

# Analysis of bicycle rentals in Washington D.C. and Seoul

Student 200019804

2023-10-14

## **Introduction**

... how season, meteorological factors and more affect the number of bicycle rentals in two cities; Seoul, South Korea, and Washington D.C., USA by an

## Climate

To begin to understand bike rental numbers in the two cities, it is important to understand each city's climate.

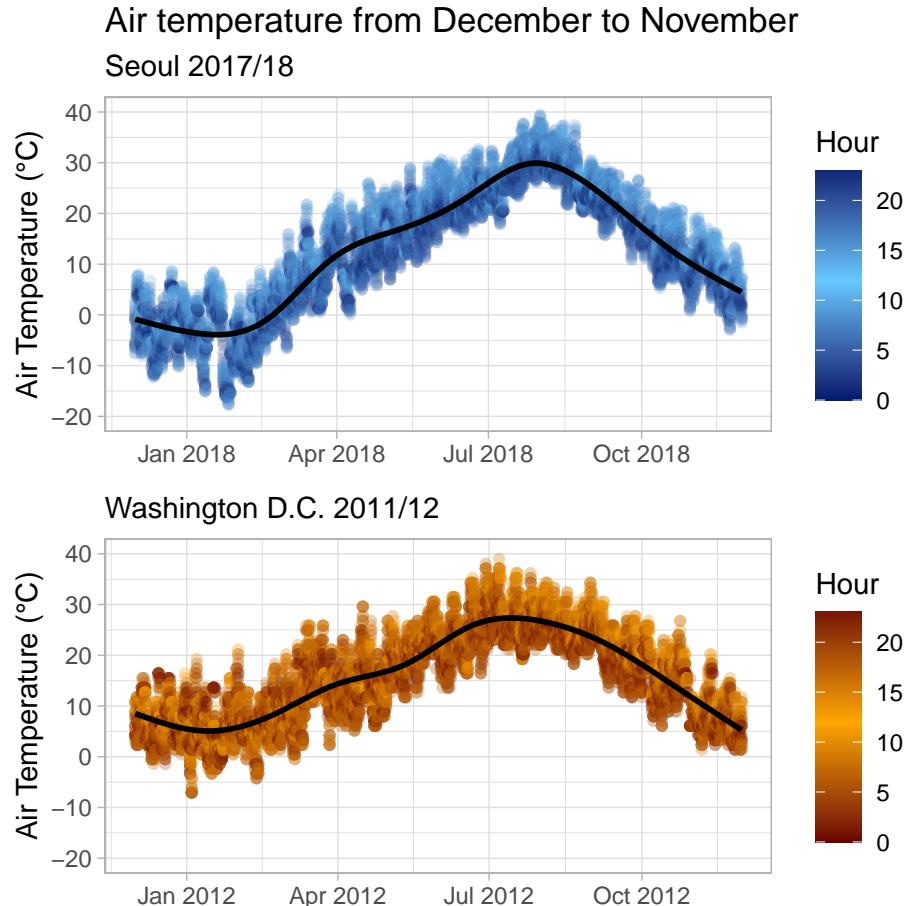


Figure 1: Air Temperature in Seoul and Washington D.C.

Figure 1 shows the air temperature ( $^{\circ}\text{C}$ ) throughout a year in Washington D.C. and Seoul. The temperature peaks between July and August in both cities. Visibly the climate in Seoul is more extreme than in Washington D.C. in the chosen year, with a hotter summer and colder winter.

Figure 3 shows the impact of Seoul's colder winters on bike rentals. The bike rentals in winter are noticeably lower than those in Washington D.C., when compared to the other seasons.

The

```
## `summarise()` has grouped output by 'Season'. You can override using the
## `.` argument.
## `summarise()` has grouped output by 'Season'. You can override using the
## `.` argument.
```

