4.969e-02	-0.402
RentedBikeCount_Lag6XHour7	-8.009e-02	3.835e-02	-2.089
RentedBikeCount_Lag6XHour9	3.308e-01	1.708e-01	1.937
RentedBikeCount_Lag6XHour10	6.364e-01	2.742e-01	2.321
RentedBikeCount_Lag6XHour16	3.843e-02	1.116e-01	0.344
RentedBikeCount_Lag6XHour17	9.201e-02	1.243e-01	0.740
RentedBikeCount_Lag6XHour18	-7.165e-01	3.692e-02	-19.405
RentedBikeCount_Lag6XHour19	6.029e-01	1.319e-01	4.572
RentedBikeCount_Lag6XHour20	8.834e-03	5.583e-02	0.158
RentedBikeCount_Lag6XHour22	2.999e-02	6.554e-02	0.458
RentedBikeCount_Lag6XHour23	1.912e-01	5.286e-02	3.618
RentedBikeCount_Lag7XHour1	7.760e-02	1.943e-02	3.995

RentedBikeCount_Lag7XHour8	1.157e-01	4.000e-02	2.892
RentedBikeCount_Lag7XHour11	-3.201e-02	1.327e-01	-0.241
RentedBikeCount_Lag7XHour16	-1.534e-02	1.084e-01	-0.142
RentedBikeCount_Lag7XHour19	-5.677e-01	1.194e-01	-4.754
RentedBikeCount_Lag7XHour21	9.684e-02	8.680e-02	1.116
RentedBikeCount_Lag7XHour22	-9.584e-02	8.778e-02	-1.092
RentedBikeCount_Lag7XHour23	-2.199e-01	8.409e-02	-2.615
RentedBikeCount_Lag8XHour4	3.977e-02	5.066e-02	0.785
RentedBikeCount_Lag8XHour5	-1.248e-02	5.893e-02	-0.212
RentedBikeCount_Lag8XHour6	-5.132e-02	7.310e-02	-0.702
RentedBikeCount_Lag8XHour10	8.767e-02	1.136e-01	0.771
RentedBikeCount_Lag8XHour16	7.711e-02	3.682e-02	2.094
RentedBikeCount_Lag8XHour17	-6.066e-02	8.856e-02	-0.685
RentedBikeCount_Lag8XHour19	4.705e-01	1.360e-01	3.459
RentedBikeCount_Lag8XHour21	2.822e-02	7.874e-02	0.358
RentedBikeCount_Lag8XHour22	1.321e-01	1.221e-01	1.082
RentedBikeCount_Lag8XHour23	1.413e-01	6.316e-02	2.237
RentedBikeCount_Lag9XHour4	-1.972e-03	4.270e-02	-0.046
RentedBikeCount_Lag9XHour5	2.819e-02	5.454e-02	0.517
RentedBikeCount_Lag9XHour6	4.036e-02	6.364e-02	0.634
RentedBikeCount_Lag9XHour7	1.360e-02	2.054e-02	0.662
RentedBikeCount_Lag9XHour8	-7.033e-02	2.935e-02	-2.396
RentedBikeCount_Lag9XHour10	-6.622e-02	7.729e-02	-0.857
RentedBikeCount_Lag9XHour13	-4.499e-02	1.404e-01	-0.321
RentedBikeCount_Lag9XHour17	1.096e-01	3.630e-02	3.021
RentedBikeCount_Lag9XHour18	1.017e+00	3.703e-02	27.465
RentedBikeCount_Lag9XHour19	-1.673e-01	9.486e-02	-1.763
RentedBikeCount_Lag9XHour22	-2.605e-02	8.804e-02	-0.296
TemperatureXIIsWinter	-1.613e+00	1.728e+00	-0.933
TemperatureXIIsSummer	-3.339e+00	1.529e+00	-2.184
TemperatureXIIsAutumn	-2.717e+00	6.726e-01	-4.040
WindSpeedXIIsSummer	2.431e+01	9.884e+00	2.459
VisibilityXIIsAutumn	1.121e+00	5.754e+00	0.195
DewPointTempXIIsWinter	1.322e-01	1.117e+00	0.118
DewPointTempXIIsSummer	-2.348e+00	1.156e+00	-2.032
SolarRadiationXIIsWinter	-2.747e+01	1.159e+01	-2.370
SolarRadiationXIIsSummer	-3.096e+01	9.775e+00	-3.167
RainfallXIIsWinter	-1.044e+00	1.018e+01	-0.103
RainfallXIIsSummer	-7.200e+00	4.354e+00	-1.654
RainfallXIIsAutumn	1.470e+00	4.869e+00	0.302
IsHolidayXIIsWinter	2.807e+01	2.626e+01	1.069
IsHolidayXIIsSummer	1.624e+01	2.536e+01	0.640
IsHolidayXIIsAutumn	6.853e+00	1.807e+01	0.379

Hour1XI	IsWinter	4.995e+01	2.727e+01	1.831
Hour1XI	IsAutumn	-4.449e+01	1.873e+01	-2.375
Hour2XI	IsWinter	8.165e-01	2.725e+01	0.030
Hour2XI	IsAutumn	-6.886e+01	2.100e+01	-3.279
Hour3XI	IsWinter	1.146e+02	2.636e+01	4.349
Hour3XI	IsSummer	-1.100e+02	2.492e+01	-4.412
Hour3XI	IsAutumn	-6.540e+01	2.162e+01	-3.025
Hour4XI	IsWinter	3.351e+01	2.738e+01	1.224
Hour4XI	IsAutumn	-4.552e+01	1.954e+01	-2.330
Hour5XI	IsWinter	4.148e+01	2.676e+01	1.550
Hour5XI	IsAutumn	-7.386e+01	1.985e+01	-3.722
Hour6XI	IsWinter	1.598e+01	2.801e+01	0.570
Hour6XI	IsSummer	-5.961e+01	2.738e+01	-2.177
Hour6XI	IsAutumn	-5.176e+01	2.171e+01	-2.384
Hour7XI	IsWinter	-8.355e+01	2.854e+01	-2.927
Hour7XI	IsSummer	-1.297e+02	2.789e+01	-4.651
Hour7XI	IsAutumn	-1.181e+02	2.318e+01	-5.095
Hour8XI	IsWinter	-6.210e+01	2.824e+01	-2.199
Hour8XI	IsSummer	3.204e+01	2.819e+01	1.137
Hour8XI	IsAutumn	-6.612e+01	2.228e+01	-2.968
Hour9XI	IsWinter	-5.409e+01	2.860e+01	-1.891
Hour9XI	IsSummer	-5.978e+01	2.988e+01	-2.001
Hour9XI	IsAutumn	-8.901e+01	2.179e+01	-4.084
Hour10XI	IsWinter	-1.455e+01	2.829e+01	-0.514
Hour10XI	IsSummer	-3.756e+01	3.256e+01	-1.154
Hour10XI	IsAutumn	-6.694e+01	2.110e+01	-3.172
Hour11XI	IsWinter	9.491e+00	2.909e+01	0.326
Hour11XI	IsSummer	-3.552e+01	3.341e+01	-1.063
Hour11XI	IsAutumn	-8.113e+01	2.071e+01	-3.917
Hour12XI	IsSummer	-4.104e+01	3.338e+01	-1.230
Hour12XI	IsAutumn	-8.500e+01	1.969e+01	-4.316
Hour13XI	IsWinter	5.536e+01	3.038e+01	1.822
Hour13XI	IsSummer	-3.078e+00	3.496e+01	-0.088
Hour13XI	IsAutumn	-6.783e+00	2.021e+01	-0.336
Hour14XI	IsSummer	4.885e+01	2.963e+01	1.649
Hour15XI	IsWinter	4.230e+01	2.747e+01	1.540
Hour15XI	IsSummer	9.306e+01	2.838e+01	3.280
Hour16XI	IsWinter	5.030e+01	2.848e+01	1.766
Hour16XI	IsSummer	1.403e+01	3.075e+01	0.456
Hour16XI	IsAutumn	-4.471e+01	2.226e+01	-2.009
Hour17XI	IsWinter	6.844e+01	2.915e+01	2.348
Hour17XI	IsSummer	3.181e+01	3.058e+01	1.040
Hour17XI	IsAutumn	1.329e+00	2.272e+01	0.059

Hour18XIIsSummer	-1.764e+02	2.689e+01	-6.562
Hour18XIIsAutumn	-1.399e+02	2.140e+01	-6.540
Hour19XIIsSummer	1.420e+02	2.822e+01	5.033
Hour19XIIsAutumn	6.151e+01	2.175e+01	2.828
Hour20XIIsWinter	3.532e+01	2.669e+01	1.323
Hour20XIIsSummer	9.684e+01	2.628e+01	3.684
Hour21XIIsWinter	1.622e+01	2.852e+01	0.569
Hour21XIIsSummer	2.075e+01	2.836e+01	0.732
Hour21XIIsAutumn	-7.203e+01	1.925e+01	-3.741
Hour22XIIsSummer	5.335e+01	2.849e+01	1.872
Hour22XIIsAutumn	-1.610e+01	1.857e+01	-0.867
Hour23XIIsWinter	4.887e+01	2.732e+01	1.789
Hour23XIIsSummer	1.597e+01	2.943e+01	0.543
Hour23XIIsAutumn	-2.262e+01	1.873e+01	-1.208
RentedBikeCount_Lag1XIIsAutumn	2.223e-02	7.943e-03	2.799
RentedBikeCount_Lag3XIIsWinter	2.591e-02	2.936e-02	0.882
RentedBikeCount_Lag5XIIsSummer	6.482e-03	1.523e-02	0.426
RentedBikeCount_Lag6XIIsSummer	1.328e-03	1.538e-02	0.086
RentedBikeCount_Lag6XIIsAutumn	-4.622e-02	1.025e-02	-4.510
RentedBikeCount_Lag8XIIsAutumn	3.992e-02	9.608e-03	4.155
RentedBikeCount_Lag9XIIsWinter	-3.883e-02	2.700e-02	-1.438
Temperature	6.131e+00	3.275e+00	1.872
WindSpeed	3.743e+00	1.283e+01	0.292
DewPointTemp	5.431e+00	4.099e+00	1.325
Snowfall	1.957e+01	2.793e+01	0.701
IsHoliday	-1.540e+01	2.521e+01	-0.611
IsWinter	8.364e-01	1.845e+01	0.045
IsSummer	1.197e+02	3.100e+01	3.863
RentedBikeCount_Lag2	-2.325e-01	2.359e-02	-9.853
RentedBikeCount_Lag3	-9.749e-02	3.300e-02	-2.955
RentedBikeCount_Lag4	1.030e-02	3.199e-02	0.322
RentedBikeCount_Lag5	-9.543e-02	2.755e-02	-3.465
RentedBikeCount_Lag7	1.043e-01	4.139e-02	2.519
Humidity2	9.691e+00	6.518e+01	0.149
Humidity3	7.173e+00	5.874e+01	0.122
Humidity4	-1.099e+01	5.698e+01	-0.193
Humidity5	-1.414e+01	5.701e+01	-0.248
Humidity6	-2.242e+01	5.840e+01	-0.384
Humidity7	-3.382e+01	6.070e+01	-0.557
Humidity8	-3.975e+01	6.401e+01	-0.621
Humidity9	-3.442e+01	6.775e+01	-0.508
Humidity10	-3.439e+01	7.206e+01	-0.477
ExtremeWind	1.597e+01	1.742e+01	0.917

	Pr(> t)
(Intercept)	0.011619 *
Humidity	0.123382
Visibility	0.244289
SolarRadiation	0.037879 *
Rainfall	0.001867 **
Hour1	0.008289 **
Hour2	0.228886
Hour3	0.045090 *
Hour4	0.025937 *
Hour5	5.10e-10 ***
Hour6	1.51e-10 ***
Hour7	0.045676 *
Hour8	0.608386
Hour9	0.847473
Hour10	0.042898 *
Hour11	0.308087
Hour12	0.423405
Hour13	0.000855 ***
Hour14	0.943435
Hour15	1.56e-07 ***
Hour16	3.15e-10 ***
Hour17	0.006402 **
Hour18	4.30e-09 ***
Hour19	0.054835 .
Hour20	0.856309
Hour21	0.057161 .
Hour22	0.470681
Hour23	2.85e-08 ***
IsAutumn	0.062913 .
RentedBikeCount_Lag1	< 2e-16 ***
RentedBikeCount_Lag6	0.248935
RentedBikeCount_Lag8	0.303872
RentedBikeCount_Lag9	0.002453 **
HumidityXWindSpeed	0.100651
HumidityXVisibility	0.045599 *
HumidityXSolarRadiation	0.002479 **
HumidityXRentedBikeCount_Lag1	0.016822 *
HumidityXRentedBikeCount_Lag6	0.018553 *
HumidityXRentedBikeCount_Lag9	0.000214 ***
TemperatureXDewPointTemp	0.008378 **
TemperatureXSolarRadiation	0.128174
TemperatureXRentedBikeCount_Lag1	2.81e-07 ***

TemperatureXRentedBikeCount_Lag3	0.122224
WindSpeedXDewPointTemp	0.722887
WindSpeedXSolarRadiation	0.578052
WindSpeedXRainfall	0.912771
WindSpeedXSnowfall	0.535113
WindSpeedXIsHoliday	0.172614
WindSpeedXRentedBikeCount_Lag1	0.785445
VisibilityXDewPointTemp	0.379003
VisibilityXSolarRadiation	0.327024
VisibilityXRainfall	0.293805
VisibilityXSnowfall	0.296885
VisibilityXRentedBikeCount_Lag7	0.043708 *
DewPointTempXSolarRadiation	0.037612 *
DewPointTempXRainfall	0.257876
DewPointTempXSnowfall	0.494090
DewPointTempXIsHoliday	0.320101
DewPointTempXRentedBikeCount_Lag3	0.668679
SolarRadiationXRainfall	0.001579 **
SolarRadiationXIsHoliday	0.064159 .
SolarRadiationXRentedBikeCount_Lag1	0.372420
SolarRadiationXRentedBikeCount_Lag2	0.889667
SolarRadiationXRentedBikeCount_Lag4	0.458731
SolarRadiationXRentedBikeCount_Lag5	0.222695
SolarRadiationXRentedBikeCount_Lag9	0.000312 ***
RainfallXSnowfall	0.891390
RainfallXIsHoliday	0.340237
RainfallXRentedBikeCount_Lag1	3.30e-09 ***
RainfallXRentedBikeCount_Lag2	0.975167
RainfallXRentedBikeCount_Lag4	0.028175 *
RainfallXRentedBikeCount_Lag8	0.333957
SnowfallXIsHoliday	0.915350
SnowfallXRentedBikeCount_Lag2	0.852834
SnowfallXRentedBikeCount_Lag9	0.589671
IsHolidayXRentedBikeCount_Lag4	0.486138
RentedBikeCount_Lag1XRentedBikeCount_Lag2	2.60e-16 ***
RentedBikeCount_Lag1XRentedBikeCount_Lag7	0.043088 *
RentedBikeCount_Lag1XRentedBikeCount_Lag8	0.000185 ***
RentedBikeCount_Lag1XRentedBikeCount_Lag9	0.046784 *
RentedBikeCount_Lag2XRentedBikeCount_Lag3	0.000152 ***
RentedBikeCount_Lag3XRentedBikeCount_Lag4	0.839187
RentedBikeCount_Lag3XRentedBikeCount_Lag5	0.208795
RentedBikeCount_Lag4XRentedBikeCount_Lag5	0.625358
RentedBikeCount_Lag4XRentedBikeCount_Lag9	0.700933

