NYPD Shooting Incidents Report

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Contents

1 Introduction

The data NYPD Shooting Incidents contains many exciting points to analyze the incidents based on location, region, race, or age. However, my interest in this report is to analyze the data based on political parties which are Republican or Democrats, economy, Covid-19, and presidential administration. The data contain the incident report from 2006 to 2020. Thus, based on my knowledge of the economy, presidential election, and covid-19 during these years, I would like to analyze the predominant factor which causes NYPD shooting incidents.

2 Importing

2.0.0.0.1 First, I will import the libraries to use for the report.

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --
```

```
## v ggplot2 3.3.3     v purrr   0.3.4
## v tibble  3.1.2     v dplyr   1.0.6
## v tidyr   1.1.3     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.1
```

```
## -- Conflicts ---------------------------------------- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()

library(lubridate)

##
## Attaching package: 'lubridate'

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

library(ggplot2)
options(width=60)
options(warn=-1)
```

2.0.0.0.2 Next, create a multiplot function for multiple charts.

```
multiplot <- function(..., plotlist=NULL, file, cols=1, layout=NULL) {
    library(grid)

    # Make a list from the ... arguments and plotlist
    plots <- c(list(...), plotlist)

    numPlots = length(plots)

    # If layout is NULL, then use 'cols' to determine layout
    if (is.null(layout)) {
        # Make the panel
        # ncol: Number of columns of plots
        # nrow: Number of rows needed, calculated from # of cols
        layout <- matrix(seq(1, cols * ceiling(numPlots/cols)),
                         ncol = cols, nrow = ceiling(numPlots/cols))
    }

    if (numPlots==1) {
        print(plots[[1]])

    } else {
        # Set up the page
        grid.newpage()
        pushViewport(viewport(layout = grid.layout(nrow(layout), ncol(layout))))

        # Make each plot, in the correct location
        for (i in 1:numPlots) {
            # Get the i,j matrix positions of the regions that contain this subplot
            matchidx <- as.data.frame(which(layout == i, arr.ind = TRUE))

            print(plots[[i]], vp = viewport(layout.pos.row = matchidx$row,
                                            layout.pos.col = matchidx$col))
        }
    }
}
```

2.0.0.0.3 Now I can load NYPD Data from https://data.cityofnewyork.us/api/views/833y-fsy8/rows.csv?accessType=DOWNLOAD link.

```
url <- "https://data.cityofnewyork.us/api/views/833y-fsy8/rows.csv?accessType=DOWNLOAD"
nypd_shooting_incident <- read_csv(url)
```

```
##
## -- Column specification --------------------------------------
## cols(
##   INCIDENT_KEY = col_double(),
##   OCCUR_DATE = col_character(),
##   OCCUR_TIME = col_time(format = ""),
##   BORO = col_character(),
##   PRECINCT = col_double(),
##   JURISDICTION_CODE = col_double(),
##   LOCATION_DESC = col_character(),
##   STATISTICAL_MURDER_FLAG = col_logical(),
##   PERP_AGE_GROUP = col_character(),
##   PERP_SEX = col_character(),
##   PERP_RACE = col_character(),
##   VIC_AGE_GROUP = col_character(),
##   VIC_SEX = col_character(),
##   VIC_RACE = col_character(),
##   X_COORD_CD = col_number(),
##   Y_COORD_CD = col_number(),
##   Latitude = col_double(),
##   Longitude = col_double(),
##   Lon_Lat = col_character()
## )
```

```
summary(nypd_shooting_incident)
```

```
##   INCIDENT_KEY        OCCUR_DATE         OCCUR_TIME
##  Min.   :  9953245   Length:23568       Length:23568
##  1st Qu.: 55317014   Class :character   Class1:hms
##  Median : 83365370   Mode  :character   Class2:difftime
##  Mean   :102218616                      Mode  :numeric
##  3rd Qu.:150772442
##  Max.   :222473262
##
##      BORO              PRECINCT      JURISDICTION_CODE
##  Length:23568       Min.   :  1.00   Min.   :0.0000
##  Class :character   1st Qu.: 44.00   1st Qu.:0.0000
##  Mode  :character   Median : 69.00   Median :0.0000
##                     Mean   : 66.21   Mean   :0.3323
##                     3rd Qu.: 81.00   3rd Qu.:0.0000
##                     Max.   :123.00   Max.   :2.0000
##                                      NA's   :2
##  LOCATION_DESC      STATISTICAL_MURDER_FLAG
##  Length:23568       Mode :logical
##  Class :character   FALSE:19080
##  Mode  :character   TRUE :4488
##
```

