

ROI on Hand Picked Stocks 2007-2020

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```
portfolio <- read.csv('all_portfolio_prices.csv', header=TRUE,
na.strings=c('', ' '),
row.names=1)

portfolio$Date <- row.names(portfolio)

Vol <- grep('Volume', colnames(portfolio))
close <- grep('Close', colnames(portfolio))
Close <- portfolio[,close]
Volume <- portfolio[,Vol]
colnames(Close)
```

## [1] "TGT.Close"	"FTR.Close"	"UBSI.Close"	"HD.Close"
"JPM.Close"			
## [6] "XOM.Close"	"CVX.Close"	"NSANY.Close"	"GNBT.Close"
"MGM.Close"			
## [11] "TEVA.Close"	"HST.Close"	"FCAU.Close"	"WFC.Close"
"WWE.Close"			
## [16] "INO.Close"	"QSR.Close"	"GRPN.Close"	"SCE.PB.Close"
"FFIN.Close"			
## [21] "GOOG.Close"	"WM.Close"	"ONCY.Close"	"S.Close"
"GM.Close"			
## [26] "F.Close"	"ASCCY.Close"	"ARWR.Close"	"COST.Close"
"AAL.Close"			
## [31] "JWN.Close"	"CSSEP.Close"	"NUS.Close"	"AMC.Close"
"ADDYY.Close"			
## [36] "KSS.Close"	"MSFT.Close"	"LUV.Close"	"HMC.Close"
"PCG.Close"			
## [41] "DLTR.Close"	"KGJI.Close"	"NKE.Close"	"AMZN.Close"
"ROST.Close"			
## [46] "TMUS.Close"	"WMT.Close"	"TJX.Close"	"TM.Close"
"PBYI.Close"			
## [51] "T.Close"	"JNJ.Close"	"C.Close"	"EPD.Close"
"VZ.Close"			
## [56] "HRB.Close"	"NFLX.Close"	"AAP.Close"	"HOFT.Close"
"SIG.Close"			
## [61] "SDC.Close"	"RRGB.Close"	"M.Close"	"JBLU.Close"
"YELP.Close"			

Remove NAs from the data. The `colSums(is.na(Close))` isn't returning the columns with NAs, so this must be done manually.

```
Close_noNAs <- Close[, -c(9,13,17,18,25,27,32,34,46,50,61,65)]
Volume_noNAs <- Volume[, -c(9,13,17,18,25,27,32,34,46,50,61,65)]
```

```
Close_noNAs$SCE.PB.Close <- as.numeric(Close_noNAs$SCE.PB.Close)
Volume_noNAs$SCE.PB.Volume <- as.numeric(Volume_noNAs$SCE.PB.Volume)
```

Add in a value of the portfolio column for each day's closing price of all stock that don't have NAs.

```
Close_noNAs$DailyValue <- rowSums(Close_noNAs, na.rm=TRUE)
```

Add in a daily change column of the portfolio closing prices.

```
dayVal <- as.data.frame(Close_noNAs$DailyValue)
colnames(dayVal) <- 'previousDayValue'
zero <- as.data.frame(as.numeric(dayVal$previousDayValue[1]))
colnames(zero) <- 'previousDayValue'
prevDay <- rbind(zero, dayVal)
Close_noNAs$prevDay <- prevDay[1:length(prevDay$previousDayValue)-1,1]
dailyChange <- as.data.frame(Close_noNAs$DailyValue-Close_noNAs$prevDay)
colnames(dailyChange) <- 'dailyValueChange'

Close1 <- cbind(Close_noNAs, dailyChange)
```

Add a column that gives the return in dollars on initial dollars invested.

```
Close1$ROI_dollars <- Close1$DailyValue-Close1$DailyValue[1]
```

Add some date fields to look at the values by date, day of the week, month, and year in analyzing this data.

```
Close1$Date <- as.Date.character(row.names(Close1))
Close1$DayOfWeek <- weekdays(as.Date(Close1$Date))

month <- month(as.Date(Close1$Date))
Month <- month.abb[month]
Close1$Month <- Month
```

Add in the year of the Date column.

```
Year <- year(as.Date(Close1$Date))

Close1$Year <- Year

Close1$MonthYear <- paste(Close1$Month, Close1$Year, sep='-')
Close1$MonthYear <- as.factor(Close1$MonthYear)
```

Add in some [unemployment](#) information as a column to see how the portfolio is doing by date.

```
ue <- read.delim('BLS_unemploymentRates2007-2020.txt', sep=',', header=TRUE,
                 na.strings=c('', ' '))
UE <- ue[, -14] #remove the empty 'Annual' column
```

Use tidyr to gather the month fields with their respective unemployment rates per month.

```
gatherMonths <- gather(UE, 'UE_Month', 'UE_monthlyRate', 2:13)

gatherMonths$MonthYear <- paste(gatherMonths$UE_Month, gatherMonths$Year,
                                sep='-')
gatherMonths$MonthYear <- as.factor(gatherMonths$MonthYear)

UE2 <- gatherMonths[, 3:4]
Close2 <- merge(Close1, UE2, by.x='MonthYear', by.y='MonthYear')
row.names(Close2) <- Close2$Date
colnames(Close2)[55:58] <- paste('portfolio', colnames(Close2)[55:58],
                                sep='_')

write.csv(Close2, 'ROI_UE_2007_2020.csv', row.names=FALSE)
```

Lets add in the volume of trades per day from the Volume_noNAs data set. But lets add in some fields for total portfolio trades per day,

```
Volume1 <- Volume_noNAs
Volume1$portfolio_DailyVolume <- rowSums(Volume1, na.rm=TRUE)

dayVol <- as.data.frame(Volume1$portfolio_DailyVolume)
colnames(dayVol) <- 'portfolio_previousDayVolume'
zero <- as.data.frame(as.numeric(dayVol$portfolio_previousDayVolume[1]))
colnames(zero) <- 'portfolio_previousDayVolume'
prevDay1 <- rbind(zero, dayVol)
Volume1$portfolio_prevDayVolume <-
  prevDay1[1:(length(prevDay1$portfolio_previousDayVolume)-1), 1]

dailyVolumeChange <- as.data.frame(Volume1$portfolio_DailyVolume -
  Volume1$portfolio_prevDayVolume)
colnames(dailyVolumeChange) <- 'portfolio_dailyVolumeChange'

Volume2 <- cbind(Volume1, dailyVolumeChange)
Volume2$portfolio_VolumeRatioDaily2Initial <-
  Volume2$portfolio_DailyVolume / Volume2$portfolio_prevDayVolume[1]

Volume2$Date <- as.Date(row.names(Volume2))

stocks <- cbind(Close2, Volume2)

Stocks <- stocks[, c(2:54, 64:116, 1, 55:63, 117:120)]
colnames(Stocks)

## [1] "TGT.Close" "FTR.Close"
## [3] "UBSI.Close" "HD.Close"
```

##	[5]	"JPM.Close"	"XOM.Close"
##	[7]	"CVX.Close"	"NSANY.Close"
##	[9]	"MGM.Close"	"TEVA.Close"
##	[11]	"HST.Close"	"WFC.Close"
##	[13]	"WWE.Close"	"INO.Close"
##	[15]	"SCE.PB.Close"	"FFIN.Close"
##	[17]	"GOOG.Close"	"WM.Close"
##	[19]	"ONCY.Close"	"S.Close"
##	[21]	"F.Close"	"ARWR.Close"
##	[23]	"COST.Close"	"AAL.Close"
##	[25]	"JWN.Close"	"NUS.Close"
##	[27]	"ADDYY.Close"	"KSS.Close"
##	[29]	"MSFT.Close"	"LUV.Close"
##	[31]	"HMC.Close"	"PCG.Close"
##	[33]	"DLTR.Close"	"KGJI.Close"
##	[35]	"NKE.Close"	"AMZN.Close"
##	[37]	"ROST.Close"	"WMT.Close"
##	[39]	"TJX.Close"	"TM.Close"
##	[41]	"T.Close"	"JNJ.Close"
##	[43]	"C.Close"	"EPD.Close"
##	[45]	"VZ.Close"	"HRB.Close"
##	[47]	"NFLX.Close"	"AAP.Close"
##	[49]	"HOFT.Close"	"SIG.Close"
##	[51]	"RRGB.Close"	"M.Close"
##	[53]	"JBLU.Close"	"TGT.Volume"
##	[55]	"FTR.Volume"	"UBSI.Volume"
##	[57]	"HD.Volume"	"JPM.Volume"
##	[59]	"XOM.Volume"	"CVX.Volume"
##	[61]	"NSANY.Volume"	"MGM.Volume"
##	[63]	"TEVA.Volume"	"HST.Volume"
##	[65]	"WFC.Volume"	"WWE.Volume"
##	[67]	"INO.Volume"	"SCE.PB.Volume"
##	[69]	"FFIN.Volume"	"GOOG.Volume"
##	[71]	"WM.Volume"	"ONCY.Volume"
##	[73]	"S.Volume"	"F.Volume"
##	[75]	"ARWR.Volume"	"COST.Volume"
##	[77]	"AAL.Volume"	"JWN.Volume"
##	[79]	"NUS.Volume"	"ADDYY.Volume"
##	[81]	"KSS.Volume"	"MSFT.Volume"
##	[83]	"LUV.Volume"	"HMC.Volume"
##	[85]	"PCG.Volume"	"DLTR.Volume"
##	[87]	"KGJI.Volume"	"NKE.Volume"
##	[89]	"AMZN.Volume"	"ROST.Volume"
##	[91]	"WMT.Volume"	"TJX.Volume"
##	[93]	"TM.Volume"	"T.Volume"
##	[95]	"JNJ.Volume"	"C.Volume"
##	[97]	"EPD.Volume"	"VZ.Volume"
##	[99]	"HRB.Volume"	"NFLX.Volume"
##	[101]	"AAP.Volume"	"HOFT.Volume"
##	[103]	"SIG.Volume"	"RRGB.Volume"

```
## [105] "M.Volume" "JBLU.Volume"
## [107] "MonthYear" "portfolio_DailyValue"
## [109] "portfolio_prevDay" "portfolio_dailyValueChange"
## [111] "portfolio_ROI_dollars" "Date"
## [113] "DayOfWeek" "Month"
## [115] "Year" "UE_monthlyRate"
## [117] "portfolio_DailyVolume" "portfolio_prevDayVolume"
## [119] "portfolio_dailyVolumeChange"
"portfolio_VolumeRatioDaily2Initial"
```

Add a value of stock daily to the initial value as a ratio.