RentedBikeCount_Lag5XRentedBikeCount_Lag6	0.253052
RentedBikeCount_Lag5XRentedBikeCount_Lag9	0.387582
RentedBikeCount_Lag6XRentedBikeCount_Lag8	0.010494 *
RentedBikeCount_Lag6XRentedBikeCount_Lag9	0.018746 *
RentedBikeCount_Lag7XRentedBikeCount_Lag8	0.012243 *
HumidityXHour1	0.000272 ***
HumidityXHour2	0.007766 **
HumidityXHour3	0.059806 .
HumidityXHour4	0.005390 **
HumidityXHour5	0.000290 ***
HumidityXHour6	4.80e-05 ***
HumidityXHour7	5.87e-07 ***
HumidityXHour8	0.211470
HumidityXHour9	0.191584
HumidityXHour10	0.013283 *
HumidityXHour11	0.506968
HumidityXHour12	0.425102
HumidityXHour13	0.031116 *
HumidityXHour14	0.492513
HumidityXHour15	0.976252
HumidityXHour16	0.012198 *
HumidityXHour17	0.069936 .
HumidityXHour18	0.073223 .
HumidityXHour19	0.311404
HumidityXHour20	0.150895
HumidityXHour21	0.004341 **
HumidityXHour22	0.052480 .
HumidityXHour23	0.172491
TemperatureXHour1	1.98e-14 ***
TemperatureXHour2	1.67e-14 ***
TemperatureXHour4	6.52e-09 ***
TemperatureXHour5	3.24e-06 ***
TemperatureXHour6	7.97e-06 ***
TemperatureXHour7	< 2e-16 ***
TemperatureXHour8	1.01e-15 ***
TemperatureXHour9	1.65e-11 ***
TemperatureXHour10	2.76e-10 ***
TemperatureXHour11	4.97e-06 ***
TemperatureXHour12	8.01e-09 ***
TemperatureXHour13	0.959836
TemperatureXHour14	7.09e-12 ***
TemperatureXHour15	8.19e-07 ***
TemperatureXHour16	3.16e-05 ***

TemperatureXHour17	0.548544
TemperatureXHour18	0.158312
TemperatureXHour19	1.36e-15 ***
TemperatureXHour20	4.31e-07 ***
TemperatureXHour21	1.36e-07 ***
TemperatureXHour22	5.99e-13 ***
TemperatureXHour23	1.74e-05 ***
WindSpeedXHour1	0.500289
WindSpeedXHour2	0.833123
WindSpeedXHour3	0.898128
WindSpeedXHour4	0.593772
WindSpeedXHour5	0.826123
WindSpeedXHour6	0.743384
WindSpeedXHour7	0.776570
WindSpeedXHour9	0.943000
WindSpeedXHour10	0.628994
WindSpeedXHour11	0.346704
WindSpeedXHour12	0.195246
WindSpeedXHour13	0.372160
WindSpeedXHour14	0.463142
WindSpeedXHour15	0.205350
WindSpeedXHour16	0.306251
WindSpeedXHour19	0.599658
WindSpeedXHour20	0.403460
WindSpeedXHour21	0.211276
WindSpeedXHour22	0.815152
VisibilityXHour1	0.728631
VisibilityXHour2	0.104977
VisibilityXHour3	0.405766
VisibilityXHour4	0.381141
VisibilityXHour7	0.277172
VisibilityXHour8	0.065794 .
VisibilityXHour9	0.078276 .
VisibilityXHour10	0.885487
VisibilityXHour11	0.611399
VisibilityXHour12	0.244497
VisibilityXHour14	0.079562 .
VisibilityXHour17	0.351333
VisibilityXHour19	0.433658
VisibilityXHour20	0.003694 **
VisibilityXHour21	0.735914
VisibilityXHour22	0.111410
DewPointTempXHour13	0.109281

DewPointTempXHour17	0.566419
SolarRadiationXHour6	0.550161
SolarRadiationXHour7	0.064302 .
SolarRadiationXHour8	3.22e-10 ***
SolarRadiationXHour9	0.570693
SolarRadiationXHour16	0.704384
SolarRadiationXHour17	0.240243
SolarRadiationXHour18	0.695136
SolarRadiationXHour19	< 2e-16 ***
RainfallXHour1	0.005632 **
RainfallXHour2	0.001613 **
RainfallXHour3	0.035980 *
RainfallXHour4	0.000519 ***
RainfallXHour5	0.141328
RainfallXHour6	0.001831 **
RainfallXHour7	5.07e-08 ***
RainfallXHour8	0.001766 **
RainfallXHour9	0.003900 **
RainfallXHour10	0.014555 *
RainfallXHour11	0.000544 ***
RainfallXHour12	0.037567 *
RainfallXHour13	0.000257 ***
RainfallXHour14	0.016682 *
RainfallXHour15	2.80e-05 ***
RainfallXHour16	0.687443
RainfallXHour18	0.029151 *
RainfallXHour19	0.071487 .
RainfallXHour20	0.000383 ***
RainfallXHour21	4.15e-06 ***
RainfallXHour22	0.416802
RainfallXHour23	0.007102 **
SnowfallXHour1	0.777898
SnowfallXHour3	0.427389
SnowfallXHour4	0.801888
SnowfallXHour6	0.843852
SnowfallXHour7	0.319009
SnowfallXHour9	0.492945
SnowfallXHour11	0.347301
SnowfallXHour12	0.493493
SnowfallXHour13	0.662012
SnowfallXHour14	0.873963
SnowfallXHour16	0.585477
SnowfallXHour17	0.883328

Snowfall1XHour18	0.123345
Snowfall1XHour20	0.766727
Snowfall1XHour21	0.799856
Snowfall1XHour22	0.863874
Snowfall1XHour23	0.341147
IsHolidayXHour1	0.246455
IsHolidayXHour2	0.140759
IsHolidayXHour3	0.943777
IsHolidayXHour4	0.947186
IsHolidayXHour5	0.521363
IsHolidayXHour6	0.819555
IsHolidayXHour7	0.455727
IsHolidayXHour8	0.286634
IsHolidayXHour10	0.727604
IsHolidayXHour12	0.672331
IsHolidayXHour13	0.400824
IsHolidayXHour14	0.221575
IsHolidayXHour15	0.048693 *
IsHolidayXHour16	0.579761
IsHolidayXHour17	0.446283
IsHolidayXHour18	0.022721 *
IsHolidayXHour19	0.002746 **
IsHolidayXHour20	0.137770
IsHolidayXHour21	0.561410
IsHolidayXHour23	0.947859
RentedBikeCount_Lag1XHour3	0.037446 *
RentedBikeCount_Lag1XHour6	< 2e-16 ***
RentedBikeCount_Lag1XHour7	< 2e-16 ***
RentedBikeCount_Lag1XHour8	< 2e-16 ***
RentedBikeCount_Lag1XHour9	< 2e-16 ***
RentedBikeCount_Lag1XHour10	0.004777 **
RentedBikeCount_Lag1XHour12	0.001580 **
RentedBikeCount_Lag1XHour13	4.44e-07 ***
RentedBikeCount_Lag1XHour14	< 2e-16 ***
RentedBikeCount_Lag1XHour15	< 2e-16 ***
RentedBikeCount_Lag1XHour16	6.33e-08 ***
RentedBikeCount_Lag1XHour17	3.80e-09 ***
RentedBikeCount_Lag1XHour18	< 2e-16 ***
RentedBikeCount_Lag1XHour20	< 2e-16 ***
RentedBikeCount_Lag1XHour21	3.36e-11 ***
RentedBikeCount_Lag1XHour23	4.81e-05 ***
RentedBikeCount_Lag2XHour1	3.48e-05 ***
RentedBikeCount_Lag2XHour2	0.000135 ***

RentedBikeCount_Lag2XHour3	0.020817 *
RentedBikeCount_Lag2XHour4	0.883018
RentedBikeCount_Lag2XHour6	1.95e-09 ***
RentedBikeCount_Lag2XHour10	0.071999 .
RentedBikeCount_Lag2XHour11	< 2e-16 ***
RentedBikeCount_Lag2XHour12	0.007894 **
RentedBikeCount_Lag2XHour16	0.019025 *
RentedBikeCount_Lag2XHour17	0.036866 *
RentedBikeCount_Lag2XHour22	0.094728 .
RentedBikeCount_Lag3XHour1	0.176032
RentedBikeCount_Lag3XHour2	0.293603
RentedBikeCount_Lag3XHour3	0.426232
RentedBikeCount_Lag3XHour4	0.196231
RentedBikeCount_Lag3XHour12	0.635779
RentedBikeCount_Lag3XHour13	0.000725 ***
RentedBikeCount_Lag3XHour14	0.663656
RentedBikeCount_Lag3XHour16	0.497353
RentedBikeCount_Lag3XHour17	0.389438
RentedBikeCount_Lag3XHour19	0.013359 *
RentedBikeCount_Lag3XHour20	6.17e-07 ***
RentedBikeCount_Lag3XHour21	4.05e-09 ***
RentedBikeCount_Lag3XHour22	0.001288 **
RentedBikeCount_Lag4XHour2	0.638474
RentedBikeCount_Lag4XHour3	0.364426
RentedBikeCount_Lag4XHour11	0.056497 .
RentedBikeCount_Lag4Xhour14	0.439714
RentedBikeCount_Lag4XHour16	0.889585
RentedBikeCount_Lag4XHour17	0.893944
RentedBikeCount_Lag4XHour19	7.44e-05 ***
RentedBikeCount_Lag4XHour20	0.001346 **
RentedBikeCount_Lag4XHour21	0.298138
RentedBikeCount_Lag4XHour22	0.523307
RentedBikeCount_Lag5XHour2	0.187227
RentedBikeCount_Lag5XHour3	0.055922 .
RentedBikeCount_Lag5XHour5	0.001517 **
RentedBikeCount_Lag5XHour9	0.000925 ***
RentedBikeCount_Lag5XHour10	0.190093
RentedBikeCount_Lag5XHour17	0.846522
RentedBikeCount_Lag5XHour19	0.000446 ***
RentedBikeCount_Lag5XHour20	0.135946
RentedBikeCount_Lag6XHour2	0.266532
RentedBikeCount_Lag6XHour3	0.076733 .
RentedBikeCount_Lag6XHour4	0.687565

RentedBikeCount_Lag6XHour7	0.036779 *
RentedBikeCount_Lag6XHour9	0.052749 .
RentedBikeCount_Lag6XHour10	0.020301 *
RentedBikeCount_Lag6XHour16	0.730726
RentedBikeCount_Lag6XHour17	0.459335
RentedBikeCount_Lag6XHour18	< 2e-16 ***
RentedBikeCount_Lag6XHour19	4.91e-06 ***
RentedBikeCount_Lag6XHour20	0.874288
RentedBikeCount_Lag6XHour22	0.647273
RentedBikeCount_Lag6XHour23	0.000299 ***
RentedBikeCount_Lag7XHour1	6.54e-05 ***
RentedBikeCount_Lag7XHour8	0.003833 **
RentedBikeCount_Lag7XHour11	0.809403
RentedBikeCount_Lag7XHour16	0.887471
RentedBikeCount_Lag7XHour19	2.02e-06 ***
RentedBikeCount_Lag7XHour21	0.264642
RentedBikeCount_Lag7XHour22	0.274945
RentedBikeCount_Lag7XHour23	0.008929 **
RentedBikeCount_Lag8XHour4	0.432409
RentedBikeCount_Lag8XHour5	0.832347
RentedBikeCount_Lag8XHour6	0.482647
RentedBikeCount_Lag8XHour10	0.440509
RentedBikeCount_Lag8XHour16	0.036266 *
RentedBikeCount_Lag8XHour17	0.493405
RentedBikeCount_Lag8XHour19	0.000545 ***
RentedBikeCount_Lag8XHour21	0.720025
RentedBikeCount_Lag8XHour22	0.279379
RentedBikeCount_Lag8XHour23	0.025302 *
RentedBikeCount_Lag9XHour4	0.963162
RentedBikeCount_Lag9XHour5	0.605224
RentedBikeCount_Lag9XHour6	0.525933
RentedBikeCount_Lag9XHour7	0.507996
RentedBikeCount_Lag9XHour8	0.016577 *
RentedBikeCount_Lag9XHour10	0.391578
RentedBikeCount_Lag9XHour13	0.748545
RentedBikeCount_Lag9XHour17	0.002531 **
RentedBikeCount_Lag9XHour18	< 2e-16 ***
RentedBikeCount_Lag9XHour19	0.077869 .
RentedBikeCount_Lag9XHour22	0.767345
TemperatureXIsWinter	0.350703
TemperatureXIsSummer	0.028977 *
TemperatureXIsAutumn	5.39e-05 ***
WindSpeedXIsSummer	0.013934 *

VisibilityXIsAutumn	0.845537
DewPointTempXIsWinter	0.905806
DewPointTempXIsSummer	0.042206 *
SolarRadiationXIsWinter	0.017801 *
SolarRadiationXIsSummer	0.001544 **
RainfallXIsWinter	0.918314
RainfallXIsSummer	0.098250 .
RainfallXIsAutumn	0.762709
IsHolidayXIsWinter	0.285106
IsHolidayXIsSummer	0.521968
IsHolidayXIsAutumn	0.704580
Hour1XIsWinter	0.067072 .
Hour1XIsAutumn	0.017568 *
Hour2XIsWinter	0.976103
Hour2XIsAutumn	0.001046 **
Hour3XIsWinter	1.38e-05 ***
Hour3XIsSummer	1.04e-05 ***
Hour3XIsAutumn	0.002497 **
Hour4XIsWinter	0.220882
Hour4XIsAutumn	0.019838 *
Hour5XIsWinter	0.121149
Hour5XIsAutumn	0.000199 ***
Hour6XIsWinter	0.568507
Hour6XIsSummer	0.029511 *
Hour6XIsAutumn	0.017130 *
Hour7XIsWinter	0.003429 **
Hour7XIsSummer	3.35e-06 ***
Hour7XIsAutumn	3.56e-07 ***
Hour8XIsWinter	0.027900 *
Hour8XIsSummer	0.255652
Hour8XIsAutumn	0.003006 **
Hour9XIsWinter	0.058664 .
Hour9XIsSummer	0.045460 *
Hour9XIsAutumn	4.46e-05 ***
Hour10XIsWinter	0.607072
Hour10XIsSummer	0.248666
Hour10XIsAutumn	0.001517 **
Hour11XIsWinter	0.744234
Hour11XIsSummer	0.287687
Hour11XIsAutumn	9.03e-05 ***
Hour12XIsSummer	0.218841
Hour12XIsAutumn	1.60e-05 ***
Hour13XIsWinter	0.068454 .

