Gun\_Stocks\_Vs\_Mass\_Shootings

Team 89

2022-06-18

library(TTR)  
library(quantmod)  
  
library(ggplot2); library(readr); library(dplyr); library(tidyverse);  
library(gridExtra);library(ggExtra); library(knitr);  
library(caret); library(gridExtra); library(lubridate); library(stringr);  
library(PerformanceAnalytics); library(xts); library(tidyquant); library(tidyverse); library(data.table); library(chron)

## Mass shootings data

* Select “location”, “date”, “fatalities”, “injured”, and “total\_victims”
* Move those dates that fall on holidays and weekend to the next working (trading) day
* Create variable “year” based on “date” variable
* Create “state” variable based on “location” variable
* Convert to integer those variables that are characters
* Select “location”, “sate”, “year”, “fatalities”, “injured”, and “total\_victims”
* Updated data of Uvalde, Texas mass shooting

us\_mass <- read.csv("US\_Mass\_Shootings\_May\_24\_2022.csv")  
  
#Select those variables that are needed for our analysis  
us\_mass02 <- us\_mass %>% select(location, date, fatalities, injured, total\_victims)  
str(us\_mass02)

## 'data.frame': 128 obs. of 5 variables:  
## $ location : chr "Uvalde, Texas" "Buffalo, New York" "Sacramento, California" "Oxford, Michigan" ...  
## $ date : chr "5/24/22" "5/14/22" "2/28/22" "11/30/21" ...  
## $ fatalities : int 15 10 4 4 9 8 4 10 8 4 ...  
## $ injured : chr "-" "3" "0" "7" ...  
## $ total\_victims: chr "-" "13" "4" "11" ...

# change date format to standardize dates  
us\_mass02 <- us\_mass02 %>% mutate(date = mdy(date)) %>%  
 #Shooting was/is in a holiday date is move to next date  
 mutate(date = ifelse(is.holiday(date), date+1,date)) %>%  
 # Moving any dates to the following Monday  
 mutate(weekday=wday(date)) %>%  
 mutate(date1 = ifelse(weekday==1,(date+1), ifelse(weekday==7, (date+2), (date)))) %>%  
 mutate(date = ifelse(is.holiday(date), date+1,date)) %>%  
 mutate(date = as.Date(date1)) %>%  
 mutate(year = year(date)) %>%  
   
 mutate(state = ifelse(location=="Washington, D.C.", "Washington, D.C.",str\_extract(location,  
 "[\\s]\*[A-Z][a-z]+[\\s]\*[[A-Z][a-z]+]\*$"))) %>%  
 mutate(fatalities = as.integer(fatalities)) %>%  
 mutate(injured = as.integer(injured)) %>%  
 mutate(total\_victims = as.integer(total\_victims)) %>%  
 select(location, state, date, year, fatalities, injured, total\_victims)

## Warning in mask$eval\_all\_mutate(quo): NAs introduced by coercion  
  
## Warning in mask$eval\_all\_mutate(quo): NAs introduced by coercion

## Update Uvalde, Texas data  
us\_mass02$fatalities[us\_mass02$location=="Uvalde, Texas"] <- as.integer(22)  
us\_mass02$injured[us\_mass02$location=="Uvalde, Texas"] <- as.integer(17)  
us\_mass02$total\_victims[us\_mass02$location=="Uvalde, Texas"] <- as.integer(39)  
  
## Add Highland Park, Illinois mass shooting   
us\_mass02 <- us\_mass02 %>% add\_row(location = "Highland Park, Illinois", state = "Illinois", date = mdy(07042022), year= as.integer(2022), fatalities = as.integer(8), injured=as.integer(29), total\_victims=as.integer(37), .before=1)  
  
  
  
  
summary(us\_mass02)

## location state date year   
## Length:129 Length:129 Min. :1982-08-20 Min. :1982   
## Class :character Class :character 1st Qu.:2001-02-05 1st Qu.:2001   
## Mode :character Mode :character Median :2013-06-07 Median :2013   
## Mean :2009-10-08 Mean :2009   
## 3rd Qu.:2018-02-14 3rd Qu.:2018   
## Max. :2022-07-04 Max. :2022   
## fatalities injured total\_victims   
## Min. : 3.000 Min. : 0.00 Min. : 3.00   
## 1st Qu.: 4.000 1st Qu.: 1.00 1st Qu.: 7.00   
## Median : 6.000 Median : 3.00 Median : 10.00   
## Mean : 8.093 Mean : 11.69 Mean : 19.78   
## 3rd Qu.: 9.000 3rd Qu.: 10.00 3rd Qu.: 18.00   
## Max. :58.000 Max. :546.00 Max. :604.00

## Group mass shooting data by year and state

Group mass shooting data by state and year

usmass\_yearly <- us\_mass02 %>% group\_by(year) %>%  
 summarise( fatalities=sum(fatalities, na.rm = TRUE), injured=sum(injured, na.rm = TRUE), total\_victims=sum(total\_victims, na.rm = TRUE))   
  
shootings\_yrl <- us\_mass02 %>% count(year)  
colnames(shootings\_yrl) <- c("year", "mass\_shootings")  
usmass\_yearly <- merge(usmass\_yearly, shootings\_yrl, by="year")  
usmass\_yearly$intensity <- usmass\_yearly$total\_victims/usmass\_yearly$mass\_shootings  
tail(usmass\_yearly)

## year fatalities injured total\_victims mass\_shootings intensity  
## 33 2017 117 587 704 11 64.000000  
## 34 2018 80 70 150 12 12.500000  
## 35 2019 73 112 185 10 18.500000  
## 36 2020 9 0 9 2 4.500000  
## 37 2021 43 16 59 6 9.833333  
## 38 2022 44 49 93 4 23.250000

usmass\_state <- us\_mass02 %>% group\_by(state) %>%  
 summarise( fatalities=sum(fatalities, na.rm = TRUE), injured=sum(injured, na.rm = TRUE), total\_victims=sum(total\_victims, na.rm = TRUE))  
  
shootings\_state <- us\_mass02 %>% count(state)  
colnames(shootings\_state) <- c("state", "mass\_shootings")  
usmass\_state <- merge(usmass\_state, shootings\_state, by="state")  
usmass\_state <- usmass\_state %>% arrange(desc(mass\_shootings))  
head(usmass\_state)

## state fatalities injured total\_victims mass\_shootings  
## 1 California 157 160 317 23  
## 2 Florida 126 109 235 12  
## 3 Texas 152 183 335 12  
## 4 Colorado 48 104 152 7  
## 5 Washington 37 28 65 7  
## 6 New York 40 28 68 5

### Exploratory plotting

#### US Mass Shooting total victims per State

Plot of total fatalities group by state

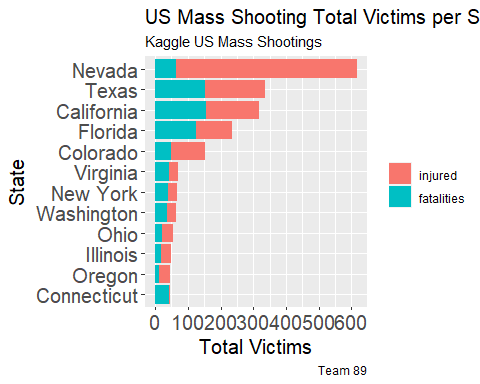
subset\_usmass\_state1 <- usmass\_state %>% arrange(desc(total\_victims)) %>% slice(1:12)  
temp\_masssate <- subset\_usmass\_state1[,c("state", "injured", "fatalities")] %>% reshape2::melt()

## Using state as id variables

usshoot\_state\_plot <- ggplot(data = temp\_masssate, aes(y=reorder(state, (value)), x=value, fill=variable))  
usshoot\_state\_plot <- usshoot\_state\_plot + geom\_col(position="stack", stat="identity")

## Warning: Ignoring unknown parameters: stat

usshoot\_state\_plot <- usshoot\_state\_plot + scale\_x\_continuous(breaks = seq(0, 700, by = 100))  
usshoot\_state\_plot <- usshoot\_state\_plot + labs(title="US Mass Shooting Total Victims per State",  
 subtitle = "Kaggle US Mass Shootings",  
 caption = "Team 89")  
usshoot\_state\_plot <- usshoot\_state\_plot + ylab("State") + xlab("Total Victims")  
usshoot\_state\_plot <- usshoot\_state\_plot + theme(plot.title = element\_text(size = 15))  
usshoot\_state\_plot <- usshoot\_state\_plot + theme(axis.title = element\_text(size = 15))   
usshoot\_state\_plot <- usshoot\_state\_plot + theme(axis.text = element\_text(size = 15))  
usshoot\_state\_plot <- usshoot\_state\_plot + theme(legend.title = element\_blank())  
usshoot\_state\_plot <- usshoot\_state\_plot + theme(legend.position = "right")  
  
  
  
  
usshoot\_state\_plot



ggsave("89plot01.png")

## Saving 5 x 4 in image

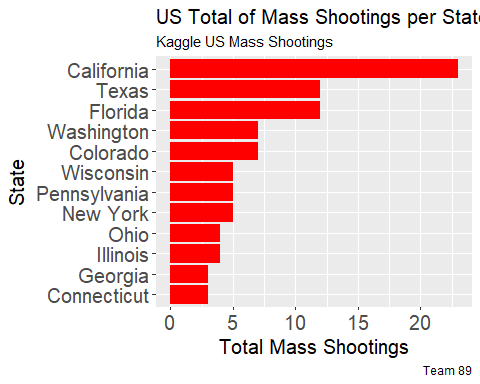
#### US Mass Shooting total shootings per State

Plot of number of mass shootings group by state

#temp\_masssate <- usmass\_state[,c("state", "injured", "fatalities")] %>% reshape2::melt()  
  
subset\_usmass\_state2 <- usmass\_state %>% arrange(desc(mass\_shootings)) %>% slice(1:12)  
   
usshoot\_state\_plot1 <- ggplot(data = subset\_usmass\_state2, aes(y=reorder(state, mass\_shootings), x=mass\_shootings))  
usshoot\_state\_plot1 <- usshoot\_state\_plot1 + geom\_col(position="stack", stat="identity", fill="red")

## Warning: Ignoring unknown parameters: stat

usshoot\_state\_plot1 <- usshoot\_state\_plot1 + scale\_x\_continuous(breaks = seq(0, 30, by = 5))  
usshoot\_state\_plot1 <- usshoot\_state\_plot1 + labs(title="US Total of Mass Shootings per State",  
 subtitle = "Kaggle US Mass Shootings",  
 caption = "Team 89")  
usshoot\_state\_plot1 <- usshoot\_state\_plot1 + ylab("State") + xlab("Total Mass Shootings")  
usshoot\_state\_plot1 <- usshoot\_state\_plot1 + theme(plot.title = element\_text(size = 15))  
usshoot\_state\_plot1 <- usshoot\_state\_plot1 + theme(axis.title = element\_text(size = 15))   
usshoot\_state\_plot1 <- usshoot\_state\_plot1 + theme(axis.text = element\_text(size = 15))  
usshoot\_state\_plot1 <- usshoot\_state\_plot1 + theme(legend.title = element\_blank())  
usshoot\_state\_plot1 <- usshoot\_state\_plot1 + theme(legend.position = "right")  
  
usshoot\_state\_plot1



ggsave("89plot02.png")