```
Stocks$portfolio_ValueRatioDaily2Initial <-
  Stocks$portfolio_DailyValue/Stocks$portfolio_DailyValue[1]
```

Add a field that multiplies the daily value and daily volume ratios compared to the initial value and volume by the unemployment rate.

```
Stocks$portfolio_DailyRatios_X_UE <-

Stocks$portfolio_ValueRatioDaily2Initial*Stocks$portfolio_VolumeRatioDaily2Initial*Stocks$UE_monthlyRate
```

Add an exponential calculation field based on the unemployment rate for rate, and using $t=1/12$ for 12 months, and a binary value of 1 or 2 where the daily change is positive is assigned a 1 and a negative is a 2. This will make those values decreasing daily have a lower poisson and those values increasing a higher poisson value. This is a modified poisson used for probability of an outcome occurring with a constant rate. Added to rank daily changes based on unemployment rate of each month.

```
Stocks <- Stocks[complete.cases(Stocks$UE_monthlyRate),]
Stocks$dayOfMonth <- day(Stocks$Date)
dayOfMonth <- day(Stocks$Date)
ue1 <- Stocks$UE_monthlyRate

incrDecr <- ifelse(Stocks$portfolio_dailyValueChange>0,1,2)

Stocks$portfolio_poisson <- round((exp(-(ue1*1/12))*(ue1*1/12)^incrDecr)/(factorial(incrDecr)),5)

summary(Stocks$portfolio_poisson)

##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## 0.03177 0.07392 0.22652 0.19506 0.29808 0.36217

write.csv(Stocks, 'StocksStats.csv', row.names=TRUE)
```

Make a daily ROI dollars column for each of the stocks in this set.

```
stocks1 <- Stocks[,1:53]
colnames(stocks1)
```

```

## [1] "TGT.Close"      "FTR.Close"      "UBSI.Close"     "HD.Close"
"JPM.Close"
## [6] "XOM.Close"      "CVX.Close"      "NSANY.Close"    "MGM.Close"
"TEVA.Close"
## [11] "HST.Close"      "WFC.Close"      "WWE.Close"      "INO.Close"
"SCE.PB.Close"
## [16] "FFIN.Close"     "GOOG.Close"     "WM.Close"       "ONCY.Close"     "S.Close"
## [21] "F.Close"        "ARWR.Close"     "COST.Close"     "AAL.Close"
"JWN.Close"
## [26] "NUS.Close"      "ADDYY.Close"    "KSS.Close"      "MSFT.Close"
"LUV.Close"
## [31] "HMC.Close"      "PCG.Close"      "DLTR.Close"     "KGJI.Close"
"NKE.Close"
## [36] "AMZN.Close"     "ROST.Close"     "WMT.Close"      "TJX.Close"
"TM.Close"
## [41] "T.Close"        "JNJ.Close"      "C.Close"        "EPD.Close"
"VZ.Close"
## [46] "HRB.Close"      "NFLX.Close"     "AAP.Close"      "HOFT.Close"
"SIG.Close"
## [51] "RRGB.Close"     "M.Close"        "JBLU.Close"

```

```

stocks1$TGT_ROI_dollars <- stocks1$TGT.Close-stocks1$TGT.Close[1]
stocks1$FTR_ROI_dollars <- stocks1$FTR.Close-stocks1$FTR.Close[1]
stocks1$UBSI_ROI_dollars <- stocks1$UBSI.Close-stocks1$UBSI.Close[1]
stocks1$HD_ROI_dollars <- stocks1$HD.Close-stocks1$HD.Close[1]
stocks1$JPM_ROI_dollars <- stocks1$JPM.Close-stocks1$JPM.Close[1]

```

```

stocks1$XOM_ROI_dollars <- stocks1$XOM.Close-stocks1$XOM.Close[1]
stocks1$CVX_ROI_dollars <- stocks1$CVX.Close-stocks1$CVX.Close[1]
stocks1$NSANY_ROI_dollars <- stocks1$NSANY.Close-stocks1$NSANY.Close[1]
stocks1$MGM_ROI_dollars <- stocks1$MGM.Close-stocks1$MGM.Close[1]
stocks1$TEVA_ROI_dollars <- stocks1$TEVA.Close-stocks1$TEVA.Close[1]

```

```

stocks1$HST_ROI_dollars <- stocks1$HST.Close-stocks1$HST.Close[1]
stocks1$WFC_ROI_dollars <- stocks1$WFC.Close-stocks1$WFC.Close[1]
stocks1$WWE_ROI_dollars <- stocks1$WWE.Close-stocks1$WWE.Close[1]
stocks1$INO_ROI_dollars <- stocks1$INO.Close-stocks1$INO.Close[1]
stocks1$SCE.PB_ROI_dollars <- stocks1$SCE.PB.Close-stocks1$SCE.PB.Close[1]

```

```

stocks1$FFIN_ROI_dollars <- stocks1$FFIN.Close-stocks1$FFIN.Close[1]
stocks1$GOOG_ROI_dollars <- stocks1$GOOG.Close-stocks1$GOOG.Close[1]
stocks1$WM_ROI_dollars <- stocks1$WM.Close-stocks1$WM.Close[1]
stocks1$ONCY_ROI_dollars <- stocks1$ONCY.Close-stocks1$ONCY.Close[1]
stocks1$S_ROI_dollars <- stocks1$S.Close-stocks1$S.Close[1]

```

```

stocks1$F_ROI_dollars <- stocks1$F.Close-stocks1$F.Close[1]
stocks1$ARWR_ROI_dollars <- stocks1$ARWR.Close-stocks1$ARWR.Close[1]
stocks1$COST_ROI_dollars <- stocks1$COST.Close-stocks1$COST.Close[1]
stocks1$AAL_ROI_dollars <- stocks1$AAL.Close-stocks1$AAL.Close[1]
stocks1$JWN_ROI_dollars <- stocks1$JWN.Close-stocks1$JWN.Close[1]

```

```

stocks1$NUS_ROI_dollars <- stocks1$NUS.Close-stocks1$NUS.Close[1]
stocks1$HMC_ROI_dollars <- stocks1$HMC.Close-stocks1$HMC.Close[1]
stocks1$AMZN_ROI_dollars <- stocks1$AMZN.Close-stocks1$AMZN.Close[1]
stocks1$T_ROI_dollars <- stocks1$T.Close-stocks1$T.Close[1]
stocks1$HRB_ROI_dollars <- stocks1$HRB.Close-stocks1$HRB.Close[1]
stocks1$RRGB_ROI_dollars <- stocks1$RRGB.Close-stocks1$RRGB.Close[1]

stocks1$ADDYY_ROI_dollars <- stocks1$ADDYY.Close-stocks1$ADDYY.Close[1]
stocks1$PCG_ROI_dollars <- stocks1$PCG.Close-stocks1$PCG.Close[1]
stocks1$ROST_ROI_dollars <- stocks1$ROST.Close-stocks1$ROST.Close[1]
stocks1$JNJ_ROI_dollars <- stocks1$JNJ.Close-stocks1$JNJ.Close[1]
stocks1$NFLX_ROI_dollars <- stocks1$NFLX.Close-stocks1$NFLX.Close[1]
stocks1$M_ROI_dollars <- stocks1$M.Close-stocks1$M.Close[1]

stocks1$KSS_ROI_dollars <- stocks1$KSS.Close-stocks1$KSS.Close[1]
stocks1$DLTR_ROI_dollars <- stocks1$DLTR.Close-stocks1$DLTR.Close[1]
stocks1$WMT_ROI_dollars <- stocks1$WMT.Close-stocks1$WMT.Close[1]
stocks1$C_ROI_dollars <- stocks1$C.Close-stocks1$C.Close[1]
stocks1$AAP_ROI_dollars <- stocks1$AAP.Close-stocks1$AAP.Close[1]
stocks1$JBLU_ROI_dollars <- stocks1$JBLU.Close-stocks1$JBLU.Close[1]

stocks1$MSFT_ROI_dollars <- stocks1$MSFT.Close-stocks1$MSFT.Close[1]
stocks1$KGJI_ROI_dollars <- stocks1$KGJI.Close-stocks1$KGJI.Close[1]
stocks1$EPD_ROI_dollars <- stocks1$EPD.Close-stocks1$EPD.Close[1]
stocks1$TJX_ROI_dollars <- stocks1$TJX.Close-stocks1$TJX.Close[1]
stocks1$HOFT_ROI_dollars <- stocks1$HOFT.Close-stocks1$HOFT.Close[1]

stocks1$LUV_ROI_dollars <- stocks1$LUV.Close-stocks1$LUV.Close[1]
stocks1$NKE_ROI_dollars <- stocks1$NKE.Close-stocks1$NKE.Close[1]
stocks1$TM_ROI_dollars <- stocks1$TM.Close-stocks1$TM.Close[1]
stocks1$VZ_ROI_dollars <- stocks1$VZ.Close-stocks1$VZ.Close[1]
stocks1$SIG_ROI_dollars <- stocks1$SIG.Close-stocks1$SIG.Close[1]

```

These are the values of the stock the previous day that will be subtracted from each day to get the daily change from the day before in dollars.