Hour1XIIsSummer	0.929835
Hour1XIIsAutumn	0.737169
Hour14XIIsSummer	0.099180 .
Hour15XIIsWinter	0.123711
Hour15XIIsSummer	0.001044 **
Hour16XIIsWinter	0.077423 .
Hour16XIIsSummer	0.648089
Hour16XIIsAutumn	0.044579 *
Hour17XIIsWinter	0.018901 *
Hour17XIIsSummer	0.298346
Hour17XIIsAutumn	0.953341
Hour18XIIsSummer	5.64e-11 ***
Hour18XIIsAutumn	6.49e-11 ***
Hour19XIIsSummer	4.92e-07 ***
Hour19XIIsAutumn	0.004691 **
Hour20XIIsWinter	0.185715
Hour20XIIsSummer	0.000231 ***
Hour21XIIsWinter	0.569474
Hour21XIIsSummer	0.464294
Hour21XIIsAutumn	0.000184 ***
Hour22XIIsSummer	0.061191 .
Hour22XIIsAutumn	0.386042
Hour23XIIsWinter	0.073710 .
Hour23XIIsSummer	0.587362
Hour23XIIsAutumn	0.227202
RentedBikeCount_Lag1XIIsAutumn	0.005137 **
RentedBikeCount_Lag3XIIsWinter	0.377560
RentedBikeCount_Lag5XIIsSummer	0.670465
RentedBikeCount_Lag6XIIsSummer	0.931201
RentedBikeCount_Lag6XIIsAutumn	6.57e-06 ***
RentedBikeCount_Lag8XIIsAutumn	3.29e-05 ***
RentedBikeCount_Lag9XIIsWinter	0.150454
Temperature	0.061189 .
WindSpeed	0.770552
DewPointTemp	0.185230
Snowfall	0.483389
IsHoliday	0.541256
IsWinter	0.963838
IsSummer	0.000113 ***
RentedBikeCount_Lag2	< 2e-16 ***
RentedBikeCount_Lag3	0.003139 **
RentedBikeCount_Lag4	0.747494
RentedBikeCount_Lag5	0.000534 ***

```

RentedBikeCount_Lag7          0.011794 *
Humidity2                      0.881811
Humidity3                      0.902805
Humidity4                      0.847048
Humidity5                      0.804178
Humidity6                      0.701044
Humidity7                      0.577506
Humidity8                      0.534651
Humidity9                      0.611430
Humidity10                     0.633207
ExtremeWind                     0.359051
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

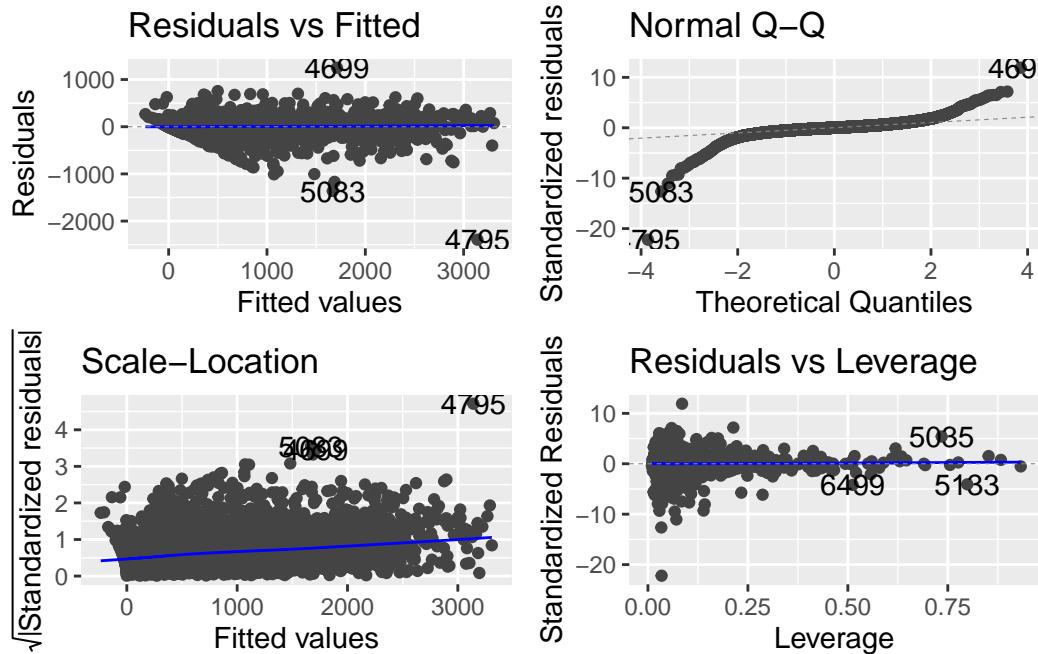
Residual standard error: 109.7 on 8311 degrees of freedom

(9 observations deleted due to missingness)

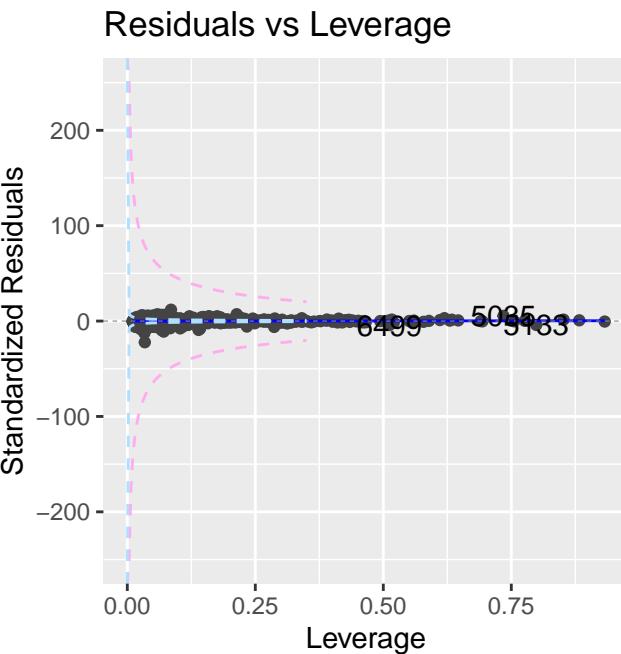
Multiple R-squared: 0.9725, Adjusted R-squared: 0.9711

F-statistic: 669.8 on 439 and 8311 DF, p-value: < 2.2e-16

```
autoplot(seoul.bike.elastic)
```



```
show_leverage(seoul.bike.elastic)
```



A.12

Most Assailant Factors for Model (4), w/ lagged effects (and lagged interactions) and lower level time effects removed

```
elastic.bike.coef = tibble(  
  Factor = names(seoul.bike.elastic$coefficients),  
  Coefficient = seoul.bike.elastic$coefficients,  
  P.Value = summary(seoul.bike.elastic)$coefficients[, "Pr(>|t|)"] %>% round(5) %>%  
    format(scientific=F)  
) %>% arrange(abs(Coefficient)) %>% desc()  
  
elastic.bike.coef$Rank = 1:nrow(elastic.bike.coef)  
  