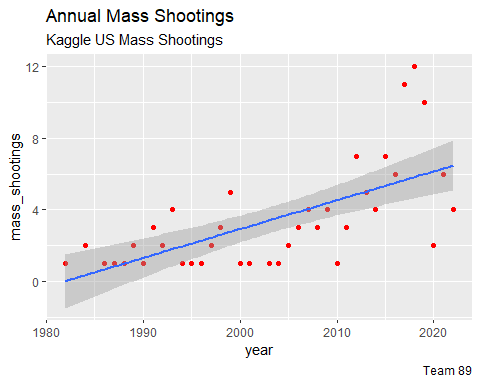
## Saving 5 x 4 in image

#### Annual Mass Shootings

Plot of number of mass shooting per year

usshoot\_plot1 <- ggplot()+ geom\_point(data = usmass\_yearly, aes(x=year, y=mass\_shootings), color="red")  
usshoot\_plot1 <- usshoot\_plot1 + geom\_smooth(data = usmass\_yearly, aes(x=year, y=mass\_shootings), method="lm")  
usshoot\_plot1 <- usshoot\_plot1 + labs(title = "Annual Mass Shootings",   
 subtitle = "Kaggle US Mass Shootings",   
 caption = "Team 89")  
  
usshoot\_plot1

## `geom\_smooth()` using formula 'y ~ x'



ggsave("89plot03.png")

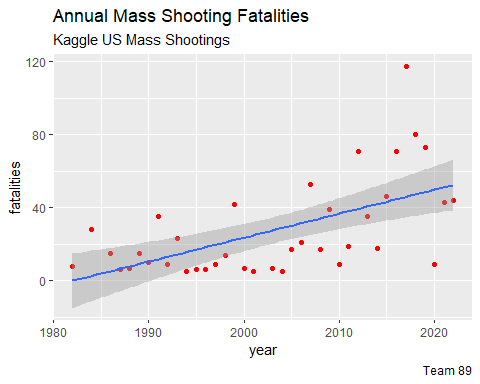
## Saving 5 x 4 in image  
## `geom\_smooth()` using formula 'y ~ x'

#### Annual Fatalities

Plot of annual fatalities

usshoot\_plot1 <- ggplot()+ geom\_point(data = usmass\_yearly, aes(x=year, y=fatalities), color="red")  
usshoot\_plot1 <- usshoot\_plot1 + geom\_smooth(data = usmass\_yearly, aes(x=year, y=fatalities), method="lm")  
usshoot\_plot1 <- usshoot\_plot1 + labs(title = "Annual Mass Shooting Fatalities",   
 subtitle = "Kaggle US Mass Shootings",   
 caption = "Team 89")  
  
usshoot\_plot1

## `geom\_smooth()` using formula 'y ~ x'



ggsave("89plot04.png")

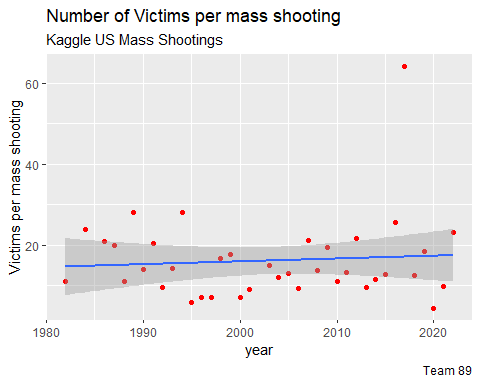
## Saving 5 x 4 in image  
## `geom\_smooth()` using formula 'y ~ x'

#### Annual Fatality Intesity

Number of victims per shooting on function of year

usshoot\_plot1 <- ggplot()+ geom\_point(data = usmass\_yearly, aes(x=year, y=intensity), color="red")  
usshoot\_plot1 <- usshoot\_plot1 + geom\_smooth(data = usmass\_yearly, aes(x=year, y=intensity), method="lm")  
usshoot\_plot1 <- usshoot\_plot1 + labs(title = "Number of Victims per mass shooting",   
 subtitle = "Kaggle US Mass Shootings",   
 caption = "Team 89")  
usshoot\_plot1 <- usshoot\_plot1 + ylab("Victims per mass shooting")  
usshoot\_plot1

## `geom\_smooth()` using formula 'y ~ x'



ggsave("89plot05.png")

## Saving 5 x 4 in image  
## `geom\_smooth()` using formula 'y ~ x'

## Obtain historical stock price of US gun manufactures.

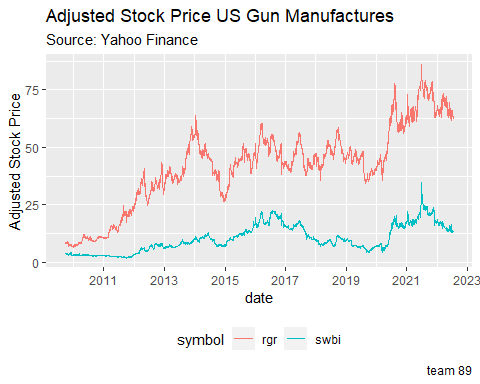
Obtain stock history ofr the companies that are been evaluated

date\_str <- "2009-10-01"  
#stocks <- c("swbi")  
stocks <- c("rgr", "swbi")  
#stocks <- c("rgr", "swbi", "oln", "npk", "bgfv", "axon" )  
  
gun\_co\_stocks <- stocks %>% tq\_get(get="stock.prices", from=date\_str, to=Sys.Date())  
head(gun\_co\_stocks)

## # A tibble: 6 × 8  
## symbol date open high low close volume adjusted  
## <chr> <date> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 rgr 2009-10-01 12.9 13.0 12.4 12.5 252500 8.38  
## 2 rgr 2009-10-02 12.4 12.7 11.8 12.3 254000 8.25  
## 3 rgr 2009-10-05 12.3 12.5 12.2 12.2 120300 8.20  
## 4 rgr 2009-10-06 12.2 12.8 12.2 12.5 111300 8.41  
## 5 rgr 2009-10-07 12.5 12.8 12.4 12.6 99300 8.45  
## 6 rgr 2009-10-08 12.7 13.0 12.5 12.8 144400 8.60

### Plotting adjusted stock price using ggplot2

gun\_stocks\_plot <- ggplot(data = gun\_co\_stocks, aes(x=date, y=adjusted, group=symbol))  
gun\_stocks\_plot <- gun\_stocks\_plot + geom\_line(aes(color=symbol))  
gun\_stocks\_plot <- gun\_stocks\_plot + theme(legend.position = "bottom")   
gun\_stocks\_plot <- gun\_stocks\_plot + labs(title = "Adjusted Stock Price US Gun Manufactures",   
 subtitle = "Source: Yahoo Finance",   
 caption = "team 89")  
gun\_stocks\_plot <- gun\_stocks\_plot + ylab("Adjusted Stock Price")  
gun\_stocks\_plot <- gun\_stocks\_plot + scale\_x\_date(date\_breaks = "2 years", date\_labels = "%Y")  
  
gun\_stocks\_plot



ggsave("89plot06B.png")

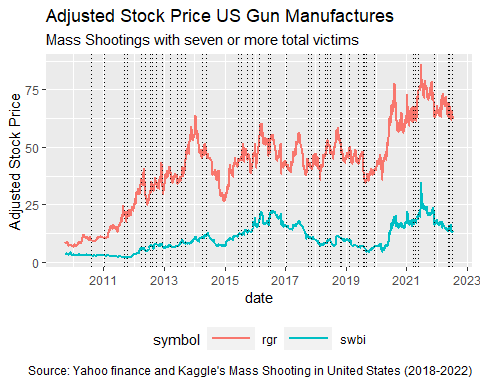
## Saving 5 x 4 in image

### Filter mass shootings that happened after 201-01-01, then Obtain mass shooting date vector

us\_mass03 <- us\_mass02 %>% filter(date>="2010-01-01" & total\_victims>=7)  
us\_mass\_dates <- us\_mass03[,3]

### Plotting adjusted stock price and mass shooting dates using ggplot2

gun\_stocks\_plot <- ggplot(data = gun\_co\_stocks, aes(x=date, y=adjusted, group=symbol))  
gun\_stocks\_plot <- gun\_stocks\_plot + geom\_line(aes(color=symbol), size=0.75)  
gun\_stocks\_plot <- gun\_stocks\_plot + theme(legend.position = "bottom")   
gun\_stocks\_plot <- gun\_stocks\_plot + theme(legend.position = "bottom", legend.key.width=unit(0.1,"npc"))  
  
## Vertical lines to show mass shootings  
gun\_stocks\_plot <- gun\_stocks\_plot + geom\_vline(data=us\_mass03, aes(xintercept=date), linetype=3)  
  
gun\_stocks\_plot <- gun\_stocks\_plot + labs(title = "Adjusted Stock Price US Gun Manufactures",   
 subtitle = "Mass Shootings with seven or more total victims",   
 caption = "Source: Yahoo finance and Kaggle's Mass Shooting in United States (2018-2022)")  
gun\_stocks\_plot <- gun\_stocks\_plot + ylab("Adjusted Stock Price")  
gun\_stocks\_plot <- gun\_stocks\_plot + scale\_x\_date(date\_breaks = "2 years", date\_labels = "%Y")  
  
gun\_stocks\_plot



ggsave("89plot07B.png")

## Saving 5 x 4 in image

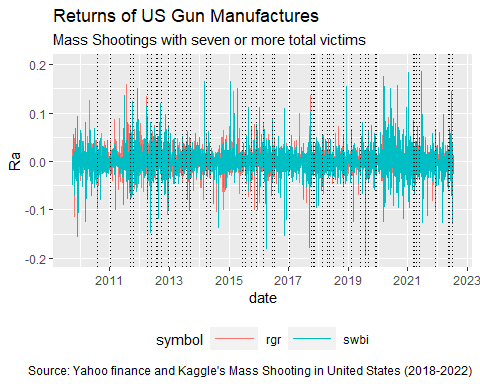
## Get stock returns

gun\_co\_returns <- gun\_co\_stocks %>% group\_by(symbol) %>% tq\_transmute(select = adjusted,   
 mutate\_fun = periodReturn,   
 period="daily",   
 col\_rename = "Ra")  
  
head(gun\_co\_returns)

## # A tibble: 6 × 3  
## # Groups: symbol [1]  
## symbol date Ra  
## <chr> <date> <dbl>  
## 1 rgr 2009-10-01 0   
## 2 rgr 2009-10-02 -0.0160   
## 3 rgr 2009-10-05 -0.00570  
## 4 rgr 2009-10-06 0.0254   
## 5 rgr 2009-10-07 0.00559  
## 6 rgr 2009-10-08 0.0175

## Plot of gun company returns

gun\_returns\_plot <- ggplot(data = gun\_co\_returns, aes(x=date, y=Ra, group=symbol))  
gun\_returns\_plot <- gun\_returns\_plot + geom\_line(aes(color=symbol))  
gun\_returns\_plot <- gun\_returns\_plot + theme(legend.position = "bottom")   
gun\_returns\_plot <- gun\_returns\_plot + theme(legend.position = "bottom", legend.key.width=unit(0.1,"npc"))  
  
## Vertical lines to show mass shootings  
gun\_returns\_plot <- gun\_returns\_plot + geom\_vline(data=us\_mass03, aes(xintercept=date), linetype=3)  
  
gun\_returns\_plot <- gun\_returns\_plot + labs(title = "Returns of US Gun Manufactures",   
 subtitle = "Mass Shootings with seven or more total victims",   
 caption = "Source: Yahoo finance and Kaggle's Mass Shooting in United States (2018-2022)")  
  
gun\_returns\_plot <- gun\_returns\_plot + ylab("Ra") + ylim(-0.2, 0.2)  
gun\_returns\_plot <- gun\_returns\_plot + scale\_x\_date(date\_breaks = "2 years", date\_labels = "%Y")  
  
gun\_returns\_plot



ggsave("89plot08B.png")

## Saving 5 x 4 in image

### Obtain market value (capitalization) for each company and create market value weighted index weight

library(rvest)