```

TGTa <- c(0,stocks1$TGT.Close[1:(length(stocks1$TGT.Close)-1)])
FTRa <- c(0, stocks1$FTR.Close[1:(length(stocks1$TGT.Close)-1)])
UBSIa <- c(0,stocks1$UBSI.Close[1:(length(stocks1$TGT.Close)-1)])
HDa <- c(0,stocks1$HD.Close[1:(length(stocks1$TGT.Close)-1)])
JPMa <- c(0,stocks1$JPM.Close[1:(length(stocks1$TGT.Close)-1)])
XOMa <- c(0,stocks1$XOM.Close[1:(length(stocks1$TGT.Close)-1)])
CVXa <- c(0,stocks1$CVX.Close[1:(length(stocks1$TGT.Close)-1)])
NSANYa <- c(0,stocks1$NSANY.Close[1:(length(stocks1$TGT.Close)-1)])
MGMa <- c(0,stocks1$MGM.Close[1:(length(stocks1$TGT.Close)-1)])
TEVAa <- c(0, stocks1$TEVA.Close[1:(length(stocks1$TGT.Close)-1)])
HSTa <- c(0, stocks1$HST.Close[1:(length(stocks1$TGT.Close)-1)])
WFCa <- c(0, stocks1$WFC.Close[1:(length(stocks1$TGT.Close)-1)])
WWEa <- c(0, stocks1$WWE.Close[1:(length(stocks1$TGT.Close)-1)])

```



```

IN0a <- c(0,stocks1$IN0.Close[1:(length(stocks1$TGT.Close)-1)])
SCEa <- c(0,stocks1$SCE.PB.Close[1:(length(stocks1$TGT.Close)-1)])
FFINa <- c(0,stocks1$FFIN.Close[1:(length(stocks1$TGT.Close)-1)])
GOOGa <- c(0,stocks1$GOOG.Close[1:(length(stocks1$TGT.Close)-1)])
WMa <- c(0,stocks1$WM.Close[1:(length(stocks1$TGT.Close)-1)])
ONCYa <- c(0,stocks1$ONCY.Close[1:(length(stocks1$TGT.Close)-1)])
Sa <- c(0,stocks1$S.Close[1:(length(stocks1$TGT.Close)-1)])
Fa <- c(0,stocks1$F.Close[1:(length(stocks1$TGT.Close)-1)])
ARWRa <- c(0,stocks1$ARWR.Close[1:(length(stocks1$TGT.Close)-1)])
COSTa <- c(0,stocks1$COST.Close[1:(length(stocks1$TGT.Close)-1)])
AALa <- c(0,stocks1$AAL.Close[1:(length(stocks1$TGT.Close)-1)])
JWNa <- c(0,stocks1$JWN.Close[1:(length(stocks1$TGT.Close)-1)])
NUSa <- c(0,stocks1$NUS.Close[1:(length(stocks1$TGT.Close)-1)])
ADDYYa <- c(0,stocks1$ADDYY.Close[1:(length(stocks1$TGT.Close)-1)])
KSSa <- c(0,stocks1$KSS.Close[1:(length(stocks1$TGT.Close)-1)])
MSFTa <- c(0,stocks1$MSFT.Close[1:(length(stocks1$TGT.Close)-1)])
LUVa <- c(0,stocks1$LUV.Close[1:(length(stocks1$TGT.Close)-1)])
HMCa <- c(0,stocks1$HMC.Close[1:(length(stocks1$TGT.Close)-1)])
PCGa <- c(0,stocks1$PCG.Close[1:(length(stocks1$TGT.Close)-1)])
DLTRa <- c(0,stocks1$DLTR.Close[1:(length(stocks1$TGT.Close)-1)])
KGJJa <- c(0,stocks1$KGJI.Close[1:(length(stocks1$TGT.Close)-1)])
NKEa <- c(0,stocks1$NKE.Close[1:(length(stocks1$TGT.Close)-1)])
AMZNa <- c(0,stocks1$AMZN.Close[1:(length(stocks1$TGT.Close)-1)])
ROSTa <- c(0,stocks1$ROST.Close[1:(length(stocks1$TGT.Close)-1)])
WMTa <- c(0,stocks1$WMT.Close[1:(length(stocks1$TGT.Close)-1)])
TJXa <- c(0,stocks1$TJX.Close[1:(length(stocks1$TGT.Close)-1)])
TMa <- c(0,stocks1$TM.Close[1:(length(stocks1$TGT.Close)-1)])
Ta <- c(0,stocks1$T.Close[1:(length(stocks1$TGT.Close)-1)])
JNJJa <- c(0,stocks1$JNJ.Close[1:(length(stocks1$TGT.Close)-1)])
Ca <- c(0,stocks1$C.Close[1:(length(stocks1$TGT.Close)-1)])
EPDa <- c(0,stocks1$EPD.Close[1:(length(stocks1$TGT.Close)-1)])
VZa <- c(0,stocks1$VZ.Close[1:(length(stocks1$TGT.Close)-1)])
HRBa <- c(0,stocks1$HRB.Close[1:(length(stocks1$TGT.Close)-1)])
NFLXa <- c(0,stocks1$NFLX.Close[1:(length(stocks1$TGT.Close)-1)])
AAPa <- c(0,stocks1$AAP.Close[1:(length(stocks1$TGT.Close)-1)])
HOFTa <- c(0,stocks1$HOFT.Close[1:(length(stocks1$TGT.Close)-1)])
SIGa <- c(0,stocks1$SIG.Close[1:(length(stocks1$TGT.Close)-1)])
RRGBa <- c(0,stocks1$RRGB.Close[1:(length(stocks1$TGT.Close)-1)])
Ma <- c(0,stocks1$M.Close[1:(length(stocks1$TGT.Close)-1)])
JBLUa <- c(0,stocks1$JBLU.Close[1:(length(stocks1$TGT.Close)-1)])

```

This creates the DailyChange per stock columns.

```

stocks1$TGT_dailyChange <- stocks1$TGT.Close-TGTa
stocks1$FTR_dailyChange <- stocks1$FTR.Close-FTRa
stocks1$UBSI_dailyChange <- stocks1$UBSI.Close-UBSIa
stocks1$HD_dailyChange <- stocks1$HD.Close-HDa
stocks1$JPM_dailyChange <- stocks1$JPM.Close-JPMa

stocks1$XOM_dailyChange <- stocks1$XOM.Close-XOMa

```



```
stocks1$CVX_dailyChange <- stocks1$CVX.Close-CVXa
stocks1$NSANY_dailyChange <- stocks1$NSANY.Close-NSANYa
stocks1$MGM_dailyChange <- stocks1$MGM.Close-MGMA
stocks1$TEVA_dailyChange <- stocks1$TEVA.Close-TEVAa
```

```
stocks1$HST_dailyChange <- stocks1$HST.Close-HSTa
stocks1$WFC_dailyChange <- stocks1$WFC.Close-WFCa
stocks1$WWE_dailyChange <- stocks1$WWE.Close-WWEa
stocks1$INO_dailyChange <- stocks1$INO.Close-INOa
stocks1$SCE.PB_dailyChange <- stocks1$SCE.PB.Close-SCEa
```

```
stocks1$FFIN_dailyChange <- stocks1$FFIN.Close-FFINa
stocks1$GOOG_dailyChange <- stocks1$GOOG.Close-GOOGa
stocks1$WM_dailyChange <- stocks1$WM.Close-WMa
stocks1$ONCY_dailyChange <- stocks1$ONCY.Close-ONCYa
stocks1$S_dailyChange <- stocks1$S.Close-Sa
```

```
stocks1$F_dailyChange <- stocks1$F.Close-Fa
stocks1$ARWR_dailyChange <- stocks1$ARWR.Close-ARWRa
stocks1$COST_dailyChange <- stocks1$COST.Close-COSTa
stocks1$AAL_dailyChange <- stocks1$AAL.Close-AALa
stocks1$JWN_dailyChange <- stocks1$JWN.Close-JWNa
```

```
stocks1$NUS_dailyChange <- stocks1$NUS.Close-NUSa
stocks1$HMC_dailyChange <- stocks1$HMC.Close-HMCA
stocks1$AMZN_dailyChange <- stocks1$AMZN.Close-AMZNa
stocks1$T_dailyChange <- stocks1$T.Close-Ta
stocks1$HRB_dailyChange <- stocks1$HRB.Close-HRBA
stocks1$RRGB_dailyChange <- stocks1$RRGB.Close-RRGBa
```

