

Analysis - Covid with other factors influencing unemployment rate

Section 1.

Summary: In this section we are analyzing the impact of various factors that may or may not contribute to the overall unemployment rate during the pandemic. Some of the contributing factors are:

- 1) Race (we are taking into consideration the unemployment rate of African Americans, Hispanic Americans, White Americans, Asian Americans).
- 2) Gender (unemployment rate for males and females).
- 3) Overall monthly job loss percent.
- 4) Monthly Covid Numbers.

As a part of this analysis we would like to understand the relationship between the different contributing factors and employment rate.

Hypothesis: *Our Hypothesis is that the following factors Race, Gender, Job Loss, Number of COVID cases influences predicting the monthly unemployment rate in the US.* Unemployment among different demographics like race and gender are contributing factors to the unemployment rate. In addition monthly job loss percent which may or may not be impacted by Covid numbers also influence the unemployment rate. All data points are represented in a percentage of the overall unemployment rate. Covid numbers are the cumulative totals for the time period.

Data Exploration: We looked at the basic metrics for the distribution of the data, by running summary and histogram of the data.

[illegible]

```
## [1] "Raw Data Metrics"
```

```
str(unemployment_df)
```

```
## 'data.frame':    27 obs. of  18 variables:
## $ Date : Date, format: "1-01-20" "1-02-20" ...
## $ Unemployment.Rate : num  4 3.8 3.8 3.7 3.7 3.6 3.6 3.7 3.5 3.6 ...
## $ Unemployment.Rate.AfricanAmerican : num  6.9 7 6.5 6.6 6.1 6 5.6 5.2 5.4 5.6 ...
## $ Unemployment.Rate.Hispanic : num  4.8 4.3 4.5 4.1 4.1 4.3 4.4 4.2 4 4.2 ...
## $ Unemployment.Rate.White : num  3.5 3.2 3.3 3.2 3.3 3.3 3.3 3.4 3.2 3.3 ...
## $ Unemployment.Rate.Asian : num  3 3.1 3.1 2.3 2.5 2.2 2.8 2.8 2.5 2.9 ...
## $ Unemployment.Rate.Women : num  3.6 3.4 3.4 3.2 3.3 3.3 3.3 3.3 3 3.2 ...
## $ Unemployment.Rate.Men : num  3.6 3.4 3.6 3.5 3.4 3.3 3.4 3.4 3.3 3.3 ...
## $ Percent.JobLosers : num  2.3 2 1.9 1.5 1.4 1.6 1.8 1.8 1.4 1.4 ...
## $ Covid.Cases : num  0 0 0 0 0 0 0 0 0 0 ...
## $ Avg.Weekly.Hrs.Private : num  34.5 34.4 34.5 34.5 34.4 34.5 34.4 34.4 34.4 34.3
## $ Avg.Weekly.Hrs.Education.Health : num  33 33 33 33 33 33 33 33 33 32.9 ...
## $ Avg.Weekly.Hrs.Financial : num  37.7 37.7 37.7 37.7 37.7 37.7 37.7 37.7 37.6 37.5 37.6
```

```
## $ Avg.Weekly.Hrs.Leisure.Hospitality      : num  26.1 26 26.1 26.1 26 26.1 25.9 25.8 25.9 25.8 ...
## $ Avg.Weekly.Hrs.Transportation.Wearhousing: num  38.7 38.6 38.7 38.7 38.6 38.7 38.7 38.6 38.5 38.4
## $ UnemploymentRate.Married                : num   2.2 2 2.1 2.2 2 2.1 1.8 2 2.1 2 ...
## $ TotalPop                                : num  3.28e+08 3.28e+08 3.28e+08 3.28e+08 3.28e+08 3.28e+08 3.28e+08 3.28e+08 3.28e+08 3.28e+08
## $ Covid.Cases.Percent                     : num   0 0 0 0 0 0 0 0 0 0 ...
```

```
summary(unemployment_df)
```

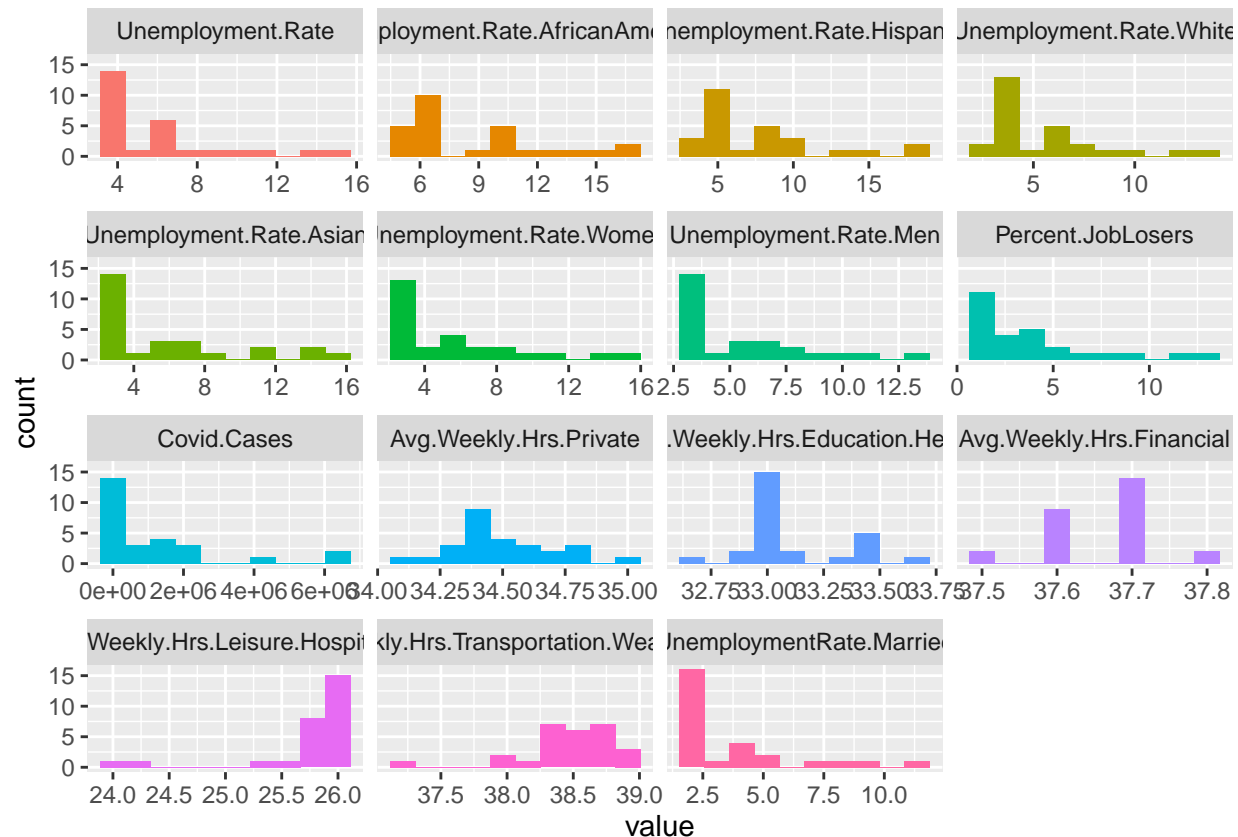
```
##      Date      Unemployment.Rate Unemployment.Rate.AfricanAmerican
## Min.   :1-01-20   Min.   : 3.500      Min.   : 5.200
## 1st Qu.:1-03-20   1st Qu.: 3.600      1st Qu.: 6.050
## Median :1-06-20   Median : 4.000      Median : 6.900
## Mean   :1-06-20   Mean   : 5.926      Mean   : 8.863
## 3rd Qu.:1-09-20   3rd Qu.: 6.800      3rd Qu.:10.550
## Max.   :1-12-20   Max.   :14.800      Max.   :16.700
## Unemployment.Rate.Hispanic Unemployment.Rate.White Unemployment.Rate.Asian
## Min.   : 4.000      Min.   : 3.000      Min.   : 2.200
## 1st Qu.: 4.300      1st Qu.: 3.300      1st Qu.: 2.700
## Median : 4.800      Median : 3.500      Median : 3.100
## Mean   : 7.489      Mean   : 5.333      Mean   : 5.722
## 3rd Qu.: 9.050      3rd Qu.: 6.000      3rd Qu.: 7.150
## Max.   :18.900      Max.   :14.100      Max.   :14.900
## Unemployment.Rate.Women Unemployment.Rate.Men Percent.JobLosers
## Min.   : 3.000      Min.   : 3.100      Min.   : 1.400
## 1st Qu.: 3.300      1st Qu.: 3.350      1st Qu.: 1.750
## Median : 3.600      Median : 3.600      Median : 2.300
## Mean   : 5.689      Mean   : 5.481      Mean   : 3.959
## 3rd Qu.: 6.400      3rd Qu.: 6.650      3rd Qu.: 4.650
## Max.   :15.500      Max.   :13.100      Max.   :13.100
## Covid.Cases      Avg.Weekly.Hrs.Private Avg.Weekly.Hrs.Education.Health
## Min.   : 0      Min.   :34.1      Min.   :32.70
## 1st Qu.: 0      1st Qu.:34.4      1st Qu.:33.00
## Median :186620   Median :34.4      Median :33.00
## Mean   :1170488   Mean   :34.5      Mean   :33.11
## 3rd Qu.:1674301   3rd Qu.:34.6      3rd Qu.:33.20
## Max.   :6380365   Max.   :35.0      Max.   :33.70
## Avg.Weekly.Hrs.Financial Avg.Weekly.Hrs.Leisure.Hospitality
## Min.   :37.50      Min.   :24.10
## 1st Qu.:37.60      1st Qu.:25.80
## Median :37.70      Median :25.90
## Mean   :37.66      Mean   :25.74
## 3rd Qu.:37.70      3rd Qu.:26.00
## Max.   :37.80      Max.   :26.10
## Avg.Weekly.Hrs.Transportation.Wearhousing UnemploymentRate.Married
## Min.   :37.30      Min.   : 1.800
## 1st Qu.:38.30      1st Qu.: 2.000
## Median :38.50      Median : 2.100
## Mean   :38.48      Mean   : 3.656
## 3rd Qu.:38.70      3rd Qu.: 4.350
## Max.   :39.00      Max.   :11.100
## TotalPop      Covid.Cases.Percent
## Min.   :328000000   Min.   :0.00000
## 1st Qu.:328000000   1st Qu.:0.00000
## Median :331000000   Median :0.05638
## Mean   :329777778   Mean   :0.35347
```

```
## 3rd Qu.:331000000 3rd Qu.:0.50431
## Max. :332000000 Max. :1.92760
```

From the distribution of data we can see that the unemployment rates for all demographics ranges between 2-18%. We also note that since Covid Cases is a total number the ranges are huge in comparison to all other attributes.