## Warning: package 'rvest' was built under R version 4.2.1

##   
## Attaching package: 'rvest'

## The following object is masked from 'package:readr':  
##   
## guess\_encoding

# Define stock name  
#stocks <- c("rgr", "swbi")  
#stocks <- c("rgr", "swbi", "oln", "npk", "bgfv", "axon" )  
  
Mkt\_Caps <- c()  
for(s in stocks){  
 # Extract and transform data  
 temp\_Co\_Metrics <- paste0("https://finance.yahoo.com/quote/", s) %>%   
 read\_html() %>% html\_table() %>% map\_df(bind\_cols) %>%   
 t() %>% as\_tibble()  
 # Set first row as column names  
 ###colnames(df) <- df[1,]  
 # Remove first row  
 ###df <- df[-1,]  
 # Add stock name column  
 ### df$Stock\_Name <- stock  
 temp\_Mkt\_Cap <- temp\_Co\_Metrics[2,9]  
 temp\_Cap\_Unit <- str\_extract(temp\_Mkt\_Cap, "[A-Z]")  
 temp\_Cap\_Amount <- as.numeric(str\_extract(temp\_Mkt\_Cap, "\\d\*\\.\\d\*"))  
 temp\_Cap\_Value <- case\_when(temp\_Cap\_Unit== "T" ~ temp\_Cap\_Amount\*1000\*1000,  
 temp\_Cap\_Unit== "B" ~ temp\_Cap\_Amount\*1000,  
 temp\_Cap\_Unit=="M" ~ temp\_Cap\_Amount\*1,  
 is.na(temp\_Cap\_Unit) ~ temp\_Cap\_Amount/(1000\*1000))  
 Mkt\_Caps <- append(Mkt\_Caps, temp\_Cap\_Value)  
 }

## Warning: The `x` argument of `as\_tibble.matrix()` must have unique column names if `.name\_repair` is omitted as of tibble 2.0.0.  
## Using compatibility `.name\_repair`.  
## This warning is displayed once every 8 hours.  
## Call `lifecycle::last\_lifecycle\_warnings()` to see where this warning was generated.

gun\_wts <- Mkt\_Caps/sum(Mkt\_Caps)  
#gun\_wts <- c(1/6, 1/6, 1/6, 1/6, 1/6, 1/6)  
  
co\_summary <- data.frame(stocks, Mkt\_Caps, gun\_wts)  
co\_summary

## stocks Mkt\_Caps gun\_wts  
## 1 rgr 1108.000 0.6480332  
## 2 swbi 601.789 0.3519668

### Create a portfolio of gun manufactures

gun\_co\_portfolio\_returns <- gun\_co\_returns %>%   
 tq\_portfolio(assets\_col = symbol,   
 returns\_col = Ra,   
 weights = gun\_wts,   
 col\_rename = "Ra")

## Warning: `spread\_()` was deprecated in tidyr 1.2.0.  
## Please use `spread()` instead.  
## This warning is displayed once every 8 hours.  
## Call `lifecycle::last\_lifecycle\_warnings()` to see where this warning was generated.

gun\_co\_portfolio\_returns <- gun\_co\_portfolio\_returns %>% tq\_mutate(select = Ra, mutate\_fun = SMA, n=2) %>%  
 rename(SMA.short = SMA) %>%  
 tq\_mutate(select = Ra, mutate\_fun = SMA, n=3) %>%  
 rename(SMA.long = SMA)  
   
  
  
gun\_co\_portfolio\_returns <- gun\_co\_portfolio\_returns %>% mutate(gunDD = Drawdowns(Ra)) %>%  
 mutate(gunDD=as.numeric(gunDD)) %>%  
 mutate(gunDD\_2day=lead(gunDD,2)) %>%  
 mutate(gunDD\_3day=lead(gunDD,3)) %>%  
 mutate(gunDD\_5day=lead(gunDD,5)) %>%  
 mutate(gunDD\_10day=lead(gunDD,10)) %>%  
 mutate(gunDD\_15day=lead(gunDD,15)) %>%  
 mutate(gunDD\_20day=lead(gunDD,20))

## Warning in merge.zoo(fx, .xts(, .index(x))): Index vectors are of different  
## classes: integer POSIXct

gun\_co\_portfolio\_returns <- gun\_co\_portfolio\_returns %>% mutate(Ra\_2day=frollmean(Ra,2)) %>%  
 mutate(Ra\_3day=frollmean(Ra,3)) %>%   
 mutate(Ra\_5day=frollmean(Ra,5)) %>%  
 mutate(Ra\_10day=frollmean(Ra,10))  
  
  
gun\_co\_portfolio\_returns <- gun\_co\_portfolio\_returns %>% mutate(Mom\_2day=lead(Ra,2) - Ra) %>%  
 mutate(Mom\_3day=lead(Ra,3) - Ra) %>%  
 mutate(Mom\_5day=lead(Ra,5) - Ra) %>%  
 mutate(Mom\_10day=lead(Ra,10) - Ra) %>%  
 mutate(Mom\_15day=lead(Ra,15) - Ra) %>%  
 mutate(Mom\_20day=lead(Ra,20) - Ra)  
  
gun\_co\_portfolio\_returns <- gun\_co\_portfolio\_returns %>% filter(date>="2010-01-01")  
  
head(gun\_co\_portfolio\_returns,20)

## # A tibble: 20 × 21  
## date Ra SMA.short SMA.long gunDD gunDD\_2day gunDD\_3day  
## <date> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 2010-01-04 0.0401 0.00675 0.0107 -0.209 -0.175 -0.174  
## 2 2010-01-05 0.0256 0.0329 0.0130 -0.189 -0.174 -0.179  
## 3 2010-01-06 0.0172 0.0214 0.0276 -0.175 -0.179 -0.178  
## 4 2010-01-07 0.00160 0.00940 0.0148 -0.174 -0.178 -0.188  
## 5 2010-01-08 -0.00688 -0.00264 0.00398 -0.179 -0.188 -0.182  
## 6 2010-01-11 0.00166 -0.00261 -0.00121 -0.178 -0.182 -0.182  
## 7 2010-01-12 -0.0122 -0.00526 -0.00580 -0.188 -0.182 -0.157  
## 8 2010-01-13 0.00701 -0.00258 -0.00117 -0.182 -0.157 -0.141  
## 9 2010-01-14 0.00103 0.00402 -0.00137 -0.182 -0.141 -0.165  
## 10 2010-01-15 0.0300 0.0155 0.0127 -0.157 -0.165 -0.178  
## 11 2010-01-19 0.0187 0.0243 0.0165 -0.141 -0.178 -0.183  
## 12 2010-01-20 -0.0271 -0.00421 0.00718 -0.165 -0.183 -0.180  
## 13 2010-01-21 -0.0158 -0.0214 -0.00807 -0.178 -0.180 -0.181  
## 14 2010-01-22 -0.00608 -0.0109 -0.0163 -0.183 -0.181 -0.181  
## 15 2010-01-25 0.00369 -0.00120 -0.00606 -0.180 -0.181 -0.193  
## 16 2010-01-26 -0.00181 0.000944 -0.00140 -0.181 -0.193 -0.212  
## 17 2010-01-27 0.000796 -0.000505 0.000894 -0.181 -0.212 -0.197  
## 18 2010-01-28 -0.0147 -0.00698 -0.00525 -0.193 -0.197 -0.192  
## 19 2010-01-29 -0.0243 -0.0195 -0.0127 -0.212 -0.192 -0.184  
## 20 2010-02-01 0.0196 -0.00235 -0.00648 -0.197 -0.184 -0.207  
## # … with 14 more variables: gunDD\_5day <dbl>, gunDD\_10day <dbl>,  
## # gunDD\_15day <dbl>, gunDD\_20day <dbl>, Ra\_2day <dbl>, Ra\_3day <dbl>,  
## # Ra\_5day <dbl>, Ra\_10day <dbl>, Mom\_2day <dbl>, Mom\_3day <dbl>,  
## # Mom\_5day <dbl>, Mom\_10day <dbl>, Mom\_15day <dbl>, Mom\_20day <dbl>

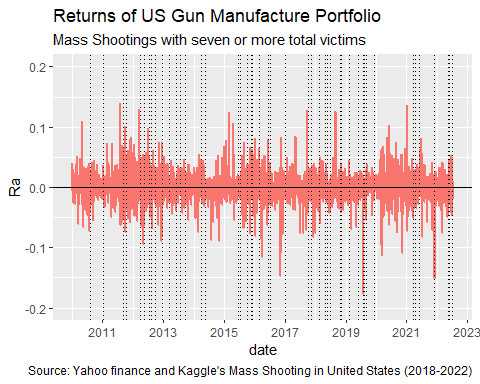
### Gun Portfolio statistics

gun\_portfolio\_stats <- table.Stats(gun\_co\_portfolio\_returns$Ra)  
gun\_portfolio\_stats

##   
## Observations 3155.0000  
## NAs 0.0000  
## Minimum -0.1775  
## Quartile 1 -0.0107  
## Median 0.0012  
## Arithmetic Mean 0.0009  
## Geometric Mean 0.0006  
## Quartile 3 0.0125  
## Maximum 0.1402  
## SE Mean 0.0004  
## LCL Mean (0.95) 0.0001  
## UCL Mean (0.95) 0.0017  
## Variance 0.0006  
## Stdev 0.0235  
## Skewness -0.1065  
## Kurtosis 5.8853

## Plot of gun portfolio returns

gun\_portfolio\_returns\_plot <- ggplot(data = gun\_co\_portfolio\_returns, aes(x=date, y=Ra))  
gun\_portfolio\_returns\_plot <- gun\_portfolio\_returns\_plot + geom\_line(aes(color="red"), size=1)  
gun\_portfolio\_returns\_plot <- gun\_portfolio\_returns\_plot + theme(legend.position = "none")  
  
## Vertical lines to show mass shootings  
gun\_portfolio\_returns\_plot <- gun\_portfolio\_returns\_plot + geom\_vline(data=us\_mass03, aes(xintercept=date), linetype=3)  
  
gun\_portfolio\_returns\_plot <- gun\_portfolio\_returns\_plot + labs(title = "Returns of US Gun Manufacture Portfolio",   
 subtitle = "Mass Shootings with seven or more total victims",   
 caption = "Source: Yahoo finance and Kaggle's Mass Shooting in United States (2018-2022)")  
gun\_portfolio\_returns\_plot <- gun\_portfolio\_returns\_plot + ylab("Ra") + ylim(-0.2, 0.2)  
gun\_portfolio\_returns\_plot <- gun\_portfolio\_returns\_plot + scale\_x\_date(date\_breaks = "2 years", date\_labels = "%Y")  
gun\_portfolio\_returns\_plot <- gun\_portfolio\_returns\_plot + geom\_hline(yintercept = 0, color="black")  
  
gun\_portfolio\_returns\_plot



ggsave("89plot09B.png")

## Saving 5 x 4 in image

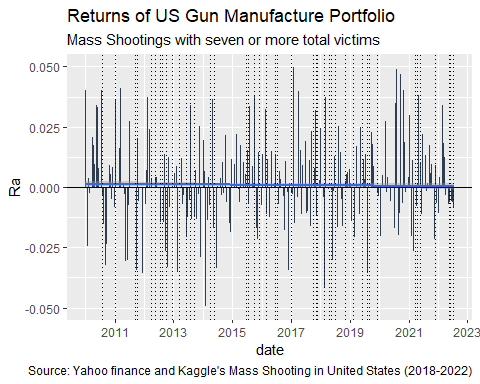
## Bar plot of portfolio returns

gun\_portfolio\_returns\_bars <- ggplot(data = gun\_co\_portfolio\_returns, aes(x=date, y=Ra))  
gun\_portfolio\_returns\_bars <- gun\_portfolio\_returns\_bars + geom\_bar(stat = "identity", fill=palette\_light()[[1]])  
gun\_portfolio\_returns\_bars <- gun\_portfolio\_returns\_bars + geom\_smooth(method = "lm")  
gun\_portfolio\_returns\_bars <- gun\_portfolio\_returns\_bars + theme(legend.position = "none")  
  