```
stocks1$ADDYY_dailyChange <- stocks1$ADDYY.Close-ADDYYa
stocks1$PCG_dailyChange <- stocks1$PCG.Close-PCGa
stocks1$ROST_dailyChange <- stocks1$ROST.Close-ROSTa
stocks1$JNJ_dailyChange <- stocks1$JNJ.Close-JNJa
stocks1$NFLX_dailyChange <- stocks1$NFLX.Close-NFLXa
stocks1$M_dailyChange <- stocks1$M.Close-Ma
```

```
stocks1$KSS_dailyChange <- stocks1$KSS.Close-KSSa
stocks1$DLTR_dailyChange <- stocks1$DLTR.Close-DLTRa
stocks1$WMT_dailyChange <- stocks1$WMT.Close-WMTa
stocks1$C_dailyChange <- stocks1$C.Close-Ca
stocks1$AAP_dailyChange <- stocks1$AAP.Close-AAPa
stocks1$JBLU_dailyChange <- stocks1$JBLU.Close-JBLUa
```

```
stocks1$MSFT_dailyChange <- stocks1$MSFT.Close-MSFTa
stocks1$KGJI_dailyChange <- stocks1$KGJI.Close-KGJIa
stocks1$EPD_dailyChange <- stocks1$EPD.Close-EPDa
stocks1$TJX_dailyChange <- stocks1$TJX.Close-TJXa
stocks1$HOFT_dailyChange <- stocks1$HOFT.Close-HOFTa
```

```
stocks1$LUV_dailyChange <- stocks1$LUV.Close-LUVa
stocks1$NKE_dailyChange <- stocks1$NKE.Close-NKEa
stocks1$TM_dailyChange <- stocks1$TM.Close-TMa
stocks1$VZ_dailyChange <- stocks1$VZ.Close-VZa
stocks1$SIG_dailyChange <- stocks1$SIG.Close-SIGa
```

Combine the stocks1 stats of ROI and daily change in dollars per stock to the stocks stats data table.

```
stocks2 <- stocks1[, -c(1:53)]
StocksSTATS <- cbind(Stocks, stocks2)
```

All the columns we now have are:

```
StocksSTATS <- StocksSTATS[, c(1:106, 125:230, 107:124)]
colnames(StocksSTATS)
```

##	[1]	"TGT.Close"	"FTR.Close"
##	[3]	"UBSI.Close"	"HD.Close"
##	[5]	"JPM.Close"	"XOM.Close"
##	[7]	"CVX.Close"	"NSANY.Close"
##	[9]	"MGM.Close"	"TEVA.Close"
##	[11]	"HST.Close"	"WFC.Close"
##	[13]	"WWE.Close"	"INO.Close"
##	[15]	"SCE.PB.Close"	"FFIN.Close"
##	[17]	"GOOG.Close"	"WM.Close"
##	[19]	"ONCY.Close"	"S.Close"
##	[21]	"F.Close"	"ARWR.Close"
##	[23]	"COST.Close"	"AAL.Close"
##	[25]	"JWN.Close"	"NUS.Close"
##	[27]	"ADDYY.Close"	"KSS.Close"
##	[29]	"MSFT.Close"	"LUV.Close"
##	[31]	"HMC.Close"	"PCG.Close"
##	[33]	"DLTR.Close"	"KGJI.Close"
##	[35]	"NKE.Close"	"AMZN.Close"
##	[37]	"ROST.Close"	"WMT.Close"
##	[39]	"TJX.Close"	"TM.Close"
##	[41]	"T.Close"	"JNJ.Close"
##	[43]	"C.Close"	"EPD.Close"
##	[45]	"VZ.Close"	"HRB.Close"
##	[47]	"NFLX.Close"	"AAP.Close"
##	[49]	"HOFT.Close"	"SIG.Close"
##	[51]	"RRGB.Close"	"M.Close"
##	[53]	"JBLU.Close"	"TGT.Volume"
##	[55]	"FTR.Volume"	"UBSI.Volume"
##	[57]	"HD.Volume"	"JPM.Volume"
##	[59]	"XOM.Volume"	"CVX.Volume"
##	[61]	"NSANY.Volume"	"MGM.Volume"
##	[63]	"TEVA.Volume"	"HST.Volume"
##	[65]	"WFC.Volume"	"WWE.Volume"

## [67]	"INO.Volume"	"SCE.PB.Volume"
## [69]	"FFIN.Volume"	"GOOG.Volume"
## [71]	"WM.Volume"	"ONCY.Volume"
## [73]	"S.Volume"	"F.Volume"
## [75]	"ARWR.Volume"	"COST.Volume"
## [77]	"AAL.Volume"	"JWN.Volume"
## [79]	"NUS.Volume"	"ADDYY.Volume"
## [81]	"KSS.Volume"	"MSFT.Volume"
## [83]	"LUV.Volume"	"HMC.Volume"
## [85]	"PCG.Volume"	"DLTR.Volume"
## [87]	"KGJI.Volume"	"NKE.Volume"
## [89]	"AMZN.Volume"	"ROST.Volume"
## [91]	"WMT.Volume"	"TJX.Volume"
## [93]	"TM.Volume"	"T.Volume"
## [95]	"JNJ.Volume"	"C.Volume"
## [97]	"EPD.Volume"	"VZ.Volume"
## [99]	"HRB.Volume"	"NFLX.Volume"
## [101]	"AAP.Volume"	"HOFT.Volume"
## [103]	"SIG.Volume"	"RRGB.Volume"
## [105]	"M.Volume"	"JBLU.Volume"
## [107]	"TGT_ROI_dollars"	"FTR_ROI_dollars"
## [109]	"UBSI_ROI_dollars"	"HD_ROI_dollars"
## [111]	"JPM_ROI_dollars"	"XOM_ROI_dollars"
## [113]	"CVX_ROI_dollars"	"NSANY_ROI_dollars"
## [115]	"MGM_ROI_dollars"	"TEVA_ROI_dollars"
## [117]	"HST_ROI_dollars"	"WFC_ROI_dollars"
## [119]	"WWE_ROI_dollars"	"INO_ROI_dollars"
## [121]	"SCE.PB_ROI_dollars"	"FFIN_ROI_dollars"
## [123]	"GOOG_ROI_dollars"	"WM_ROI_dollars"
## [125]	"ONCY_ROI_dollars"	"S_ROI_dollars"
## [127]	"F_ROI_dollars"	"ARWR_ROI_dollars"
## [129]	"COST_ROI_dollars"	"AAL_ROI_dollars"
## [131]	"JWN_ROI_dollars"	"NUS_ROI_dollars"
## [133]	"HMC_ROI_dollars"	"AMZN_ROI_dollars"
## [135]	"T_ROI_dollars"	"HRB_ROI_dollars"
## [137]	"RRGB_ROI_dollars"	"ADDYY_ROI_dollars"
## [139]	"PCG_ROI_dollars"	"ROST_ROI_dollars"
## [141]	"JNJ_ROI_dollars"	"NFLX_ROI_dollars"
## [143]	"M_ROI_dollars"	"KSS_ROI_dollars"
## [145]	"DLTR_ROI_dollars"	"WMT_ROI_dollars"
## [147]	"C_ROI_dollars"	"AAP_ROI_dollars"
## [149]	"JBLU_ROI_dollars"	"MSFT_ROI_dollars"
## [151]	"KGJI_ROI_dollars"	"EPD_ROI_dollars"
## [153]	"TJX_ROI_dollars"	"HOFT_ROI_dollars"
## [155]	"LUV_ROI_dollars"	"NKE_ROI_dollars"
## [157]	"TM_ROI_dollars"	"VZ_ROI_dollars"
## [159]	"SIG_ROI_dollars"	"TGT_dailyChange"
## [161]	"FTR_dailyChange"	"UBSI_dailyChange"
## [163]	"HD_dailyChange"	"JPM_dailyChange"
## [165]	"XOM_dailyChange"	"CVX_dailyChange"