```
##
##
##
##  PERP_AGE_GROUP       PERP_SEX          PERP_RACE
##  Length:23568       Length:23568       Length:23568
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##  VIC_AGE_GROUP        VIC_SEX            VIC_RACE
##  Length:23568       Length:23568       Length:23568
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##    X_COORD_CD        Y_COORD_CD        Latitude
##  Min.   : 914928   Min.   :125757   Min.   :40.51
##  1st Qu.: 999900   1st Qu.:182565   1st Qu.:40.67
##  Median :1007645   Median :193482   Median :40.70
##  Mean   :1009363   Mean   :207312   Mean   :40.74
##  3rd Qu.:1016807   3rd Qu.:239163   3rd Qu.:40.82
##  Max.   :1066815   Max.   :271128   Max.   :40.91
##
##    Longitude        Lon_Lat
##  Min.   :-74.25   Length:23568
##  1st Qu.:-73.94   Class :character
##  Median :-73.92   Mode  :character
##  Mean   :-73.91
##  3rd Qu.:-73.88
##  Max.   :-73.70
##
```

2.0.0.0.4 Let's select only remarkable columns for this report.

```
nypd_shooting_incident <- nypd_shooting_incident %>%
    select(OCCUR_DATE,BORO,PERP_AGE_GROUP,PERP_RACE,
           VIC_AGE_GROUP,VIC_SEX,VIC_RACE)
```

3 Tidying and Transforming NYPD Data

3.0.0.0.1 Create YEAR and YEAR_MONTH columns for the analysis.

```
nypd_si_all <- nypd_shooting_incident %>%
    select(BORO, OCCUR_DATE) %>%
    mutate(OCCUR_DATE = mdy(OCCUR_DATE), INCIDENTS_all = 1,
           YEAR = format_ISO8601(OCCUR_DATE, precision = "y"),
           YEAR_MONTH = format_ISO8601(OCCUR_DATE, precision = "ym"))
```

3.0.0.0.2 Group and count NYPD Shooting Incidents by year.

```
nypd_si_all_global <- nypd_si_all %>%
    select(YEAR, INCIDENTS_all) %>%
    group_by(YEAR) %>%
    summarise(INCIDENTS_all = sum(INCIDENTS_all), .groups = "keep") %>%
    ungroup()
```

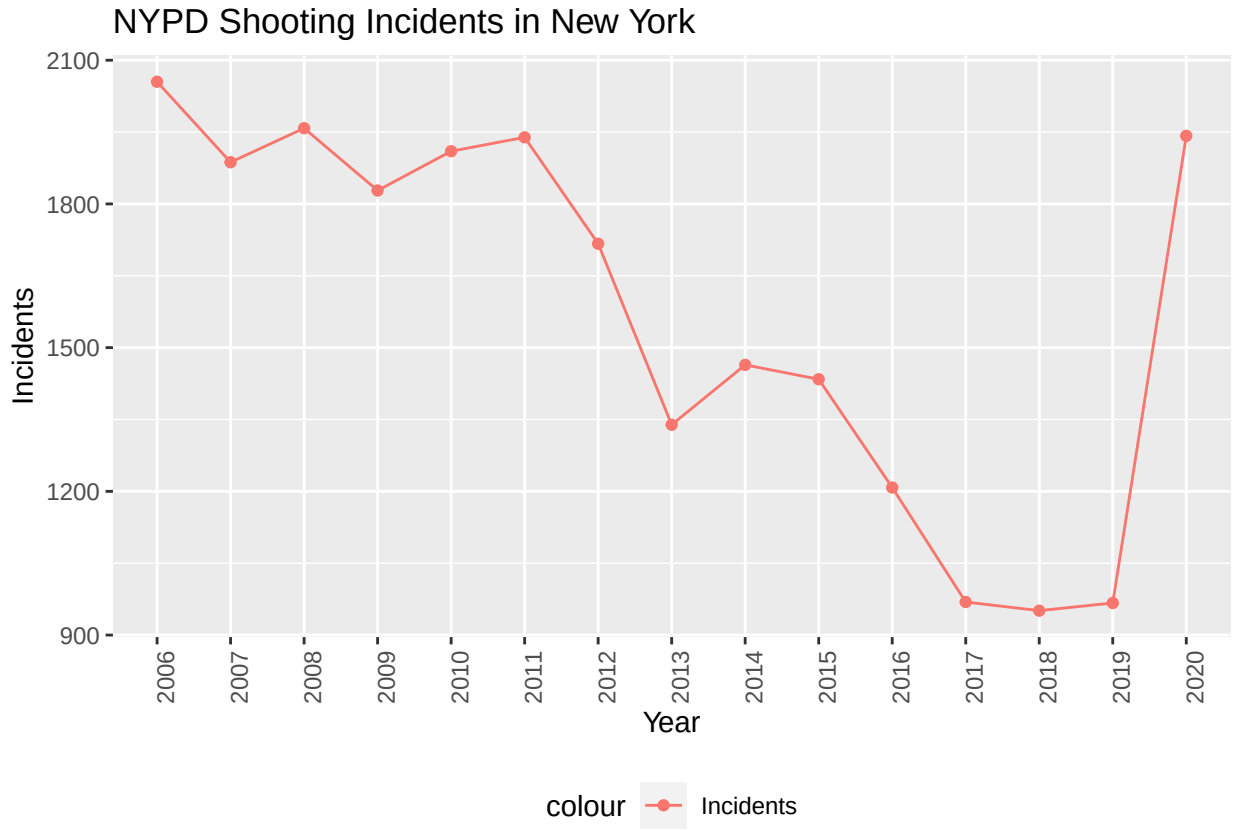
3.0.0.0.3 Group and count NYPD Shooting Incidents by month for 2018, 2019, and 2020.