## Vertical lines to show mass shootings  
gun\_portfolio\_returns\_bars <- gun\_portfolio\_returns\_bars + geom\_vline(data=us\_mass03, aes(xintercept=date), linetype=3)  
  
gun\_portfolio\_returns\_bars <- gun\_portfolio\_returns\_bars + labs(title = "Returns of US Gun Manufacture Portfolio",   
 subtitle = "Mass Shootings with seven or more total victims",   
 caption = "Source: Yahoo finance and Kaggle's Mass Shooting in United States (2018-2022)")  
gun\_portfolio\_returns\_bars <- gun\_portfolio\_returns\_bars + ylab("Ra") + ylim(-0.05,0.05)  
gun\_portfolio\_returns\_bars <- gun\_portfolio\_returns\_bars + scale\_x\_date(date\_breaks = "2 years", date\_labels = "%Y")  
gun\_portfolio\_returns\_bars <- gun\_portfolio\_returns\_bars + geom\_hline(yintercept = 0, color="black")  
gun\_portfolio\_returns\_bars

## `geom\_smooth()` using formula 'y ~ x'

## Warning: Removed 140 rows containing non-finite values (stat\_smooth).

## Warning: Removed 140 rows containing missing values (position\_stack).



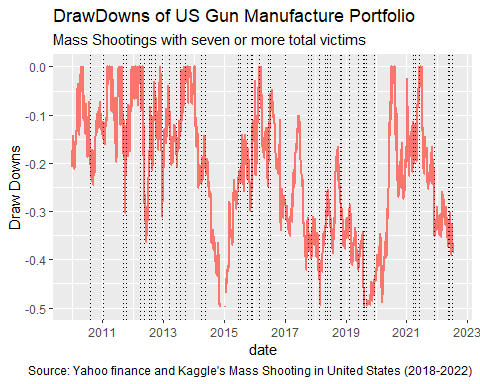
ggsave("89plot10B.png")

## Saving 5 x 4 in image  
## `geom\_smooth()` using formula 'y ~ x'

## Warning: Removed 140 rows containing non-finite values (stat\_smooth).  
## Removed 140 rows containing missing values (position\_stack).

## plot of portfolio drawdowsn

gun\_portfolio\_DD\_plot <- ggplot(data = gun\_co\_portfolio\_returns, aes(x=date, y=gunDD))  
gun\_portfolio\_DD\_plot <- gun\_portfolio\_DD\_plot + geom\_line(aes(color="red"), size=1)  
gun\_portfolio\_DD\_plot <- gun\_portfolio\_DD\_plot + theme(legend.position = "none")  
  
## Vertical lines to show mass shootings  
gun\_portfolio\_DD\_plot <- gun\_portfolio\_DD\_plot + geom\_vline(data=us\_mass03, aes(xintercept=date), linetype=3)  
  
gun\_portfolio\_DD\_plot <- gun\_portfolio\_DD\_plot + labs(title = "DrawDowns of US Gun Manufacture Portfolio",   
 subtitle = "Mass Shootings with seven or more total victims",   
 caption = "Source: Yahoo finance and Kaggle's Mass Shooting in United States (2018-2022)")  
gun\_portfolio\_DD\_plot <- gun\_portfolio\_DD\_plot + ylab("Draw Downs") + ylim(-0.5, 0)  
gun\_portfolio\_DD\_plot <- gun\_portfolio\_DD\_plot + scale\_x\_date(date\_breaks = "2 years", date\_labels = "%Y")  
  
gun\_portfolio\_DD\_plot

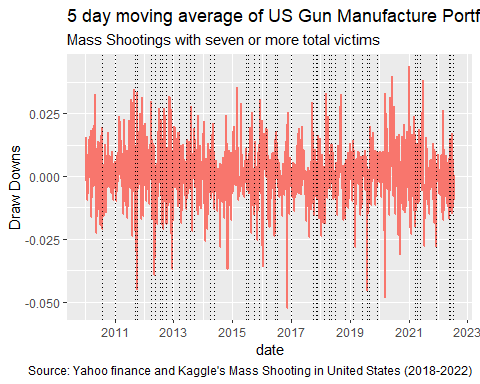


ggsave("89plot11B.png")

## Saving 5 x 4 in image

#### Portfolio return moving averages

gun\_portfolio\_RaAvg <- ggplot(data = gun\_co\_portfolio\_returns, aes(x=date, y=Ra\_5day))  
gun\_portfolio\_RaAvg <- gun\_portfolio\_RaAvg + geom\_line(aes(color="red"), size=1)  
gun\_portfolio\_RaAvg <- gun\_portfolio\_RaAvg + theme(legend.position = "none")  
  
## Vertical lines to show mass shootings  
gun\_portfolio\_RaAvg <- gun\_portfolio\_RaAvg + geom\_vline(data=us\_mass03, aes(xintercept=date), linetype=3)  
  
gun\_portfolio\_RaAvg <- gun\_portfolio\_RaAvg + labs(title = "5 day moving average of US Gun Manufacture Portfolio",   
 subtitle = "Mass Shootings with seven or more total victims",   
 caption = "Source: Yahoo finance and Kaggle's Mass Shooting in United States (2018-2022)")  
gun\_portfolio\_RaAvg <- gun\_portfolio\_RaAvg + ylab("Draw Downs")  
gun\_portfolio\_RaAvg <- gun\_portfolio\_RaAvg + scale\_x\_date(date\_breaks = "2 years", date\_labels = "%Y")  
  
gun\_portfolio\_RaAvg



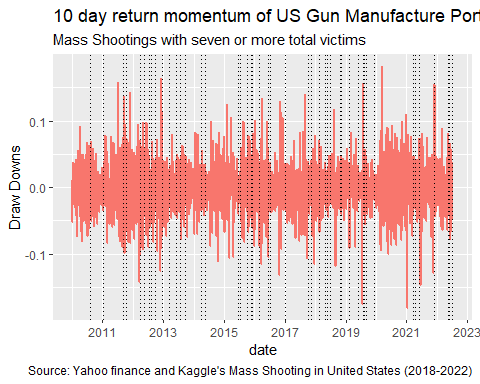
ggsave("89plot12B.png")

## Saving 5 x 4 in image

#### Portfolio return momentum

gun\_portfolio\_RaAvg <- ggplot(data = gun\_co\_portfolio\_returns, aes(x=date, y=Mom\_10day))  
gun\_portfolio\_RaAvg <- gun\_portfolio\_RaAvg + geom\_line(aes(color="red"), size=1)  
gun\_portfolio\_RaAvg <- gun\_portfolio\_RaAvg + theme(legend.position = "none")  
  
## Vertical lines to show mass shootings  
gun\_portfolio\_RaAvg <- gun\_portfolio\_RaAvg + geom\_vline(data=us\_mass03, aes(xintercept=date), linetype=3)  
  
gun\_portfolio\_RaAvg <- gun\_portfolio\_RaAvg + labs(title = "10 day return momentum of US Gun Manufacture Portfolio",   
 subtitle = "Mass Shootings with seven or more total victims",   
 caption = "Source: Yahoo finance and Kaggle's Mass Shooting in United States (2018-2022)")  
gun\_portfolio\_RaAvg <- gun\_portfolio\_RaAvg + ylab("Draw Downs")  
gun\_portfolio\_RaAvg <- gun\_portfolio\_RaAvg + scale\_x\_date(date\_breaks = "2 years", date\_labels = "%Y")  
  
gun\_portfolio\_RaAvg

## Warning: Removed 10 row(s) containing missing values (geom\_path).



ggsave("89plot13B.png")

## Saving 5 x 4 in image

## Warning: Removed 10 row(s) containing missing values (geom\_path).

## Portfolio’s Cumulative return

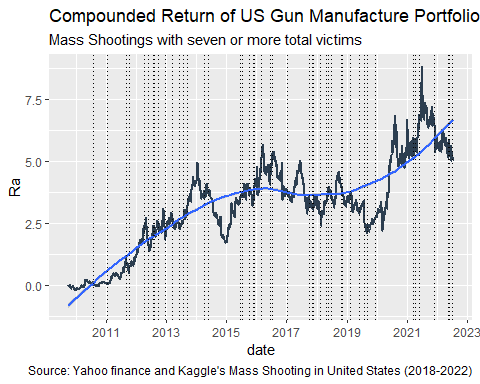
gun\_co\_portfolio\_growth <- gun\_co\_returns %>% tq\_portfolio(assets\_col = symbol, returns\_col = Ra, weights = gun\_wts, col\_rename = "investment.growth", wealth.index=TRUE)  
gun\_co\_portfolio\_growth$investment.growth <- gun\_co\_portfolio\_growth$investment.growth-1  
head(gun\_co\_portfolio\_growth)

## # A tibble: 6 × 2  
## date investment.growth  
## <date> <dbl>  
## 1 2009-10-01 0   
## 2 2009-10-02 -0.0270   
## 3 2009-10-05 -0.0348   
## 4 2009-10-06 -0.0159   
## 5 2009-10-07 -0.00746   
## 6 2009-10-08 0.000493

## Portfolio’s compounded return plot

gun\_portfolio\_cum\_return <- ggplot(data = gun\_co\_portfolio\_growth, aes(x=date, y=investment.growth))  
gun\_portfolio\_cum\_return <- gun\_portfolio\_cum\_return + geom\_line(size=1, color=palette\_light()[[1]])  
gun\_portfolio\_cum\_return <- gun\_portfolio\_cum\_return + geom\_smooth(method = "loess")  
gun\_portfolio\_cum\_return <- gun\_portfolio\_cum\_return + theme(legend.position = "none")  
  
## Vertical lines to show mass shootings  
gun\_portfolio\_cum\_return <- gun\_portfolio\_cum\_return + geom\_vline(data=us\_mass03, aes(xintercept=date), linetype=3)  
  
gun\_portfolio\_cum\_return <- gun\_portfolio\_cum\_return + labs(title = "Compounded Return of US Gun Manufacture Portfolio",   
 subtitle = "Mass Shootings with seven or more total victims",   
 caption = "Source: Yahoo finance and Kaggle's Mass Shooting in United States (2018-2022)")  
gun\_portfolio\_cum\_return <- gun\_portfolio\_cum\_return + ylab("Ra")   
gun\_portfolio\_cum\_return <- gun\_portfolio\_cum\_return + scale\_x\_date(date\_breaks = "2 years", date\_labels = "%Y")  
  
gun\_portfolio\_cum\_return

## `geom\_smooth()` using formula 'y ~ x'



ggsave("89plot14B.png")

## Saving 5 x 4 in image  
## `geom\_smooth()` using formula 'y ~ x'

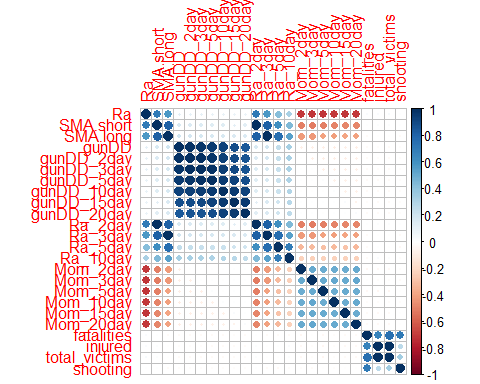
#### Join portfolio dataframe with mass shooting dataframe

temp\_mass\_dates <- us\_mass02 %>% filter(total\_victims >= 7) %>% select("date", "fatalities", "injured", "total\_victims")  
merged\_df <- merge(gun\_co\_portfolio\_returns, temp\_mass\_dates, by.x = "date", by.y = "date", all.x = TRUE)  
merged\_df <- merged\_df %>% replace\_na(list(fatalities=0, injured=0, total\_victims=0)) %>%  
 mutate(shooting = ifelse(total\_victims>0,1,0))  
merged\_df2 <- merged\_df %>% drop\_na(Mom\_20day) %>% drop\_na(Ra\_10day)  
tail(merged\_df2, 200)