```
## [167] "NSANY_dailyChange"      "MGM_dailyChange"
## [169] "TEVA_dailyChange"      "HST_dailyChange"
## [171] "WFC_dailyChange"       "WWE_dailyChange"
## [173] "INO_dailyChange"       "SCE.PB_dailyChange"
## [175] "FFIN_dailyChange"      "GOOG_dailyChange"
## [177] "WM_dailyChange"        "ONCY_dailyChange"
## [179] "S_dailyChange"         "F_dailyChange"
## [181] "ARWR_dailyChange"      "COST_dailyChange"
## [183] "AAL_dailyChange"       "JWN_dailyChange"
## [185] "NUS_dailyChange"       "HMC_dailyChange"
## [187] "AMZN_dailyChange"      "T_dailyChange"
## [189] "HRB_dailyChange"       "RRGB_dailyChange"
## [191] "ADDYY_dailyChange"     "PCG_dailyChange"
## [193] "ROST_dailyChange"      "JNJ_dailyChange"
## [195] "NFLX_dailyChange"      "M_dailyChange"
## [197] "KSS_dailyChange"       "DLTR_dailyChange"
## [199] "WMT_dailyChange"       "C_dailyChange"
## [201] "AAP_dailyChange"       "JBLU_dailyChange"
## [203] "MSFT_dailyChange"      "KGJI_dailyChange"
## [205] "EPD_dailyChange"       "TJX_dailyChange"
## [207] "HOFT_dailyChange"      "LUV_dailyChange"
## [209] "NKE_dailyChange"       "TM_dailyChange"
## [211] "VZ_dailyChange"        "SIG_dailyChange"
## [213] "MonthYear"             "portfolio_DailyValue"
## [215] "portfolio_prevDay"     "portfolio_dailyValueChange"
## [217] "portfolio_ROI_dollars"  "Date"
## [219] "DayOfWeek"            "Month"
## [221] "Year"                 "UE_monthlyRate"
## [223] "portfolio_DailyVolume" "portfolio_prevDayVolume"
## [225] "portfolio_dailyVolumeChange"
"portfolio_VolumeRatioDaily2Initial"
## [227] "portfolio_ValueRatioDaily2Initial" "portfolio_DailyRatios_X_UE"
## [229] "dayOfMonth"           "portfolio_poisson"

write.csv(StocksSTATS, 'STOCKS_STATS.csv', row.names=TRUE)
```

Lets us pick one stock, look at the stats we added for that stock and then pull out some googled articles of that stock as a company in the news since 2007 till today's date of Feb. 18, 2020 to compare the sentiments on the company with words that we will count the number of times the company is in the news, the comments by readers, zoom in on the dates of those articles, and see how the company behaved. Lets choose the highest ROI in dollars out of our stocks and compare it to the lowest ROI in dollars.

```
m <- StocksSTATS[order(StocksSTATS$Date,
decreasing=FALSE)[length(StocksSTATS$Date)], 107:159]
t <- as.data.frame(t(m))
colnames(t) <- row.names(m)
t$StockROI <- row.names(t)

Troi <- t[order(t$'2020-01-31', decreasing=TRUE),]
```

```

mostLeast <- rbind(head(Troi,3),tail(Troi,3))
mostLeast <- na.omit(mostLeast)
mostLeast

##              2020-01-31              StockROI
## AMZN_ROI_dollars    1968.300    AMZN_ROI_dollars
## GOOG_ROI_dollars    1205.821    GOOG_ROI_dollars
## SCE.PB_ROI_dollars    679.000    SCE.PB_ROI_dollars
## MGM_ROI_dollars     -40.520    MGM_ROI_dollars
## FTR_ROI_dollars     -225.200    FTR_ROI_dollars
## C_ROI_dollars       -436.090    C_ROI_dollars

```

The above table shows the three highest returns on investment and the three lowest since Jan 3, 2007 to Jan 31, 2020. Lets use the lowest stock for now (C is Citigroup bank), because AMZN (Amazon) is always in the news and it would fluctuate a lot I would think, but we could look at the quartiles for each and get the news releases of each date where the stock was in that quartile range, look at the median ROI, the min and max too, and cross referencing with the other stat fields.

```

amzn <- grep('AMZN', colnames(StocksSTATS))
c <- grep('^C[.]_', colnames(StocksSTATS))
C_stock <- StocksSTATS[,c(c,213:230)]
amzn_stock <- StocksSTATS[,c(amzn,213:230)]

```

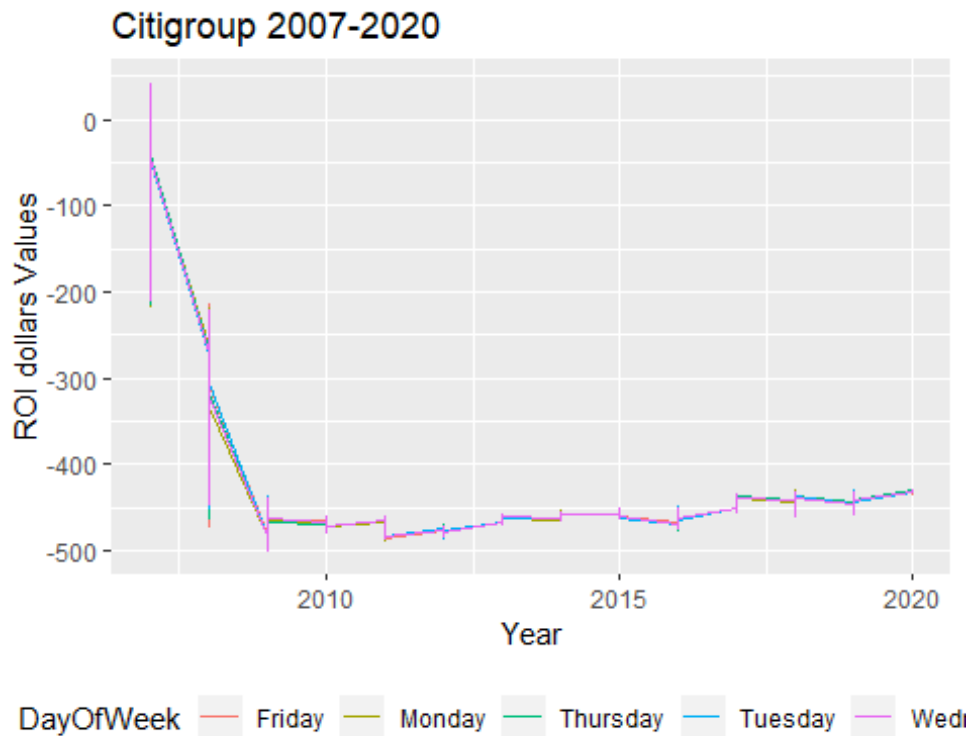
Citigroup is our C_stock table and Amazon is our amzn_stock table. Lets look at the daily ratios of volume and ROI in dollars times the unemployment rate column and the day of the week and day of the year and poisson columns.

```

ggplot(data = C_stock, aes(x=Year, y=C_ROI_dollars,group=DayOfWeek)) +
  geom_line(aes(color=DayOfWeek))+
  scale_y_continuous()+
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom")+
  ggtitle('Citigroup 2007-2020')+
  ylab('ROI dollars Values')

## Warning in pal_name(palette, type): Unknown palette paired

```



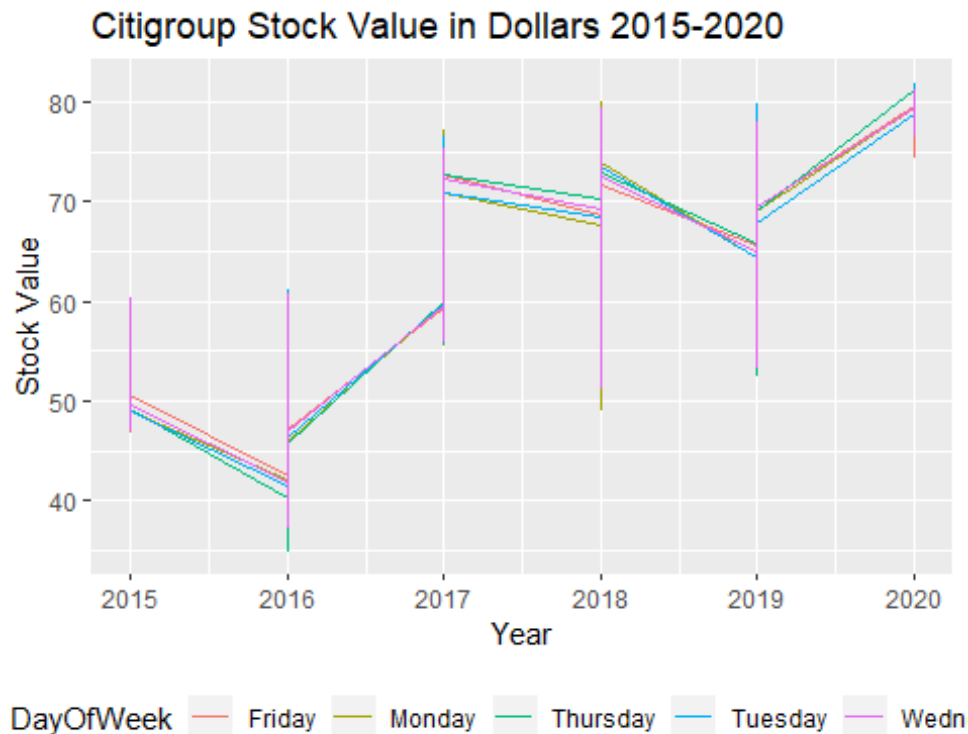
We can see from the plot above that buying Citigroup stock anywhere before 2010, was a bad idea. But we also see that the stock would have been good to buy around 2010-2016, as it overall increased its return on investment in dollars initially invested.

Lets look at the years from 2016-2020 to see this plotted Citigroup stock.