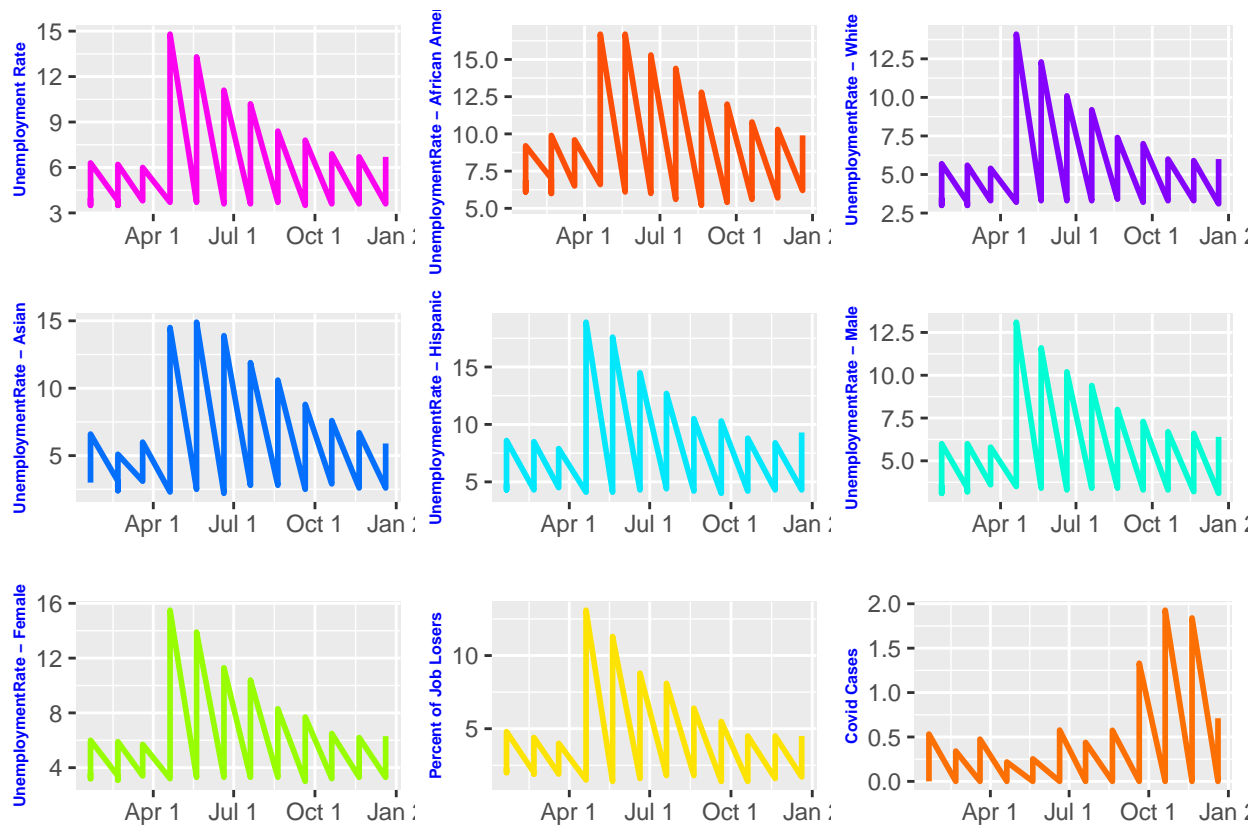
Histograms of data columns

```
hist_cols<-unemployment_df[,2:16,18]
plot_num(hist_cols)
```



As we observe the figures above we can say that the data is right skewed which is desired as we would like the unemployment rate to be low. Unemployment among African, Hispanic and Asian Americans was considerably higher than White Americans. Male and Female distributions were fairly similar.

Time Series Plots:



```
require(ggplot2)
require(reshape2)
```

```
## Loading required package: reshape2
```

```
##
```

```
## Attaching package: 'reshape2'
```

```
## The following object is masked from 'package:tidyr':
```

```
##
```

```
## smiths
```

```
t_df<-unemployment_df[,c("Date","Unemployment.Rate","Unemployment.Rate.AfricanAmerican","Unemployment.Rate.White","Unemployment.Rate.Asian","Unemployment.Rate.Hispanic","Unemployment.Rate.Male","Unemployment.Rate.Female","Percent of Job Losers","Covid Cases")]
```

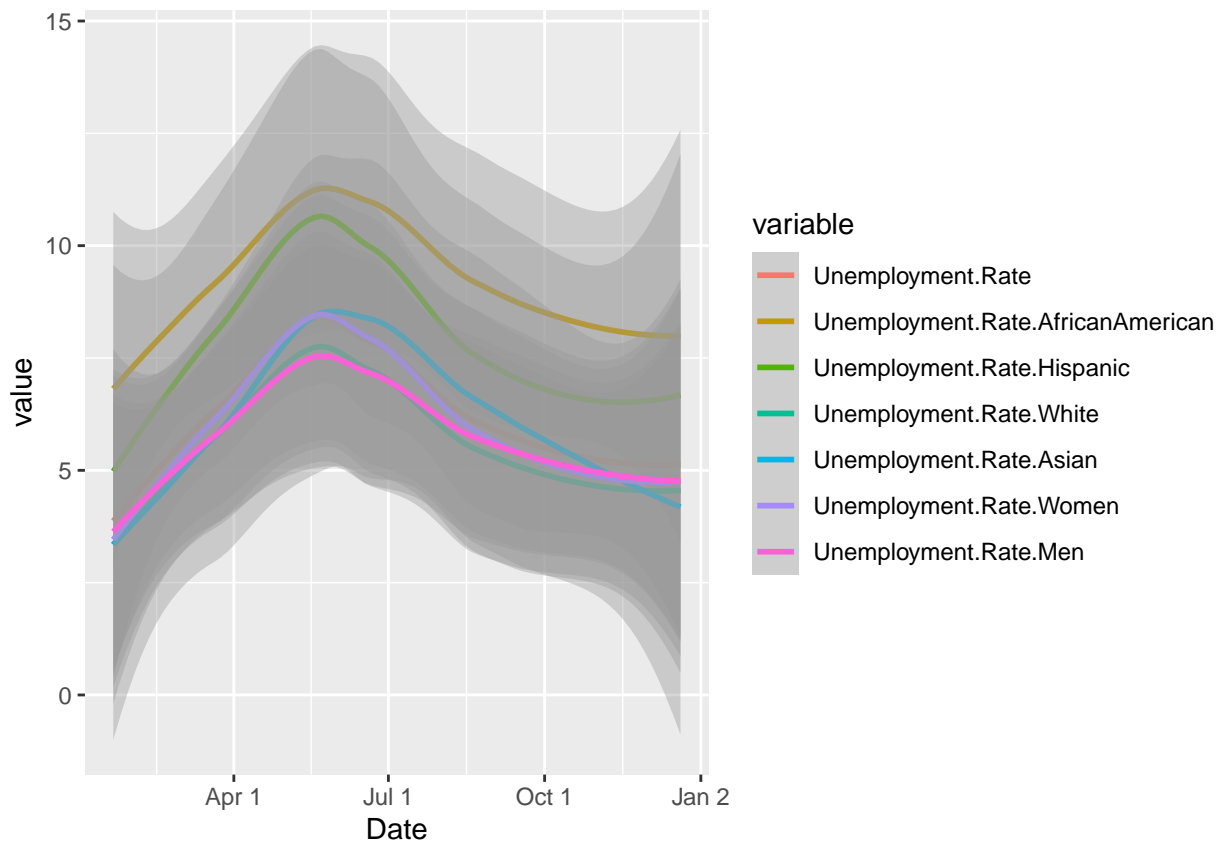
```
t_df$Date <- as.POSIXct(t_df$Date, format = "%m/%d/%Y %H:%M:%S")
```

```
t_df.m <- melt(t_df, id.vars = "Date")
```

```
plot_1 <- ggplot(t_df.m)+geom_smooth(aes(x = Date, y = value, colour = variable))
```

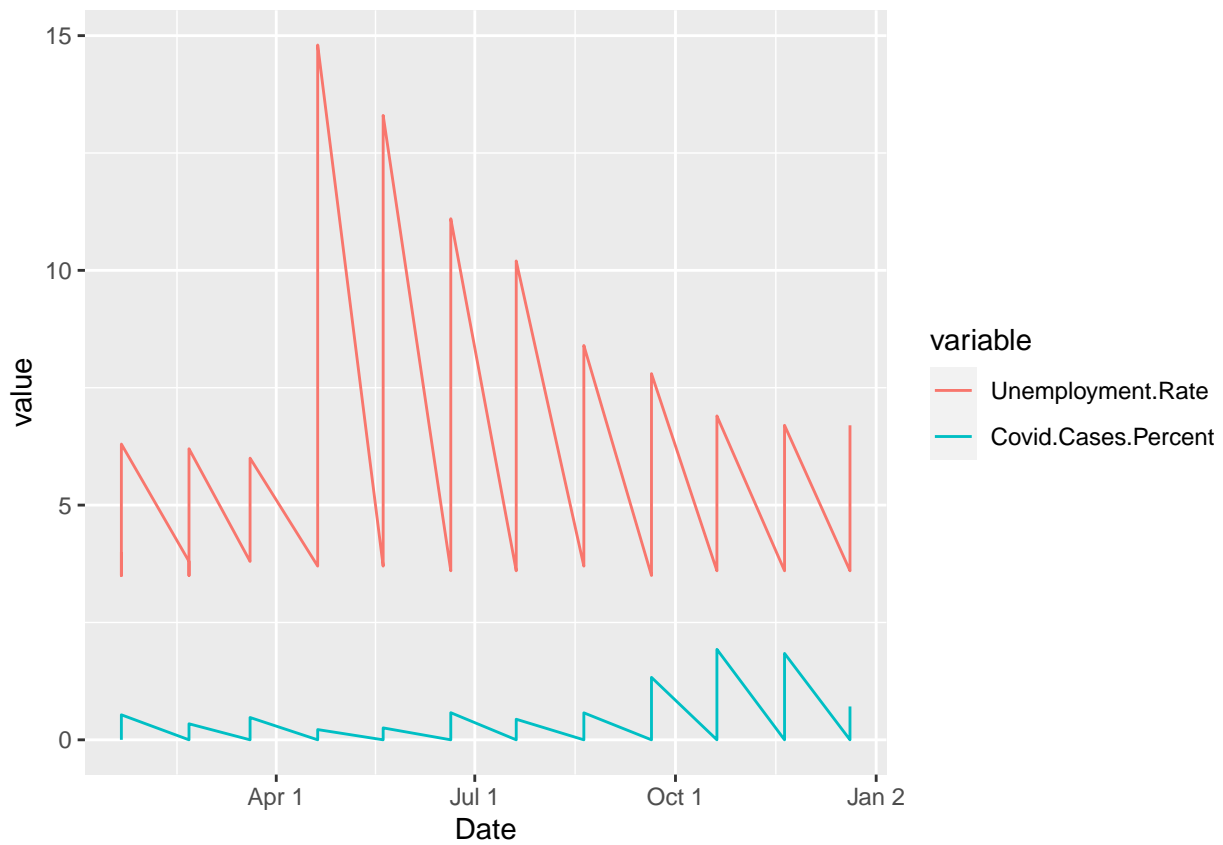
```
plot_1
```

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```

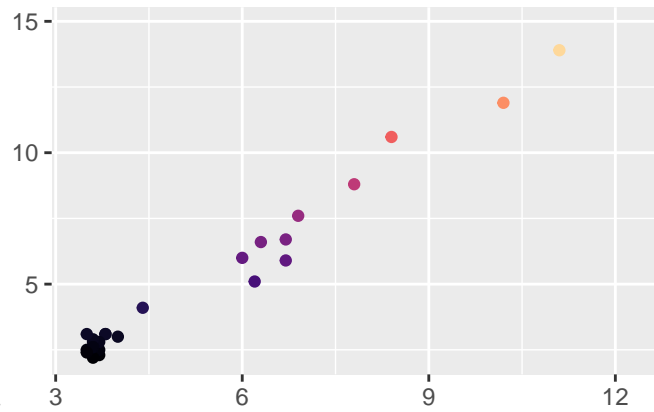
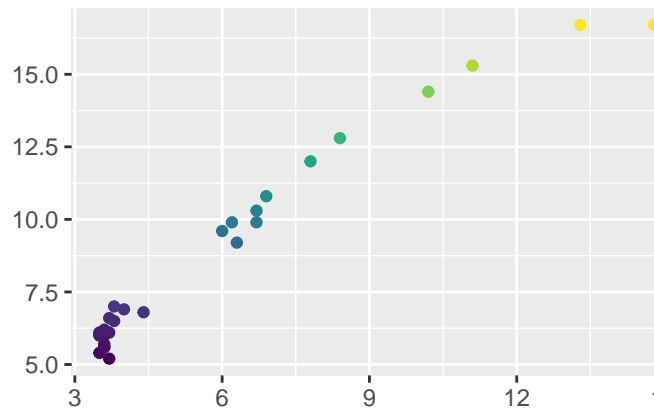


```
##rlang::last_error()
```