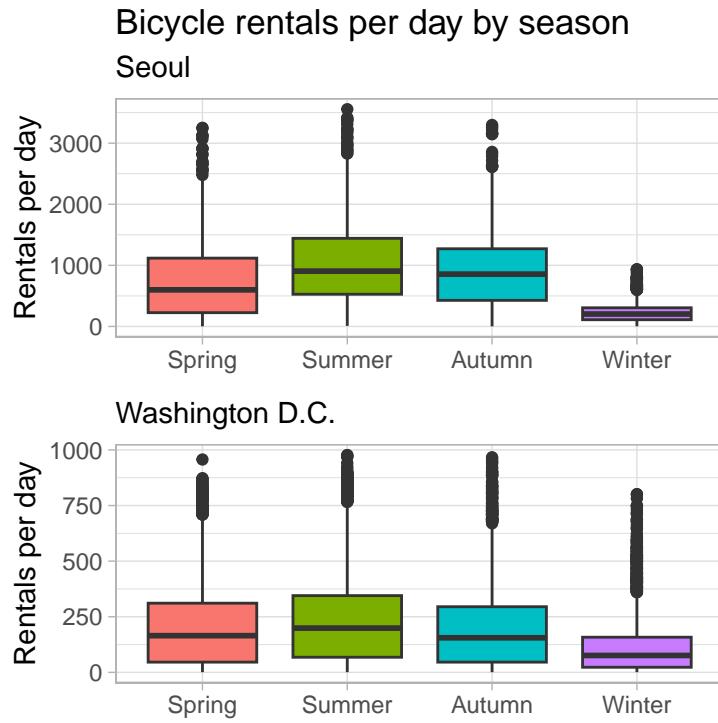


Figure 2: Bike rentals in Seoul and Washington D.C.

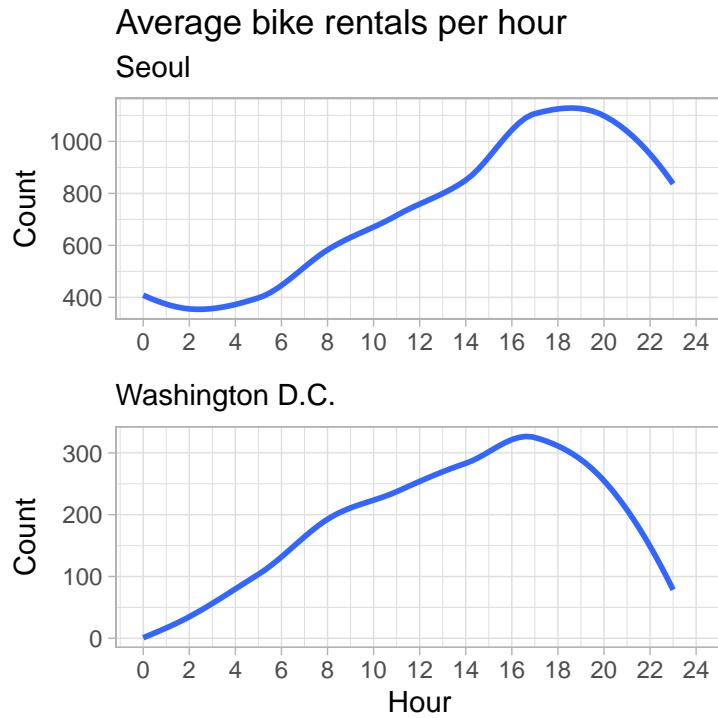
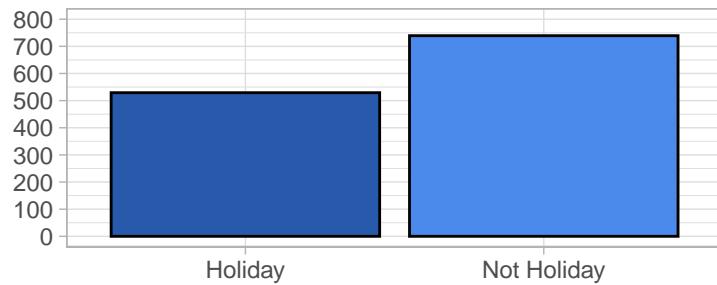


Figure 3: Placeholder

Average number of bike rentals on holidays and not holidays in Seoul



Washington D.C.

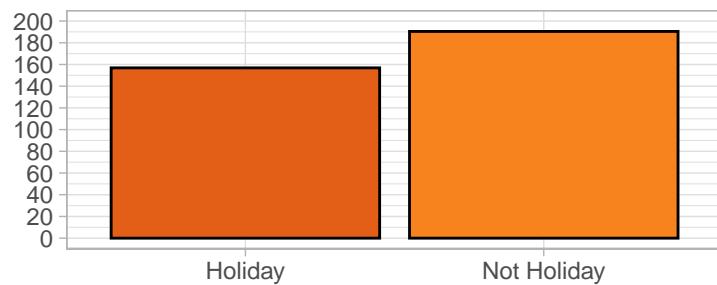


Figure 4: Bike rentals in Seoul and Washington D.C.