```
y2015plus <- subset(C_stock, C_stock$Year>2014)

ggplot(data = y2015plus, aes(x=Year, y=C.Close,group=DayOfWeek)) +
  geom_line(aes(color=DayOfWeek))+
  scale_y_continuous()+
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom")+
  ggtitle('Citigroup Stock Value in Dollars 2015-2020')+
  ylab('Stock Value')

## Warning in pal_name(palette, type): Unknown palette paired
```

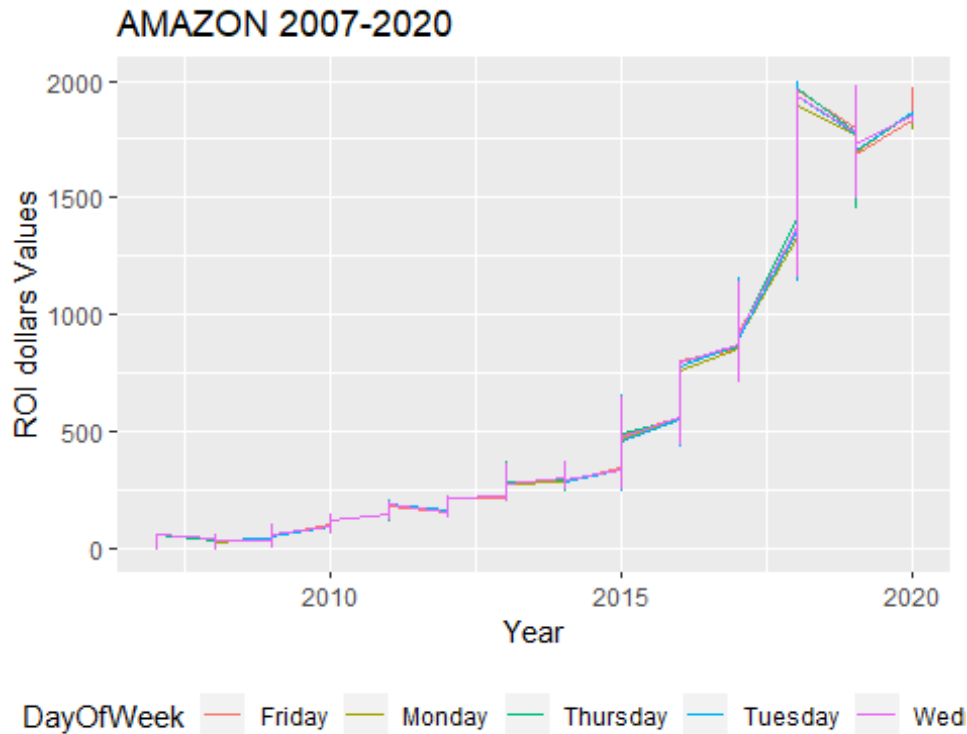


We see from the above plot that Citigroup was good to buy at the start of 2016 or 2019 if you want to see an increase all year long, but in 2017-2018 it decreased. Overall, if investing since 2016, the stock increased from the high \$40 to the mid-high \$70 range. This would be good to cross reference with unemployment rates and the news articles online text mined for public sentiment on Citigroup.

Lets look at amazon for the same quick plotted analysis as done with Citigroup.

```
ggplot(data = amzn_stock, aes(x=Year, y=AMZN_ROI_dollars, group=DayOfWeek)) +
  geom_line(aes(color=DayOfWeek)) +
  scale_y_continuous() +
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom") +
  ggtitle('AMAZON 2007-2020') +
  ylab('ROI dollars Values')
```

```
## Warning in pal_name(palette, type): Unknown palette paired
```

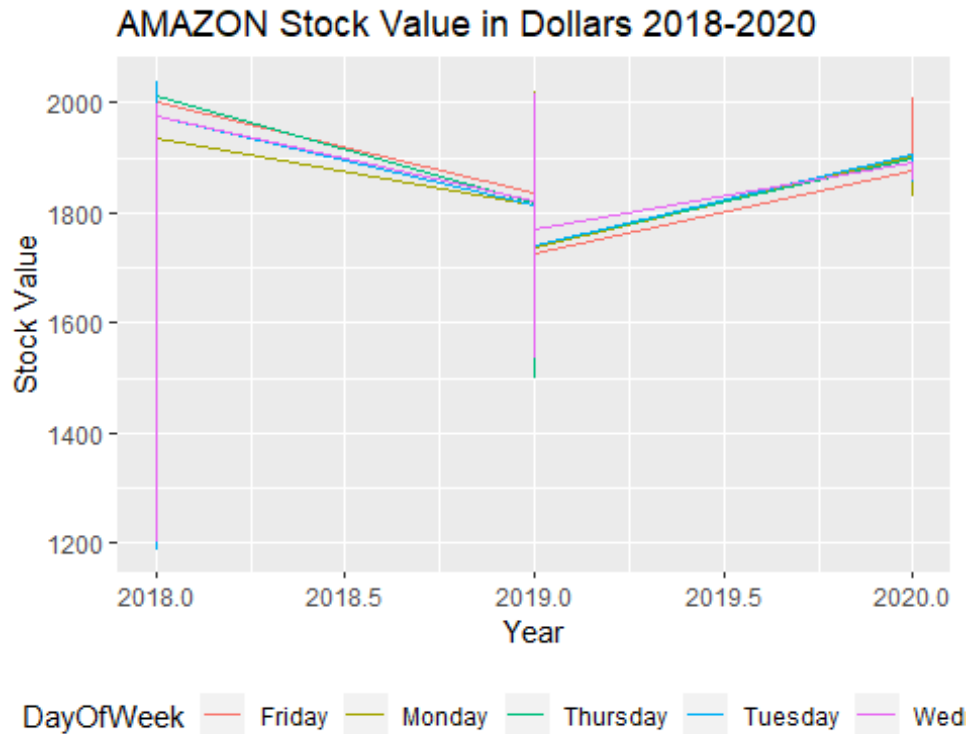
We can see from the plot above that buying AMAZON stock anywhere before 2010, was a great idea. But we also see that the stock would have been good to buy around 2010-2018 or 2019 but not in 2018, as it overall increased its return on investment in dollars initially invested. In 2018, you bought high and it decreased the entire year. This would be great to see what happened in 2018 with the value. So we will.

Lets look at the years from 2018-2020 to see this plotted Citigroup stock.

```
y2015plus <- subset(amzn_stock, amzn_stock$Year>2017)

ggplot(data = y2015plus, aes(x=Year, y=AMZN.Close, group=DayOfWeek)) +
  geom_line(aes(color=DayOfWeek)) +
  scale_y_continuous() +
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom") +
  ggtitle('AMAZON Stock Value in Dollars 2018-2020') +
  ylab('Stock Value')

## Warning in pal_name(palette, type): Unknown palette paired
```



The chart above shows how the value in dollars and day of the week from 2018-2020 decreases in 2018 and increases in 2019. If you bought in 2018, you lost money the entire year, but you gained it back in 2019 plus some additional earnings.

Lets group by the day of the month in this time series of the Citigroup stock and get the median value for the volume of stocks traded for Citigroup by days 1-31 of the month.

```
v1 <- as.vector(colnames(C_stock)[2])
Citi <- C_stock %>% group_by(dayOfMonth) %>% summarise_at(vars(v1), median,
na.rm=T)

Citi <- as.data.frame(Citi)
colnames(Citi)[2] <- 'Citi_Median_Volume'
Citi <- Citi[order(Citi$Citi_Median_Volume, decreasing=T),]
headTail_Citi_volume <- rbind(head(Citi,3), tail(Citi,3))
headTail_Citi_volume
```

##	dayOfMonth	Citi_Median_Volume
## 16	16	22388100
## 31	31	22302200
## 3	3	21221500
## 25	25	17960700
## 20	20	17548500
## 2	2	17134600

From the above table we see that the most volume of trades for Citigroup is at the middle and end of the month, and the lowest volume of trades are at the beginning of the new month and the third week of the month.

Lets look at the statistics of citigroup.

```
summary(C_stock)
```

```
##      C.Close      C.Volume      C_ROI_dollars      C_dailyChange
## Min.   : 10.20   Min.   : 1005100   Min.   :-500.3   Min.   :-298.300
## 1st Qu.: 41.80   1st Qu.: 13019600   1st Qu.: -468.7   1st Qu.: -0.680
## Median : 51.49   Median : 19493900   Median : -459.0   Median : -0.010
## Mean   : 93.38   Mean   : 26987469   Mean   : -417.1   Mean   :  0.021
## 3rd Qu.: 69.46   3rd Qu.: 33280800   3rd Qu.: -441.0   3rd Qu.:  0.650
## Max.   :552.50   Max.   :377263800   Max.   :  42.0   Max.   : 510.500
##
##      MonthYear      portfolio_DailyValue      portfolio_prevDay
## Aug-2007: 23   Min.   :1229      Min.   :1229
## Aug-2011: 23   1st Qu.:2821      1st Qu.:2821
## Aug-2012: 23   Median :3542      Median :3541
## Aug-2016: 23   Mean   :3988      Mean   :3986
## Aug-2017: 23   3rd Qu.:5104      3rd Qu.:5104
## Aug-2018: 23   Max.   :7910      Max.   :7910
## (Other) :3155
## portfolio_dailyValueChange      portfolio_ROI_dollars      Date
## Min.   :-1014.322      Min.   :-1748.9      Min.   :2007-01-03
## 1st Qu.: -39.065      1st Qu.: -157.4      1st Qu.:2010-04-12
## Median :  2.276      Median :  563.9      Median :2013-07-18
## Mean   :  1.475      Mean   : 1009.6      Mean   :2013-07-16
## 3rd Qu.: 43.517      3rd Qu.: 2126.4      3rd Qu.:2016-10-21
## Max.   : 1025.453      Max.   : 4931.7      Max.   :2020-01-31
##
##      DayOfWeek      Month      Year      UE_monthlyRate
## Length:3293      Length:3293      Min.   :2007      Min.   : 3.500
## Class :character      Class :character      1st Qu.:2010      1st Qu.: 4.600
## Mode  :character      Mode  :character      Median :2013      Median : 5.600
##                                     Mean   :2013      Mean   : 6.282
##                                     3rd Qu.:2016      3rd Qu.: 8.200
##                                     Max.   :2020      Max.   :10.000
##
## portfolio_DailyVolume      portfolio_prevDayVolume      portfolio_dailyVolumeChange
## Min.   :1.133e+08      Min.   :1.133e+08      Min.   : -714176400
## 1st Qu.:3.370e+08      1st Qu.:3.370e+08      1st Qu.: -50722061
## Median :4.194e+08      Median :4.196e+08      Median :  250560
## Mean   :4.752e+08      Mean   :4.753e+08      Mean   : -55791
## 3rd Qu.:5.716e+08      3rd Qu.:5.716e+08      3rd Qu.: 50561500
## Max.   :1.611e+09      Max.   :1.611e+09      Max.   : 620907605
##
## portfolio_VolumeRatioDaily2Initial      portfolio_ValueRatioDaily2Initial
## Min.   :0.1981      Min.   :0.4236
## 1st Qu.:0.5891      1st Qu.:0.9720
## Median :0.7333      Median :1.2206
## Mean   :0.8307      Mean   :1.3742
## 3rd Qu.:0.9992      3rd Qu.:1.7591
```