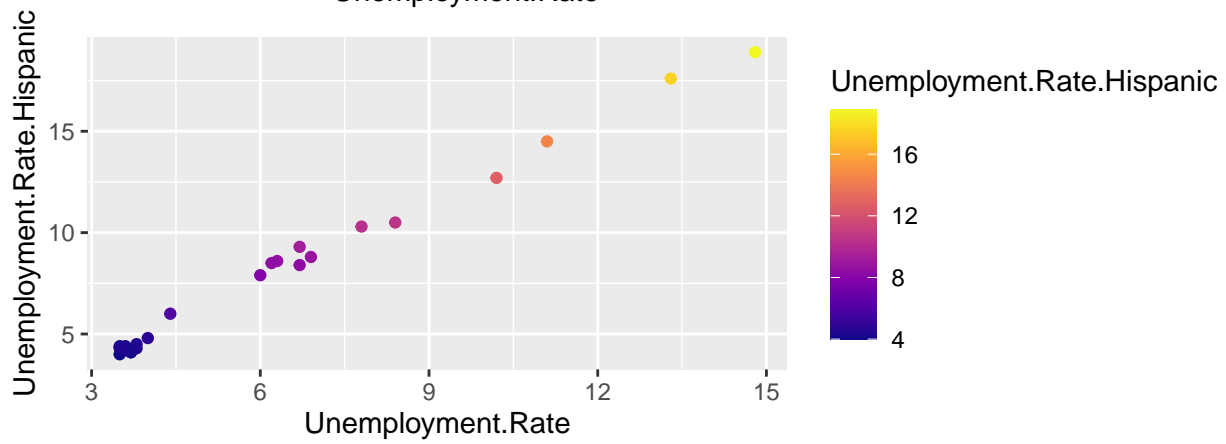
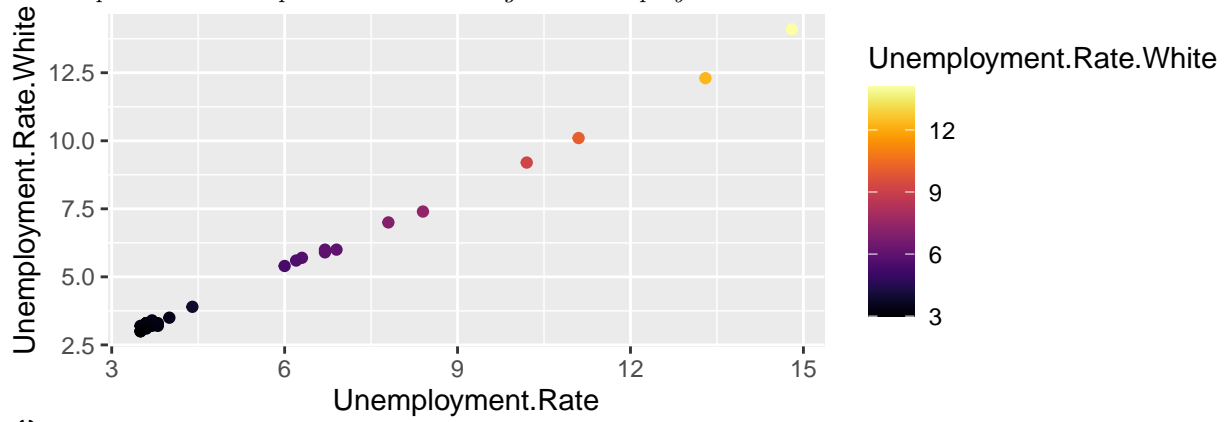
```
require(ggplot2)
require(reshape2)
t_df<-unemployment_df[,c("Date","Unemployment.Rate","Covid.Cases.Percent")]
t_df$Date <- as.POSIXct(t_df$Date, format = "%m/%d/%Y %H:%M:%S")
t_df.m <- melt(t_df, id.vars = "Date")
ggplot(t_df.m) + geom_line(aes(x = Date, y = value, colour = variable))
```

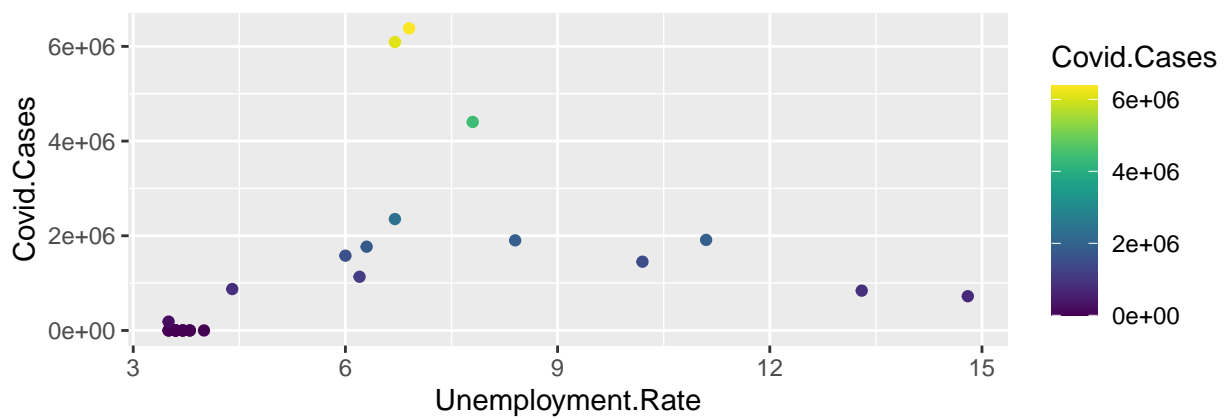
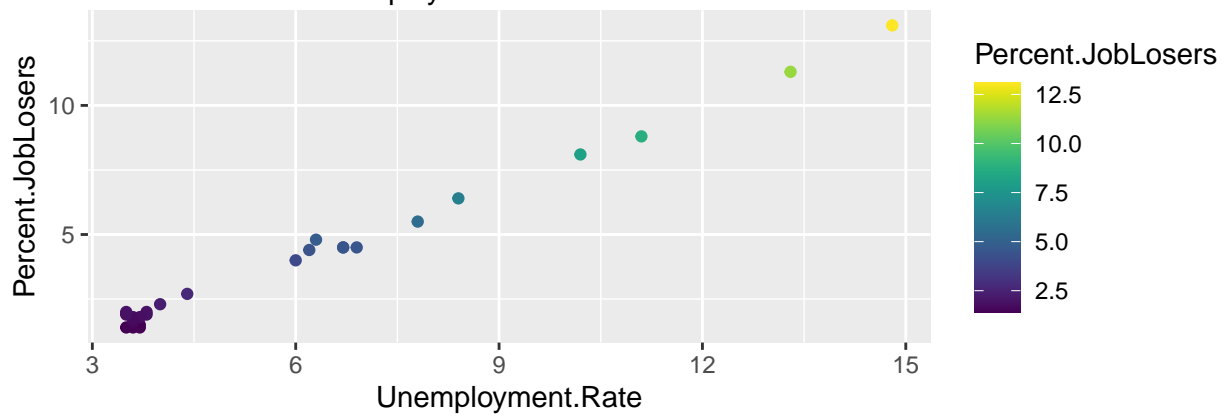
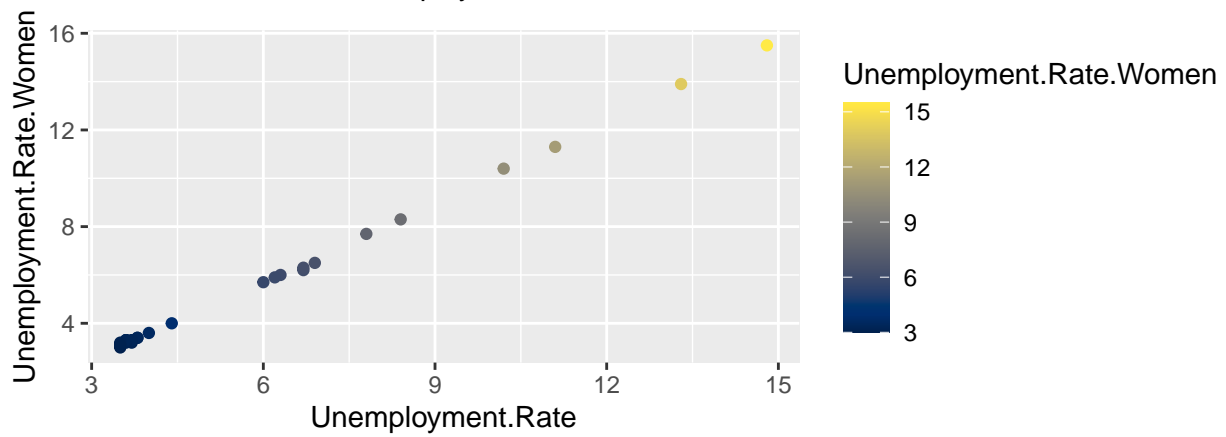
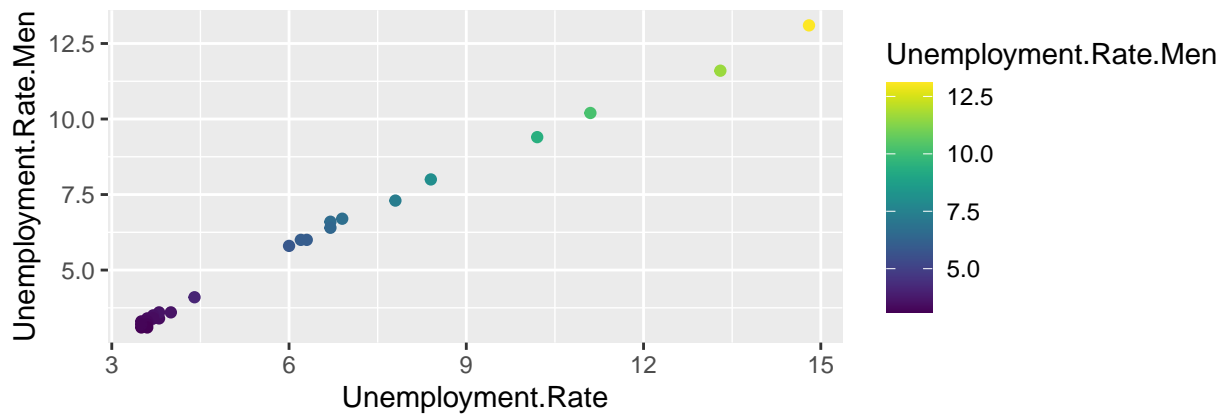


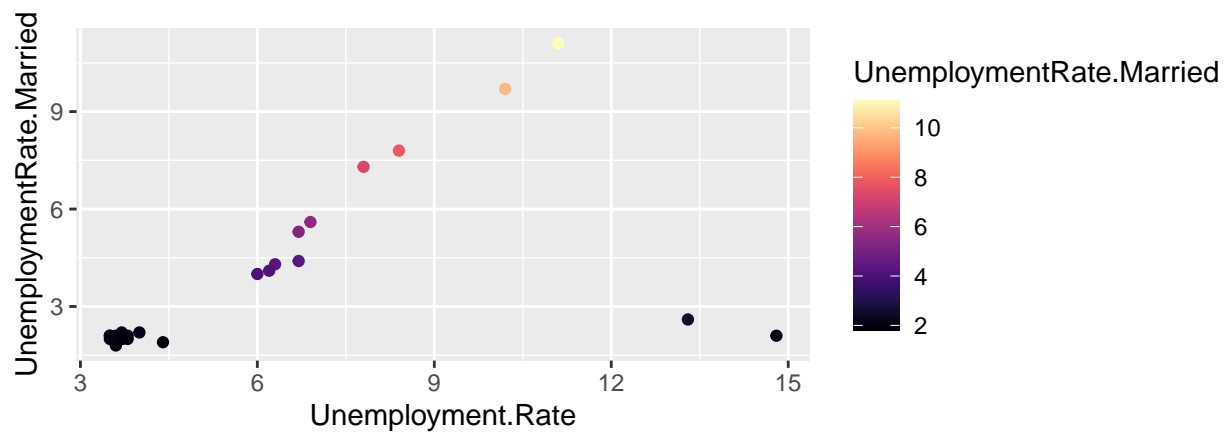
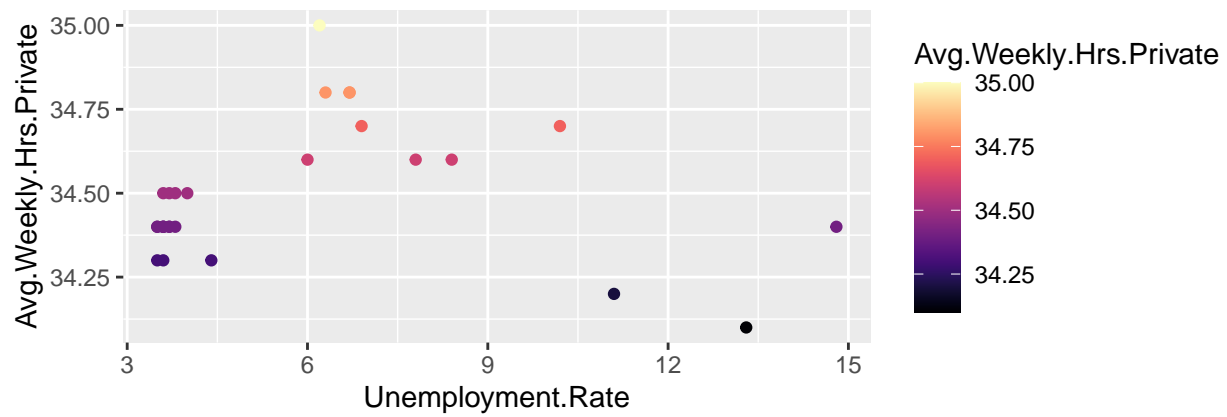
If we observe the time series plots there are spikes in the various employment rates stats and job loss stats after the initial spike in Covid, with time these numbers stabilize to pre-covid rates even though the number of Covid cases spike.