## date Ra SMA.short SMA.long gunDD gunDD\_2day  
## 2937 2021-08-31 -8.077537e-03 -8.230895e-03 -7.680736e-04 -0.1798142 -0.2169876  
## 2938 2021-09-01 1.360854e-02 2.765502e-03 -9.510831e-04 -0.1686527 -0.2129563  
## 2939 2021-09-02 -5.814051e-02 -2.226598e-02 -1.753650e-02 -0.2169876 -0.2280165  
## 2940 2021-09-03 5.148430e-03 -2.649604e-02 -1.312784e-02 -0.2129563 -0.2415241  
## 2941 2021-09-07 -1.913506e-02 -6.993313e-03 -2.404238e-02 -0.2280165 -0.2276345  
## 2942 2021-09-08 -1.749730e-02 -1.831618e-02 -1.049464e-02 -0.2415241 -0.2342855  
## 2943 2021-09-09 1.831249e-02 4.075942e-04 -6.106623e-03 -0.2276345 -0.2390815  
## 2944 2021-09-10 -8.611170e-03 4.850662e-03 -2.598660e-03 -0.2342855 -0.2535572  
## 2945 2021-09-13 -6.263470e-03 -7.437320e-03 1.145951e-03 -0.2390815 -0.2426638  
## 2946 2021-09-14 -1.902394e-02 -1.264370e-02 -1.129953e-02 -0.2535572 -0.2492617  
## 2947 2021-09-15 1.459374e-02 -2.215101e-03 -3.564557e-03 -0.2426638 -0.2361135  
## 2948 2021-09-16 -8.712037e-03 2.940849e-03 -4.380746e-03 -0.2492617 -0.2429015  
## 2949 2021-09-17 1.751367e-02 4.400816e-03 7.798456e-03 -0.2361135 -0.2410449  
## 2950 2021-09-20 -8.886095e-03 4.313788e-03 -2.815403e-05 -0.2429015 -0.2368405  
## 2951 2021-09-21 2.452226e-03 -3.216934e-03 3.693267e-03 -0.2410449 -0.2271074  
## 2952 2021-09-22 5.539723e-03 3.995975e-03 -2.980485e-04 -0.2368405 -0.2248959  
## 2953 2021-09-23 1.275376e-02 9.146739e-03 6.915235e-03 -0.2271074 -0.2178635  
## 2954 2021-09-24 2.861296e-03 7.807525e-03 7.051591e-03 -0.2248959 -0.2313153  
## 2955 2021-09-27 9.072930e-03 5.967113e-03 8.229327e-03 -0.2178635 -0.2269890  
## 2956 2021-09-28 -1.719880e-02 -4.062935e-03 -1.754858e-03 -0.2313153 -0.2440117  
## 2957 2021-09-29 5.628096e-03 -5.785352e-03 -8.325916e-04 -0.2269890 -0.2311457  
## 2958 2021-09-30 -2.202129e-02 -8.196600e-03 -1.119733e-02 -0.2440117 -0.2328213  
## 2959 2021-10-01 1.701887e-02 -2.501211e-03 2.085578e-04 -0.2311457 -0.2233931  
## 2960 2021-10-04 -2.179432e-03 7.419721e-03 -2.393951e-03 -0.2328213 -0.2366971  
## 2961 2021-10-05 1.228954e-02 5.055056e-03 9.042995e-03 -0.2233931 -0.2188620  
## 2962 2021-10-06 -1.713097e-02 -2.420714e-03 -2.340286e-03 -0.2366971 -0.2256841  
## 2963 2021-10-07 2.336561e-02 3.117320e-03 6.174727e-03 -0.2188620 -0.2251005  
## 2964 2021-10-08 -8.733444e-03 7.316083e-03 -8.329348e-04 -0.2256841 -0.2175697  
## 2965 2021-10-11 7.536187e-04 -3.989913e-03 5.128595e-03 -0.2251005 -0.2203637  
## 2966 2021-10-12 9.718441e-03 5.236030e-03 5.795386e-04 -0.2175697 -0.2025389  
## 2967 2021-10-13 -3.570853e-03 3.073794e-03 2.300402e-03 -0.2203637 -0.2103017  
## 2968 2021-10-14 2.286290e-02 9.646021e-03 9.670161e-03 -0.2025389 -0.2002956  
## 2969 2021-10-15 -9.734398e-03 6.564249e-03 3.185882e-03 -0.2103017 -0.1945428  
## 2970 2021-10-18 1.267085e-02 1.468227e-03 8.599784e-03 -0.2002956 -0.1966052  
## 2971 2021-10-19 7.193581e-03 9.932216e-03 3.376678e-03 -0.1945428 -0.1927670  
## 2972 2021-10-20 -2.560505e-03 2.316538e-03 5.767976e-03 -0.1966052 -0.1903428  
## 2973 2021-10-21 4.777447e-03 1.108471e-03 3.136841e-03 -0.1927670 -0.1772607  
## 2974 2021-10-22 3.003112e-03 3.890280e-03 1.740018e-03 -0.1903428 -0.1951025  
## 2975 2021-10-25 1.615763e-02 9.580373e-03 7.979397e-03 -0.1772607 -0.2162990  
## 2976 2021-10-26 -2.168590e-02 -2.764136e-03 -8.417199e-04 -0.1951025 -0.2102243  
## 2977 2021-10-27 -2.633435e-02 -2.401013e-02 -1.062087e-02 -0.2162990 -0.1982377  
## 2978 2021-10-28 7.751267e-03 -9.291541e-03 -1.342300e-02 -0.2102243 -0.1949900  
## 2979 2021-10-29 1.517722e-02 1.146424e-02 -1.135288e-03 -0.1982377 -0.1976315  
## 2980 2021-11-01 4.050736e-03 9.613977e-03 8.993074e-03 -0.1949900 -0.1639693  
## 2981 2021-11-02 -3.281312e-03 3.847120e-04 5.315547e-03 -0.1976315 -0.2231010  
## 2982 2021-11-03 4.195346e-02 1.933607e-02 1.424096e-02 -0.1639693 -0.2362730  
## 2983 2021-11-04 -7.072903e-02 -1.438779e-02 -1.068563e-02 -0.2231010 -0.2439596  
## 2984 2021-11-05 -1.695466e-02 -4.384184e-02 -1.524341e-02 -0.2362730 -0.2350285  
## 2985 2021-11-08 -1.006451e-02 -1.350958e-02 -3.258273e-02 -0.2439596 -0.2400941  
## 2986 2021-11-09 1.181293e-02 8.742123e-04 -5.068744e-03 -0.2350285 -0.2355086  
## 2987 2021-11-10 -6.621947e-03 2.595492e-03 -1.624507e-03 -0.2400941 -0.2270328  
## 2988 2021-11-11 6.034295e-03 -2.938260e-04 3.741759e-03 -0.2355086 -0.2100890  
## 2989 2021-11-12 1.108688e-02 8.560589e-03 3.499744e-03 -0.2270328 -0.1924845  
## 2990 2021-11-15 2.192039e-02 1.650364e-02 1.301386e-02 -0.2100890 -0.1997517  
## 2991 2021-11-16 2.228672e-02 2.210356e-02 1.843133e-02 -0.1924845 -0.2170803  
## 2992 2021-11-17 -8.999417e-03 6.643652e-03 1.173590e-02 -0.1997517 -0.2094237  
## 2993 2021-11-18 -2.165401e-02 -1.532671e-02 -2.788901e-03 -0.2170803 -0.2185082  
## 2994 2021-11-19 9.779462e-03 -5.937273e-03 -6.957988e-03 -0.2094237 -0.2318057  
## 2995 2021-11-22 -1.149099e-02 -8.557645e-04 -7.788512e-03 -0.2185082 -0.2288409  
## 2996 2021-11-23 -1.701550e-02 -1.425325e-02 -6.242344e-03 -0.2318057 -0.2416034  
## 2997 2021-11-24 3.859407e-03 -6.578049e-03 -8.215696e-03 -0.2288409 -0.2422079  
## 2998 2021-11-26 -1.654975e-02 -6.345173e-03 -9.901950e-03 -0.2416034 -0.2354148  
## 2999 2021-11-29 -7.969902e-04 -8.673372e-03 -4.495779e-03 -0.2422079 -0.2462993  
## 3000 2021-11-30 8.964308e-03 4.083659e-03 -2.794145e-03 -0.2354148 -0.2350010  
## 3001 2021-12-01 -1.423587e-02 -2.635782e-03 -2.022852e-03 -0.2462993 -0.3506227  
## 3002 2021-12-02 1.499047e-02 3.772987e-04 3.239635e-03 -0.2350010 -0.3414655  
## 3003 2021-12-03 -1.511396e-01 -6.807458e-02 -5.012834e-02 -0.3506227 -0.3276279  
## 3004 2021-12-06 1.410150e-02 -6.851906e-02 -4.068255e-02 -0.3414655 -0.3233455  
## 3005 2021-12-07 2.101271e-02 1.755710e-02 -3.867514e-02 -0.3276279 -0.3249996  
## 3006 2021-12-08 6.369057e-03 1.369088e-02 1.382776e-02 -0.3233455 -0.3347326  
## 3007 2021-12-09 -2.444581e-03 1.962238e-03 8.312396e-03 -0.3249996 -0.3390153  
## 3008 2021-12-10 -1.441920e-02 -8.431889e-03 -3.498240e-03 -0.3347326 -0.3344488  
## 3009 2021-12-13 -6.437524e-03 -1.042836e-02 -7.767101e-03 -0.3390153 -0.3166630  
## 3010 2021-12-14 6.908614e-03 2.355451e-04 -4.649369e-03 -0.3344488 -0.3203572  
## 3011 2021-12-15 2.672340e-02 1.681601e-02 9.064831e-03 -0.3166630 -0.3178102  
## 3012 2021-12-16 -5.406075e-03 1.065866e-02 9.408647e-03 -0.3203572 -0.3381088  
## 3013 2021-12-17 3.747531e-03 -8.292719e-04 8.354953e-03 -0.3178102 -0.3283281  
## 3014 2021-12-20 -2.975510e-02 -1.300379e-02 -1.047122e-02 -0.3381088 -0.3215956  
## 3015 2021-12-21 1.477696e-02 -7.489074e-03 -3.743539e-03 -0.3283281 -0.3237155  
## 3016 2021-12-22 1.002339e-02 1.240017e-02 -1.651585e-03 -0.3215956 -0.3179891  
## 3017 2021-12-23 -3.124822e-03 3.449285e-03 7.225175e-03 -0.3237155 -0.3194112  
## 3018 2021-12-27 8.467544e-03 2.671361e-03 5.122038e-03 -0.3179891 -0.3157314  
## 3019 2021-12-28 -2.085202e-03 3.191171e-03 1.085840e-03 -0.3194112 -0.3120895  
## 3020 2021-12-29 5.406818e-03 1.660808e-03 3.929720e-03 -0.3157314 -0.3091221  
## 3021 2021-12-30 5.322262e-03 5.364540e-03 2.881293e-03 -0.3120895 -0.2998556  
## 3022 2021-12-31 4.313596e-03 4.817929e-03 5.014225e-03 -0.3091221 -0.2883612  
## 3023 2022-01-03 1.341271e-02 8.863151e-03 7.682854e-03 -0.2998556 -0.3034642  
## 3024 2022-01-04 1.641713e-02 1.491492e-02 1.138114e-02 -0.2883612 -0.3032768  
## 3025 2022-01-05 -2.122274e-02 -2.402803e-03 2.869033e-03 -0.3034642 -0.3107150  
## 3026 2022-01-06 2.690625e-04 -1.047684e-02 -1.512181e-03 -0.3032768 -0.3085638  
## 3027 2022-01-07 -1.067609e-02 -5.203512e-03 -1.054325e-02 -0.3107150 -0.3134304  
## 3028 2022-01-10 3.120974e-03 -3.777556e-03 -2.428683e-03 -0.3085638 -0.3199211  
## 3029 2022-01-11 -7.038349e-03 -1.958688e-03 -4.864487e-03 -0.3134304 -0.3118850  
## 3030 2022-01-12 -9.453911e-03 -8.246130e-03 -4.457095e-03 -0.3199211 -0.3196276  
## 3031 2022-01-13 1.181644e-02 1.181266e-03 -1.558606e-03 -0.3118850 -0.3291338  
## 3032 2022-01-14 -1.125187e-02 2.822843e-04 -2.963114e-03 -0.3196276 -0.3264223  
## 3033 2022-01-18 -1.397205e-02 -1.261196e-02 -4.469159e-03 -0.3291338 -0.3382415  
## 3034 2022-01-19 4.041799e-03 -4.965123e-03 -7.060707e-03 -0.3264223 -0.3371291  
## 3035 2022-01-20 -1.754694e-02 -6.752572e-03 -9.159063e-03 -0.3382415 -0.3152335  
## 3036 2022-01-21 1.681007e-03 -7.932968e-03 -3.941379e-03 -0.3371291 -0.3241289  
## 3037 2022-01-24 3.303150e-02 1.735625e-02 5.721853e-03 -0.3152335 -0.3450277  
## 3038 2022-01-25 -1.299048e-02 1.002051e-02 7.240676e-03 -0.3241289 -0.3488155  
## 3039 2022-01-26 -3.092121e-02 -2.195584e-02 -3.626730e-03 -0.3450277 -0.3292037  
## 3040 2022-01-27 -5.783262e-03 -1.835224e-02 -1.656498e-02 -0.3488155 -0.3219553  
## 3041 2022-01-28 3.011713e-02 1.216694e-02 -2.195780e-03 -0.3292037 -0.3277821  
## 3042 2022-01-31 1.080567e-02 2.046140e-02 1.171318e-02 -0.3219553 -0.3241797  
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## 3048 2022-02-08 1.363741e-02 9.270520e-03 5.215759e-03 -0.3217451 -0.3204105  
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## 3050 2022-02-10 -9.240830e-03 1.036119e-03 5.236551e-03 -0.3204105 -0.3030247  
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## 3052 2022-02-14 4.830137e-03 1.274150e-02 5.414059e-03 -0.3030247 -0.3182698  
## 3053 2022-02-15 -5.369116e-03 -2.694894e-04 6.704631e-03 -0.3067669 -0.3294748  
## 3054 2022-02-16 -1.659318e-02 -1.098115e-02 -5.710720e-03 -0.3182698 -0.3258887  
## 3055 2022-02-17 -1.643616e-02 -1.651467e-02 -1.279948e-02 -0.3294748 -0.3532179  
## 3056 2022-02-18 5.348217e-03 -5.543970e-03 -9.227041e-03 -0.3258887 -0.3481616  
## 3057 2022-02-22 -4.054102e-02 -1.759640e-02 -1.720965e-02 -0.3532179 -0.3259635  
## 3058 2022-02-23 7.817646e-03 -1.636169e-02 -9.125054e-03 -0.3481616 -0.3031071  
## 3059 2022-02-24 3.405459e-02 2.093612e-02 4.437365e-04 -0.3259635 -0.2768899  
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## 3061 2022-02-28 3.762008e-02 3.576490e-02 3.519480e-02 -0.2768899 -0.2581110  