Number of bike rentals for different meteorological factors in Seoul

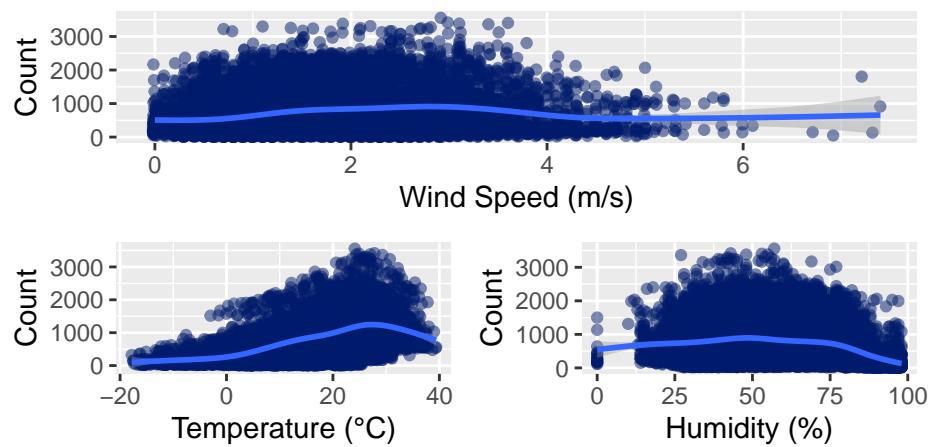


Figure 5: Seoul bike rentals

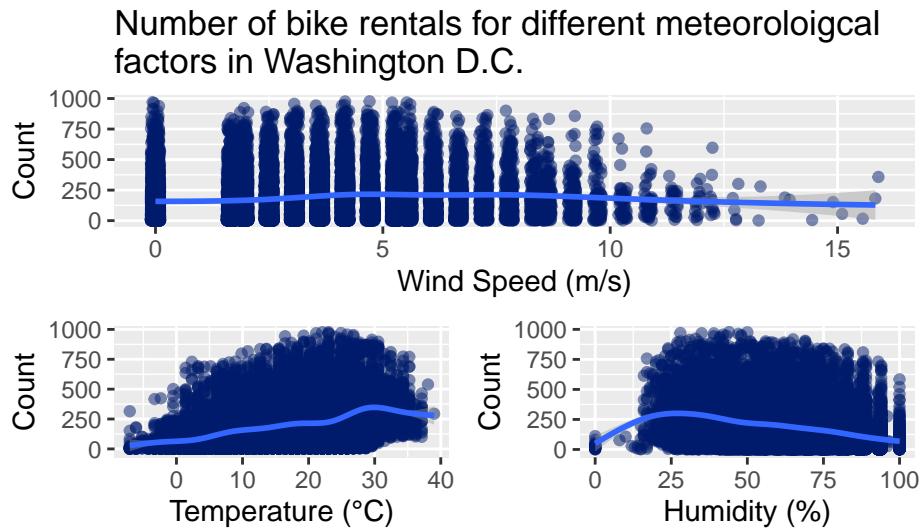


Figure 6: Washington D.C. bike rentals

## Modelling

$$\log(\text{Count}) \sim \text{Season} + \text{Temperature} + \text{Humidity} + \text{WindSpeed}$$

```
##
## Call:
## lm(formula = log(Count) ~ Season + Temperature + Humidity + WindSpeed,
##      data = seoul3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -5.1073 -0.4281  0.0812  0.5493  2.4352
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 6.7336965  0.0467062 144.171 < 2e-16 ***
## SeasonSummer 0.0036038  0.0327843  0.110  0.91247
## SeasonAutumn 0.3733211  0.0261578 14.272 < 2e-16 ***
## SeasonWinter -0.3830362  0.0349918 -10.946 < 2e-16 ***
## Temperature  0.0492700  0.0015053 32.732 < 2e-16 ***
## Humidity     -0.0224974  0.0004844 -46.441 < 2e-16 ***
## WindSpeed    0.0253809  0.0093544  2.713  0.00668 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8276 on 8458 degrees of freedom
## Multiple R-squared:  0.4941, Adjusted R-squared:  0.4937
## F-statistic:  1377 on 6 and 8458 DF,  p-value: < 2.2e-16
##
## Call:
## lm(formula = log(Count) ~ Season + Temperature + Humidity + WindSpeed,
```

```

##      data = washington3)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -5.4834 -0.6069  0.2458  0.8440  3.5203
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 4.6264010  0.0576892 80.195 < 2e-16 ***
## SeasonSummer -0.3651680  0.0300276 -12.161 < 2e-16 ***
## SeasonAutumn  0.5361839  0.0289332 18.532 < 2e-16 ***
## SeasonWinter  0.1046103  0.0341346  3.065 0.00218 **
## Temperature   0.0797914  0.0017401 45.856 < 2e-16 ***
## Humidity      -0.0233425  0.0005317 -43.901 < 2e-16 ***
## WindSpeed     0.0245022  0.0044358  5.524 3.37e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.263 on 17372 degrees of freedom
## Multiple R-squared:  0.278, Adjusted R-squared:  0.2777
## F-statistic:  1115 on 6 and 17372 DF, p-value: < 2.2e-16