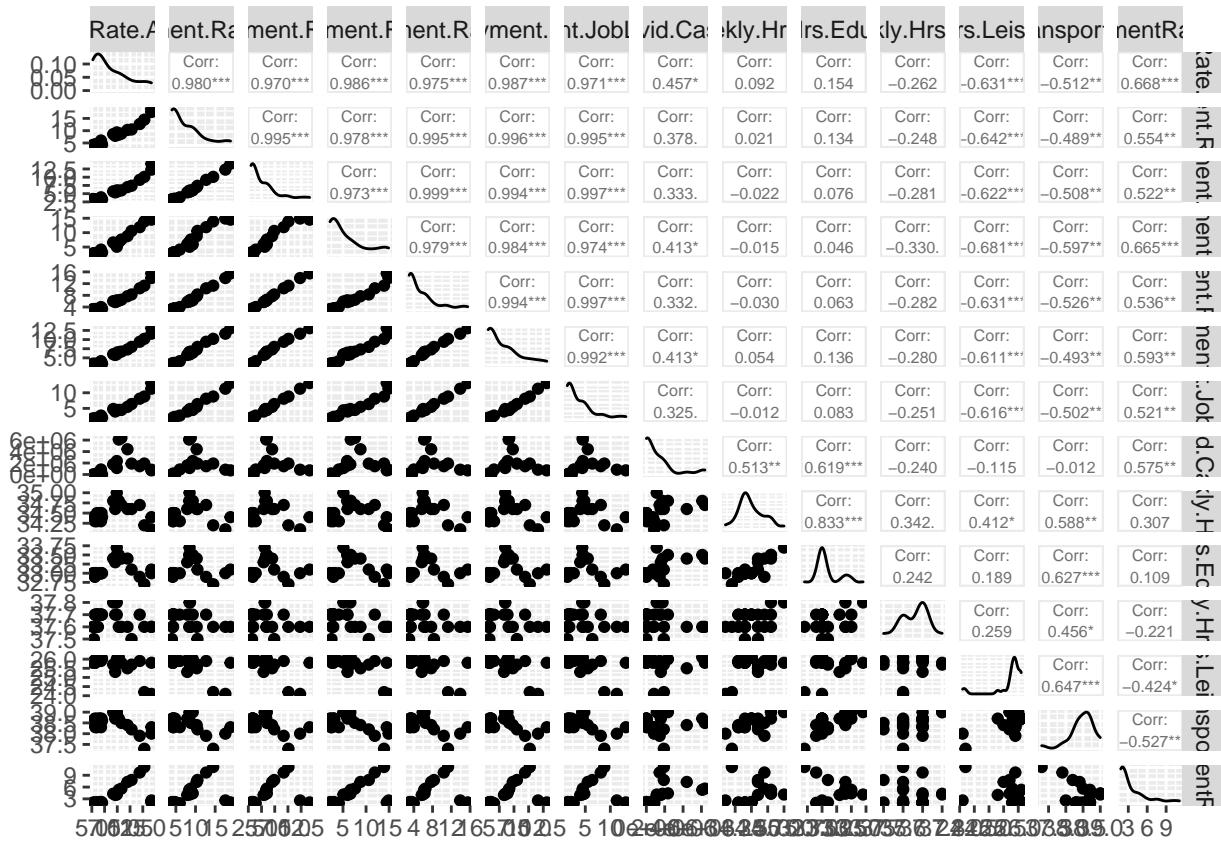
Scatter plot evaluate all predictor variables against unemployment rate.







Most scatter plots show a positive linear relationship among the variables and the unemployment rate however a negative linear relationship is observed between COVID cases and unemployment rate.



Correlation Matrix.

```
library(corpcor)
str(pair_df)
```

```
## 'data.frame': 27 obs. of 14 variables:
## $ Unemployment.Rate.AfricanAmerican : num 6.9 7 6.5 6.6 6.1 6 5.6 5.2 5.4 5.6 ...
## $ Unemployment.Rate.Hispanic : num 4.8 4.3 4.5 4.1 4.1 4.3 4.4 4.2 4 4.2 ...
## $ Unemployment.Rate.White : num 3.5 3.2 3.3 3.2 3.3 3.3 3.3 3.4 3.2 3.3 ...
## $ Unemployment.Rate.Asian : num 3 3.1 3.1 2.3 2.5 2.2 2.8 2.8 2.5 2.9 ...
## $ Unemployment.Rate.Women : num 3.6 3.4 3.4 3.2 3.3 3.3 3.3 3.3 3 3.2 ...
## $ Unemployment.Rate.Men : num 3.6 3.4 3.6 3.5 3.4 3.3 3.4 3.4 3.3 3.3 ...
## $ Percent.JobLosers : num 2.3 2 1.9 1.5 1.4 1.6 1.8 1.8 1.4 1.4 ...
## $ Covid.Cases : num 0 0 0 0 0 0 0 0 0 ...
## $ Avg.Weekly.Hrs.Private : num 34.5 34.4 34.5 34.5 34.4 34.5 34.4 34.4 34.4 34.3 ...
## $ Avg.Weekly.Hrs.Education.Health : num 33 33 33 33 33 33 33 33 33 32.9 ...
## $ Avg.Weekly.Hrs.Financial : num 37.7 37.7 37.7 37.7 37.7 37.7 37.7 37.7 37.6 37.5 37.6 ...
## $ Avg.Weekly.Hrs.Leisure.Hospitality : num 26.1 26 26.1 26.1 26 26.1 25.9 25.8 25.9 25.8 ...
## $ Avg.Weekly.Hrs.Transportation.Wearhousing : num 38.7 38.6 38.7 38.7 38.6 38.7 38.7 38.6 38.5 38.4 ...
## $ UnemploymentRate.Married : num 2.2 2 2.1 2.2 2 2.1 1.8 2 2.1 2 ...
```

```
cor2pcor(cov(pair_df))
```

```
##           [,1]      [,2]      [,3]      [,4]      [,5]      [,6]
## [1,] 1.00000000 0.09051504 0.1394904 0.3040252 -0.16364215 0.20424792
## [2,] 0.09051502 1.00000000 0.5663404 -0.2251583 0.65653065 0.21983572
## [3,] 0.13949041 0.56634042 1.00000000 0.2687634 -0.79386789 -0.73566583
## [4,] 0.30402516 -0.22515830 0.2687634 1.00000000 0.63460210 -0.32954046
## [5,] -0.16364214 0.65653057 -0.7938678 0.6346021 1.00000000 -0.21895944
## [6,] 0.20424792 0.21983568 -0.7356658 -0.3295405 -0.21895942 1.00000000
```

```
## [7,] 0.08018453 0.55599618 0.1605264 0.4106669 -0.19037304 0.57576460
## [8,] 0.07707933 0.36411399 -0.1133904 0.4432712 -0.45747316 0.39803982
## [9,] 0.25779829 0.59618927 -0.2414035 -0.1897122 0.05656954 -0.38648178
## [10,] 0.25960722 0.43102016 -0.1239284 -0.1432867 0.19722497 -0.28417834
## [11,] -0.02862849 0.24340552 0.4206509 0.4700038 0.04718543 0.76281150
## [12,] -0.02828439 -0.69460276 0.4738357 -0.4372656 0.48544893 0.05968294
## [13,] 0.27717337 0.46569272 -0.3769300 -0.3812087 0.09571398 -0.66801958
## [14,] 0.35860387 0.22370656 -0.2564748 0.6010906 -0.34611402 0.14049817
##      [,7]      [,8]      [,9]     [,10]     [,11]     [,12]
## [1,] 0.08018452 0.07707933 0.25779828 0.2596072 -0.02862849 -0.02828438
## [2,] 0.55599614 0.36411398 0.59618928 0.4310202 0.24340554 -0.69460276
## [3,] 0.16052640 -0.11339040 -0.24140354 -0.1239284 0.42065084 0.47383575
## [4,] 0.41066685 0.44327119 -0.18971219 -0.1432867 0.47000385 -0.43726558
## [5,] -0.19037296 -0.45747311 0.05656959 0.1972250 0.04718545 0.48544886
## [6,] 0.57576463 0.39803984 -0.38648175 -0.2841783 0.76281153 0.05968291
## [7,] 1.00000000 -0.55123587 -0.39641225 -0.3775688 -0.91917672 0.53588410
## [8,] -0.55123587 1.00000000 0.11562334 0.1382546 -0.44636811 0.38790993
## [9,] -0.39641223 0.11562335 1.00000000 -0.9490816 -0.23795420 0.49562069
## [10,] -0.37756879 0.13825461 -0.94908159 1.00000000 -0.32177329 0.56830691
## [11,] -0.91917667 -0.44636808 -0.23795418 -0.3217733 1.00000000 0.42492200
## [12,] 0.53588408 0.38790992 0.49562069 0.5683069 0.42492204 1.00000000
## [13,] -0.03296982 0.29708842 -0.92222898 -0.8838245 0.12465340 0.40235379
## [14,] -0.49479849 -0.21215843 -0.19871532 -0.2148710 -0.47205813 0.40979479
##      [,13]      [,14]
## [1,] 0.2771733625 0.3586038673
## [2,] 0.4656927251 0.2237065493
## [3,] -0.3769300076 -0.2564748518
## [4,] -0.3812086535 0.6010905803
## [5,] 0.0957140165 -0.3461139782
## [6,] -0.6680195597 0.1404981851
## [7,] -0.0329698300 -0.4947984928
## [8,] 0.2970884150 -0.2121584282
## [9,] -0.9222289780 -0.1987153160
## [10,] -0.8838244768 -0.2148709687
## [11,] 0.1246534144 -0.4720581049
## [12,] 0.4023537973 0.4097947846
## [13,] 1.0000000000 0.0004838766
## [14,] 0.0004838753 1.0000000000
```

```
library(mctest)
unemployment_rt<-as.vector(unemployment_df$Unemployment.Rate)
pair_df$Unemployment.Rate=unemployment_rt
model=lm(pair_df$Unemployment.Rate~., data=pair_df)
omcdiag(model)
```

```
##
## Call:
## omcdiag(mod = model)
##
##
## Overall Multicollinearity Diagnostics
##
##          MC Results detection
## Determinant |X'X|:          0.0000          1
## Farrar Chi-Square:        919.6354          1
```

```
## Red Indicator:          0.6052          1
## Sum of Lambda Inverse: 17528.1425       1
## Theil's Method:         0.2343          0
## Condition Number:       5260.3959        1
##
## 1 --> COLLINEARITY is detected by the test
## 0 --> COLLINEARITY is not detected by the test
```

```
imcdiag(model)
```

```
##
```

```
## Call:
```

```
## imcdiag(mod = model)
```

```
##
```

```
##
```

```
## All Individual Multicollinearity Diagnostics Result
```

```
##
```