```
nypd_si_all_global_monthly <- nypd_si_all %>%
    select(YEAR_MONTH, INCIDENTS_all) %>%
    group_by(YEAR_MONTH) %>%
    summarise(INCIDENTS_all = sum(INCIDENTS_all), .groups = "keep") %>%
    ungroup()

nypd_si_2020 <- nypd_shooting_incident %>%
    select(BORO, OCCUR_DATE) %>%
    mutate(OCCUR_DATE = mdy(OCCUR_DATE), INCIDENTS_2020 = 1,
           MONTH = format(OCCUR_DATE, "%b")) %>%
    filter(OCCUR_DATE >= as.Date("2020-01-01") & OCCUR_DATE <= as.Date("2020-12-31"))

nypd_si_2020_global <- nypd_si_2020 %>%
    select(MONTH, INCIDENTS_2020) %>%
    group_by(MONTH) %>%
    summarise(INCIDENTS_2020 = sum(INCIDENTS_2020), .groups = "keep") %>%
    ungroup()

nypd_si_2019 <- nypd_shooting_incident %>%
    select(BORO, OCCUR_DATE) %>%
    mutate(OCCUR_DATE = mdy(OCCUR_DATE), INCIDENTS_2019 = 1,
           MONTH = format(OCCUR_DATE, "%b")) %>%
    filter(OCCUR_DATE >= as.Date("2019-01-01") & OCCUR_DATE <= as.Date("2019-12-31"))

nypd_si_2019_global <- nypd_si_2019 %>%
    select( MONTH, INCIDENTS_2019) %>%
    group_by(MONTH) %>%
    summarise(INCIDENTS_2019 = sum(INCIDENTS_2019), .groups = "keep") %>%
    ungroup()

nypd_si_2018 <- nypd_shooting_incident %>%
    select(BORO, OCCUR_DATE) %>%
    mutate(OCCUR_DATE = mdy(OCCUR_DATE), INCIDENTS_2018 = 1,
           MONTH = format(OCCUR_DATE, "%b")) %>%
    filter(OCCUR_DATE >= as.Date("2018-01-01") & OCCUR_DATE <= as.Date("2018-12-31"))

nypd_si_2018_global <- nypd_si_2018 %>%
    select(MONTH, INCIDENTS_2018) %>%
    group_by(MONTH) %>%
    summarise(INCIDENTS_2018 = sum(INCIDENTS_2018), .groups = "keep") %>%
    ungroup()
```

4 Visualizing Data

4.0.0.0.1 Visualize NYPD Data that shows the number of incidents that occurred yearly.