```
## Max.      :2.8163                      Max.      :2.7259
##
## portfolio_DailyRatios_X_UE  dayOfMonth  portfolio_poisson
## Min.      : 0.9658          Min.      : 1.00      Min.      :0.03177
## 1st Qu.: 4.4923            1st Qu.: 8.00      1st Qu.:0.07392
## Median : 5.6528            Median :16.00      Median :0.22652
## Mean    : 6.4285            Mean    :15.74      Mean    :0.19506
## 3rd Qu.: 7.8497            3rd Qu.:23.00      3rd Qu.:0.29808
## Max.     :24.2627          Max.     :31.00      Max.     :0.36217
##
```

From the above summary statistics of Citigroup, we see the min, quantiles, median, mean, and max numeric values as well as length and class type for the non-numeric features of this data set.

Some interesting insights into the above table are that considering an initial investment of 510 USD, the return on the initial investment in dollars is almost the entire amount invested but not quite. Definitely about 80% from the quantile and statistics on the ROI column.

The daily changes fluctuated from a loss of 298 USD in one day to a profit of 510 USD on another day. These are good indicators of where to look on these days, to see if the public sentiment on these dates for Citigroup would indicate more people getting rid of their Citi stock or buying up more of it.

Also, the max and min volume of stock is much more and less respectively than the median volume of trades for this Citigroup stock. These dates for information would also be an interesting place to start to find a pattern with buying/selling stock and combining web scraped text from news articles and comments about Citigroup on those dates.

First, we should grab those points of interest in the data and create a table to compare these values.

```
C_stock_minmaxValueChanges <- subset(C_stock,
C_stock$C_dailyChange==min(C_stock$C_dailyChange) |
C_stock$C_dailyChange==max(C_stock$C_dailyChange) |
C_stock$C.Volume==min(C_stock$C.Volume) |
C_stock$C.Volume==max(C_stock$C.Volume))
C_stock_minmaxValueChanges

##           C.Close  C.Volume  C_ROI_dollars  C_dailyChange  MonthYear
## 2007-04-02  510.50   2282100         0.00     510.500000  Apr-2007
## 2013-04-02   44.11   1005100        -466.39      0.320000  Apr-2013
## 2015-12-28   52.38  377263800        -458.12     -0.329998  Dec-2015
## 2008-06-02  214.60  15302800        -295.90    -298.300018  Jun-2008
##           portfolio_DailyValue  portfolio_prevDay
```

```

portfolio_dailyValueChange
## 2007-04-02          2901.650          2891.963
9.686608
## 2013-04-02          3433.938          3354.901
79.037872
## 2015-12-28          5005.455          4984.970
20.485009
## 2008-06-02          3120.541          3144.698          -
24.157199
##          portfolio_ROI_dollars          Date DayOfWeek Month Year
UE_monthlyRate
## 2007-04-02          -76.28907 2007-04-02   Monday   Apr 2007
4.5
## 2013-04-02          455.99978 2013-04-02  Tuesday   Apr 2013
7.6
## 2015-12-28          2027.51641 2015-12-28   Monday   Dec 2015
5.0
## 2008-06-02          142.60220 2008-06-02   Monday   Jun 2008
5.6
##          portfolio_DailyVolume portfolio_prevDayVolume
## 2007-04-02          572035712          572035712
## 2013-04-02          258084601          330998801
## 2015-12-28          975152259          752607802
## 2008-06-02          464823559          265152951
##          portfolio_dailyVolumeChange portfolio_VolumeRatioDaily2Initial
## 2007-04-02          0          1.0000000
## 2013-04-02          -72914200          0.4511687
## 2015-12-28          222544457          1.7047052
## 2008-06-02          199670608          0.8125779
##          portfolio_ValueRatioDaily2Initial portfolio_DailyRatios_X_UE
## 2007-04-02          1.000000          4.500000
## 2013-04-02          1.183444          4.057888
## 2015-12-28          1.725038          14.703404
## 2008-06-02          1.075437          4.893707
##          dayOfMonth portfolio_poisson
## 2007-04-02          2          0.25773
## 2013-04-02          2          0.33619
## 2015-12-28          28          0.27468
## 2008-06-02          2          0.06828

```

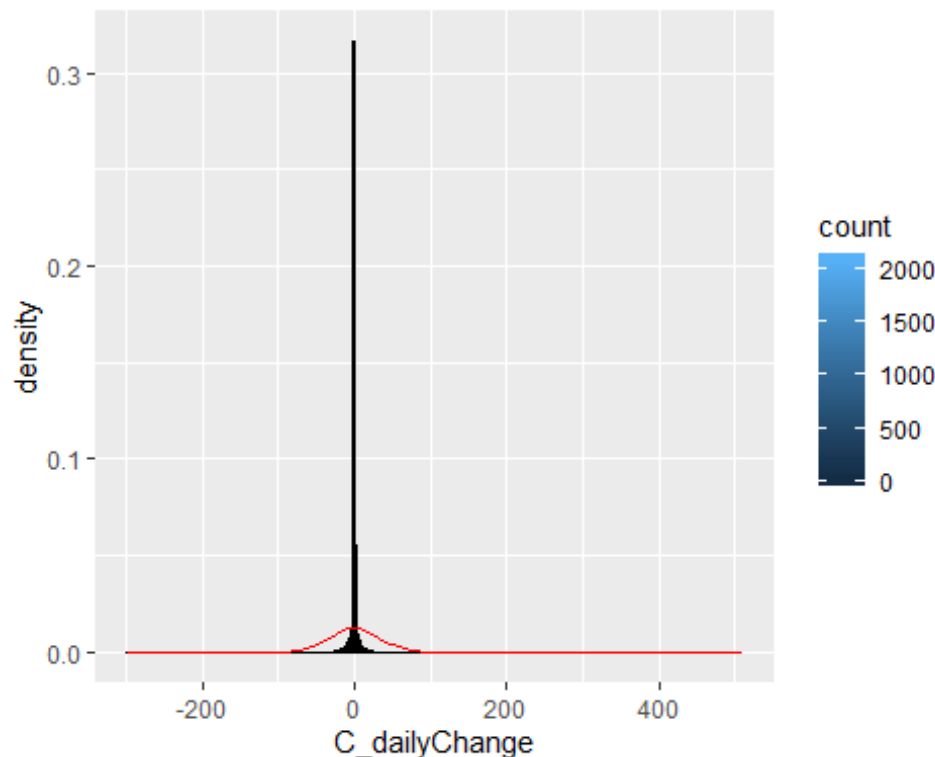
From the above information, Monday is the day of the week with the highest and lowest daily change, as well as the highest volume of trade. Tuesday is the day with the lowest volume of trade. The dates to pull an internet search of news articles about Citigroup to analyze public sentiment on Citi stock are:

- April 2, 2007
- April 2, 2013
- December 28, 2015
- June 2, 2008

This should be interesting to see what type of articles are available on line with a google search of those dates and citigroup.

Lets see if there are any other outlier dates to examine by looking at the standard deviation of the daily change on Citigroup stock. We want to see if there are any days where the stock has a daily change more than or less than this amount times three then times two. Because most values will be within the standard deviation for the Gaussian curve.

```
gg <- ggplot(C_stock, aes(x=C_dailyChange))
gg <- gg + geom_histogram(binwidth=2, colour="black",
                           aes(y=..density.., fill=..count..))
gg <- gg + stat_function(fun=dnorm,
                        color="red",
                        args=list(mean=mean(C_stock$C_dailyChange),
                                sd=sd(C_stock$C_dailyChange)))
gg
```



```
sdC <- sd(C_stock$C_dailyChange)
out <- sdC*3
sdC;out

## [1] 32.16953
## [1] 96.50858
```

The standard error for the daily change in dollars is 32.17 USD and our threshold to find dates outside this normal range of daily change dollar values is 96.51 USD.

Lets add another column to this data set called threshold3 for those daily change values inside the threshold and those outside the threshold.