elastic.bike.coef %>%  
  filter(!(str_detect(Factor, "RentedBikeCount") |  
    Factor %in% time.bike)) %>%  
  knitr::kable()
```

Factor	Coefficient	P.Value	Rank
SolarRadiationXHour19	642.0547204	0.00000	1
SolarRadiationXHour6	-312.1833504	0.55016	7
(Intercept)	246.9425430	0.01162	12
SolarRadiationXHour8	-189.0022551	0.00000	19
Hour18XIsSummer	-176.4157669	0.00000	20
Hour19XIsSummer	142.0421160	0.00000	22
Hour18XIsAutumn	-139.9424547	0.00000	23
SolarRadiation	-136.7314420	0.03788	25
Hour7XIsSummer	-129.7270124	0.00000	26
SolarRadiationXHour7	-129.4709733	0.06430	27
IsSummer	119.7468458	0.00011	28
Hour7XIsAutumn	-118.0940431	0.00000	29
Hour3XIsWinter	114.6466170	0.00001	30
Hour3XIsSummer	-109.9525044	0.00001	31
Hour20XIsSummer	96.8384048	0.00023	33
IsHolidayXHour19	94.0835649	0.00275	34
Hour15XIsSummer	93.0635947	0.00104	35
Hour9XIsAutumn	-89.0108437	0.00004	36
Hour12XIsAutumn	-85.0002828	0.00002	38
Hour7XIsWinter	-83.5453853	0.00343	39
Hour11XIsAutumn	-81.1348186	0.00009	40
IsAutumn	77.7438775	0.06291	41
Hour5XIsAutumn	-73.8644781	0.00020	42
Hour21XIsAutumn	-72.0266905	0.00018	43
IsHolidayXHour18	-71.0531484	0.02272	44
Hour2XIsAutumn	-68.8626145	0.00105	45
Hour17XIsWinter	68.4358111	0.01890	46
SolarRadiationXRainfall	67.6047481	0.00158	47
Hour10XIsAutumn	-66.9354411	0.00152	48
Hour8XIsAutumn	-66.1239362	0.00301	49
Hour3XIsAutumn	-65.3988908	0.00250	50
IsHolidayXHour15	-64.2859280	0.04869	51
Hour8XIsWinter	-62.0998797	0.02790	52
Hour19XIsAutumn	61.5138754	0.00469	53
Hour9XIsSummer	-59.7787509	0.04546	55
Hour6XIsSummer	-59.6129230	0.02951	56
Hour13XIsWinter	55.3606158	0.06845	57
Hour9XIsWinter	-54.0867854	0.05866	58
Hour22XIsSummer	53.3521512	0.06119	59
Hour6XIsAutumn	-51.7615267	0.01713	60
Hour16XIsWinter	50.2992412	0.07742	61

Factor	Coefficient	P.Value	Rank
Hour1XIsWinter	49.9511623	0.06707	62
Rainfall	-49.2136625	0.00187	63
Hour23XIsWinter	48.8725506	0.07371	64
Hour14XIsSummer	48.8543012	0.09918	65
IsHolidayXHour20	46.9947614	0.13777	66
RainfallXHour7	46.6654995	0.00000	67
IsHolidayXHour2	46.1101879	0.14076	68
Hour4XIsAutumn	-45.5193891	0.01984	69
Hour16XIsAutumn	-44.7085739	0.04458	70
Hour1XIsAutumn	-44.4860913	0.01757	71
Hour15XIsWinter	42.2950178	0.12371	72
RainfallXHour15	41.7555549	0.00003	73
Hour5XIsWinter	41.4830644	0.12115	74
IsHolidayXHour14	-41.2852792	0.22158	75
Hour12XIsSummer	-41.0422766	0.21884	76
RainfallXHour23	40.8124801	0.00710	77
Humidity8	-39.7482771	0.53465	78
VisibilityXHour20	-38.7716623	0.00369	79
RainfallXHour2	38.1182518	0.00161	80
RainfallXHour1	38.0084372	0.00563	81
RainfallXHour14	37.6313680	0.01668	82
Hour10XIsSummer	-37.5601068	0.24867	83
IsHolidayXHour1	36.1431270	0.24645	84
Hour11XIsSummer	-35.5249719	0.28769	85
Hour20XIsWinter	35.3211146	0.18571	86
Humidity9	-34.4214879	0.61143	87
Humidity10	-34.3910581	0.63321	88
Humidity7	-33.8158162	0.57751	89
IsHolidayXHour8	-33.6472243	0.28663	90
Hour4XIsWinter	33.5149272	0.22088	91
Hour8XIsSummer	32.0428108	0.25565	92
Hour17XIsSummer	31.8055535	0.29835	93
SnowfallXHour18	31.4712484	0.12335	94
SolarRadiationXIsSummer	-30.9608433	0.00154	95
RainfallXHour21	30.6764167	0.00000	96
RainfallXHour11	30.4690107	0.00054	97
RainfallXHour6	29.8264845	0.00183	98
IsHolidayXHour13	-28.8689826	0.40082	99
IsHolidayXIsWinter	28.0711014	0.28511	100
RainfallXHour13	27.9951786	0.00026	101
RainfallXHour4	27.4940933	0.00052	102

Factor	Coefficient	P.Value	Rank
SolarRadiationXIsWinter	-27.4726426	0.01780	103
RainfallXHour20	27.0034785	0.00038	104
VisibilityXHour14	-25.9914493	0.07956	105
SolarRadiationXHour17	25.1004464	0.24024	106
RainfallXHour3	24.9922540	0.03598	107
WindSpeedXIsSummer	24.3090585	0.01393	109
RainfallXHour10	24.0590588	0.01456	110
RainfallXHour8	24.0239322	0.00177	111
IsHolidayXHour17	-23.8203448	0.44628	112
IsHolidayXHour7	-23.7931013	0.45573	113
VisibilityXHour9	-23.2959383	0.07828	114
RainfallXHour12	22.6969366	0.03757	115
Hour23XIsAutumn	-22.6199435	0.22720	116
WindSpeedXHour12	22.5451864	0.19525	117
RainfallXHour9	22.4639606	0.00390	118
Humidity6	-22.4204070	0.70104	119
VisibilityXHour8	-22.3357877	0.06579	120
SolarRadiationXIsHoliday	22.3349643	0.06416	121
RainfallXHour19	22.0369278	0.07149	123
WindSpeedXHour21	-21.8836730	0.21128	124
VisibilityXHour22	-21.3044953	0.11141	125
Hour21XIsSummer	20.7511383	0.46429	126
IsHolidayXHour5	-20.0954107	0.52136	127
VisibilityXHour2	-19.9657231	0.10498	128
Snowfall	19.5743764	0.48339	129
RainfallXHour5	19.4353518	0.14133	130
WindSpeedXIsHoliday	-19.3150075	0.17261	131
WindSpeedXHour15	18.7071412	0.20535	132
IsHolidayXHour21	18.5331036	0.56141	133
VisibilityXHour12	-17.9132048	0.24450	134
SnowfallXHour23	17.7193076	0.34115	135
IsHolidayXHour16	-17.6452211	0.57976	136
WindSpeedXHour11	17.2976258	0.34670	137
RainfallXHour18	16.3778555	0.02915	138
IsHolidayXIsSummer	16.2422007	0.52197	139
Hour21XIsWinter	16.2211067	0.56947	140
Hour22XIsAutumn	-16.0978571	0.38604	141
Hour6XIsWinter	15.9755484	0.56851	142
ExtremeWind	15.9748739	0.35905	143
Hour23XIsSummer	15.9702134	0.58736	144
IsHoliday	-15.3998121	0.54126	145

Factor	Coefficient	P.Value	Rank
TemperatureXHour7	-15.2702799	0.00000	146
WindSpeedXHour13	15.1268625	0.37216	147
SnowfallXHour7	-15.0709389	0.31901	148
IsHolidayXHour12	-14.5849117	0.67233	149
Hour10XIIsWinter	-14.5480982	0.60707	150
WindSpeedXHour16	14.2738894	0.30625	151
Humidity5	-14.1354019	0.80418	152
Hour16XIIsSummer	14.0349378	0.64809	153
WindSpeedXHour20	13.7613546	0.40346	154
VisibilityXHour17	13.5471672	0.35133	155
SnowfallXHour3	13.4584924	0.42739	156
WindSpeedXHour1	-12.8196643	0.50029	157
TemperatureXHour8	-12.3382468	0.00000	158
SolarRadiationXHour9	12.2967425	0.57069	159
VisibilityXHour7	-12.2622535	0.27717	160
RainfallXIIsHoliday	12.1397983	0.34024	161
WindSpeedXHour14	11.7176352	0.46314	162
RainfallXHour22	11.5848293	0.41680	163
SnowfallXHour16	11.5639444	0.58548	164
IsHolidayXHour10	11.2850350	0.72760	165
SolarRadiationXHour18	-11.2565176	0.69514	166
Visibility	11.1276675	0.24429	167
VisibilityXHour19	-11.1150656	0.43366	168
Humidity4	-10.9918176	0.84705	169
TemperatureXHour9	-10.8692503	0.00000	170
WindSpeedXHour4	10.8193789	0.59377	171
TemperatureXHour19	-10.6933128	0.00000	172
SnowfallXHour11	10.6728338	0.34730	173
TemperatureXHour2	-10.4172391	0.00000	174
SnowfallXHour9	-10.2774680	0.49295	175
TemperatureXHour1	-10.2565321	0.00000	176
VisibilityXHour3	-10.1913316	0.40577	177
TemperatureXHour14	-9.8681369	0.00000	178
TemperatureXHour10	-9.8509294	0.00000	179
VisibilityXHour4	-9.7198205	0.38114	180
Humidity2	9.6909383	0.88181	181
Hour11XIIsWinter	9.4906888	0.74423	182
TemperatureXHour22	-9.3405747	0.00000	183
WindSpeedXHour10	9.0973258	0.62899	184
SnowfallXHour12	9.0644663	0.49349	185
TemperatureXHour12	-8.5013181	0.00000	187

Factor	Coefficient	P.Value	Rank
DewPointTempXHour13	-8.4793756	0.10928	188
WindSpeedXHour19	8.1429845	0.59966	189
TemperatureXHour21	-7.8711333	0.00000	190
VisibilityXHour11	-7.7979797	0.61140	191
TemperatureXHour4	-7.7740019	0.00000	192
TemperatureXHour15	-7.5543078	0.00000	193
TemperatureXHour11	-7.5407601	0.00000	194
TemperatureXHour20	-7.4552196	0.00000	195
IsHolidayXHour6	7.3189452	0.81955	196
RainfallXIsSummer	-7.2002438	0.09825	197
Humidity3	7.1733017	0.90281	198
IsHolidayXIsAutumn	6.8532105	0.70458	199
RainfallXHour16	6.8415202	0.68744	200
Hour13XIsAutumn	-6.7830252	0.73717	201
WindSpeedXHour6	6.7329739	0.74338	202
TemperatureXHour6	-6.6853540	0.00001	203
WindSpeedXSnowfall	6.6480273	0.53511	204
TemperatureXHour16	-6.4548565	0.00003	205
TemperatureXHour23	-6.2793340	0.00002	206
SnowfallXHour13	-6.2722448	0.66201	207
TemperatureXHour5	-6.1311983	0.00000	208
Temperature	6.1311297	0.06119	209
WindSpeedXHour7	-6.1078204	0.77657	210
SolarRadiationXHour16	5.8275072	0.70438	211
SnowfallXHour20	5.6706841	0.76673	212
DewPointTemp	5.4309214	0.18523	213
VisibilityXSnowfall	-4.8548507	0.29689	214
SnowfallXHour21	4.7089055	0.79986	215
VisibilityXHour21	-4.6637793	0.73591	216
SnowfallXHour1	4.6325217	0.77790	217
VisibilityXSolarRadiation	4.6247153	0.32702	218
WindSpeedXHour5	4.6157521	0.82612	219
VisibilityXHour1	-4.2775273	0.72863	220
SnowfallXHour4	4.1517243	0.80189	221
WindSpeedXHour2	4.1484333	0.83312	222
WindSpeedXHour22	4.0883028	0.81515	223
DewPointTempXSolarRadiation	-3.7600638	0.03761	224
WindSpeed	3.7432093	0.77055	225
HumidityXHour13	3.6626446	0.03112	226
HumidityXHour7	3.4798661	0.00000	227
TemperatureXIsSummer	-3.3392981	0.02898	228

Factor	Coefficient	P.Value	Rank
SnowfallXHour6	-3.1900724	0.84385	229
SnowfallXHour22	3.1588081	0.86387	230
WindSpeedXSolarRadiation	-3.1292584	0.57805	231
SnowfallXHour17	-3.0896910	0.88333	232
HumidityXHour17	3.0822310	0.06994	233
Hour13XIIsSummer	-3.0783186	0.92983	234
DewPointTempXHour17	-3.0467047	0.56642	235
TemperatureXHour17	-3.0134068	0.54854	236
SnowfallXIIsHoliday	-2.9679705	0.91535	237
TemperatureXIIsAutumn	-2.7172065	0.00005	238
WindSpeedXHour3	2.5801317	0.89813	239
TemperatureXSolarRadiation	2.5663111	0.12817	240
SnowfallXHour14	2.5554865	0.87396	241
HumidityXHour6	2.4798644	0.00005	242
HumidityXHour1	2.3959941	0.00027	243
DewPointTempXIIsSummer	-2.3477760	0.04221	244
IsHolidayXHour3	-2.2162505	0.94378	246
VisibilityXRainfall	2.1651718	0.29381	247
HumidityXHour5	2.1246893	0.00029	248
HumidityXSolarRadiation	2.0965265	0.00248	249
IsHolidayXHour4	2.0779455	0.94719	250
IsHolidayXHour23	2.0670483	0.94786	251
VisibilityXHour10	-2.0381289	0.88549	252
TemperatureXHour18	-1.9476592	0.15831	253
HumidityXHour21	1.9153037	0.00434	254
HumidityXHour4	1.8408981	0.00539	255
HumidityXHour2	1.7909180	0.00777	256
HumidityXHour10	1.7713334	0.01328	257
HumidityXHour16	1.6674715	0.01220	258
Humidity	-1.6264424	0.12338	260
TemperatureXIIsWinter	-1.6126035	0.35070	261
RainfallXIIsAutumn	1.4700678	0.76271	262
WindSpeedXHour9	1.4388480	0.94300	263
Hour17XIIsAutumn	1.3293900	0.95334	264
HumidityXHour22	1.2887950	0.05248	265
HumidityXHour3	1.2733962	0.05981	266
VisibilityXIIsAutumn	1.1210397	0.84554	267
HumidityXHour18	1.0765412	0.07322	268
HumidityXHour9	1.0482842	0.19158	269
RainfallXIIsWinter	-1.0440860	0.91831	270
HumidityXHour20	0.9405049	0.15090	272

Factor	Coefficient	P.Value	Rank
DewPointTempXIsHoliday	0.9403672	0.32010	273
HumidityXHour8	0.9266114	0.21147	274
IsWinter	0.8363896	0.96384	278
Hour2XIsWinter	0.8164507	0.97610	279
HumidityXHour23	0.7822874	0.17249	280
HumidityXHour19	0.6799769	0.31140	283
HumidityXHour12	0.5814804	0.42510	287
HumidityXHour11	0.4826495	0.50697	292
HumidityXHour14	-0.4680455	0.49251	294
DewPointTempXRainfall	0.4614361	0.25788	295
DewPointTempXSnowfall	-0.4278501	0.49409	297
WindSpeedXRainfall	-0.4128349	0.91277	298
RainfallXSnowfall	0.3890195	0.89139	299
VisibilityXDewPointTemp	-0.2805012	0.37900	312
TemperatureXHour13	0.2617269	0.95984	314
DewPointTempXIsWinter	0.1322032	0.90581	333
WindSpeedXDewPointTemp	-0.1132904	0.72289	339
HumidityXWindSpeed	-0.1044493	0.10065	343
TemperatureXDewPointTemp	-0.0892874	0.00838	352
HumidityXHour15	-0.0184116	0.97625	397
HumidityXVisibility	0.0002643	0.04560	426

A.13

The full model (Model 4), can be written as,

$$\begin{aligned}
\text{RentedBikeCount}_{st} = & \beta_0 + \sum_{i=1}^9 \beta_i I(10i \leq \text{Humidity}_{st} < 10(i+1)) + \beta_{10} \ln(\text{Visibility}_{st} + 1) + \beta_{11} \text{Rainfall}_{st} + \beta_{12} \text{Temperature}_{st} + \beta_{13} (\ln \text{WindSpeed}_{st} + 1) + \beta_{14} I(\text{ExtremeWind}_{st} = 1) + \beta_{15} \text{DewPointTemp}_{st} + \beta_{16} \text{Snowfall}_{st} + \beta_{17} \text{SolarRadiation}_{st} + \\
& \beta_{18} I(\text{Day}_t = \text{Holiday}_t) + \beta_{19} I(\text{Season}_s = \text{Winter}) + \beta_{20} I(\text{Season}_s = \text{Summer}) + \beta_{21} I(\text{Season}_s = \text{Autumn}) + \sum_{i=1}^{23} \beta_{21+i} I(\text{Hour}_t = i) + \sum_{h=1}^9 \sum_{i=1}^{23} \beta_{44+ih} I(\text{Hour}_t = i) I(10h \leq \text{Humidity}_{st} < 10(h+1)) + \sum_{i=1}^9 \beta_{207+i} I(\text{Hour}_t = i) I(\text{Day}_t = \text{Holiday}) + \\
& \beta_{217} \text{Temperature}_{st} \text{DewPointTemp}_{st} + \beta_{218} \ln(\text{WindSpeed}_{st} + 1) I(\text{Day}_t = \text{Holiday}_{st}) + \beta_{218} \text{SolarRadiation}_{st} \text{Rainfall}_{st} + \beta_{219} \text{SolarRadiation}_{st} I(\text{Day}_t = \text{Holiday}_{st}) + \beta_{220} \text{Snowfall}_{st} I(\text{ExtremeWind}_{st} = 1) + \\
& \beta_{221} \text{Temperature}_{st} I(\text{Hour}_t = 1) + \beta_{222} \text{Temperature}_{st} I(\text{Hour}_t = 7) + \beta_{223} \text{Temperature}_{st} I(\text{Hour}_t = 18) + \beta_{224} \ln(\text{WindSpeed}_{st} + 1) I(\text{Hour}_t = 1) + \beta_{225} \ln(\text{WindSpeed}_{st} + 1) I(\text{Hour}_t = 3) + \beta_{226} \ln(\text{WindSpeed}_{st} + 1) I(\text{Hour}_t = 11) + \\
& \beta_{227} \ln(\text{WindSpeed}_{st} + 1) I(\text{Hour}_t = 18) + \beta_{228} \ln(\text{Visibility}_{st} + 1) I(\text{Hour}_t = 2) + \dots + \beta_{230} \ln(\text{Visibility}_{st} + 1) I(\text{Hour}_t = 4) + \beta_{231} \ln(\text{Visibility}_{st} + 1) I(\text{Hour}_t = 11) + \beta_{232} \text{DewPointTemp}_{st} I(\text{Hour}_t = 1)
\end{aligned}$$

$$\begin{aligned}
& 5) + \beta_{233} \text{DewPointTemp}_{st} I(\text{Hour}_t = 8) + \\
& \beta_{234} \text{DewPointTemp}_{st} I(\text{Hour}_t = 11) + \beta_{235} \text{DewPointTemp}_{st} I(\text{Hour}_t = 16) + \beta_{236} \text{DewPointTemp}_{st} I(\text{Hour}_t = 17) + \beta_{237} \text{DewPointTemp}_{st} I(\text{Hour}_t = 19) + \dots + \beta_{239} \text{DewPointTemp}_{st} I(\text{Hour}_t = 21) + \beta_{240} \text{SolarRadiation}_{st} I(\text{Hour}_t = 8) + \\
& \beta_{241} \text{SolarRadiation}_{st} I(\text{Hour}_t = 19) + \beta_{242} \text{Rainfall}_{st} I(\text{Hour}_t = 9) + \beta_{243} \text{Rainfall}_{st} I(\text{Hour}_t = 13) + \beta_{244} \text{Rainfall}_{st} I(\text{Hour}_t = 17) + \beta_{245} \text{Rainfall}_{st} I(\text{Hour}_t = 19) + \beta_{246} \text{Rainfall}_{st} I(\text{Hour}_t = 20) + \beta_{247} \text{Snowfall}_{st} I(\text{Hour}_t = 7) + \beta_{248} \text{Snowfall}_{st} I(\text{Hour}_t = 9) + \beta_{249} \text{Snowfall}_{st} I(\text{Hour}_t = 13) + \beta_{250} I(\text{ExtremeWind}_{st} = 1) I(\text{Hour}_t = 8) + \beta_{251} I(\text{ExtremeWind}_{st} = 1) I(\text{Hour}_t = 18) + \beta_{252} I(\text{ExtremeWind}_{st} = 1) I(\text{Hour}_t = 19) + \beta_{253} \ln(\text{WindSpeed}_{st} + 1) I(\text{Season}_s = \text{Winter}) + \beta_{254} \ln(\text{Visibility}_{st} + 1) I(\text{Season}_s = \text{Winter}) + \beta_{255} \text{SolarRadiation}_{st} I(\text{Season}_s = \text{Summer}) + \\
& \beta_{256} \text{SolarRadiation}_{st} I(\text{Season}_s = \text{Autumn}) + \beta_{257} \text{Rainfall}_{st} I(\text{Season}_s = \text{Winter}) + \sum_{i=1}^{23} \sum_{\text{All } j \in \text{Seasons}, j \neq \text{Spring}} \beta_{257+i+j \text{th Season}} I(\text{Hour}_t = i) I(\text{Season}_s = j) + \sum_{i=1}^3 \beta_{327+i} I(60 + 10i \leq \text{Humidity}_{st} < 60 + 10(i+1)) I(\text{Season}_s = \text{Autumn}) + \\
& \beta_{331} I(60 \leq \text{Humidity}_{st} < 70) I(\text{Season}_s = \text{Summer}) + \beta_{332} \text{Temperature}_{st} I(20 \leq \text{Humidity}_{st} < 30) + \beta_{333} \ln(\text{WindSpeed}_{st} + 1) I(90 \leq \text{Humidity}_{st} < 100) + \beta_{334} \text{SolarRadiation}_{st} I(60 \leq \text{Humidity}_{st} < 70) + \sum_{i=1}^4 \beta_{335+i} \text{SolarRadiation}_{st} I(50 + 10i \leq \text{Humidity}_{st} < 60 + 10(i+1)) + \\
& \sum_{i=1}^3 \beta_{339+i} \text{Rainfall}_{st} I(30 + 10i \leq \text{Humidity}_{st} < 30 + 10(i+1)) + \beta_{343} \text{Rainfall}_{st} I(90 \leq \text{Humidity}_{st} < 100) + \beta_{344} I(\text{ExtremeWind}_{st} = 1) I(30 \leq \text{Humidity}_{st} < 40) + \beta_{345} I(\text{ExtremeWind}_{st} = 1) I(60 \leq \text{Humidity}_{st} < 70) + \beta_{346} I(\text{ExtremeWind}_{st} = 1) I(70 \leq \text{Humidity}_{st} < 80) + \\
& \sum_{p=1}^9 \delta_p \text{RentedBikeCount}_{st-p} + \sum_{p=1}^9 \sum_{t=1}^{23} \delta_{9+pt} \text{RentedBikeCount}_{st-p} I(\text{Hour}_t = t) + \\
& \sum_{p=1}^9 \sum_{i=1}^9 \delta_{216+ip} \text{RentedBikeCount}_{st-p} I(10i < \text{Humidity}_{st} \leq 10(i+1)) + \\
& \delta_{298} \text{RentedBikeCount}_{st-1} I(\text{Season}_s = \text{Autumn}) + \delta_{299} \text{RentedBikeCount}_{st-3} I(\text{Season}_s = \text{Summer}) + \delta_{300} \text{RentedBikeCount}_{st-6} I(\text{Season}_s = \text{Summer}) + \delta_{301} \text{RentedBikeCount}_{st-9} I(\text{Season}_s = \text{Autumn}) + \\
& \delta_{302} \text{RentedBikeCount}_{st-2} \text{RentedBikeCount}_{st-5} + \delta_{303} \text{RentedBikeCount}_{st-2} \text{RentedBikeCount}_{st-6} + \delta_{304} \text{RentedBikeCount}_{st-5} I(\text{ExtremeWind}_{st} = 1) + \delta_{305} \text{RentedBikeCount}_{st-1} \text{Temperature}_{st} + \delta_{306} \text{RentedBikeCount}_{st-1} \ln(\text{WindSpeed}_{st} + 1) + \delta_{307} \text{RentedBikeCount}_{st-9} \ln(\text{WindSpeed}_{st} + 1) + \delta_{308} \text{RentedBikeCount}_{st-1} \ln(\text{Visibility}_{st} + 1) + \delta_{309} \text{RentedBikeCount}_{st-1} \text{SolarRadiation}_{st} + \delta_{310} \text{RentedBikeCount}_{st-9} \text{SolarRadiation}_{st} + \\
& \delta_{311} \text{RentedBikeCount}_{st-1} \text{Rainfall}_{st} + \delta_{312} \text{RentedBikeCount}_{st-3} \text{Rainfall}_{st} + \delta_{313} \text{RentedBikeCount}_{st-8} \text{Rainfall}_{st} + \delta_{314} \text{RentedBikeCount}_{st-9} \text{Snowfall}_{st} + \eta_{st}
\end{aligned}$$

$$\eta_{st} \stackrel{iid}{\sim} N(0, \sigma^2)$$

NOTE: Not all parameter coefficients are estimated to be > 0 . See model output to see which coefficients.

A.14

Model Output for Model 4