```

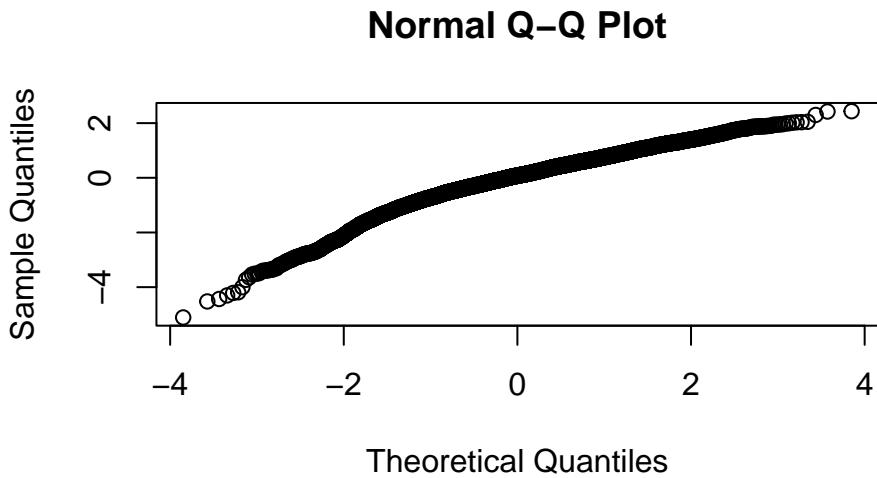


Figure 7: Seoul normal Q-Q plot

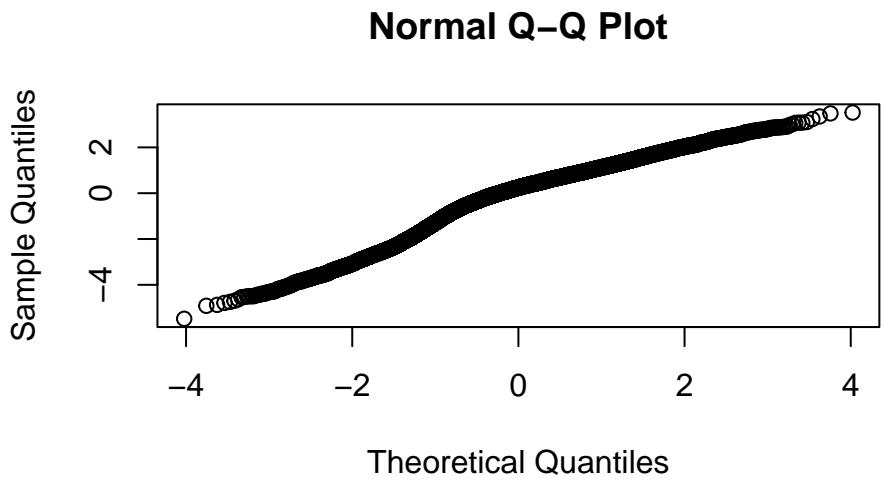


Figure 8: Washington D.C. normal Q-Q plot

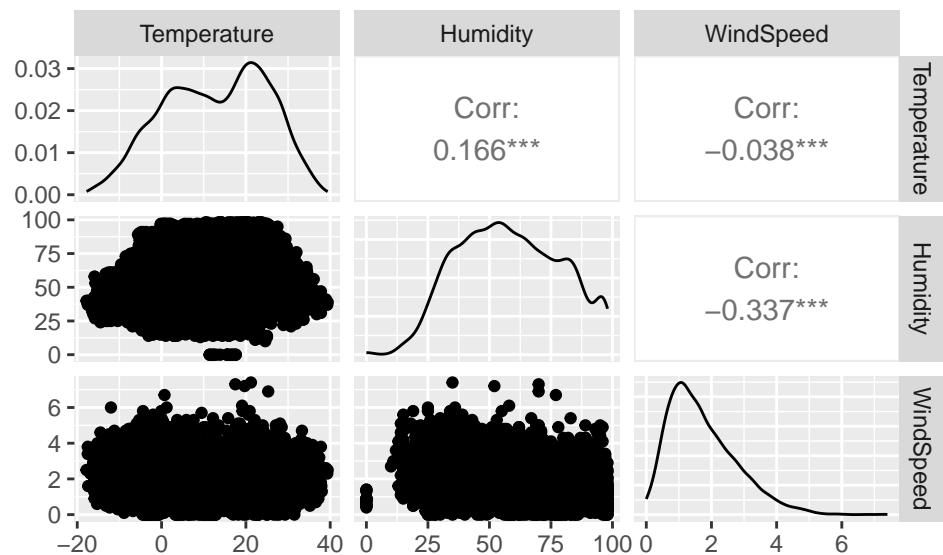


Figure 9: Seoul scatterplot matrix

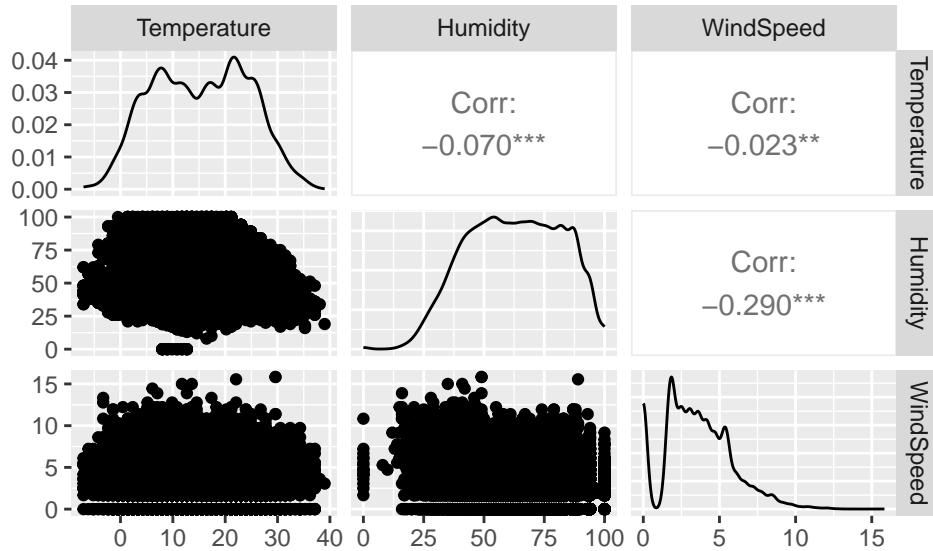


Figure 10: Washington D.C. scatterplot matrix

Table 1: Seoul model parameters 97% CI

	1.5 %	98.5 %
Intercept	6.6323227	6.8350703
Summer	-0.0675531	0.0747607
Autumn	0.3165466	0.4300955
Winter	-0.4589844	-0.3070880
Temperature	0.0460029	0.0525372
Humidity	-0.0235488	-0.0214459
Wind Speed	0.0050777	0.0456842

Table 2: Wasjington D.C. model parameters 97% CI

	1.5 %	98.5 %
Intercept	4.5012000	4.7516020
Summer	-0.4303359	-0.3000002
Autumn	0.4733911	0.5989767
Winter	0.0305290	0.1786916
Temperature	0.0760151	0.0835678
Humidity	-0.0244964	-0.0221885
Wind Speed	0.0148754	0.0341290

## Prediction

Table 3: Seoul prediction

Prediction	5%	95%
5.913404	5.865934	5.960874

Table 4: Washington D.C. prediction

Prediction	5%	95%
4.276413	4.215417	4.33741