## 3062 2022-03-01 3.346530e-03 2.048331e-02 2.495878e-02 -0.2744700 -0.2593519  
## 3063 2022-03-02 2.254762e-02 1.294708e-02 2.117141e-02 -0.2581110 -0.3163998  
## 3064 2022-03-03 -1.672638e-03 1.043749e-02 8.073837e-03 -0.2593519 -0.3200816  
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## 3068 2022-03-09 4.106039e-02 7.213983e-03 3.014017e-03 -0.3110152 -0.3010643  
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## 3070 2022-03-11 -3.829900e-03 7.256555e-03 1.852450e-02 -0.3010643 -0.3022663  
## 3071 2022-03-14 1.475880e-02 5.464448e-03 9.757302e-03 -0.2907489 -0.2812767  
## 3072 2022-03-15 -1.623885e-02 -7.400252e-04 -1.769983e-03 -0.3022663 -0.2722722  
## 3073 2022-03-16 3.008255e-02 6.921851e-03 9.534166e-03 -0.2812767 -0.2638328  
## 3074 2022-03-17 1.252847e-02 2.130551e-02 8.790724e-03 -0.2722722 -0.2836649  
## 3075 2022-03-18 1.159690e-02 1.206269e-02 1.806931e-02 -0.2638328 -0.2748066  
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## 3077 2022-03-22 1.236615e-02 -7.286732e-03 -9.921871e-04 -0.2748066 -0.2932294  
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## 3079 2022-03-24 -1.952120e-03 -1.272497e-02 -4.361264e-03 -0.2932294 -0.3011741  
## 3080 2022-03-25 7.421154e-03 2.734517e-03 -6.009597e-03 -0.2879844 -0.2924121  
## 3081 2022-03-28 -1.852452e-02 -5.551684e-03 -4.351830e-03 -0.3011741 -0.3059898  
## 3082 2022-03-29 1.253822e-02 -2.993150e-03 4.782847e-04 -0.2924121 -0.3143863  
## 3083 2022-03-30 -1.918876e-02 -3.325268e-03 -8.391686e-03 -0.3059898 -0.3050860  
## 3084 2022-03-31 -1.209850e-02 -1.564363e-02 -6.249680e-03 -0.3143863 -0.3073722  
## 3085 2022-04-01 1.356493e-02 7.332122e-04 -5.907445e-03 -0.3050860 -0.3218137  
## 3086 2022-04-04 -3.289937e-03 5.137496e-03 -6.078376e-04 -0.3073722 -0.3281123  
## 3087 2022-04-05 -2.085023e-02 -1.207008e-02 -3.525080e-03 -0.3218137 -0.3079549  
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## 3093 2022-04-13 8.486171e-03 6.119245e-03 7.562011e-04 -0.2995970 -0.2991507  
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## 3095 2022-04-18 3.775628e-03 3.245039e-04 3.045060e-03 -0.2991507 -0.2915912  
## 3096 2022-04-19 1.413761e-02 8.956621e-03 4.928874e-03 -0.2892424 -0.2987852  
## 3097 2022-04-20 -3.304668e-03 5.416473e-03 4.869525e-03 -0.2915912 -0.3096592  
## 3098 2022-04-21 -1.015518e-02 -6.729922e-03 2.259231e-04 -0.2987852 -0.2973402  
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## 3105 2022-05-02 2.213415e-02 2.626207e-03 3.179998e-03 -0.3244092 -0.3118801  
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## 3108 2022-05-05 -4.977174e-02 -1.658719e-02 -1.041937e-02 -0.3461290 -0.3544124  
## 3109 2022-05-06 -1.440846e-02 -3.209010e-02 -1.586095e-02 -0.3555503 -0.3637072  
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## 3111 2022-05-10 -1.439735e-02 -6.315827e-03 -9.013372e-03 -0.3637072 -0.3577107  
## 3112 2022-05-11 -7.124370e-03 -1.076086e-02 -6.585341e-03 -0.3682403 -0.3501096  
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## 3117 2022-05-18 -4.705813e-02 -1.567714e-02 -1.085577e-02 -0.3717298 -0.3641196  
## 3118 2022-05-19 -4.279272e-03 -2.566870e-02 -1.187785e-02 -0.3744183 -0.3679892  
## 3119 2022-05-20 1.646262e-02 6.091673e-03 -1.162493e-02 -0.3641196 -0.3670495  
## 3120 2022-05-23 -6.085440e-03 5.188589e-03 2.032636e-03 -0.3679892 -0.3373553  
## 3121 2022-05-24 1.486801e-03 -2.299320e-03 3.954660e-03 -0.3670495 -0.3273217  
## 3122 2022-05-25 4.691398e-02 2.420039e-02 1.410511e-02 -0.3373553 -0.3273566  
## 3123 2022-05-26 1.514174e-02 3.102786e-02 2.118084e-02 -0.3273217 -0.3190439  
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## 3127 2022-06-02 3.477259e-02 1.300112e-02 1.278681e-02 -0.3015452 -0.3313196  
## 3128 2022-06-03 -2.950908e-02 2.631753e-03 -1.168944e-03 -0.3221559 -0.3259278  
## 3129 2022-06-06 -1.351881e-02 -2.151394e-02 -2.751767e-03 -0.3313196 -0.3345690  
## 3130 2022-06-07 8.063399e-03 -2.727705e-03 -1.165483e-02 -0.3259278 -0.3315121  
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## 3133 2022-06-10 -2.797788e-03 8.980098e-04 -3.674483e-03 -0.3333824 -0.3532928  
## 3134 2022-06-13 -2.991688e-02 -1.635733e-02 -9.373620e-03 -0.3533255 -0.3501417  
## 3135 2022-06-14 5.069507e-05 -1.493309e-02 -1.088799e-02 -0.3532928 -0.3782572  
## 3136 2022-06-15 4.872537e-03 2.461616e-03 -8.331216e-03 -0.3501417 -0.3817369  
## gunDD\_3day gunDD\_5day gunDD\_10day gunDD\_15day gunDD\_20day Ra\_2day  
## 2937 -0.2129563 -0.2415241 -0.2426638 -0.2368405 -0.2269890 -8.230895e-03  
## 2938 -0.2280165 -0.2276345 -0.2492617 -0.2271074 -0.2440117 2.765502e-03  
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## 2940 -0.2276345 -0.2390815 -0.2429015 -0.2178635 -0.2328213 -2.649604e-02  
## 2941 -0.2342855 -0.2535572 -0.2410449 -0.2313153 -0.2233931 -6.993313e-03  
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## 2974 1.740018e-03 5.016897e-03 4.511419e-03 -2.468902e-02 -2.933746e-02  
## 2975 7.979397e-03 5.714254e-03 6.051821e-03 -4.249198e-02 -8.406366e-03  
## 2976 -8.417199e-04 -6.164349e-05 2.911386e-03 2.943717e-02 3.686312e-02  
## 2977 -1.062087e-02 -4.816413e-03 6.350364e-04 4.151157e-02 3.038509e-02  
## 2978 -1.342300e-02 -4.221648e-03 -8.761265e-04 -3.700532e-03 -1.103258e-02  
## 2979 -1.135288e-03 -1.786827e-03 1.615035e-03 -1.845853e-02 2.677624e-02  
## 2980 8.993074e-03 -4.208207e-03 7.530234e-04 3.790272e-02 -7.477977e-02  
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## 2985 -3.258273e-02 -1.181521e-02 -8.011708e-03 3.442559e-03 1.609880e-02  
## 2986 -5.068744e-03 -8.796361e-03 -4.661825e-03 -5.778636e-03 -7.260475e-04  
## 2987 -1.624507e-03 -1.851144e-02 -2.690584e-03 1.770883e-02 2.854234e-02  
## 2988 3.741759e-03 -3.158777e-03 -2.862282e-03 1.588610e-02 1.625243e-02  
## 2989 3.499744e-03 2.449531e-03 -3.271315e-03 1.119984e-02 -2.008630e-02  
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## 2993 -2.788901e-03 4.928114e-03 8.846686e-04 1.016302e-02 4.638504e-03  
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## 2997 -8.215696e-03 -7.304327e-03 1.580724e-03 -4.656397e-03 5.104901e-03  
## 2998 -9.901950e-03 -6.283476e-03 -6.776809e-04 2.551406e-02 2.313881e-03  
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## 3001 -2.022852e-03 -3.751780e-03 -6.813936e-03 -1.369037e-01 2.833737e-02  
## 3002 3.239635e-03 -1.525568e-03 -4.414947e-03 -8.889742e-04 6.022242e-03  
## 3003 -5.012834e-02 -2.844354e-02 -1.736351e-02 1.721523e-01 1.575087e-01  
## 3004 -4.068255e-02 -2.546384e-02 -1.693131e-02 -7.732438e-03 -1.654608e-02  
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## 3008 -3.498240e-03 4.923898e-03 -1.175982e-02 2.132781e-02 4.114260e-02  
## 3009 -7.767101e-03 8.160936e-04 -1.232388e-02 3.316093e-02 1.031449e-03  
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## 3011 9.064831e-03 2.066143e-03 -8.433517e-03 -2.297587e-02 -5.647850e-02  
## 3012 9.408647e-03 1.473844e-03 -1.047317e-02 -2.434903e-02 2.018303e-02  
## 3013 8.354953e-03 5.107190e-03 5.015544e-03 1.102942e-02 6.275861e-03  
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## 3015 -3.743539e-03 2.017342e-03 6.308027e-06 -1.790178e-02 -6.309411e-03  
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## 3018 5.122038e-03 7.759336e-05 2.592391e-03 -3.060726e-03 -3.145282e-03  
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## 3020 3.929720e-03 3.737546e-03 2.877444e-03 -1.093222e-03 8.005888e-03  
## 3021 2.881293e-03 2.797320e-03 7.373301e-04 8.090444e-03 1.109487e-02  
## 3022 5.014225e-03 4.285004e-03 1.709297e-03 1.210354e-02 -2.553633e-02  
## 3023 7.682854e-03 5.274036e-03 2.675815e-03 -3.463544e-02 -1.314364e-02  
## 3024 1.138114e-02 8.974503e-03 7.293038e-03 -1.614807e-02 -2.709322e-02  
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## 3052 5.414059e-03 8.238532e-03 2.809608e-03 -2.142332e-02 -2.126629e-02  
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## 3133 -3.674483e-03 -3.295772e-03 -7.679335e-04 2.848483e-03 7.670325e-03  
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## Mom\_5day Mom\_10day Mom\_15day Mom\_20day fatalities injured  
## 2937 -9.419768e-03 0.0226712731 0.0136172603 0.0137056325 0 0  
## 2938 4.703953e-03 -0.0223205777 -0.0008547853 -0.0356298353 0 0  
## 2939 4.952934e-02 0.0756541759 0.0610018013 0.0751593784 0 0  
## 2940 -1.141190e-02 -0.0140345254 0.0039244995 -0.0073278620 0 0  
## 2941 1.111178e-04 0.0215872824 0.0019362559 0.0314245987 0 0  
## 2942 3.209104e-02 0.0230370280 0.0231254003 0.0003663350 0 0  
## 2943 -2.702453e-02 -0.0055587379 -0.0403337880 0.0050531162 0 0  
## 2944 2.612484e-02 0.0114724652 0.0256300423 -0.0001222744 0 0  
## 2945 -2.622625e-03 0.0153363997 0.0040840381 0.0070170885 0 0  
## 2946 2.147616e-02 0.0018251380 0.0313134809 0.0287423793 0 0  
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## 3102 0 0  
## 3103 0 0  
## 3104 0 0  
## 3105 0 0  
## 3106 0 0  
## 3107 0 0  
## 3108 0 0  
## 3109 0 0  
## 3110 0 0  
## 3111 0 0  
## 3112 0 0  
## 3113 0 0  
## 3114 0 0  
## 3115 13 1  
## 3116 0 0  
## 3117 0 0  
## 3118 0 0  
## 3119 0 0  
## 3120 0 0  
## 3121 39 1  
## 3122 0 0  
## 3123 0 0  
## 3124 0 0  
## 3125 0 0  
## 3126 0 0  
## 3127 0 0  
## 3128 0 0  
## 3129 0 0  
## 3130 0 0  
## 3131 0 0  
## 3132 0 0  
## 3133 0 0  
## 3134 0 0  
## 3135 0 0  
## 3136 0 0