```
summary(seoul.bike.elastic)
```

Call:

```
lm(formula = RentedBikeCount ~ ., data = seoul.bike[c("RentedBikeCount",  
elastic.bike.factors)])
```

Residuals:

Min	1Q	Median	3Q	Max
-2394.93	-35.89	1.38	38.94	1250.22

Coefficients:

	Estimate	Std. Error	t value
(Intercept)	2.469e+02	9.784e+01	2.524
Humidity	-1.626e+00	1.056e+00	-1.541
Visibility	1.113e+01	9.556e+00	1.164
SolarRadiation	-1.367e+02	6.585e+01	-2.076
Rainfall	-4.921e+01	1.582e+01	-3.112
Hour1	-3.061e+02	1.159e+02	-2.641
Hour2	-1.426e+02	1.185e+02	-1.203
Hour3	-2.392e+02	1.193e+02	-2.004
Hour4	-2.423e+02	1.088e+02	-2.228
Hour5	-3.131e+02	5.031e+01	-6.223
Hour6	-3.308e+02	5.159e+01	-6.412
Hour7	-2.238e+02	1.120e+02	-1.999
Hour8	6.126e+01	1.195e+02	0.512
Hour9	-2.439e+01	1.268e+02	-0.192
Hour10	-2.591e+02	1.280e+02	-2.025
Hour11	-1.388e+02	1.362e+02	-1.019
Hour12	-1.052e+02	1.313e+02	-0.801
Hour13	-4.886e+02	1.465e+02	-3.336
Hour14	8.937e+00	1.260e+02	0.071
Hour15	-2.507e+02	4.776e+01	-5.250
Hour16	-3.501e+02	5.558e+01	-6.299
Hour17	-5.381e+02	1.973e+02	-2.727
Hour18	-2.284e+02	3.885e+01	-5.878
Hour19	-2.396e+02	1.248e+02	-1.920
Hour20	-2.206e+01	1.218e+02	-0.181
Hour21	-2.388e+02	1.255e+02	-1.902
Hour22	-8.659e+01	1.200e+02	-0.721
Hour23	-2.481e+02	4.466e+01	-5.556
IsAutumn	7.774e+01	4.180e+01	1.860

RentedBikeCount_Lag1	7.524e-01	2.962e-02	25.403
RentedBikeCount_Lag6	-3.295e-02	2.858e-02	-1.153
RentedBikeCount_Lag8	-2.683e-02	2.609e-02	-1.028
RentedBikeCount_Lag9	8.907e-02	2.939e-02	3.030
HumidityXWindSpeed	-1.044e-01	6.362e-02	-1.642
HumidityXVisibility	2.643e-04	1.322e-04	1.999
HumidityXSolarRadiation	2.097e+00	6.926e-01	3.027
HumidityXRentedBikeCount_Lag1	7.582e-04	3.171e-04	2.391
HumidityXRentedBikeCount_Lag6	6.629e-04	2.815e-04	2.355
HumidityXRentedBikeCount_Lag9	-9.725e-04	2.626e-04	-3.703
TemperatureXDewPointTemp	-8.929e-02	3.386e-02	-2.637
TemperatureXSolarRadiation	2.566e+00	1.687e+00	1.521
TemperatureXRentedBikeCount_Lag1	3.787e-03	7.368e-04	5.140
TemperatureXRentedBikeCount_Lag3	2.230e-03	1.443e-03	1.546
WindSpeedXDewPointTemp	-1.133e-01	3.195e-01	-0.355
WindSpeedXSolarRadiation	-3.129e+00	5.626e+00	-0.556
WindSpeedXRainfall	-4.128e-01	3.769e+00	-0.110
WindSpeedXSnowfall	6.648e+00	1.072e+01	0.620
WindSpeedXIsHoliday	-1.932e+01	1.416e+01	-1.364
WindSpeedXRentedBikeCount_Lag1	1.809e-03	6.646e-03	0.272
VisibilityXDewPointTemp	-2.805e-01	3.188e-01	-0.880
VisibilityXSolarRadiation	4.625e+00	4.718e+00	0.980
VisibilityXRainfall	2.165e+00	2.062e+00	1.050
VisibilityXSnowfall	-4.855e+00	4.654e+00	-1.043
VisibilityXRentedBikeCount_Lag7	-9.799e-03	4.858e-03	-2.017
DewPointTempXSolarRadiation	-3.760e+00	1.808e+00	-2.079
DewPointTempXRainfall	4.614e-01	4.078e-01	1.132
DewPointTempXSnowfall	-4.279e-01	6.257e-01	-0.684
DewPointTempXIsHoliday	9.404e-01	9.457e-01	0.994
DewPointTempXRentedBikeCount_Lag3	-4.864e-04	1.136e-03	-0.428
SolarRadiationXRainfall	6.760e+01	2.139e+01	3.161
SolarRadiationXIsHoliday	2.233e+01	1.206e+01	1.851
SolarRadiationXRentedBikeCount_Lag1	1.320e-02	1.480e-02	0.892
SolarRadiationXRentedBikeCount_Lag2	1.885e-03	1.359e-02	0.139
SolarRadiationXRentedBikeCount_Lag4	7.229e-03	9.755e-03	0.741
SolarRadiationXRentedBikeCount_Lag5	-9.928e-03	8.141e-03	-1.219
SolarRadiationXRentedBikeCount_Lag9	3.564e-02	9.882e-03	3.607
RainfallXSnowfall	3.890e-01	2.849e+00	0.137
RainfallXIsHoliday	1.214e+01	1.273e+01	0.954
RainfallXRentedBikeCount_Lag1	-8.525e-02	1.440e-02	-5.922
RainfallXRentedBikeCount_Lag2	-3.649e-04	1.172e-02	-0.031
RainfallXRentedBikeCount_Lag4	2.059e-02	9.380e-03	2.195
RainfallXRentedBikeCount_Lag8	-5.230e-03	5.412e-03	-0.966

SnowfallXIsHoliday	-2.968e+00	2.792e+01	-0.106
SnowfallXRentedBikeCount_Lag2	5.260e-03	2.836e-02	0.186
SnowfallXRentedBikeCount_Lag9	-1.328e-02	2.463e-02	-0.539
IsHolidayXRentedBikeCount_Lag4	-9.188e-03	1.319e-02	-0.696
RentedBikeCount_Lag1XRentedBikeCount_Lag2	-8.857e-05	1.079e-05	-8.207
RentedBikeCount_Lag1XRentedBikeCount_Lag7	3.733e-05	1.845e-05	2.023
RentedBikeCount_Lag1XRentedBikeCount_Lag8	-9.645e-05	2.579e-05	-3.741
RentedBikeCount_Lag1XRentedBikeCount_Lag9	3.718e-05	1.870e-05	1.989
RentedBikeCount_Lag2XRentedBikeCount_Lag3	5.882e-05	1.552e-05	3.789
RentedBikeCount_Lag3XRentedBikeCount_Lag4	-3.487e-06	1.718e-05	-0.203
RentedBikeCount_Lag3XRentedBikeCount_Lag5	-2.541e-05	2.022e-05	-1.257
RentedBikeCount_Lag4XRentedBikeCount_Lag5	8.432e-06	1.727e-05	0.488
RentedBikeCount_Lag4XRentedBikeCount_Lag9	6.997e-06	1.822e-05	0.384
RentedBikeCount_Lag5XRentedBikeCount_Lag6	1.435e-05	1.255e-05	1.143
RentedBikeCount_Lag5XRentedBikeCount_Lag9	1.855e-05	2.147e-05	0.864
RentedBikeCount_Lag6XRentedBikeCount_Lag8	5.527e-05	2.159e-05	2.560
RentedBikeCount_Lag6XRentedBikeCount_Lag9	-4.366e-05	1.857e-05	-2.351
RentedBikeCount_Lag7XRentedBikeCount_Lag8	-3.298e-05	1.316e-05	-2.506
HumidityXHour1	2.396e+00	6.578e-01	3.642
HumidityXHour2	1.791e+00	6.726e-01	2.663
HumidityXHour3	1.273e+00	6.764e-01	1.882
HumidityXHour4	1.841e+00	6.614e-01	2.783
HumidityXHour5	2.125e+00	5.860e-01	3.626
HumidityXHour6	2.480e+00	6.097e-01	4.067
HumidityXHour7	3.480e+00	6.961e-01	4.999
HumidityXHour8	9.266e-01	7.415e-01	1.250
HumidityXHour9	1.048e+00	8.027e-01	1.306
HumidityXHour10	1.771e+00	7.152e-01	2.477
HumidityXHour11	4.826e-01	7.273e-01	0.664
HumidityXHour12	5.815e-01	7.290e-01	0.798
HumidityXHour13	3.663e+00	1.699e+00	2.156
HumidityXHour14	-4.680e-01	6.819e-01	-0.686
HumidityXHour15	-1.841e-02	6.185e-01	-0.030
HumidityXHour16	1.667e+00	6.651e-01	2.507
HumidityXHour17	3.082e+00	1.700e+00	1.813
HumidityXHour18	1.077e+00	6.009e-01	1.792
HumidityXHour19	6.800e-01	6.717e-01	1.012
HumidityXHour20	9.405e-01	6.547e-01	1.437
HumidityXHour21	1.915e+00	6.713e-01	2.853
HumidityXHour22	1.289e+00	6.645e-01	1.939
HumidityXHour23	7.823e-01	5.734e-01	1.364
TemperatureXHour1	-1.026e+01	1.338e+00	-7.666
TemperatureXHour2	-1.042e+01	1.355e+00	-7.688

TemperatureXHour4	-7.774e+00	1.338e+00	-5.809
TemperatureXHour5	-6.131e+00	1.316e+00	-4.658
TemperatureXHour6	-6.685e+00	1.496e+00	-4.469
TemperatureXHour7	-1.527e+01	1.472e+00	-10.372
TemperatureXHour8	-1.234e+01	1.534e+00	-8.041
TemperatureXHour9	-1.087e+01	1.612e+00	-6.743
TemperatureXHour10	-9.851e+00	1.559e+00	-6.320
TemperatureXHour11	-7.541e+00	1.650e+00	-4.569
TemperatureXHour12	-8.501e+00	1.472e+00	-5.774
TemperatureXHour13	2.617e-01	5.197e+00	0.050
TemperatureXHour14	-9.868e+00	1.437e+00	-6.866
TemperatureXHour15	-7.554e+00	1.531e+00	-4.934
TemperatureXHour16	-6.455e+00	1.550e+00	-4.164
TemperatureXHour17	-3.013e+00	5.023e+00	-0.600
TemperatureXHour18	-1.948e+00	1.380e+00	-1.411
TemperatureXHour19	-1.069e+01	1.336e+00	-8.005
TemperatureXHour20	-7.455e+00	1.474e+00	-5.059
TemperatureXHour21	-7.871e+00	1.492e+00	-5.275
TemperatureXHour22	-9.341e+00	1.295e+00	-7.212
TemperatureXHour23	-6.279e+00	1.461e+00	-4.298
WindSpeedXHour1	-1.282e+01	1.902e+01	-0.674
WindSpeedXHour2	4.148e+00	1.969e+01	0.211
WindSpeedXHour3	2.580e+00	2.015e+01	0.128
WindSpeedXHour4	1.082e+01	2.028e+01	0.533
WindSpeedXHour5	4.616e+00	2.101e+01	0.220
WindSpeedXHour6	6.733e+00	2.057e+01	0.327
WindSpeedXHour7	-6.108e+00	2.152e+01	-0.284
WindSpeedXHour9	1.439e+00	2.012e+01	0.072
WindSpeedXHour10	9.097e+00	1.883e+01	0.483
WindSpeedXHour11	1.730e+01	1.838e+01	0.941
WindSpeedXHour12	2.255e+01	1.741e+01	1.295
WindSpeedXHour13	1.513e+01	1.695e+01	0.892
WindSpeedXHour14	1.172e+01	1.597e+01	0.734
WindSpeedXHour15	1.871e+01	1.477e+01	1.267
WindSpeedXHour16	1.427e+01	1.395e+01	1.023
WindSpeedXHour19	8.143e+00	1.551e+01	0.525
WindSpeedXHour20	1.376e+01	1.647e+01	0.836
WindSpeedXHour21	-2.188e+01	1.750e+01	-1.250
WindSpeedXHour22	4.088e+00	1.749e+01	0.234
VisibilityXHour1	-4.278e+00	1.233e+01	-0.347
VisibilityXHour2	-1.997e+01	1.231e+01	-1.621
VisibilityXHour3	-1.019e+01	1.226e+01	-0.831
VisibilityXHour4	-9.720e+00	1.110e+01	-0.876

VisibilityXHour7	-1.226e+01	1.128e+01	-1.087
VisibilityXHour8	-2.234e+01	1.214e+01	-1.840
VisibilityXHour9	-2.330e+01	1.323e+01	-1.761
VisibilityXHour10	-2.038e+00	1.415e+01	-0.144
VisibilityXHour11	-7.798e+00	1.535e+01	-0.508
VisibilityXHour12	-1.791e+01	1.539e+01	-1.164
VisibilityXHour14	-2.599e+01	1.482e+01	-1.753
VisibilityXHour17	1.355e+01	1.453e+01	0.932
VisibilityXHour19	-1.112e+01	1.420e+01	-0.783
VisibilityXHour20	-3.877e+01	1.335e+01	-2.904
VisibilityXHour21	-4.664e+00	1.383e+01	-0.337
VisibilityXHour22	-2.130e+01	1.338e+01	-1.592
DewPointTempXHour13	-8.479e+00	5.294e+00	-1.602
DewPointTempXHour17	-3.047e+00	5.314e+00	-0.573
SolarRadiationXHour6	-3.122e+02	5.224e+02	-0.598
SolarRadiationXHour7	-1.295e+02	6.997e+01	-1.850
SolarRadiationXHour8	-1.890e+02	3.002e+01	-6.295
SolarRadiationXHour9	1.230e+01	2.169e+01	0.567
SolarRadiationXHour16	5.828e+00	1.536e+01	0.379
SolarRadiationXHour17	2.510e+01	2.137e+01	1.174
SolarRadiationXHour18	-1.126e+01	2.872e+01	-0.392
SolarRadiationXHour19	6.421e+02	5.755e+01	11.157
Rainfall1XHour1	3.801e+01	1.373e+01	2.769
Rainfall1XHour2	3.812e+01	1.208e+01	3.155
Rainfall1XHour3	2.499e+01	1.192e+01	2.097
Rainfall1XHour4	2.749e+01	7.918e+00	3.472
Rainfall1XHour5	1.944e+01	1.321e+01	1.471
Rainfall1XHour6	2.983e+01	9.568e+00	3.117
Rainfall1XHour7	4.667e+01	8.557e+00	5.454
Rainfall1XHour8	2.402e+01	7.680e+00	3.128
Rainfall1XHour9	2.246e+01	7.781e+00	2.887
Rainfall1XHour10	2.406e+01	9.845e+00	2.444
Rainfall1XHour11	3.047e+01	8.807e+00	3.459
Rainfall1XHour12	2.270e+01	1.091e+01	2.080
Rainfall1XHour13	2.800e+01	7.656e+00	3.657
Rainfall1XHour14	3.763e+01	1.572e+01	2.394
Rainfall1XHour15	4.176e+01	9.961e+00	4.192
Rainfall1XHour16	6.842e+00	1.700e+01	0.402
Rainfall1XHour18	1.638e+01	7.507e+00	2.182
Rainfall1XHour19	2.204e+01	1.223e+01	1.803
Rainfall1XHour20	2.700e+01	7.600e+00	3.553
Rainfall1XHour21	3.068e+01	6.659e+00	4.607
Rainfall1XHour22	1.158e+01	1.427e+01	0.812

RainfallXHour23	4.081e+01	1.516e+01	2.693
SnowfallXHour1	4.633e+00	1.642e+01	0.282
SnowfallXHour3	1.346e+01	1.696e+01	0.794
SnowfallXHour4	4.152e+00	1.655e+01	0.251
SnowfallXHour6	-3.190e+00	1.620e+01	-0.197
SnowfallXHour7	-1.507e+01	1.512e+01	-0.997
SnowfallXHour9	-1.028e+01	1.499e+01	-0.686
SnowfallXHour11	1.067e+01	1.136e+01	0.940
SnowfallXHour12	9.064e+00	1.324e+01	0.685
SnowfallXHour13	-6.272e+00	1.435e+01	-0.437
SnowfallXHour14	2.555e+00	1.611e+01	0.159
SnowfallXHour16	1.156e+01	2.120e+01	0.545
SnowfallXHour17	-3.090e+00	2.105e+01	-0.147
SnowfallXHour18	3.147e+01	2.042e+01	1.541
SnowfallXHour20	5.671e+00	1.911e+01	0.297
SnowfallXHour21	4.709e+00	1.857e+01	0.254
SnowfallXHour22	3.159e+00	1.842e+01	0.171
SnowfallXHour23	1.772e+01	1.861e+01	0.952
IsHolidayXHour1	3.614e+01	3.118e+01	1.159
IsHolidayXHour2	4.611e+01	3.130e+01	1.473
IsHolidayXHour3	-2.216e+00	3.142e+01	-0.071
IsHolidayXHour4	2.078e+00	3.137e+01	0.066
IsHolidayXHour5	-2.010e+01	3.134e+01	-0.641
IsHolidayXHour6	7.319e+00	3.208e+01	0.228
IsHolidayXHour7	-2.379e+01	3.190e+01	-0.746
IsHolidayXHour8	-3.365e+01	3.158e+01	-1.066
IsHolidayXHour10	1.129e+01	3.240e+01	0.348
IsHolidayXHour12	-1.458e+01	3.448e+01	-0.423
IsHolidayXHour13	-2.887e+01	3.436e+01	-0.840
IsHolidayXHour14	-4.129e+01	3.377e+01	-1.222
IsHolidayXHour15	-6.429e+01	3.261e+01	-1.972
IsHolidayXHour16	-1.765e+01	3.186e+01	-0.554
IsHolidayXHour17	-2.382e+01	3.127e+01	-0.762
IsHolidayXHour18	-7.105e+01	3.118e+01	-2.279
IsHolidayXHour19	9.408e+01	3.141e+01	2.996
IsHolidayXHour20	4.699e+01	3.166e+01	1.484
IsHolidayXHour21	1.853e+01	3.191e+01	0.581
IsHolidayXHour23	2.067e+00	3.161e+01	0.065
RentedBikeCount_Lag1XHour3	-2.039e-01	9.799e-02	-2.081
RentedBikeCount_Lag1XHour6	2.311e+00	1.390e-01	16.631
RentedBikeCount_Lag1XHour7	1.627e+00	4.541e-02	35.839
RentedBikeCount_Lag1XHour8	9.001e-01	2.284e-02	39.413
RentedBikeCount_Lag1XHour9	-2.261e-01	1.899e-02	-11.907

RentedBikeCount_Lag1XHour10	1.835e-01	6.503e-02	2.822
RentedBikeCount_Lag1XHour12	2.750e-01	8.701e-02	3.161
RentedBikeCount_Lag1XHour13	2.917e-01	5.772e-02	5.053