```
nypd_si_all_global %>%
    ggplot(aes(x = YEAR, y = INCIDENTS_all, group = 1)) +
    geom_line(aes(color = "Incidents")) +
    geom_point(aes(color = "Incidents")) +
    theme(legend.position = "bottom",
          axis.text.x = element_text(angle = 90)) +
    labs(title = "NYPD Shooting Incidents in New York", y = "Incidents", x="Year")
```



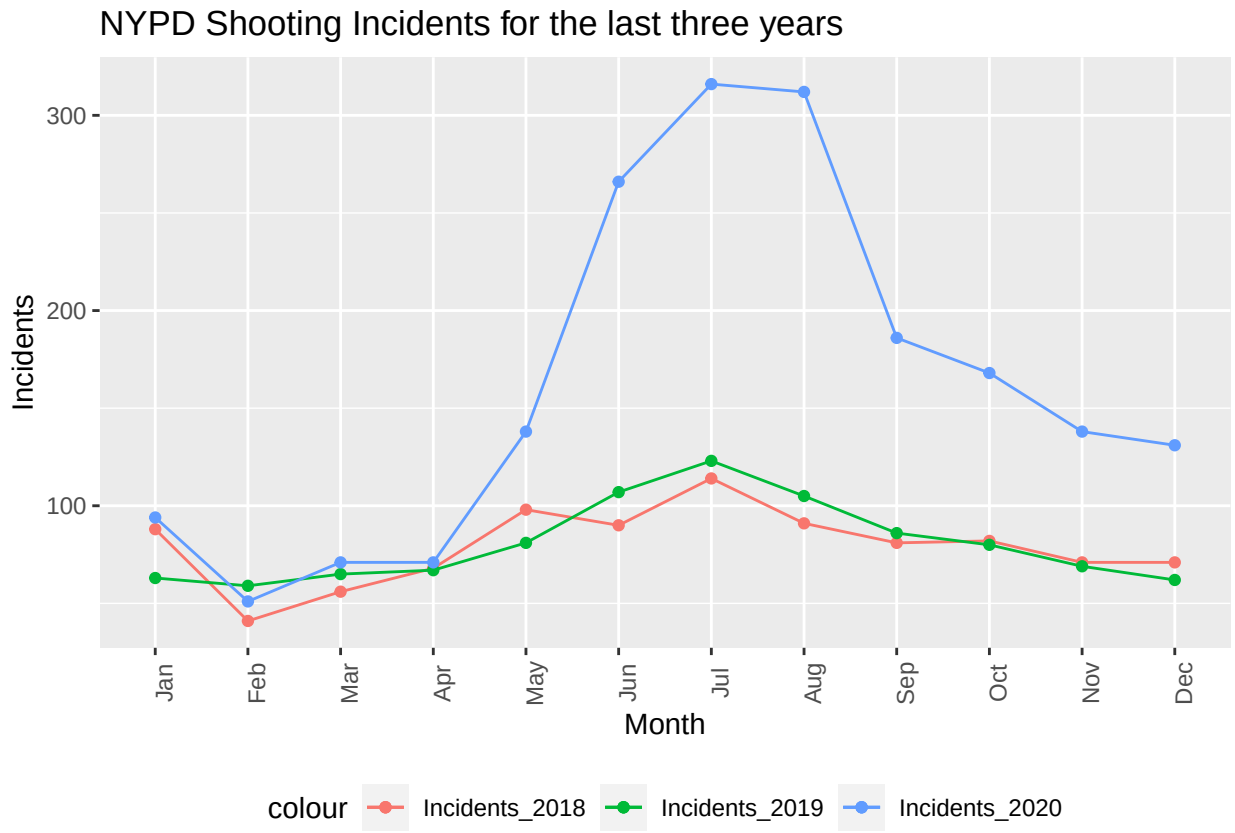
5 Analyzing NYPD Data

The graph above shows that the lowest NYPD Shooting Incidents were from 2016 to 2019, the Trump administration period until covid-19 came. After Covid-19, the economy became terrible, and the number of incidents became high. Thus we can see that the primary part in shooting incidents plays the status of the economy and not the political parties, which are either Republicans or Democrats.

5.0.0.0.1 For better analysis, let's see the monthly comparison for the last three years.