#### correlation

corrplot::corrplot(cor(merged\_df2[,-1]))



ggsave("89plot15B.png")

## Saving 5 x 4 in image

## `geom\_smooth()` using formula 'y ~ x'

#### Splitting data set in trainig and test set

merged\_df\_train <- merged\_df2 %>% filter(date<="2019-12-31")  
  
merged\_df\_test <- merged\_df2 %>% filter(date > "2019-12-31")  
head(merged\_df\_test)

## date Ra SMA.short SMA.long gunDD gunDD\_2day  
## 1 2020-01-02 0.0004492599 0.003527722 0.0031873752 -0.4363904 -0.4183317  
## 2 2020-01-03 0.0101585846 0.005303922 0.0057380098 -0.4306649 -0.4217553  
## 3 2020-01-06 0.0216624332 0.015910509 0.0107567593 -0.4183317 -0.4125968  
## 4 2020-01-07 -0.0058858140 0.007888310 0.0086450679 -0.4217553 -0.4181984  
## 5 2020-01-08 0.0158384598 0.004976323 0.0105383597 -0.4125968 -0.4209632  
## 6 2020-01-09 -0.0095361833 0.003151138 0.0001388208 -0.4181984 -0.4113746  
## gunDD\_3day gunDD\_5day gunDD\_10day gunDD\_15day gunDD\_20day Ra\_2day  
## 1 -0.4217553 -0.4181984 -0.3882139 -0.4130340 -0.4104515 0.003527722  
## 2 -0.4125968 -0.4209632 -0.4007050 -0.4130638 -0.4115651 0.005303922  
## 3 -0.4181984 -0.4113746 -0.4046009 -0.4076978 -0.4000556 0.015910509  
## 4 -0.4209632 -0.4036779 -0.4100610 -0.4022920 -0.3859103 0.007888310  
## 5 -0.4113746 -0.3941886 -0.4073576 -0.4015421 -0.3725415 0.004976323  
## 6 -0.4036779 -0.3882139 -0.4130340 -0.4104515 -0.3846337 0.003151138  
## Ra\_3day Ra\_5day Ra\_10day Mom\_2day Mom\_3day  
## 1 0.0031873752 0.0003511159 0.001072329 0.021213173 -0.0063350739  
## 2 0.0057380098 0.0034100880 0.002002773 -0.016044399 0.0056798752  
## 3 0.0107567593 0.0082766287 0.003057090 -0.005823973 -0.0311986165  
## 4 0.0086450679 0.0065981297 0.002367205 -0.003650369 0.0011336597  
## 5 0.0105383597 0.0084445847 0.004302138 -0.020590614 0.0007212137  
## 6 0.0001388208 0.0064474961 0.003399306 0.026095857 0.0226117837  
## Mom\_5day Mom\_10day Mom\_15day Mom\_20day fatalities injured  
## 1 -9.985443e-03 9.413029e-03 -0.01002743 -0.015336623 0 0  
## 2 -1.491074e-02 -3.057602e-02 -0.01020944 -0.012047351 0 0  
## 3 -5.102760e-03 -2.816327e-02 -0.01251996 -0.002102954 0 0  
## 4 1.896141e-02 -3.284619e-03 0.01501253 0.029463417 0 0  
## 5 7.464955e-05 -1.125591e-02 -0.01458377 0.005931735 0 0  
## 6 1.939847e-02 -4.198829e-05 -0.00535118 -0.009735516 0 0  
## total\_victims shooting  
## 1 0 0  
## 2 0 0  
## 3 0 0  
## 4 0 0  
## 5 0 0  
## 6 0 0

#### Linear regressions

##### SMA Short

sma1 <- lm(data = merged\_df\_train, formula = SMA.short ~ total\_victims)  
summary(sma1)

##   
## Call:  
## lm(formula = SMA.short ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.129456 -0.008150 0.000012 0.008073 0.086445   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 8.645e-04 3.215e-04 2.689 0.00721 \*\*  
## total\_victims 1.934e-05 2.558e-05 0.756 0.44963   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.01611 on 2515 degrees of freedom  
## Multiple R-squared: 0.0002273, Adjusted R-squared: -0.0001702   
## F-statistic: 0.5718 on 1 and 2515 DF, p-value: 0.4496

##### SMA long

sma2 <- lm(data = merged\_df\_train, formula = SMA.long ~ total\_victims)  
summary(sma2)

##   
## Call:  
## lm(formula = SMA.long ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.094696 -0.007124 -0.000122 0.006983 0.056223   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 8.583e-04 2.650e-04 3.238 0.00122 \*\*  
## total\_victims -1.022e-05 2.109e-05 -0.485 0.62802   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.01328 on 2515 degrees of freedom  
## Multiple R-squared: 9.336e-05, Adjusted R-squared: -0.0003042   
## F-statistic: 0.2348 on 1 and 2515 DF, p-value: 0.628

##### Draw Down 2 day

DD1 <- lm(data = merged\_df\_train, formula = gunDD\_2day ~ total\_victims)  
summary(DD1)

##   
## Call:  
## lm(formula = gunDD\_2day ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.33120 -0.11241 0.01846 0.10413 0.22260   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.2173734 0.0027632 -78.666 <2e-16 \*\*\*  
## total\_victims -0.0002615 0.0002199 -1.189 0.234   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.1385 on 2515 degrees of freedom  
## Multiple R-squared: 0.000562, Adjusted R-squared: 0.0001646   
## F-statistic: 1.414 on 1 and 2515 DF, p-value: 0.2345

##### Draw Down 3 day

DD2 <- lm(data = merged\_df\_train, formula = gunDD\_3day ~ total\_victims)  
summary(DD2)

##   
## Call:  
## lm(formula = gunDD\_3day ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.33109 -0.11266 0.01836 0.10424 0.22162   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.2174772 0.0027643 -78.673 <2e-16 \*\*\*  
## total\_victims -0.0002439 0.0002200 -1.109 0.268   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.1385 on 2515 degrees of freedom  
## Multiple R-squared: 0.0004886, Adjusted R-squared: 9.12e-05   
## F-statistic: 1.229 on 1 and 2515 DF, p-value: 0.2676

##### Draw Down 5 day

DD3 <- lm(data = merged\_df\_train, formula = gunDD\_5day ~ total\_victims)  
summary(DD3)

##   
## Call:  
## lm(formula = gunDD\_5day ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.33093 -0.11259 0.01816 0.10500 0.22349   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.2176460 0.0027664 -78.674 <2e-16 \*\*\*  
## total\_victims -0.0002920 0.0002201 -1.326 0.185   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.1386 on 2515 degrees of freedom  
## Multiple R-squared: 0.0006989, Adjusted R-squared: 0.0003016   
## F-statistic: 1.759 on 1 and 2515 DF, p-value: 0.1849

##### Draw Down 10 day

DD4 <- lm(data = merged\_df\_train, formula = gunDD\_10day ~ total\_victims)  
summary(DD4)