RentedBikeCount_Lag1XHour14	5.540e-01	5.698e-02	9.723
RentedBikeCount_Lag1XHour15	5.017e-01	2.596e-02	19.325
RentedBikeCount_Lag1XHour16	3.219e-01	5.946e-02	5.414
RentedBikeCount_Lag1XHour17	3.513e-01	5.956e-02	5.899
RentedBikeCount_Lag1XHour18	5.840e-01	2.485e-02	23.501
RentedBikeCount_Lag1XHour20	3.361e-01	3.125e-02	10.757
RentedBikeCount_Lag1XHour21	2.118e-01	3.191e-02	6.639
RentedBikeCount_Lag1XHour23	1.467e-01	3.607e-02	4.067
RentedBikeCount_Lag2XHour1	2.604e-01	6.287e-02	4.142
RentedBikeCount_Lag2XHour2	1.599e-01	4.186e-02	3.819
RentedBikeCount_Lag2XHour3	2.294e-01	9.925e-02	2.312
RentedBikeCount_Lag2XHour4	-1.426e-02	9.694e-02	-0.147
RentedBikeCount_Lag2XHour6	-8.401e-01	1.398e-01	-6.008
RentedBikeCount_Lag2XHour10	7.024e-02	3.904e-02	1.799
RentedBikeCount_Lag2XHour11	5.070e-01	5.476e-02	9.259
RentedBikeCount_Lag2XHour12	3.184e-01	1.198e-01	2.657
RentedBikeCount_Lag2XHour16	2.898e-01	1.236e-01	2.345
RentedBikeCount_Lag2XHour17	1.844e-01	8.834e-02	2.088
RentedBikeCount_Lag2XHour22	8.826e-02	5.281e-02	1.671
RentedBikeCount_Lag3XHour1	-7.623e-02	5.633e-02	-1.353
RentedBikeCount_Lag3XHour2	7.700e-02	7.331e-02	1.050
RentedBikeCount_Lag3XHour3	5.933e-02	7.456e-02	0.796
RentedBikeCount_Lag3XHour4	1.012e-01	7.831e-02	1.292
RentedBikeCount_Lag3XHour12	3.414e-02	7.209e-02	0.474
RentedBikeCount_Lag3XHour13	2.814e-01	8.322e-02	3.381
RentedBikeCount_Lag3XHour14	-4.396e-02	1.011e-01	-0.435
RentedBikeCount_Lag3XHour16	-9.416e-02	1.387e-01	-0.679
RentedBikeCount_Lag3XHour17	-1.060e-01	1.231e-01	-0.861
RentedBikeCount_Lag3XHour19	1.603e-01	6.476e-02	2.475
RentedBikeCount_Lag3XHour20	3.035e-01	6.083e-02	4.990
RentedBikeCount_Lag3XHour21	1.858e-01	3.155e-02	5.889
RentedBikeCount_Lag3XHour22	2.168e-01	6.733e-02	3.220
RentedBikeCount_Lag4XHour2	-4.648e-02	9.892e-02	-0.470
RentedBikeCount_Lag4XHour3	-6.336e-02	6.985e-02	-0.907
RentedBikeCount_Lag4XHour11	-8.825e-02	4.627e-02	-1.907
RentedBikeCount_Lag4XHour14	-6.969e-02	9.019e-02	-0.773
RentedBikeCount_Lag4XHour16	-1.315e-02	9.474e-02	-0.139
RentedBikeCount_Lag4XHour17	1.828e-02	1.371e-01	0.133
RentedBikeCount_Lag4XHour19	3.521e-01	8.884e-02	3.964
RentedBikeCount_Lag4XHour20	-2.822e-01	8.798e-02	-3.207

RentedBikeCount_Lag4XHour21	-4.851e-02	4.662e-02	-1.041
RentedBikeCount_Lag4XHour22	2.314e-02	3.625e-02	0.638
RentedBikeCount_Lag5XHour2	1.318e-01	9.996e-02	1.319
RentedBikeCount_Lag5XHour3	1.807e-01	9.453e-02	1.912
RentedBikeCount_Lag5XHour5	1.073e-01	3.383e-02	3.172
RentedBikeCount_Lag5XHour9	9.255e-01	2.793e-01	3.313
RentedBikeCount_Lag5XHour10	-3.067e-01	2.340e-01	-1.310
RentedBikeCount_Lag5XHour17	2.316e-02	1.196e-01	0.194
RentedBikeCount_Lag5XHour19	-4.345e-01	1.237e-01	-3.512
RentedBikeCount_Lag5XHour20	1.263e-01	8.471e-02	1.491
RentedBikeCount_Lag6XHour2	-6.588e-02	5.929e-02	-1.111
RentedBikeCount_Lag6XHour3	-1.167e-01	6.592e-02	-1.770
RentedBikeCount_Lag6XHour4	-1.998e-02	4.969e-02	-0.402
RentedBikeCount_Lag6XHour7	-8.009e-02	3.835e-02	-2.089
RentedBikeCount_Lag6XHour9	3.308e-01	1.708e-01	1.937
RentedBikeCount_Lag6XHour10	6.364e-01	2.742e-01	2.321
RentedBikeCount_Lag6XHour16	3.843e-02	1.116e-01	0.344
RentedBikeCount_Lag6XHour17	9.201e-02	1.243e-01	0.740
RentedBikeCount_Lag6XHour18	-7.165e-01	3.692e-02	-19.405
RentedBikeCount_Lag6XHour19	6.029e-01	1.319e-01	4.572
RentedBikeCount_Lag6XHour20	8.834e-03	5.583e-02	0.158
RentedBikeCount_Lag6XHour22	2.999e-02	6.554e-02	0.458
RentedBikeCount_Lag6XHour23	1.912e-01	5.286e-02	3.618
RentedBikeCount_Lag7XHour1	7.760e-02	1.943e-02	3.995
RentedBikeCount_Lag7XHour8	1.157e-01	4.000e-02	2.892
RentedBikeCount_Lag7XHour11	-3.201e-02	1.327e-01	-0.241
RentedBikeCount_Lag7XHour16	-1.534e-02	1.084e-01	-0.142
RentedBikeCount_Lag7XHour19	-5.677e-01	1.194e-01	-4.754
RentedBikeCount_Lag7XHour21	9.684e-02	8.680e-02	1.116
RentedBikeCount_Lag7XHour22	-9.584e-02	8.778e-02	-1.092
RentedBikeCount_Lag7XHour23	-2.199e-01	8.409e-02	-2.615
RentedBikeCount_Lag8XHour4	3.977e-02	5.066e-02	0.785
RentedBikeCount_Lag8XHour5	-1.248e-02	5.893e-02	-0.212
RentedBikeCount_Lag8XHour6	-5.132e-02	7.310e-02	-0.702
RentedBikeCount_Lag8XHour10	8.767e-02	1.136e-01	0.771
RentedBikeCount_Lag8XHour16	7.711e-02	3.682e-02	2.094
RentedBikeCount_Lag8XHour17	-6.066e-02	8.856e-02	-0.685
RentedBikeCount_Lag8XHour19	4.705e-01	1.360e-01	3.459
RentedBikeCount_Lag8XHour21	2.822e-02	7.874e-02	0.358
RentedBikeCount_Lag8XHour22	1.321e-01	1.221e-01	1.082
RentedBikeCount_Lag8XHour23	1.413e-01	6.316e-02	2.237
RentedBikeCount_Lag9XHour4	-1.972e-03	4.270e-02	-0.046
RentedBikeCount_Lag9XHour5	2.819e-02	5.454e-02	0.517

RentedBikeCount_Lag9XHour6	4.036e-02	6.364e-02	0.634
RentedBikeCount_Lag9XHour7	1.360e-02	2.054e-02	0.662
RentedBikeCount_Lag9XHour8	-7.033e-02	2.935e-02	-2.396
RentedBikeCount_Lag9XHour10	-6.622e-02	7.729e-02	-0.857
RentedBikeCount_Lag9XHour13	-4.499e-02	1.404e-01	-0.321
RentedBikeCount_Lag9XHour17	1.096e-01	3.630e-02	3.021
RentedBikeCount_Lag9XHour18	1.017e+00	3.703e-02	27.465
RentedBikeCount_Lag9XHour19	-1.673e-01	9.486e-02	-1.763
RentedBikeCount_Lag9XHour22	-2.605e-02	8.804e-02	-0.296
TemperatureXIIsWinter	-1.613e+00	1.728e+00	-0.933
TemperatureXIIsSummer	-3.339e+00	1.529e+00	-2.184
TemperatureXIIsAutumn	-2.717e+00	6.726e-01	-4.040
WindSpeedXIIsSummer	2.431e+01	9.884e+00	2.459
VisibilityXIIsAutumn	1.121e+00	5.754e+00	0.195
DewPointTempXIIsWinter	1.322e-01	1.117e+00	0.118
DewPointTempXIIsSummer	-2.348e+00	1.156e+00	-2.032
SolarRadiationXIIsWinter	-2.747e+01	1.159e+01	-2.370
SolarRadiationXIIsSummer	-3.096e+01	9.775e+00	-3.167
RainfallXIIsWinter	-1.044e+00	1.018e+01	-0.103
RainfallXIIsSummer	-7.200e+00	4.354e+00	-1.654
RainfallXIIsAutumn	1.470e+00	4.869e+00	0.302
IsHolidayXIIsWinter	2.807e+01	2.626e+01	1.069
IsHolidayXIIsSummer	1.624e+01	2.536e+01	0.640
IsHolidayXIIsAutumn	6.853e+00	1.807e+01	0.379
Hour1XIIsWinter	4.995e+01	2.727e+01	1.831
Hour1XIIsAutumn	-4.449e+01	1.873e+01	-2.375
Hour2XIIsWinter	8.165e-01	2.725e+01	0.030
Hour2XIIsAutumn	-6.886e+01	2.100e+01	-3.279
Hour3XIIsWinter	1.146e+02	2.636e+01	4.349
Hour3XIIsSummer	-1.100e+02	2.492e+01	-4.412
Hour3XIIsAutumn	-6.540e+01	2.162e+01	-3.025
Hour4XIIsWinter	3.351e+01	2.738e+01	1.224
Hour4XIIsAutumn	-4.552e+01	1.954e+01	-2.330
Hour5XIIsWinter	4.148e+01	2.676e+01	1.550
Hour5XIIsAutumn	-7.386e+01	1.985e+01	-3.722
Hour6XIIsWinter	1.598e+01	2.801e+01	0.570
Hour6XIIsSummer	-5.961e+01	2.738e+01	-2.177
Hour6XIIsAutumn	-5.176e+01	2.171e+01	-2.384
Hour7XIIsWinter	-8.355e+01	2.854e+01	-2.927
Hour7XIIsSummer	-1.297e+02	2.789e+01	-4.651
Hour7XIIsAutumn	-1.181e+02	2.318e+01	-5.095
Hour8XIIsWinter	-6.210e+01	2.824e+01	-2.199
Hour8XIIsSummer	3.204e+01	2.819e+01	1.137

Hour8XIIsAutumn	-6.612e+01	2.228e+01	-2.968
Hour9XIIsWinter	-5.409e+01	2.860e+01	-1.891
Hour9XIIsSummer	-5.978e+01	2.988e+01	-2.001
Hour9XIIsAutumn	-8.901e+01	2.179e+01	-4.084
Hour10XIIsWinter	-1.455e+01	2.829e+01	-0.514
Hour10XIIsSummer	-3.756e+01	3.256e+01	-1.154
Hour10XIIsAutumn	-6.694e+01	2.110e+01	-3.172
Hour11XIIsWinter	9.491e+00	2.909e+01	0.326
Hour11XIIsSummer	-3.552e+01	3.341e+01	-1.063
Hour11XIIsAutumn	-8.113e+01	2.071e+01	-3.917
Hour12XIIsSummer	-4.104e+01	3.338e+01	-1.230
Hour12XIIsAutumn	-8.500e+01	1.969e+01	-4.316
Hour13XIIsWinter	5.536e+01	3.038e+01	1.822
Hour13XIIsSummer	-3.078e+00	3.496e+01	-0.088
Hour13XIIsAutumn	-6.783e+00	2.021e+01	-0.336
Hour14XIIsSummer	4.885e+01	2.963e+01	1.649
Hour15XIIsWinter	4.230e+01	2.747e+01	1.540
Hour15XIIsSummer	9.306e+01	2.838e+01	3.280
Hour16XIIsWinter	5.030e+01	2.848e+01	1.766
Hour16XIIsSummer	1.403e+01	3.075e+01	0.456
Hour16XIIsAutumn	-4.471e+01	2.226e+01	-2.009
Hour17XIIsWinter	6.844e+01	2.915e+01	2.348
Hour17XIIsSummer	3.181e+01	3.058e+01	1.040
Hour17XIIsAutumn	1.329e+00	2.272e+01	0.059
Hour18XIIsSummer	-1.764e+02	2.689e+01	-6.562
Hour18XIIsAutumn	-1.399e+02	2.140e+01	-6.540
Hour19XIIsSummer	1.420e+02	2.822e+01	5.033
Hour19XIIsAutumn	6.151e+01	2.175e+01	2.828
Hour20XIIsWinter	3.532e+01	2.669e+01	1.323
Hour20XIIsSummer	9.684e+01	2.628e+01	3.684
Hour21XIIsWinter	1.622e+01	2.852e+01	0.569
Hour21XIIsSummer	2.075e+01	2.836e+01	0.732
Hour21XIIsAutumn	-7.203e+01	1.925e+01	-3.741
Hour22XIIsSummer	5.335e+01	2.849e+01	1.872
Hour22XIIsAutumn	-1.610e+01	1.857e+01	-0.867
Hour23XIIsWinter	4.887e+01	2.732e+01	1.789
Hour23XIIsSummer	1.597e+01	2.943e+01	0.543
Hour23XIIsAutumn	-2.262e+01	1.873e+01	-1.208
RentedBikeCount_Lag1XIIsAutumn	2.223e-02	7.943e-03	2.799
RentedBikeCount_Lag3XIIsWinter	2.591e-02	2.936e-02	0.882
RentedBikeCount_Lag5XIIsSummer	6.482e-03	1.523e-02	0.426
RentedBikeCount_Lag6XIIsSummer	1.328e-03	1.538e-02	0.086
RentedBikeCount_Lag6XIIsAutumn	-4.622e-02	1.025e-02	-4.510

RentedBikeCount_Lag8XIsAutumn	3.992e-02	9.608e-03	4.155
RentedBikeCount_Lag9XIsWinter	-3.883e-02	2.700e-02	-1.438
Temperature	6.131e+00	3.275e+00	1.872
WindSpeed	3.743e+00	1.283e+01	0.292
DewPointTemp	5.431e+00	4.099e+00	1.325
Snowfall	1.957e+01	2.793e+01	0.701
IsHoliday	-1.540e+01	2.521e+01	-0.611
IsWinter	8.364e-01	1.845e+01	0.045
IsSummer	1.197e+02	3.100e+01	3.863
RentedBikeCount_Lag2	-2.325e-01	2.359e-02	-9.853
RentedBikeCount_Lag3	-9.749e-02	3.300e-02	-2.955
RentedBikeCount_Lag4	1.030e-02	3.199e-02	0.322
RentedBikeCount_Lag5	-9.543e-02	2.755e-02	-3.465
RentedBikeCount_Lag7	1.043e-01	4.139e-02	2.519
Humidity2	9.691e+00	6.518e+01	0.149
Humidity3	7.173e+00	5.874e+01	0.122
Humidity4	-1.099e+01	5.698e+01	-0.193
Humidity5	-1.414e+01	5.701e+01	-0.248
Humidity6	-2.242e+01	5.840e+01	-0.384
Humidity7	-3.382e+01	6.070e+01	-0.557
Humidity8	-3.975e+01	6.401e+01	-0.621
Humidity9	-3.442e+01	6.775e+01	-0.508
Humidity10	-3.439e+01	7.206e+01	-0.477
ExtremeWind	1.597e+01	1.742e+01	0.917
Pr(> t)			
(Intercept)	0.011619	*	
Humidity	0.123382		
Visibility	0.244289		
SolarRadiation	0.037879	*	
Rainfall	0.001867	**	
Hour1	0.008289	**	
Hour2	0.228886		
Hour3	0.045090	*	
Hour4	0.025937	*	
Hour5	5.10e-10	***	
Hour6	1.51e-10	***	
Hour7	0.045676	*	
Hour8	0.608386		
Hour9	0.847473		
Hour10	0.042898	*	
Hour11	0.308087		
Hour12	0.423405		
Hour13	0.000855	***	

Hour14	0.943435
Hour15	1.56e-07 ***
Hour16	3.15e-10 ***
Hour17	0.006402 **
Hour18	4.30e-09 ***
Hour19	0.054835 .
Hour20	0.856309
Hour21	0.057161 .
Hour22	0.470681
Hour23	2.85e-08 ***
IsAutumn	0.062913 .
RentedBikeCount_Lag1	< 2e-16 ***
RentedBikeCount_Lag6	0.248935
RentedBikeCount_Lag8	0.303872
RentedBikeCount_Lag9	0.002453 **
HumidityXWindSpeed	0.100651
HumidityXVisibility	0.045599 *
HumidityXSolarRadiation	0.002479 **
HumidityXRentedBikeCount_Lag1	0.016822 *
HumidityXRentedBikeCount_Lag6	0.018553 *
HumidityXRentedBikeCount_Lag9	0.000214 ***
TemperatureXDewPointTemp	0.008378 **
TemperatureXSolarRadiation	0.128174
TemperatureXRentedBikeCount_Lag1	2.81e-07 ***
TemperatureXRentedBikeCount_Lag3	0.122224
WindSpeedXDewPointTemp	0.722887
WindSpeedXSolarRadiation	0.578052
WindSpeedXRainfall	0.912771
WindSpeedXSnowfall	0.535113
WindSpeedXIsholiday	0.172614
WindSpeedXRentedBikeCount_Lag1	0.785445
VisibilityXDewPointTemp	0.379003
VisibilityXSolarRadiation	0.327024
VisibilityXRainfall	0.293805
VisibilityXSnowfall	0.296885
VisibilityXRentedBikeCount_Lag7	0.043708 *
DewPointTempXSolarRadiation	0.037612 *
DewPointTempXRainfall	0.257876
DewPointTempXSnowfall	0.494090
DewPointTempXIsholiday	0.320101
DewPointTempXRentedBikeCount_Lag3	0.668679
SolarRadiationXRainfall	0.001579 **
SolarRadiationXIsholiday	0.064159 .

SolarRadiationXRentedBikeCount_Lag1	0.372420
SolarRadiationXRentedBikeCount_Lag2	0.889667
SolarRadiationXRentedBikeCount_Lag4	0.458731
SolarRadiationXRentedBikeCount_Lag5	0.222695
SolarRadiationXRentedBikeCount_Lag9	0.000312 ***
RainfallXSnowfall	0.891390
RainfallXIsHoliday	0.340237
RainfallXRentedBikeCount_Lag1	3.30e-09 ***
RainfallXRentedBikeCount_Lag2	0.975167
RainfallXRentedBikeCount_Lag4	0.028175 *
RainfallXRentedBikeCount_Lag8	0.333957
SnowfallXIsHoliday	0.915350
SnowfallXRentedBikeCount_Lag2	0.852834
SnowfallXRentedBikeCount_Lag9	0.589671