	VIF	TOL	Wi	Fi
## Unemployment.Rate.AfricanAmerican	365.1818	0.0027	364.1818	424.8788
## Unemployment.Rate.Hispanic	597.4941	0.0017	596.4941	695.9097
## Unemployment.Rate.White	7211.7272	0.0001	7210.7272	8412.5150
## Unemployment.Rate.Asian	328.6425	0.0030	327.6425	382.2496
## Unemployment.Rate.Women	6478.8535	0.0002	6477.8535	7557.4957
## Unemployment.Rate.Men	1942.4905	0.0005	1941.4905	2265.0722
## Percent.JobLosers	488.4269	0.0020	487.4269	568.6647
## Covid.Cases	7.4103	0.1349	6.4103	7.4787
## Avg.Weekly.Hrs.Private	30.5492	0.0327	29.5492	34.4741
## Avg.Weekly.Hrs.Education.Health	26.6195	0.0376	25.6195	29.8895
## Avg.Weekly.Hrs.Financial	3.0245	0.3306	2.0245	2.3619
## Avg.Weekly.Hrs.Leisure.Hospitality	9.1073	0.1098	8.1073	9.4585
## Avg.Weekly.Hrs.Transportation.Wearhousing	14.4385	0.0693	13.4385	15.6783
## UnemploymentRate.Married	24.1769	0.0414	23.1769	27.0397

```
##
```

	Leamer	CVIF	Klein	IND1	IND2
## Unemployment.Rate.AfricanAmerican	0.0523	-0.0038	0	0.0027	1.0550
## Unemployment.Rate.Hispanic	0.0409	-0.0062	0	0.0017	1.0562
## Unemployment.Rate.White	0.0118	-0.0746	0	0.0001	1.0578
## Unemployment.Rate.Asian	0.0552	-0.0034	0	0.0030	1.0547
## Unemployment.Rate.Women	0.0124	-0.0670	0	0.0002	1.0578
## Unemployment.Rate.Men	0.0227	-0.0201	0	0.0005	1.0574
## Percent.JobLosers	0.0452	-0.0051	0	0.0020	1.0558
## Covid.Cases	0.3674	-0.0001	0	0.1349	0.9152
## Avg.Weekly.Hrs.Private	0.1809	-0.0003	0	0.0327	1.0233
## Avg.Weekly.Hrs.Education.Health	0.1938	-0.0003	0	0.0376	1.0182
## Avg.Weekly.Hrs.Financial	0.5750	0.0000	0	0.3306	0.7081
## Avg.Weekly.Hrs.Leisure.Hospitality	0.3314	-0.0001	0	0.1098	0.9418
## Avg.Weekly.Hrs.Transportation.Wearhousing	0.2632	-0.0001	0	0.0693	0.9847
## UnemploymentRate.Married	0.2034	-0.0003	0	0.0414	1.0142

```
##
```

```
## 1 --> COLLINEARITY is detected by the test
```

```
## 0 --> COLLINEARITY is not detected by the test
```

```
##
```

```
## Unemployment.Rate.AfricanAmerican , Unemployment.Rate.Hispanic , Unemployment.Rate.White , UnemploymentRate.Married
```

```
##
```

```
## R-square of y on all x: 0.9999
```

```
##
```

```
## * use method argument to check which regressors may be the reason of collinearity
## =====
```

```
library(ppcor)
```

```
## Loading required package: MASS
```

```
##
```

```
## Attaching package: 'MASS'
```

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

```
##
```

```
##      select
```

```
dim(pair_df)
```

```
## [1] 27 15
```

```
cor(pair_df, method = "kendall")
```

```
##                                Unemployment.Rate.AfricanAmerican
## Unemployment.Rate.AfricanAmerican                1.0000000
## Unemployment.Rate.Hispanic                        0.7749068
## Unemployment.Rate.White                          0.7003196
## Unemployment.Rate.Asian                          0.7467446
## Unemployment.Rate.Women                          0.8290853
## Unemployment.Rate.Men                            0.7749068
## Percent.JobLosers                                0.7918696
## Covid.Cases                                       0.5381784
## Avg.Weekly.Hrs.Private                           0.2642684
## Avg.Weekly.Hrs.Education.Health                  0.2810874
## Avg.Weekly.Hrs.Financial                         -0.1082447
## Avg.Weekly.Hrs.Leisure.Hospitality                -0.2416981
## Avg.Weekly.Hrs.Transportation.Wearhousing         -0.1582661
## UnemploymentRate.Married                         0.6122705
## Unemployment.Rate                               0.8396237
##                                Unemployment.Rate.Hispanic
## Unemployment.Rate.AfricanAmerican                0.77490680
## Unemployment.Rate.Hispanic                      1.00000000
## Unemployment.Rate.White                         0.78629118
## Unemployment.Rate.Asian                         0.79067110
## Unemployment.Rate.Women                         0.86570636
## Unemployment.Rate.Men                          0.76331361
## Percent.JobLosers                               0.89544320
## Covid.Cases                                     0.57995157
## Avg.Weekly.Hrs.Private                          0.21390206
## Avg.Weekly.Hrs.Education.Health                  0.28439440
## Avg.Weekly.Hrs.Financial                       -0.08031337
## Avg.Weekly.Hrs.Leisure.Hospitality              -0.35427201
## Avg.Weekly.Hrs.Transportation.Wearhousing       -0.16936632
## UnemploymentRate.Married                       0.54090647
## Unemployment.Rate                              0.78690709
##                                Unemployment.Rate.White
## Unemployment.Rate.AfricanAmerican                0.7003196
## Unemployment.Rate.Hispanic                      0.7862912
## Unemployment.Rate.White                        1.0000000
## Unemployment.Rate.Asian                        0.7664366
```

## Unemployment.Rate.Women	0.8868788
## Unemployment.Rate.Men	0.8789719
## Percent.JobLosers	0.7381770
## Covid.Cases	0.4916324
## Avg.Weekly.Hrs.Private	0.2352243
## Avg.Weekly.Hrs.Education.Health	0.2483582
## Avg.Weekly.Hrs.Financial	-0.1992064
## Avg.Weekly.Hrs.Leisure.Hospitality	-0.3865116
## Avg.Weekly.Hrs.Transportation.Wearhousing	-0.1213594
## UnemploymentRate.Married	0.5679714
## Unemployment.Rate	0.8915703
## Unemployment.Rate.Asian	
## Unemployment.Rate.AfricanAmerican	0.7467446
## Unemployment.Rate.Hispanic	0.7906711
## Unemployment.Rate.White	0.7664366
## Unemployment.Rate.Asian	1.0000000
## Unemployment.Rate.Women	0.8184670
## Unemployment.Rate.Men	0.7701722
## Percent.JobLosers	0.8338334
## Covid.Cases	0.5708487
## Avg.Weekly.Hrs.Private	0.1401094
## Avg.Weekly.Hrs.Education.Health	0.2085144
## Avg.Weekly.Hrs.Financial	-0.1915093
## Avg.Weekly.Hrs.Leisure.Hospitality	-0.4437550
## Avg.Weekly.Hrs.Transportation.Wearhousing	-0.2377430
## UnemploymentRate.Married	0.4875347
## Unemployment.Rate	0.8054359
## Unemployment.Rate.Women	
## Unemployment.Rate.AfricanAmerican	0.8290853
## Unemployment.Rate.Hispanic	0.8657064
## Unemployment.Rate.White	0.8868788
## Unemployment.Rate.Asian	0.8184670
## Unemployment.Rate.Women	1.0000000
## Unemployment.Rate.Men	0.8657064
## Percent.JobLosers	0.8500017
## Covid.Cases	0.5103971
## Avg.Weekly.Hrs.Private	0.2602611
## Avg.Weekly.Hrs.Education.Health	0.2834101
## Avg.Weekly.Hrs.Financial	-0.1326041
## Avg.Weekly.Hrs.Leisure.Hospitality	-0.3289888
## Avg.Weekly.Hrs.Transportation.Wearhousing	-0.1180694
## UnemploymentRate.Married	0.5457723
## Unemployment.Rate	0.9443620
## Unemployment.Rate.Men	
## Unemployment.Rate.AfricanAmerican	0.77490680
## Unemployment.Rate.Hispanic	0.76331361
## Unemployment.Rate.White	0.87897188
## Unemployment.Rate.Asian	0.77017222
## Unemployment.Rate.Women	0.86570636
## Unemployment.Rate.Men	1.00000000
## Percent.JobLosers	0.75994851
## Covid.Cases	0.50906860
## Avg.Weekly.Hrs.Private	0.27681443
## Avg.Weekly.Hrs.Education.Health	0.27035024

## Avg.Weekly.Hrs.Financial	-0.15697613	
## Avg.Weekly.Hrs.Leisure.Hospitality	-0.27902840	
## Avg.Weekly.Hrs.Transportation.Wearhousing	-0.06466714	
## UnemploymentRate.Married	0.63156118	
## Unemployment.Rate	0.93594253	
##	Percent.JobLosers	Covid.Cases
## Unemployment.Rate.AfricanAmerican	0.79186959	0.5381784
## Unemployment.Rate.Hispanic	0.89544320	0.5799516
## Unemployment.Rate.White	0.73817697	0.4916324
## Unemployment.Rate.Asian	0.83383342	0.5708487
## Unemployment.Rate.Women	0.85000171	0.5103971
## Unemployment.Rate.Men	0.75994851	0.5090686
## Percent.JobLosers	1.00000000	0.5902258
## Covid.Cases	0.59022582	1.0000000
## Avg.Weekly.Hrs.Private	0.20982731	0.3014565
## Avg.Weekly.Hrs.Education.Health	0.28663620	0.4703023
## Avg.Weekly.Hrs.Financial	-0.09449736	-0.1073408
## Avg.Weekly.Hrs.Leisure.Hospitality	-0.35895285	-0.3619097
## Avg.Weekly.Hrs.Transportation.Wearhousing	-0.17168547	-0.1408476
## UnemploymentRate.Married	0.53852186	0.6252571
## Unemployment.Rate	0.79827582	0.5031380
##	Avg.Weekly.Hrs.Private	
## Unemployment.Rate.AfricanAmerican	0.2642684	
## Unemployment.Rate.Hispanic	0.2139021	
## Unemployment.Rate.White	0.2352243	
## Unemployment.Rate.Asian	0.1401094	
## Unemployment.Rate.Women	0.2602611	
## Unemployment.Rate.Men	0.2768144	
## Percent.JobLosers	0.2098273	
## Covid.Cases	0.3014565	
## Avg.Weekly.Hrs.Private	1.0000000	
## Avg.Weekly.Hrs.Education.Health	0.6495432	
## Avg.Weekly.Hrs.Financial	0.2406465	
## Avg.Weekly.Hrs.Leisure.Hospitality	0.1600009	
## Avg.Weekly.Hrs.Transportation.Wearhousing	0.5140280	
## UnemploymentRate.Married	0.4530134	
## Unemployment.Rate	0.2693774	
##	Avg.Weekly.Hrs.Education.Health	
## Unemployment.Rate.AfricanAmerican	0.28108738	
## Unemployment.Rate.Hispanic	0.28439440	
## Unemployment.Rate.White	0.24835815	
## Unemployment.Rate.Asian	0.20851441	
## Unemployment.Rate.Women	0.28341010	
## Unemployment.Rate.Men	0.27035024	
## Percent.JobLosers	0.28663620	
## Covid.Cases	0.47030225	
## Avg.Weekly.Hrs.Private	0.64954319	
## Avg.Weekly.Hrs.Education.Health	1.00000000	
## Avg.Weekly.Hrs.Financial	0.07798129	
## Avg.Weekly.Hrs.Leisure.Hospitality	-0.09301460	
## Avg.Weekly.Hrs.Transportation.Wearhousing	0.41660256	
## UnemploymentRate.Married	0.31199033	
## Unemployment.Rate	0.26883503	
##	Avg.Weekly.Hrs.Financial	