```
nypd_si_last_3_year <- full_join(nypd_si_2018_global,
                                 nypd_si_2019_global, by="MONTH")
```

```
nypd_si_last_3_year <- full_join(nypd_si_last_3_year,
                                 nypd_si_2020_global, by="MONTH")

level_order <- c('Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul','Aug', 'Sep', 'Oct', 'Nov', 'Dec')
nypd_si_last_3_year %>%
    ggplot(aes(x = factor(MONTH, level = level_order), y = INCIDENTS_2018, group = 1)) +
    geom_line(aes(color = "Incidents_2018")) +
    geom_point(aes(color = "Incidents_2018")) +
    geom_line(aes(y = INCIDENTS_2019, color = "Incidents_2019")) +
    geom_point(aes(y = INCIDENTS_2019, color = "Incidents_2019")) +
    geom_line(aes(y = INCIDENTS_2020, color = "Incidents_2020")) +
    geom_point(aes(y = INCIDENTS_2020, color = "Incidents_2020")) +
    theme(legend.position = "bottom",
          axis.text.x = element_text(angle = 90)) +
    labs(title = "NYPD Shooting Incidents for the last three years", y = "Incidents", x="Month")
```



The graph above shows that the number of NYPD shooting incidents started growing in May 2020. However, in September it moved lower but not up to the level of the previous two years.

6 Modeling NYPD Data

6.0.0.0.1 To see a better picture, I would like to compare how 2019 year correlates with 2018 and 2020. For this, I will create the model for 2019_2018 and 2019_2020.

```r
mod_2019_2018 <- lm(INCIDENTS_2019 ~ INCIDENTS_2018, data = nypd_si_last_3_year)
summary(mod_2019_2018)
```

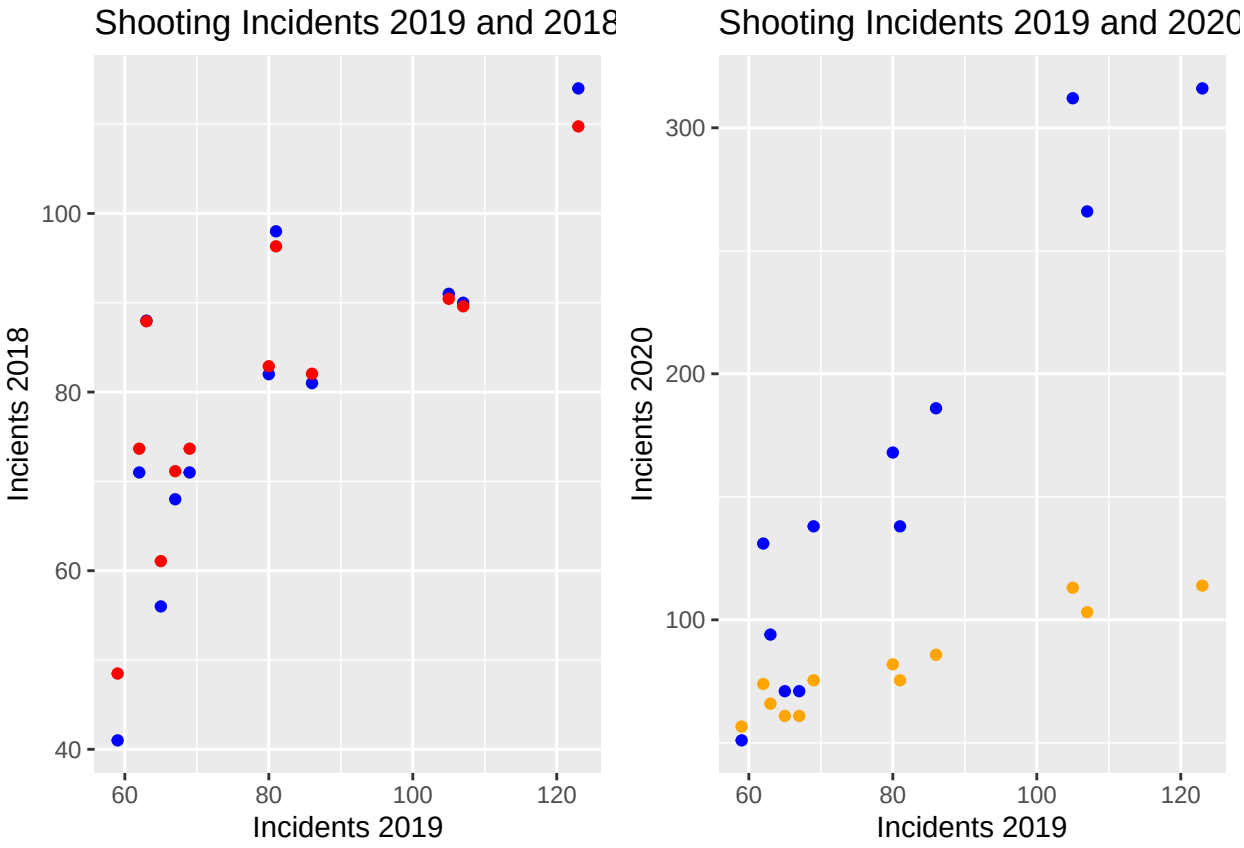
```
##
## Call:
## lm(formula = INCIDENTS_2019 ~ INCIDENTS_2018, data = nypd_si_last_3_year)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -24.9262  -6.4101   0.5183  11.2003  17.3954
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)     14.0780    17.2519   0.816  0.43349
## INCIDENTS_2018   0.8392     0.2119   3.960  0.00269 **
## ---
## Signif. codes:
## 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 13.68 on 10 degrees of freedom
## Multiple R-squared:  0.6106, Adjusted R-squared:  0.5717
## F-statistic: 15.68 on 1 and 10 DF,  p-value: 0.002686
```