##   
## Call:  
## lm(formula = gunDD\_10day ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.33047 -0.11271 0.01832 0.10486 0.21810   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.2181018 0.0027715 -78.69 <2e-16 \*\*\*  
## total\_victims -0.0003109 0.0002205 -1.41 0.159   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.1389 on 2515 degrees of freedom  
## Multiple R-squared: 0.0007898, Adjusted R-squared: 0.0003925   
## F-statistic: 1.988 on 1 and 2515 DF, p-value: 0.1587

##### Draw Down 15 day

DD5 <- lm(data = merged\_df\_train, formula = gunDD\_15day ~ total\_victims)  
summary(DD5)

##   
## Call:  
## lm(formula = gunDD\_15day ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.32997 -0.11333 0.01825 0.10619 0.22301   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.218603 0.002777 -78.729 <2e-16 \*\*\*  
## total\_victims -0.000259 0.000221 -1.172 0.241   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.1392 on 2515 degrees of freedom  
## Multiple R-squared: 0.000546, Adjusted R-squared: 0.0001486   
## F-statistic: 1.374 on 1 and 2515 DF, p-value: 0.2413

##### Draw Down 20 day

DD6 <- lm(data = merged\_df\_train, formula = gunDD\_20day ~ total\_victims)  
summary(DD6)

##   
## Call:  
## lm(formula = gunDD\_20day ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.32956 -0.11391 0.01802 0.10637 0.21901   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.2190149 0.0027816 -78.738 <2e-16 \*\*\*  
## total\_victims -0.0002920 0.0002213 -1.319 0.187   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.1394 on 2515 degrees of freedom  
## Multiple R-squared: 0.0006916, Adjusted R-squared: 0.0002943   
## F-statistic: 1.741 on 1 and 2515 DF, p-value: 0.1872

##### Momentum 2 day

mom1 <- lm(data = merged\_df\_train, formula = Mom\_2day ~ total\_victims)  
summary(mom1)

##   
## Call:  
## lm(formula = Mom\_2day ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.191105 -0.016088 -0.000586 0.016235 0.192480   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.602e-05 6.386e-04 0.056 0.9550   
## total\_victims -1.149e-04 5.082e-05 -2.261 0.0238 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.032 on 2515 degrees of freedom  
## Multiple R-squared: 0.002029, Adjusted R-squared: 0.001632   
## F-statistic: 5.113 on 1 and 2515 DF, p-value: 0.02383

##### Momentum 3 day

mom2 <- lm(data = merged\_df\_train, formula = Mom\_3day ~ total\_victims)  
summary(mom2)

##   
## Call:  
## lm(formula = Mom\_3day ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.170479 -0.017754 -0.000509 0.017420 0.229282   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 1.326e-05 6.553e-04 0.020 0.984  
## total\_victims -4.221e-05 5.214e-05 -0.809 0.418  
##   
## Residual standard error: 0.03284 on 2515 degrees of freedom  
## Multiple R-squared: 0.0002605, Adjusted R-squared: -0.000137   
## F-statistic: 0.6552 on 1 and 2515 DF, p-value: 0.4183

##### Momentum 5 day

mom3 <- lm(data = merged\_df\_train, formula = Mom\_5day ~ total\_victims)  
summary(mom3)

##   
## Call:  
## lm(formula = Mom\_5day ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.169370 -0.016492 -0.000331 0.017014 0.191844   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 6.203e-05 6.507e-04 0.095 0.9241   
## total\_victims -1.191e-04 5.178e-05 -2.300 0.0215 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.03261 on 2515 degrees of freedom  
## Multiple R-squared: 0.0021, Adjusted R-squared: 0.001703   
## F-statistic: 5.291 on 1 and 2515 DF, p-value: 0.02151

##### Momentum 10 day

mom4 <- lm(data = merged\_df\_train, formula = Mom\_10day ~ total\_victims)  
summary(mom4)

##   
## Call:  
## lm(formula = Mom\_10day ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.175062 -0.017508 0.000229 0.017611 0.164331   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 2.076e-05 6.425e-04 0.032 0.974  
## total\_victims -4.765e-05 5.113e-05 -0.932 0.351  
##   
## Residual standard error: 0.0322 on 2515 degrees of freedom  
## Multiple R-squared: 0.0003453, Adjusted R-squared: -5.221e-05   
## F-statistic: 0.8686 on 1 and 2515 DF, p-value: 0.3514

##### Momentum 15 day

mom5 <- lm(data = merged\_df\_train, formula = Mom\_15day ~ total\_victims )  
summary(mom5)

##   
## Call:  
## lm(formula = Mom\_15day ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.172239 -0.017141 0.000443 0.017604 0.191811   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 4.547e-05 6.494e-04 0.070 0.9442   
## total\_victims -9.120e-05 5.167e-05 -1.765 0.0777 .  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.03255 on 2515 degrees of freedom  
## Multiple R-squared: 0.001237, Adjusted R-squared: 0.0008398   
## F-statistic: 3.115 on 1 and 2515 DF, p-value: 0.07771

##### Momentum 20 day linear - linear

mom6A <- lm(data = merged\_df\_train, formula = Mom\_20day ~ total\_victims)  
summary(mom6A)

##   
## Call:  
## lm(formula = Mom\_20day ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.181347 -0.017052 -0.000356 0.016627 0.206841   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 6.550e-05 6.546e-04 0.100 0.9203   
## total\_victims -1.134e-04 5.209e-05 -2.177 0.0296 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.03281 on 2515 degrees of freedom  
## Multiple R-squared: 0.00188, Adjusted R-squared: 0.001484   
## F-statistic: 4.738 on 1 and 2515 DF, p-value: 0.02959

##### Momentum 20 day linear - log

mom6B <- lm(data = merged\_df\_train, formula = Mom\_20day ~ log(total\_victims+1))  
summary(mom6B)

##   
## Call:  
## lm(formula = Mom\_20day ~ log(total\_victims + 1), data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.181392 -0.017045 -0.000332 0.016881 0.206795   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 0.0001114 0.0006594 0.169 0.866  
## log(total\_victims + 1) -0.0022918 0.0016911 -1.355 0.175  
##   
## Residual standard error: 0.03283 on 2515 degrees of freedom  
## Multiple R-squared: 0.0007297, Adjusted R-squared: 0.0003324   
## F-statistic: 1.837 on 1 and 2515 DF, p-value: 0.1755

##### Momentum 20 day log - linear

c <- abs(min(merged\_df\_train$Mom\_20day))  
c

## [1] 0.181281

mom6C <- lm(data = merged\_df\_train, formula = log(Mom\_20day+c+1) ~ total\_victims)  
summary(mom6C)

##   
## Call:  
## lm(formula = log(Mom\_20day + c + 1) ~ total\_victims, data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.166269 -0.014154 0.000084 0.014362 0.161730   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 1.663e-01 5.555e-04 299.31 <2e-16 \*\*\*  
## total\_victims -9.859e-05 4.421e-05 -2.23 0.0258 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.02784 on 2515 degrees of freedom  
## Multiple R-squared: 0.001974, Adjusted R-squared: 0.001577   
## F-statistic: 4.974 on 1 and 2515 DF, p-value: 0.02582

##### Momentum 20 day log - log

c <- abs(min(merged\_df\_train$Mom\_20day))  
c

## [1] 0.181281

mom6D <- lm(data = merged\_df\_train, formula = log(Mom\_20day+c+1) ~ log(total\_victims+1))  
summary(mom6D)

##   
## Call:  
## lm(formula = log(Mom\_20day + c + 1) ~ log(total\_victims + 1),   
## data = merged\_df\_train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.16631 -0.01415 0.00010 0.01457 0.16169   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 0.1663123 0.0005596 297.207 <2e-16 \*\*\*  
## log(total\_victims + 1) -0.0020589 0.0014351 -1.435 0.152   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.02786 on 2515 degrees of freedom  
## Multiple R-squared: 0.0008177, Adjusted R-squared: 0.0004204   
## F-statistic: 2.058 on 1 and 2515 DF, p-value: 0.1515

#### Prediction

predict\_01 <- predict(mom6A, newdata = merged\_df\_test)  
head(predict\_01,10)

## 1 2 3 4 5 6   
## 6.550121e-05 6.550121e-05 6.550121e-05 6.550121e-05 6.550121e-05 6.550121e-05   
## 7 8 9 10   
## 6.550121e-05 6.550121e-05 6.550121e-05 6.550121e-05

library(forecast)  
  
accuracy\_01 <- accuracy(predict\_01, merged\_df\_test$Mom\_20day)  
accuracy\_01

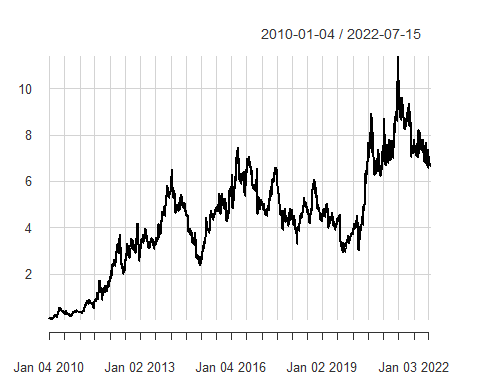
## ME RMSE MAE MPE MAPE  
## Test set -0.0002102817 0.03548388 0.02575234 100.141 100.141

### Calculating compound return of gun portfolio

gun\_co\_portfolio\_returns1 <- gun\_co\_portfolio\_returns  
gun\_co\_portfolio\_returns1 <- xts(gun\_co\_portfolio\_returns1[,-1], order.by = gun\_co\_portfolio\_returns$date,)  
#head(gun\_co\_portfolio\_returns1)  
  
gun\_comp\_return <- Return.cumulative(gun\_co\_portfolio\_returns1$Ra, geometric = TRUE)  
gun\_comp\_return

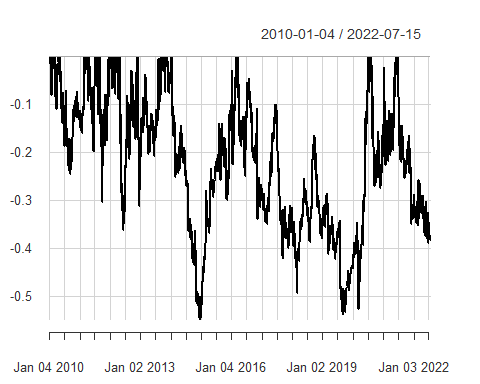
## Ra  
## Cumulative Return 6.690666

chart.CumReturns(gun\_co\_portfolio\_returns1$Ra, wealth.index = FALSE, geometric = TRUE)



### Estimating gun Portfolio Drawdown

library(data.table)  
gun\_DD\_plot <- chart.Drawdown(gun\_co\_portfolio\_returns1$Ra)  
gun\_DD\_plot



gun\_DDtable <- table.Drawdowns(gun\_co\_portfolio\_returns1$Ra, top = 7, digits = 4)  
gun\_DDtable

## From Trough To Depth Length To Trough Recovery  
## 1 2014-01-17 2014-12-16 2016-02-26 -0.5486 531 231 300  
## 2 2016-03-23 2019-09-03 2020-07-02 -0.5365 1078 868 210  
## 3 2021-07-01 2022-06-22 <NA> -0.3906 263 246 NA  
## 4 2012-05-03 2012-06-07 2012-11-23 -0.3636 141 25 116  
## 5 2012-11-30 2012-12-18 2013-09-11 -0.3124 196 13 183  
## 6 2011-08-31 2011-10-03 2011-12-21 -0.3037 79 23 56  
## 7 2020-08-11 2020-11-24 2021-06-03 -0.2744 205 75 130