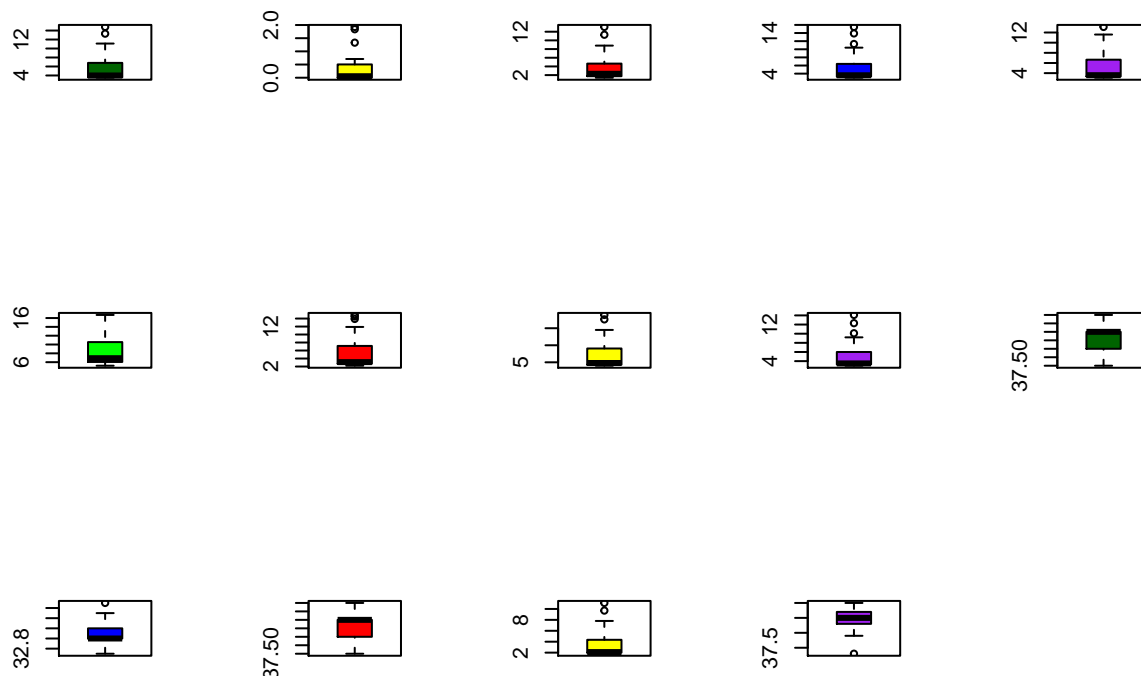
## Unemployment.Rate.AfricanAmerican	-0.10824472
## Unemployment.Rate.Hispanic	-0.08031337
## Unemployment.Rate.White	-0.19920639
## Unemployment.Rate.Asian	-0.19150928
## Unemployment.Rate.Women	-0.13260411
## Unemployment.Rate.Men	-0.15697613
## Percent.JobLosers	-0.09449736
## Covid.Cases	-0.10734080
## Avg.Weekly.Hrs.Private	0.24064653
## Avg.Weekly.Hrs.Education.Health	0.07798129
## Avg.Weekly.Hrs.Financial	1.00000000
## Avg.Weekly.Hrs.Leisure.Hospitality	0.25918811
## Avg.Weekly.Hrs.Transportation.Wearhousing	0.43696239
## UnemploymentRate.Married	-0.11931663
## Unemployment.Rate	-0.15079441
## Avg.Weekly.Hrs.Leisure.Hospitality	
## Unemployment.Rate.AfricanAmerican	-0.2416981
## Unemployment.Rate.Hispanic	-0.3542720
## Unemployment.Rate.White	-0.3865116
## Unemployment.Rate.Asian	-0.4437550
## Unemployment.Rate.Women	-0.3289888
## Unemployment.Rate.Men	-0.2790284
## Percent.JobLosers	-0.3589528
## Covid.Cases	-0.3619097
## Avg.Weekly.Hrs.Private	0.1600009
## Avg.Weekly.Hrs.Education.Health	-0.0930146
## Avg.Weekly.Hrs.Financial	0.2591881
## Avg.Weekly.Hrs.Leisure.Hospitality	1.0000000
## Avg.Weekly.Hrs.Transportation.Wearhousing	0.3850538
## UnemploymentRate.Married	-0.1985345
## Unemployment.Rate	-0.3095428
## Avg.Weekly.Hrs.Transportation.Wearhousing	
## Unemployment.Rate.AfricanAmerican	-0.15826614
## Unemployment.Rate.Hispanic	-0.16936632
## Unemployment.Rate.White	-0.12135937
## Unemployment.Rate.Asian	-0.23774301
## Unemployment.Rate.Women	-0.11806937
## Unemployment.Rate.Men	-0.06466714
## Percent.JobLosers	-0.17168547
## Covid.Cases	-0.14084764
## Avg.Weekly.Hrs.Private	0.51402798
## Avg.Weekly.Hrs.Education.Health	0.41660256
## Avg.Weekly.Hrs.Financial	0.43696239
## Avg.Weekly.Hrs.Leisure.Hospitality	0.38505384
## Avg.Weekly.Hrs.Transportation.Wearhousing	1.00000000
## UnemploymentRate.Married	-0.03145214
## Unemployment.Rate	-0.09927744
## UnemploymentRate.Married	
## Unemployment.Rate.AfricanAmerican	0.61227046
## Unemployment.Rate.Hispanic	0.54090647
## Unemployment.Rate.White	0.56797137
## Unemployment.Rate.Asian	0.48753472
## Unemployment.Rate.Women	0.54577229
## Unemployment.Rate.Men	0.63156118


```
## Percent.JobLosers 0.53852186
## Covid.Cases 0.62525715
## Avg.Weekly.Hrs.Private 0.45301336
## Avg.Weekly.Hrs.Education.Health 0.31199033
## Avg.Weekly.Hrs.Financial -0.11931663
## Avg.Weekly.Hrs.Leisure.Hospitality -0.19853448
## Avg.Weekly.Hrs.Transportation.Wearhousing -0.03145214
## UnemploymentRate.Married 1.00000000
## Unemployment.Rate 0.59975186
## Unemployment.Rate
## Unemployment.Rate.AfricanAmerican 0.83962371
## Unemployment.Rate.Hispanic 0.78690709
## Unemployment.Rate.White 0.89157031
## Unemployment.Rate.Asian 0.80543590
## Unemployment.Rate.Women 0.94436197
## Unemployment.Rate.Men 0.93594253
## Percent.JobLosers 0.79827582
## Covid.Cases 0.50313804
## Avg.Weekly.Hrs.Private 0.26937744
## Avg.Weekly.Hrs.Education.Health 0.26883503
## Avg.Weekly.Hrs.Financial -0.15079441
## Avg.Weekly.Hrs.Leisure.Hospitality -0.30954280
## Avg.Weekly.Hrs.Transportation.Wearhousing -0.09927744
## UnemploymentRate.Married 0.59975186
## Unemployment.Rate 1.00000000
```

Spearman's correlation shows a strong correlation between all predictor variables and unemployment rate. It shows a better correlation between Covid cases and unemployment rate .76 however running the recommended Kendall correlation (because we have fewer data points) we note that the correlation between Covid cases and unemployment rate reduces to .49.

Outliers.

```
par(mfrow=c(3,5))
bp1<-boxplot(unemployment_df$Unemployment.Rate, col="darkgreen")
bp2<-boxplot(unemployment_df$Covid.Cases.Percent, col="yellow")
bp3<-boxplot(unemployment_df$Percent.JobLosers, col="red")
bp4<-boxplot(unemployment_df$Unemployment.Rate.Women, col="blue")
bp5<-boxplot(unemployment_df$Unemployment.Rate.Men, col="purple")
bp6<-boxplot(unemployment_df$Unemployment.Rate.AfricanAmerican, col="green")
bp7<-boxplot(unemployment_df$Unemployment.Rate.Asian, col="red")
bp8<-boxplot(unemployment_df$Unemployment.Rate.Hispanic, col="yellow")
bp9<-boxplot(unemployment_df$Unemployment.Rate.White, col="purple")
bp10<-boxplot(unemployment_df$Avg.Weekly.Hrs.Financial, col="darkgreen")
bp11<-boxplot(unemployment_df$Avg.Weekly.Hrs.Education.Health, col="blue")
bp12<-boxplot(unemployment_df$Avg.Weekly.Hrs.Financial, col="red")
bp13<-boxplot(unemployment_df$UnemploymentRate.Married, col="yellow")
bp14<-boxplot(unemployment_df$Avg.Weekly.Hrs.Transportation.Wearhousing, col="purple")
```



As we can see above there are some outliers for each of the predictor variables, however this can be explained by the spikes in the months that COVID spread in the US.

```
model <- lm(Unemployment.Rate ~ Unemployment.Rate.AfricanAmerican+Unemployment.Rate.Hispanic+Unemployment.Rate.White+Unemployment.Rate.Asian+Percent.JobLosers+Covid.Cases.Percent+Avg.Weekly.Hrs.Education.Health+Avg.Weekly.Hrs.Financial+Avg.Weekly.Hrs.Leisure.Hospitality+Avg.Weekly.Hrs.Transportation.Wearhousing+UnemploymentRate.Married, data = unemployment_df)
```

```
##
## Call:
## lm(formula = Unemployment.Rate ~ Unemployment.Rate.AfricanAmerican +
##   Unemployment.Rate.Hispanic + Unemployment.Rate.White + Unemployment.Rate.Asian +
##   Percent.JobLosers + Covid.Cases.Percent + Avg.Weekly.Hrs.Education.Health +
##   Avg.Weekly.Hrs.Financial + Avg.Weekly.Hrs.Leisure.Hospitality +
##   Avg.Weekly.Hrs.Transportation.Wearhousing + UnemploymentRate.Married,
##   data = unemployment_df)
##
## Residuals:
```

	Min	1Q	Median	3Q	Max
	-0.068748	-0.021582	0.003279	0.023435	0.061166

```
##
## Coefficients:
```