IsHolidayXRentedBikeCount_Lag4	0.486138
RentedBikeCount_Lag1XRentedBikeCount_Lag2	2.60e-16 ***
RentedBikeCount_Lag1XRentedBikeCount_Lag7	0.043088 *
RentedBikeCount_Lag1XRentedBikeCount_Lag8	0.000185 ***
RentedBikeCount_Lag1XRentedBikeCount_Lag9	0.046784 *
RentedBikeCount_Lag2XRentedBikeCount_Lag3	0.000152 ***
RentedBikeCount_Lag3XRentedBikeCount_Lag4	0.839187
RentedBikeCount_Lag3XRentedBikeCount_Lag5	0.208795
RentedBikeCount_Lag4XRentedBikeCount_Lag5	0.625358
RentedBikeCount_Lag4XRentedBikeCount_Lag9	0.700933
RentedBikeCount_Lag5XRentedBikeCount_Lag6	0.253052
RentedBikeCount_Lag5XRentedBikeCount_Lag9	0.387582
RentedBikeCount_Lag6XRentedBikeCount_Lag8	0.010494 *
RentedBikeCount_Lag6XRentedBikeCount_Lag9	0.018746 *
RentedBikeCount_Lag7XRentedBikeCount_Lag8	0.012243 *
HumidityXHour1	0.000272 ***
HumidityXHour2	0.007766 **
HumidityXHour3	0.059806 .
HumidityXHour4	0.005390 **
HumidityXHour5	0.000290 ***
HumidityXHour6	4.80e-05 ***
HumidityXHour7	5.87e-07 ***
HumidityXHour8	0.211470
HumidityXHour9	0.191584
HumidityXHour10	0.013283 *
HumidityXHour11	0.506968
HumidityXHour12	0.425102
HumidityXHour13	0.031116 *
HumidityXHour14	0.492513

HumidityXHour15	0.976252
HumidityXHour16	0.012198 *
HumidityXHour17	0.069936 .
HumidityXHour18	0.073223 .
HumidityXHour19	0.311404
HumidityXHour20	0.150895
HumidityXHour21	0.004341 **
HumidityXHour22	0.052480 .
HumidityXHour23	0.172491
TemperatureXHour1	1.98e-14 ***
TemperatureXHour2	1.67e-14 ***
TemperatureXHour4	6.52e-09 ***
TemperatureXHour5	3.24e-06 ***
TemperatureXHour6	7.97e-06 ***
TemperatureXHour7	< 2e-16 ***
TemperatureXHour8	1.01e-15 ***
TemperatureXHour9	1.65e-11 ***
TemperatureXHour10	2.76e-10 ***
TemperatureXHour11	4.97e-06 ***
TemperatureXHour12	8.01e-09 ***
TemperatureXHour13	0.959836
TemperatureXHour14	7.09e-12 ***
TemperatureXHour15	8.19e-07 ***
TemperatureXHour16	3.16e-05 ***
TemperatureXHour17	0.548544
TemperatureXHour18	0.158312
TemperatureXHour19	1.36e-15 ***
TemperatureXHour20	4.31e-07 ***
TemperatureXHour21	1.36e-07 ***
TemperatureXHour22	5.99e-13 ***
TemperatureXHour23	1.74e-05 ***
WindSpeedXHour1	0.500289
WindSpeedXHour2	0.833123
WindSpeedXHour3	0.898128
WindSpeedXHour4	0.593772
WindSpeedXHour5	0.826123
WindSpeedXHour6	0.743384
WindSpeedXHour7	0.776570
WindSpeedXHour9	0.943000
WindSpeedXHour10	0.628994
WindSpeedXHour11	0.346704
WindSpeedXHour12	0.195246
WindSpeedXHour13	0.372160

WindSpeedXHour14	0.463142
WindSpeedXHour15	0.205350
WindSpeedXHour16	0.306251
WindSpeedXHour19	0.599658
WindSpeedXHour20	0.403460
WindSpeedXHour21	0.211276
WindSpeedXHour22	0.815152
VisibilityXHour1	0.728631
VisibilityXHour2	0.104977
VisibilityXHour3	0.405766
VisibilityXHour4	0.381141
VisibilityXHour7	0.277172
VisibilityXHour8	0.065794 .
VisibilityXHour9	0.078276 .
VisibilityXHour10	0.885487
VisibilityXHour11	0.611399
VisibilityXHour12	0.244497
VisibilityXHour14	0.079562 .
VisibilityXHour17	0.351333
VisibilityXHour19	0.433658
VisibilityXHour20	0.003694 **
VisibilityXHour21	0.735914
VisibilityXHour22	0.111410
DewPointTempXHour13	0.109281
DewPointTempXHour17	0.566419
SolarRadiationXHour6	0.550161
SolarRadiationXHour7	0.064302 .
SolarRadiationXHour8	3.22e-10 ***
SolarRadiationXHour9	0.570693
SolarRadiationXHour16	0.704384
SolarRadiationXHour17	0.240243
SolarRadiationXHour18	0.695136
SolarRadiationXHour19	< 2e-16 ***
RainfallXHour1	0.005632 **
RainfallXHour2	0.001613 **
RainfallXHour3	0.035980 *
RainfallXHour4	0.000519 ***
RainfallXHour5	0.141328
RainfallXHour6	0.001831 **
RainfallXHour7	5.07e-08 ***
RainfallXHour8	0.001766 **
RainfallXHour9	0.003900 **
RainfallXHour10	0.014555 *

RainfallXHour11	0.000544 ***
RainfallXHour12	0.037567 *
RainfallXHour13	0.000257 ***
RainfallXHour14	0.016682 *
RainfallXHour15	2.80e-05 ***
RainfallXHour16	0.687443
RainfallXHour18	0.029151 *
RainfallXHour19	0.071487 .
RainfallXHour20	0.000383 ***
RainfallXHour21	4.15e-06 ***
RainfallXHour22	0.416802
RainfallXHour23	0.007102 **
SnowfallXHour1	0.777898
SnowfallXHour3	0.427389
SnowfallXHour4	0.801888
SnowfallXHour6	0.843852
SnowfallXHour7	0.319009
SnowfallXHour9	0.492945
SnowfallXHour11	0.347301
SnowfallXHour12	0.493493
SnowfallXHour13	0.662012
SnowfallXHour14	0.873963
SnowfallXHour16	0.585477
SnowfallXHour17	0.883328
SnowfallXHour18	0.123345
SnowfallXHour20	0.766727
SnowfallXHour21	0.799856
SnowfallXHour22	0.863874
SnowfallXHour23	0.341147
IsHolidayXHour1	0.246455
IsHolidayXHour2	0.140759
IsHolidayXHour3	0.943777
IsHolidayXHour4	0.947186
IsHolidayXHour5	0.521363
IsHolidayXHour6	0.819555
IsHolidayXHour7	0.455727
IsHolidayXHour8	0.286634
IsHolidayXHour10	0.727604
IsHolidayXHour12	0.672331
IsHolidayXHour13	0.400824
IsHolidayXHour14	0.221575
IsHolidayXHour15	0.048693 *
IsHolidayXHour16	0.579761

IsHolidayXHour17	0.446283
IsHolidayXHour18	0.022721 *
IsHolidayXHour19	0.002746 **
IsHolidayXHour20	0.137770
IsHolidayXHour21	0.561410
IsHolidayXHour23	0.947859
RentedBikeCount_Lag1XHour3	0.037446 *
RentedBikeCount_Lag1XHour6	< 2e-16 ***
RentedBikeCount_Lag1XHour7	< 2e-16 ***
RentedBikeCount_Lag1XHour8	< 2e-16 ***
RentedBikeCount_Lag1XHour9	< 2e-16 ***
RentedBikeCount_Lag1XHour10	0.004777 **
RentedBikeCount_Lag1XHour12	0.001580 **
RentedBikeCount_Lag1XHour13	4.44e-07 ***
RentedBikeCount_Lag1XHour14	< 2e-16 ***
RentedBikeCount_Lag1XHour15	< 2e-16 ***
RentedBikeCount_Lag1XHour16	6.33e-08 ***
RentedBikeCount_Lag1XHour17	3.80e-09 ***
RentedBikeCount_Lag1XHour18	< 2e-16 ***
RentedBikeCount_Lag1XHour20	< 2e-16 ***
RentedBikeCount_Lag1XHour21	3.36e-11 ***
RentedBikeCount_Lag1XHour23	4.81e-05 ***
RentedBikeCount_Lag2XHour1	3.48e-05 ***
RentedBikeCount_Lag2XHour2	0.000135 ***
RentedBikeCount_Lag2XHour3	0.020817 *
RentedBikeCount_Lag2XHour4	0.883018
RentedBikeCount_Lag2XHour6	1.95e-09 ***
RentedBikeCount_Lag2XHour10	0.071999 .
RentedBikeCount_Lag2XHour11	< 2e-16 ***
RentedBikeCount_Lag2XHour12	0.007894 **
RentedBikeCount_Lag2XHour16	0.019025 *
RentedBikeCount_Lag2XHour17	0.036866 *
RentedBikeCount_Lag2Xhour22	0.094728 .
RentedBikeCount_Lag3XHour1	0.176032
RentedBikeCount_Lag3XHour2	0.293603
RentedBikeCount_Lag3XHour3	0.426232
RentedBikeCount_Lag3XHour4	0.196231
RentedBikeCount_Lag3XHour12	0.635779
RentedBikeCount_Lag3XHour13	0.000725 ***
RentedBikeCount_Lag3XHour14	0.663656
RentedBikeCount_Lag3XHour16	0.497353
RentedBikeCount_Lag3XHour17	0.389438
RentedBikeCount_Lag3XHour19	0.013359 *

RentedBikeCount_Lag3XHour20	6.17e-07 ***
RentedBikeCount_Lag3XHour21	4.05e-09 ***
RentedBikeCount_Lag3XHour22	0.001288 **
RentedBikeCount_Lag4XHour2	0.638474
RentedBikeCount_Lag4XHour3	0.364426
RentedBikeCount_Lag4XHour11	0.056497 .
RentedBikeCount_Lag4XHour14	0.439714
RentedBikeCount_Lag4XHour16	0.889585
RentedBikeCount_Lag4XHour17	0.893944
RentedBikeCount_Lag4XHour19	7.44e-05 ***
RentedBikeCount_Lag4XHour20	0.001346 **
RentedBikeCount_Lag4XHour21	0.298138
RentedBikeCount_Lag4XHour22	0.523307
RentedBikeCount_Lag5XHour2	0.187227
RentedBikeCount_Lag5XHour3	0.055922 .
RentedBikeCount_Lag5XHour5	0.001517 **
RentedBikeCount_Lag5XHour9	0.000925 ***
RentedBikeCount_Lag5XHour10	0.190093
RentedBikeCount_Lag5XHour17	0.846522
RentedBikeCount_Lag5XHour19	0.000446 ***
RentedBikeCount_Lag5XHour20	0.135946
RentedBikeCount_Lag6XHour2	0.266532
RentedBikeCount_Lag6XHour3	0.076733 .
RentedBikeCount_Lag6XHour4	0.687565
RentedBikeCount_Lag6XHour7	0.036779 *
RentedBikeCount_Lag6XHour9	0.052749 .
RentedBikeCount_Lag6XHour10	0.020301 *
RentedBikeCount_Lag6XHour16	0.730726
RentedBikeCount_Lag6XHour17	0.459335
RentedBikeCount_Lag6XHour18	< 2e-16 ***
RentedBikeCount_Lag6XHour19	4.91e-06 ***
RentedBikeCount_Lag6XHour20	0.874288
RentedBikeCount_Lag6XHour22	0.647273
RentedBikeCount_Lag6XHour23	0.000299 ***
RentedBikeCount_Lag7XHour1	6.54e-05 ***
RentedBikeCount_Lag7XHour8	0.003833 **
RentedBikeCount_Lag7XHour11	0.809403
RentedBikeCount_Lag7XHour16	0.887471
RentedBikeCount_Lag7XHour19	2.02e-06 ***
RentedBikeCount_Lag7XHour21	0.264642
RentedBikeCount_Lag7XHour22	0.274945
RentedBikeCount_Lag7XHour23	0.008929 **
RentedBikeCount_Lag8XHour4	0.432409

RentedBikeCount_Lag8XHour5	0.832347
RentedBikeCount_Lag8XHour6	0.482647
RentedBikeCount_Lag8XHour10	0.440509
RentedBikeCount_Lag8XHour16	0.036266 *
RentedBikeCount_Lag8XHour17	0.493405
RentedBikeCount_Lag8XHour19	0.000545 ***
RentedBikeCount_Lag8XHour21	0.720025
RentedBikeCount_Lag8XHour22	0.279379
RentedBikeCount_Lag8XHour23	0.025302 *
RentedBikeCount_Lag9XHour4	0.963162
RentedBikeCount_Lag9XHour5	0.605224
RentedBikeCount_Lag9XHour6	0.525933
RentedBikeCount_Lag9XHour7	0.507996
RentedBikeCount_Lag9XHour8	0.016577 *
RentedBikeCount_Lag9XHour10	0.391578
RentedBikeCount_Lag9XHour13	0.748545
RentedBikeCount_Lag9XHour17	0.002531 **
RentedBikeCount_Lag9XHour18	< 2e-16 ***
RentedBikeCount_Lag9XHour19	0.077869 .
RentedBikeCount_Lag9XHour22	0.767345
TemperatureXIIsWinter	0.350703
TemperatureXIIsSummer	0.028977 *
TemperatureXIIsAutumn	5.39e-05 ***
WindSpeedXIIsSummer	0.013934 *
VisibilityXIIsAutumn	0.845537
DewPointTempXIIsWinter	0.905806
DewPointTempXIIsSummer	0.042206 *
SolarRadiationXIIsWinter	0.017801 *
SolarRadiationXIIsSummer	0.001544 **
RainfallXIIsWinter	0.918314
RainfallXIIsSummer	0.098250 .
RainfallXIIsAutumn	0.762709
IsHolidayXIIsWinter	0.285106
IsHolidayXIIsSummer	0.521968
IsHolidayXIIsAutumn	0.704580
Hour1XIIsWinter	0.067072 .
Hour1XIIsAutumn	0.017568 *
Hour2XIIsWinter	0.976103
Hour2XIIsAutumn	0.001046 **
Hour3XIIsWinter	1.38e-05 ***
Hour3XIIsSummer	1.04e-05 ***
Hour3XIIsAutumn	0.002497 **
Hour4XIIsWinter	0.220882

Hour4XIIsAutumn	0.019838 *
Hour5XIIsWinter	0.121149
Hour5XIIsAutumn	0.000199 ***
Hour6XIIsWinter	0.568507
Hour6XIIsSummer	0.029511 *
Hour6XIIsAutumn	0.017130 *
Hour7XIIsWinter	0.003429 **
Hour7XIIsSummer	3.35e-06 ***
Hour7XIIsAutumn	3.56e-07 ***
Hour8XIIsWinter	0.027900 *
Hour8XIIsSummer	0.255652
Hour8XIIsAutumn	0.003006 **
Hour9XIIsWinter	0.058664 .
Hour9XIIsSummer	0.045460 *
Hour9XIIsAutumn	4.46e-05 ***
Hour10XIIsWinter	0.607072
Hour10XIIsSummer	0.248666
Hour10XIIsAutumn	0.001517 **
Hour11XIIsWinter	0.744234
Hour11XIIsSummer	0.287687
Hour11XIIsAutumn	9.03e-05 ***
Hour12XIIsSummer	0.218841
Hour12XIIsAutumn	1.60e-05 ***
Hour13XIIsWinter	0.068454 .
Hour13XIIsSummer	0.929835
Hour13XIIsAutumn	0.737169
Hour14XIIsSummer	0.099180 .
Hour15XIIsWinter	0.123711
Hour15XIIsSummer	0.001044 **
Hour16XIIsWinter	0.077423 .
Hour16XIIsSummer	0.648089
Hour16XIIsAutumn	0.044579 *
Hour17XIIsWinter	0.018901 *
Hour17XIIsSummer	0.298346
Hour17XIIsAutumn	0.953341
Hour18XIIsSummer	5.64e-11 ***
Hour18XIIsAutumn	6.49e-11 ***
Hour19XIIsSummer	4.92e-07 ***
Hour19XIIsAutumn	0.004691 **
Hour20XIIsWinter	0.185715
Hour20XIIsSummer	0.000231 ***
Hour21XIIsWinter	0.569474
Hour21XIIsSummer	0.464294

Hour21XIsAutumn	0.000184 ***
Hour22XIsSummer	0.061191 .
Hour22XIsAutumn	0.386042
Hour23XIsWinter	0.073710 .
Hour23XIsSummer	0.587362
Hour23XIsAutumn	0.227202
RentedBikeCount_Lag1XIsAutumn	0.005137 **
RentedBikeCount_Lag3XIsWinter	0.377560
RentedBikeCount_Lag5XIsSummer	0.670465
RentedBikeCount_Lag6XIsSummer	0.931201
RentedBikeCount_Lag6XIsAutumn	6.57e-06 ***
RentedBikeCount_Lag8XIsAutumn	3.29e-05 ***
RentedBikeCount_Lag9XIsWinter	0.150454
Temperature	0.061189 .
WindSpeed	0.770552
DewPointTemp	0.185230
Snowfall	0.483389
IsHoliday	0.541256
IsWinter	0.963838
IsSummer	0.000113 ***
RentedBikeCount_Lag2	< 2e-16 ***
RentedBikeCount_Lag3	0.003139 **
RentedBikeCount_Lag4	0.747494
RentedBikeCount_Lag5	0.000534 ***
RentedBikeCount_Lag7	0.011794 *
Humidity2	0.881811
Humidity3	0.902805
Humidity4	0.847048
Humidity5	0.804178
Humidity6	0.701044
Humidity7	0.577506
Humidity8	0.534651
Humidity9	0.611430
Humidity10	0.633207
ExtremeWind	0.359051

Signif. codes:	0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 109.7 on 8311 degrees of freedom
(9 observations deleted due to missingness)
Multiple R-squared: 0.9725, Adjusted R-squared: 0.9711
F-statistic: 669.8 on 439 and 8311 DF, p-value: < 2.2e-16

A.15