```r
mod_2019_2020 <- lm(INCIDENTS_2019 ~ INCIDENTS_2020, data = nypd_si_last_3_year)
summary(mod_2019_2020)
```

```
##
## Call:
## lm(formula = INCIDENTS_2019 ~ INCIDENTS_2020, data = nypd_si_last_3_year)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -11.919  -3.799   1.283   4.429   9.095
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)    45.60440    4.03858  11.292 5.16e-07 ***
## INCIDENTS_2020  0.21614    0.02191   9.863 1.80e-06 ***
## ---
## Signif. codes:
## 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.693 on 10 degrees of freedom
## Multiple R-squared:  0.9068, Adjusted R-squared:  0.8975
## F-statistic: 97.28 on 1 and 10 DF,  p-value: 1.804e-06
```

```r
nypd_si_last_3_year_pred <- nypd_si_last_3_year %>%
    mutate(pred_2019_2018 = predict(mod_2019_2018), pred_2019_2020 = predict(mod_2019_2020))

p1 <- nypd_si_last_3_year_pred %>% ggplot(aes(x = factor(MONTH, level = level_order),
                                              y = factor(MONTH, level = level_order), group = 1)) +
    geom_point(aes(y = INCIDENTS_2018, x = INCIDENTS_2019),
               color = "blue") +
```

```
    geom_point(aes(y = pred_2019_2018, x = INCIDENTS_2019),
               color = "red") +
    labs(title = "Shooting Incidents 2019 and 2018", x = "Incidents 2019", y="Incients 2018")

p2 <- nypd_si_last_3_year_pred %>% ggplot(aes(x = factor(MONTH, level = level_order),
                                             y = factor(MONTH, level = level_order), group = 1)) +
    geom_point(aes(y = INCIDENTS_2020, x = INCIDENTS_2019),
               color = "blue") +
    geom_point(aes(y = pred_2019_2020, x = INCIDENTS_2019),
               color = "orange") +
    labs(title = "Shooting Incidents 2019 and 2020", x = "Incidents 2019", y="Incients 2020")


multiplot(p1, p2, cols = 2)
```



6.0.0.0.2 The graph above shows that predicted shooting incidents for 2018 is very close to incidents for 2019, while indicated incidents for 2020 are far away.

7 Conclusion and Bias

The analysis above shows that the economy plays a primary role in shooting incidents. The other factors like President or Covid-19 can only affect the economy but not shooting incidents. The bias of this analysis can be that during the Trump administration, the economy was good before Covid-19 started, and the number

of shooting incidents was low. However, when Covid-19 affected the economy, the number of shooting incidents became high again, and Trump could not handle it. So it is still unclear if Trump, who created a good economy or economy, started improving just during the second term of Obama and continue the improvement.