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	13.26014	7.83891	1.692	0.1114
Unemployment.Rate.AfricanAmerican	0.15277	0.02128	7.179	3.18e-06
Unemployment.Rate.Hispanic	0.06108	0.04411	1.385	0.1864
Unemployment.Rate.White	0.70531	0.05379	13.113	1.27e-09
Unemployment.Rate.Asian	0.01560	0.03219	0.485	0.6349
Percent.JobLosers	0.07200	0.05779	1.246	0.2319
Covid.Cases.Percent	0.07299	0.03758	1.942	0.0711
Avg.Weekly.Hrs.Education.Health	-0.23101	0.13538	-1.706	0.1085
Avg.Weekly.Hrs.Financial	-0.20539	0.18046	-1.138	0.2729
Avg.Weekly.Hrs.Leisure.Hospitality	0.05234	0.04062	1.289	0.2171
Avg.Weekly.Hrs.Transportation.Wearhousing	0.02016	0.07547	0.267	0.7930
UnemploymentRate.Married	-0.01301	0.01026	-1.268	0.2242

```
##
## (Intercept)
## Unemployment.Rate.AfricanAmerican      ***
## Unemployment.Rate.Hispanic
## Unemployment.Rate.White                ***
## Unemployment.Rate.Asian
## Percent.JobLosers
## Covid.Cases.Percent                    .
## Avg.Weekly.Hrs.Education.Health
## Avg.Weekly.Hrs.Financial
## Avg.Weekly.Hrs.Leisure.Hospitality
## Avg.Weekly.Hrs.Transportation.Wearhousing
## UnemploymentRate.Married
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.04366 on 15 degrees of freedom
## Multiple R-squared:  0.9999, Adjusted R-squared:  0.9998
## F-statistic: 1.263e+04 on 11 and 15 DF,  p-value: < 2.2e-16

#"logit", "probit", "cauchit", "cloglog", "identity", "log", "sqrt", "1/mu^2", "inverse"

library(mctest)
library(olsrr)

##
## Attaching package: 'olsrr'

## The following object is masked from 'package:MASS':
##
##      cement

## The following object is masked from 'package:datasets':
##
##      rivers

reduced_df <- unemployment_df[,c("Unemployment.Rate.AfricanAmerican", "Unemployment.Rate.Hispanic", "Unemployment.Rate.White", "Unemployment.Rate.Asian", "Percent.JobLosers", "Covid.Cases.Percent", "Avg.Weekly.Hrs.Education.Health", "Avg.Weekly.Hrs.Financial", "Avg.Weekly.Hrs.Leisure.Hospitality", "Avg.Weekly.Hrs.Transportation.Wearhousing", "UnemploymentRate.Married")]
unemployment_rt<-as.vector(unemployment_df$Unemployment.Rate)
reduced_df$Unemployment.Rate=unemployment_rt
model=lm(reduced_df$Unemployment.Rate~log(Unemployment.Rate.AfricanAmerican)+log(Unemployment.Rate.White)+log(Unemployment.Rate.Hispanic)+log(Unemployment.Rate.Asian)+log(Percent.JobLosers)+log(Covid.Cases.Percent)+log(Avg.Weekly.Hrs.Education.Health)+log(Avg.Weekly.Hrs.Financial)+log(Avg.Weekly.Hrs.Leisure.Hospitality)+log(Avg.Weekly.Hrs.Transportation.Wearhousing)+log(UnemploymentRate.Married), data = reduced_df)
#model=lm(sqrt(reduced_df$Unemployment.Rate)~sqrt(Unemployment.Rate.AfricanAmerican)+sqrt(Unemployment.Rate.White)+sqrt(Unemployment.Rate.Hispanic)+sqrt(Unemployment.Rate.Asian)+sqrt(Percent.JobLosers)+sqrt(Covid.Cases.Percent)+sqrt(Avg.Weekly.Hrs.Education.Health)+sqrt(Avg.Weekly.Hrs.Financial)+sqrt(Avg.Weekly.Hrs.Leisure.Hospitality)+sqrt(Avg.Weekly.Hrs.Transportation.Wearhousing)+sqrt(UnemploymentRate.Married), data = reduced_df)
#model=lm(reduced_df$Unemployment.Rate~poly(Unemployment.Rate.AfricanAmerican, degree=3)+poly(Unemployment.Rate.White, degree=3)+poly(Unemployment.Rate.Hispanic, degree=3)+poly(Unemployment.Rate.Asian, degree=3)+poly(Percent.JobLosers, degree=3)+poly(Covid.Cases.Percent, degree=3)+poly(Avg.Weekly.Hrs.Education.Health, degree=3)+poly(Avg.Weekly.Hrs.Financial, degree=3)+poly(Avg.Weekly.Hrs.Leisure.Hospitality, degree=3)+poly(Avg.Weekly.Hrs.Transportation.Wearhousing, degree=3)+poly(UnemploymentRate.Married, degree=3), data = reduced_df)
#
# "identity", "log", "sqrt", "1/mu^2", "inverse"
#bc <- boxcox(Unemployment.Rate ~ ., data = reduced_df)
summary(model)

##
## Call:
## lm(formula = reduced_df$Unemployment.Rate ~ log(Unemployment.Rate.AfricanAmerican) +
##      log(Unemployment.Rate.White) + log(Avg.Weekly.Hrs.Financial) +
##      log(UnemploymentRate.Married) + log(Percent.JobLosers), data = reduced_df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.58422 -0.22697 -0.02267  0.12923  0.84728
##
```

```
## Coefficients:
##
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      245.4951    165.0478   1.487   0.1518
## log(Unemployment.Rate.AfricanAmerican)  2.2602     1.2818   1.763   0.0924 .
## log(Unemployment.Rate.White)           6.6575     1.0617   6.270 3.22e-06 ***
## log(Avg.Weekly.Hrs.Financial)      -69.6221    45.3943  -1.534   0.1400
## log(UnemploymentRate.Married)       -1.2514     0.2242  -5.581 1.54e-05 ***
## log(Percent.JobLosers)              -0.5849     0.7334  -0.798   0.4341
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4049 on 21 degrees of freedom
## Multiple R-squared:  0.987, Adjusted R-squared:  0.9839
## F-statistic: 318.8 on 5 and 21 DF,  p-value: < 2.2e-16
```

```
omcdiag(model)
```

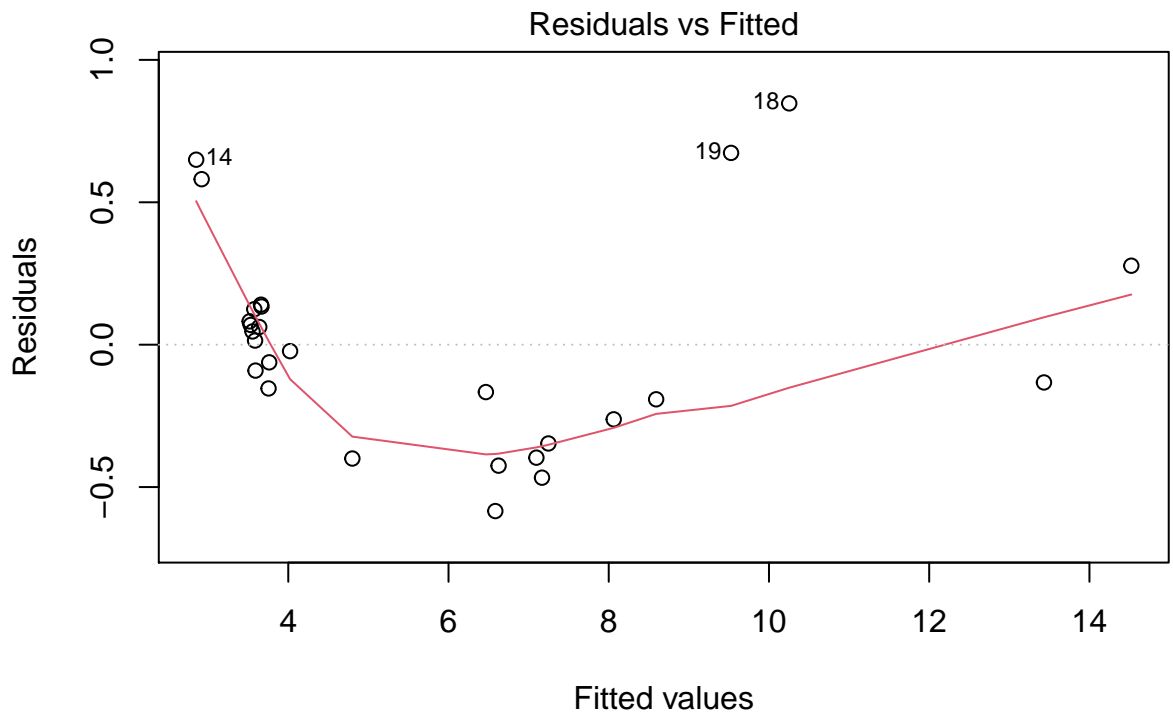
```
##
## Call:
## omcdiag(mod = model)
##
##
## Overall Multicollinearity Diagnostics
##
##              MC Results detection
## Determinant |X'X|:           0.0004           1
## Farrar Chi-Square:          183.4034           1
## Red Indicator:              0.6728            1
## Sum of Lambda Inverse:      122.6031           1
## Theil's Method:             -0.1857            0
## Condition Number:           7139.9157           1
##
## 1 --> COLLINEARITY is detected by the test
## 0 --> COLLINEARITY is not detected by the test
```

```
imcdiag(model)
```

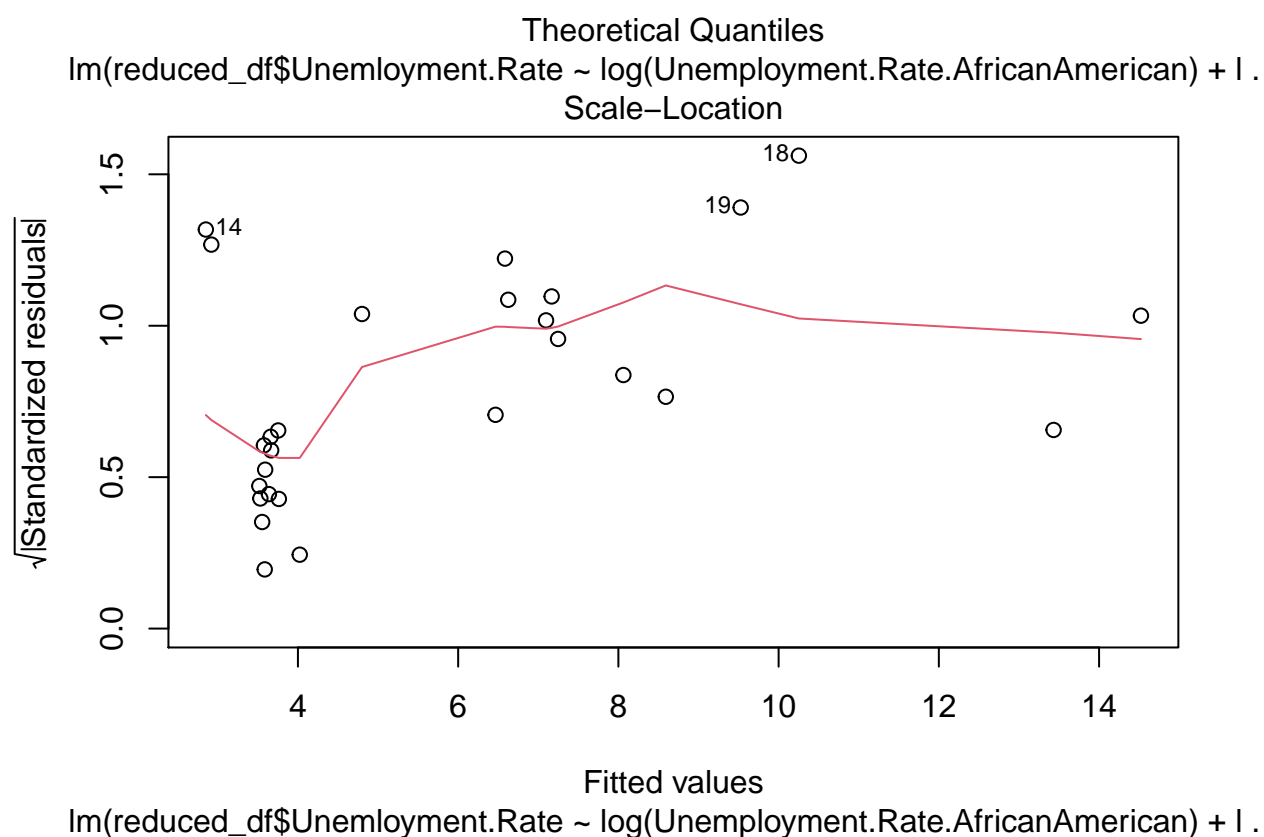
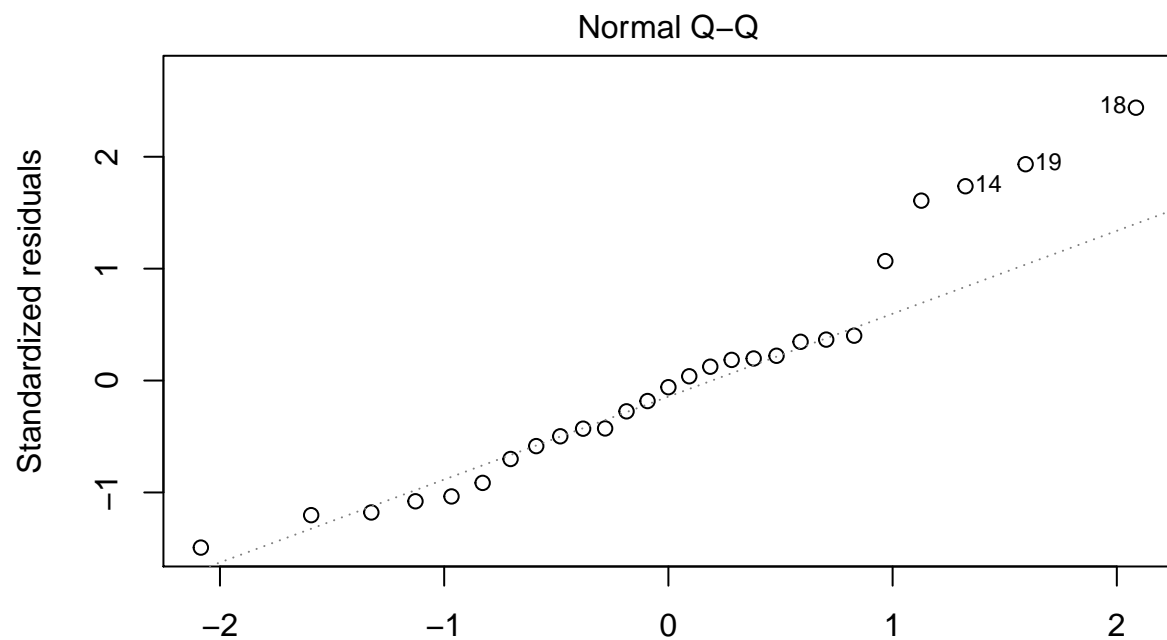
```
##
## Call:
## imcdiag(mod = model)
##
##
## All Individual Multicollinearity Diagnostics Result
##
##              VIF    TOL      Wi      Fi Leamer
## log(Unemployment.Rate.AfricanAmerican) 37.5004 0.0267 200.7524 279.8367 0.1633
## log(Unemployment.Rate.White)           39.7878 0.0251 213.3328 297.3730 0.1585
## log(Avg.Weekly.Hrs.Financial)           1.2874 0.7767   1.5808   2.2035 0.8813
## log(UnemploymentRate.Married)           2.5971 0.3850   8.7840  12.2444 0.6205
## log(Percent.JobLosers)                  41.4303 0.0241 222.3669 309.9660 0.1554
##
##              CVIF Klein  IND1  IND2
## log(Unemployment.Rate.AfricanAmerican) -0.2264     0 0.0048 1.2935
## log(Unemployment.Rate.White)           -0.2402     0 0.0046 1.2956
## log(Avg.Weekly.Hrs.Financial)           -0.0078     0 0.1412 0.2967
## log(UnemploymentRate.Married)          -0.0157     0 0.0700 0.8173
```