```
response <- GET(api_url)
fetch_time = ymd_h(paste(Sys.Date(), hour(now())))
content <- content(response, "text", encoding = "UTF-8")

data <- fromJSON(content)

hourly_data <- data$hourly

forecast <- as_tibble(hourly_data) %>% mutate(
  time = as.POSIXct(time, format = "%Y-%m-%dT%H:%M"),
  diffuse_radiation = diffuse_radiation/100,
  visibility = visibility/100,
  Hour = time %>% hour(),
  f = time >= as.POSIXct(fetch_time, format = "%Y-%m-%dT%H:%M")
) %>% setNames(c("Time", "Temperature", "Humidity", "DewPointTemp", "Rainfall", "Snowfall",
  "Visibility", "WindSpeed", "SolarRadiation", "Hour", "Forecast"))

forecast$Seasons = "Winter"

time.forecast = c()
for(h in unique(forecast$Hour)){
  factor = str_c("Hour", h)
  forecast[factor] = as.numeric(forecast$Hour == h)
  time.forecast = c(time.forecast, factor)
}
time.forecast.base = "Hour0"
time.forecast = setdiff(time.forecast, time.forecast.base)

forecast.factors = c("Temperature", "Humidity", "DewPointTemp",
  "WindSpeed", "Visibility", "SolarRadiation", "Rainfall",
  "Snowfall", time.forecast)

forecast = format_change_table(forecast)

forecast$PredictedChange = predict(seoul.elastic, forecast)
forecast$PredictedTemperature = forecast$PredictedChange+
  lag(forecast$Temperature, n=difference)

forecast[complete.cases(forecast[forecast.factors]),] -> forecast
```

```

pred_ints <- predict(seoul.elastic,
                      newdata = forecast,
                      interval = "prediction",
                      level = 0.95)

forecast$LowerBoundTemperatureChange = pred_ints[, "lwr"]
forecast$UpperBoundTemperatureChange = pred_ints[, "upr"]

forecast$LowerBoundTemperature = forecast$LowerBoundTemperatureChange +
  lag(forecast$Temperature, n=difference)
forecast$UpperBoundTemperature = forecast$UpperBoundTemperatureChange +
  lag(forecast$Temperature, n=difference)

p.change = forecast %>% ggplot(aes(x=Time, y=TemperatureChange, color=Forecast))+
  geom_line() +
  geom_ribbon(aes(ymin=LowerBoundTemperatureChange, ymax=UpperBoundTemperatureChange),
              color=NA, fill="#14DD32", alpha=0.2) +
  geom_line(aes(y=PredictedChange), color="#14DD32", alpha=0.5) +
  ylab(expression(Delta~Temperature))+
  labs(
    title="Current Weekly Forecast of Change in Temperature in Seoul",
    subtitle = "Overlaid by Prediction"
  )+
  guides(color="none")+
  theme_minimal()

p.temp = forecast %>% ggplot(aes(x=Time, y=Temperature, color=Forecast))+
  geom_line() +
  geom_ribbon(aes(ymin=LowerBoundTemperature, ymax=UpperBoundTemperature),
              color=NA, fill="#14DD32", alpha=0.2) +
  geom_line(aes(y=PredictedTemperature), color="#14DD32", alpha=0.5) +
  ylab("Temperature")+
  labs(
    title="Current Weekly Forecast of Temperature in Seoul",
    subtitle = "Overlaid by Prediction"
  )+
  theme_minimal()

grid.arrange(p.change, p.temp, ncol=2)

```