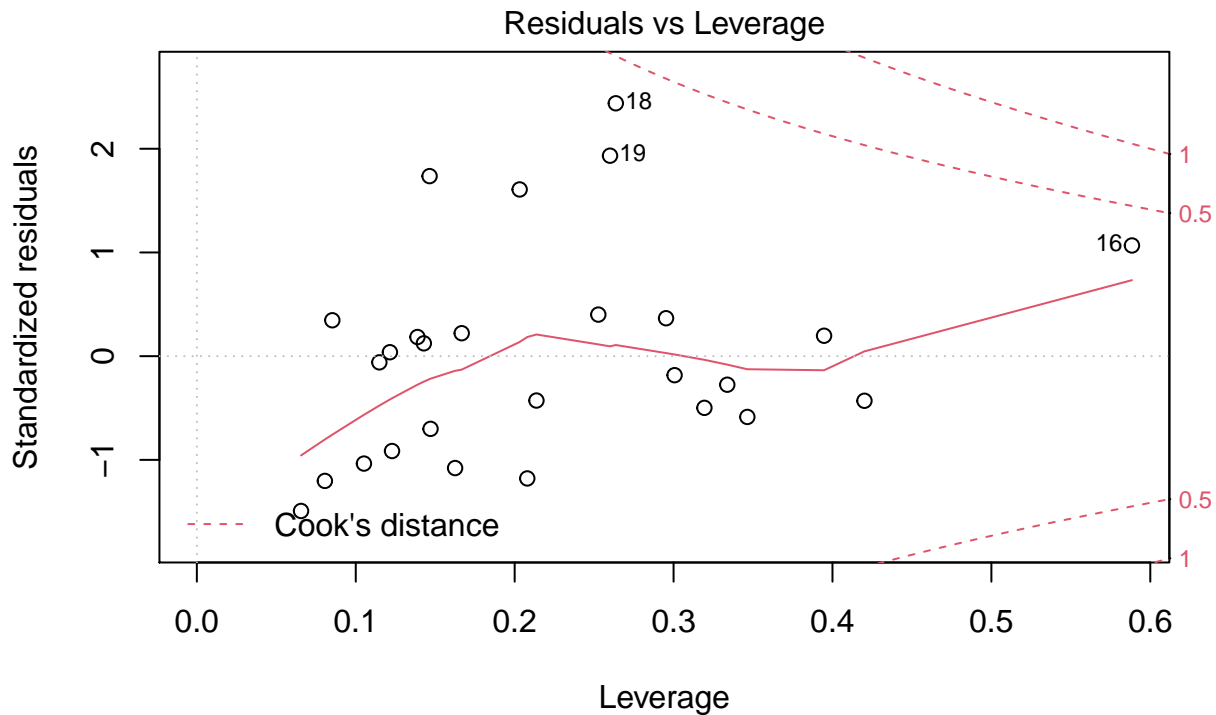
```
## log(Percent.JobLosers)                -0.2501      0 0.0044 1.2969
##
## 1 --> COLLINEARITY is detected by the test
## 0 --> COLLINEARITY is not detected by the test
##
## log(Unemployment.Rate.AfricanAmerican) , log(Avg.Weekly.Hrs.Financial) , log(Percent.JobLosers) , co
##
## R-square of y on all x: 0.987
##
## * use method argument to check which regressors may be the reason of collinearity
## =====
```

```
#ols_step_both_p(model)
plot(model)
```



lm(reduced_df\$Unemployment.Rate ~ log(Unemployment.Rate.AfricanAmerican) + I .





$\text{lm}(\text{reduced_df}\$Unemployment.Rate \sim \log(Unemployment.Rate.AfricanAmerican) + I.$

```
library(dominanceanalysis)
glm.model <- glm(Unemployment.Rate ~ ., family=gaussian(link="identity"), data=unemployment_df)
summary(glm.model)
```

```
##
## Call:
## glm(formula = Unemployment.Rate ~ ., family = gaussian(link = "identity"),
##      data = unemployment_df)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -0.067641 -0.010810  0.000217  0.013717  0.046807
##
## Coefficients:
##              Estimate Std. Error t value
## (Intercept)    9.673e+01  1.446e+02  0.669
## Date           1.250e-04  2.127e-04  0.588
## Unemployment.Rate.AfricanAmerican  9.752e-02  6.148e-02  1.586
## Unemployment.Rate.Hispanic        2.168e-02  7.604e-02  0.285
## Unemployment.Rate.White          3.639e-01  3.370e-01  1.080
## Unemployment.Rate.Asian        -1.142e-02  4.143e-02 -0.276
## Unemployment.Rate.Women         1.965e-01  2.703e-01  0.727
## Unemployment.Rate.Men           2.440e-01  1.524e-01  1.601
## Percent.JobLosers              1.072e-01  8.890e-02  1.206
## Covid.Cases                   -1.229e-05  1.679e-05 -0.732
## Avg.Weekly.Hrs.Private          6.586e-02  2.609e-01  0.252
## Avg.Weekly.Hrs.Education.Health -2.371e-01  2.251e-01 -1.053
## Avg.Weekly.Hrs.Financial        -4.891e-02  2.942e-01 -0.166
## Avg.Weekly.Hrs.Leisure.Hospitality -3.161e-02  6.689e-02 -0.472
## Avg.Weekly.Hrs.Transportation.Wearhousing  2.830e-02  1.223e-01  0.231
```

```
## UnemploymentRate.Married      -1.812e-02  1.629e-02  -1.112
## TotalPop                      1.438e-09  2.387e-08   0.060
## Covid.Cases.Percent           4.073e+01  5.557e+01   0.733
##                               Pr(>|t|)
## (Intercept)                   0.520
## Date                          0.571
## Unemployment.Rate.AfricanAmerican 0.147
## Unemployment.Rate.Hispanic      0.782
## Unemployment.Rate.White         0.308
## Unemployment.Rate.Asian         0.789
## Unemployment.Rate.Women         0.486
## Unemployment.Rate.Men           0.144
## Percent.JobLosers               0.258
## Covid.Cases                    0.483
## Avg.Weekly.Hrs.Private          0.806
## Avg.Weekly.Hrs.Education.Health 0.320
## Avg.Weekly.Hrs.Financial        0.872
## Avg.Weekly.Hrs.Leisure.Hospitality 0.648
## Avg.Weekly.Hrs.Transportation.Wearhousing 0.822
## UnemploymentRate.Married        0.295
## TotalPop                        0.953
## Covid.Cases.Percent             0.482
```

```
##
## (Dispersion parameter for gaussian family taken to be 0.001880119)
##
```

```
## Null deviance: 264.811852 on 26 degrees of freedom
## Residual deviance: 0.016921 on 9 degrees of freedom
## AIC: -84.503
```

```
##
## Number of Fisher Scoring iterations: 2
```

```
car::vif(glm.model)
```

```
##                               Date
##                               7.607615e+00
##      Unemployment.Rate.AfricanAmerican
##                               6.968706e+02
##      Unemployment.Rate.Hispanic
##                               1.473378e+03
##      Unemployment.Rate.White
##                               1.419235e+04
##      Unemployment.Rate.Asian
##                               3.985360e+02
##      Unemployment.Rate.Women
##                               1.221046e+04
##      Unemployment.Rate.Men
##                               2.633294e+03
##      Percent.JobLosers
##                               1.092385e+03
##      Covid.Cases
##                               1.260914e+07
##      Avg.Weekly.Hrs.Private
##                               3.946451e+01
##      Avg.Weekly.Hrs.Education.Health
##                               3.714566e+01
```



```

##              Avg.Weekly.Hrs.Financial
##              6.684674e+00
##      Avg.Weekly.Hrs.Leisure.Hospitality
##              1.515223e+01
## Avg.Weekly.Hrs.Transportation.Wearhousing
##              2.691504e+01
##              UnemploymentRate.Married
##              2.450950e+01
##              TotalPop
##              2.142318e+01
##              Covid.Cases.Percent
##              1.260371e+07

#bootavemodpres100<-bootAverageDominanceAnalysis(glm.model,R=10)
#summary(bootavemodpres100,fit.functions=c("r2.m"))
# "identity", "log", "sqrt", "1/mu^2", "inverse"
# identity -> 0 -84.503 vif -- vlow
# log -> 2 -39.542 vif -- vlow
# sqrt -> 2 -59.369 vif - vlow
# 1/mu^2 -> 5 -19 vif - vlow
# inverse -> 4 -> AIC -24.392 - vlow

glm.model <- glm(Unemployment.Rate ~ Unemployment.Rate.AfricanAmerican+Unemployment.Rate.White+Avg.Weekly.Hrs.Financial+Percent.JobLosers,
summary(glm.model)

##
## Call:
## glm(formula = Unemployment.Rate ~ Unemployment.Rate.AfricanAmerican +
##      Unemployment.Rate.White + Avg.Weekly.Hrs.Financial + Percent.JobLosers,
##      family = inverse.gaussian(link = "1/mu^2"), data = unemployment_df)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -0.09414  -0.05370  -0.03371   0.07027   0.10731
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.132502   1.232527   0.919   0.368
## Unemployment.Rate.AfricanAmerican -0.008692   0.001618  -5.373 2.14e-05 ***
## Unemployment.Rate.White      0.001795   0.011325   0.159   0.875
## Avg.Weekly.Hrs.Financial    -0.027274   0.032525  -0.839   0.411
## Percent.JobLosers      0.001638   0.010688   0.153   0.880
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for inverse.gaussian family taken to be 0.005880349)
##
##      Null deviance: 1.01244  on 26  degrees of freedom
## Residual deviance: 0.11947  on 22  degrees of freedom
## AIC: 77.306
##
## Number of Fisher Scoring iterations: 6

model <- lm(Unemployment.Rate ~ Unemployment.Rate.AfricanAmerican+Unemployment.Rate.Hispanic+Unemployment.Rate.White+Avg.Weekly.Hrs.Financial+Percent.JobLosers,
summary(model)

```

```
##
## Call:
## lm(formula = Unemployment.Rate ~ Unemployment.Rate.AfricanAmerican +
##   Unemployment.Rate.Hispanic + Unemployment.Rate.White + Unemployment.Rate.Asian +
##   Unemployment.Rate.Women + Avg.Weekly.Hrs.Private, data = unemployment_df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.081164 -0.036388  0.006334  0.029631  0.089043
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.40079     2.94971   -0.136  0.89328
## Unemployment.Rate.AfricanAmerican  0.12224     0.03206    3.813  0.00109 **
## Unemployment.Rate.Hispanic        0.01739     0.03251    0.535  0.59857
## Unemployment.Rate.White          0.68626     0.13410    5.118 5.25e-05 ***
## Unemployment.Rate.Asian          0.02490     0.02092    1.190  0.24793
## Unemployment.Rate.Women          0.14915     0.12543    1.189  0.24835
## Avg.Weekly.Hrs.Private          0.01339     0.08851    0.151  0.88122
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.05474 on 20 degrees of freedom
## Multiple R-squared:  0.9998, Adjusted R-squared:  0.9997
## F-statistic: 1.473e+04 on 6 and 20 DF, p-value: < 2.2e-16
```