```
C_stock$Threshold3 <- ifelse(C_stock$C_dailyChange < out, 'inside','outside')
```

```
C_outer_SD <- subset(C_stock, C_stock$Threshold3=='outside')
summary(C_outer_SD)
```

```
##      C.Close      C.Volume      C_ROI_dollars      C_dailyChange
##  Min.   :330.6    Min.    : 2282100    Min.    :-179.90    Min.    :266.2
##  1st Qu.:471.2    1st Qu.:13456250    1st Qu.: -39.30    1st Qu.:399.6
##  Median :510.6    Median :19551450    Median :   0.15    Median :441.4
##  Mean   :488.2    Mean   :30425167    Mean    :-22.32    Mean   :424.4
##  3rd Qu.:542.8    3rd Qu.:35952375    3rd Qu.: 32.27    3rd Qu.:475.4
##  Max.   :552.5    Max.    :81343800    Max.     : 42.00    Max.    :510.5
##
##      MonthYear portfolio_DailyValue portfolio_prevDay
portfolio_dailyValueChange
## Apr-2007:1    Min.    :2724          Min.    :2744          Min.    :-85.034
## Aug-2007:1    1st Qu.:2899          1st Qu.:2878          1st Qu.: -4.048
## Dec-2007:1    Median :2974          Median :2942          Median : -1.393
## Feb-2007:1    Mean    :3104          Mean    :3044          Mean    : 59.150
## Jan-2007:1    3rd Qu.:3343          3rd Qu.:3076          3rd Qu.: 20.755
## Jul-2007:1    Max.    :3656          Max.    :3619          Max.    :734.207
## (Other) :6
## portfolio_ROI_dollars      Date      DayOfWeek
## Min.    :-253.961          Min.    :2007-01-03    Length:12
## 1st Qu.: -79.356          1st Qu.:2007-03-25    Class :character
## Median :  -4.371          Median :2007-06-16    Mode  :character
## Mean    : 125.597          Mean    :2007-06-17
## 3rd Qu.: 364.923          3rd Qu.:2007-09-10
## Max.    : 677.926          Max.    :2007-12-03
##
##      Month      Year      UE_monthlyRate      portfolio_DailyVolume
## Length:12          Min.    :2007    Min.    :4.400    Min.    :2.160e+08
## Class :character    1st Qu.:2007    1st Qu.:4.500    1st Qu.:3.962e+08
## Mode  :character    Median :2007    Median :4.600    Median :4.644e+08
##                      Mean    :2007    Mean    :4.617    Mean    :5.398e+08
##                      3rd Qu.:2007    3rd Qu.:4.700    3rd Qu.:6.314e+08
##                      Max.    :2007    Max.    :5.000    Max.    :1.005e+09
##
##      portfolio_prevDayVolume      portfolio_dailyVolumeChange
## Min.    :198190500          Min.    :-197842207
## 1st Qu.:387785669          1st Qu.: -23781530
## Median :564614969          Median : 26069930
## Mean    :528884214          Mean    : 10878309
## 3rd Qu.:594041737          3rd Qu.: 70618878
```



```
## Max. :971072459 Max. : 124348468
##
## portfolio_VolumeRatioDaily2Initial portfolio_ValueRatioDaily2Initial
## Min. :0.3776 Min. :0.9388
## 1st Qu.:0.6926 1st Qu.:0.9989
## Median :0.8118 Median :1.0248
## Mean :0.9436 Mean :1.0696
## 3rd Qu.:1.1038 3rd Qu.:1.1521
## Max. :1.7576 Max. :1.2599
##
## portfolio_DailyRatios_X_UE dayOfMonth portfolio_poisson Threshold3
## Min. :1.654 Min. :1.00 Min. :0.04659 Length:12
## 1st Qu.:3.696 1st Qu.:1.00 1st Qu.:0.05008 Class
:character
## Median :4.400 Median :1.00 Median :0.05454 Mode
:character
## Mean :4.641 Mean :1.75 Mean :0.13836
## 3rd Qu.:5.116 3rd Qu.:2.25 3rd Qu.:0.25948
## Max. :8.297 Max. :4.00 Max. :0.26474
##
```

We can see from the above statistics on the subset of Citigroup stock that are outside this threshold that there are 12 dates to select in the range of Jan 2007 through Sep 2008. So we will add those dates to our data set of text scraped news articles on Citigroup.

```
NLP_dates_Citi <- rbind(C_stock_minmaxValueChanges, C_outer_SD[, -23])
NLP_dates_Citi
```

```
## C.Close C.Volume C_ROI_dollars C_dailyChange MonthYear
## 2007-04-02 510.50 2282100 0.000000 510.500000 Apr-2007
## 2013-04-02 44.11 1005100 -466.389999 0.320000 Apr-2013
## 2015-12-28 52.38 377263800 -458.119999 -0.329998 Dec-2015
## 2008-06-02 214.60 15302800 -295.899994 -298.300018 Jun-2008
## 2007-04-02 510.50 2282100 0.000000 510.500000 Apr-2007
## 2007-08-01 468.50 13495700 -42.000000 397.800003 Aug-2007
## 2007-12-03 330.60 81343800 -179.899994 266.250008 Dec-2007
## 2007-02-01 547.30 80864600 36.799988 467.409989 Feb-2007
## 2007-01-03 552.50 43508100 42.000000 488.520000 Jan-2007
## 2007-07-02 516.40 32822200 5.900024 441.990020 Jul-2007
## 2007-06-01 545.10 23057000 34.599976 473.939972 Jun-2007
## 2007-03-01 510.80 8981300 0.299988 440.769989 Mar-2007
## 2007-05-01 542.00 13337900 31.500000 479.779999 May-2007
## 2007-11-01 385.10 33433800 -125.399994 322.950004 Nov-2007
## 2007-10-01 477.20 16045900 -33.299988 402.080009 Oct-2007
## 2007-09-04 472.10 15929600 -38.399994 400.240005 Sep-2007
## portfolio_DailyValue portfolio_prevDay
portfolio_dailyValueChange
## 2007-04-02 2901.650 2891.963
9.686608
## 2013-04-02 3433.938 3354.901
```

79.037872					
## 2015-12-28	5005.455	4984.970			
20.485009					
## 2008-06-02	3120.541	3144.698		-	
24.157199					
## 2007-04-021	2901.650	2891.963			
9.686608					
## 2007-08-01	2778.299	2781.133		-	
2.834138					
## 2007-12-03	2723.978	2743.972		-	
19.993872					
## 2007-02-01	3279.015	3281.965		-	
2.949476					
## 2007-01-03	2977.939	2977.939			
0.000000					
## 2007-07-02	2969.196	2946.619			
22.576765					
## 2007-06-01	3003.989	3006.774		-	
2.785581					
## 2007-03-01	2889.381	2896.725		-	
7.344424					
## 2007-05-01	2957.539	2937.392			
20.147648					
## 2007-11-01	3534.398	3619.433		-	
85.034241					
## 2007-10-01	3655.864	3611.738			
44.126353					
## 2007-09-04	3571.178	2836.972			
734.206543					
##	portfolio_ROI_dollars	Date	DayOfWeek	Month	Year
## 2007-04-02	-76.289072	2007-04-02	Monday	Apr	2007
## 2013-04-02	455.999776	2013-04-02	Tuesday	Apr	2013
## 2015-12-28	2027.516411	2015-12-28	Monday	Dec	2015
## 2008-06-02	142.602196	2008-06-02	Monday	Jun	2008
## 2007-04-021	-76.289072	2007-04-02	Monday	Apr	2007
## 2007-08-01	-199.639490	2007-08-01	Wednesday	Aug	2007
## 2007-12-03	-253.960930	2007-12-03	Monday	Dec	2007
## 2007-02-01	301.076786	2007-02-01	Thursday	Feb	2007
## 2007-01-03	0.000000	2007-01-03	Wednesday	Jan	2007
## 2007-07-02	-8.742779	2007-07-02	Monday	Jul	2007
## 2007-06-01	26.049900	2007-06-01	Friday	Jun	2007
## 2007-03-01	-88.557542	2007-03-01	Thursday	Mar	2007
## 2007-05-01	-20.399119	2007-05-01	Tuesday	May	2007
## 2007-11-01	556.459753	2007-11-01	Thursday	Nov	2007
## 2007-10-01	677.925528	2007-10-01	Monday	Oct	2007
## 2007-09-04	593.239860	2007-09-04	Tuesday	Sep	2007
##	UE_monthlyRate	portfolio_DailyVolume	portfolio_prevDayVolume		
## 2007-04-02	4.5	572035712	572035712		
## 2013-04-02	7.6	258084601	330998801		
## 2015-12-28	5.0	975152259	752607802		

##	2008-06-02	5.6	464823559	265152951
##	2007-04-021	4.5	572035712	572035712
##	2007-08-01	4.6	686001371	572681959
##	2007-12-03	5.0	1005429691	971072459
##	2007-02-01	4.5	933350159	809001691
##	2007-01-03	4.6	613250413	565411759
##	2007-07-02	4.7	460278863	658121070
##	2007-06-01	4.6	381151267	397701502
##	2007-03-01	4.4	215973129	198190500
##	2007-05-01	4.4	314742689	233827359
##	2007-11-01	4.7	468477291	563818179
##	2007-10-01	4.7	401234791	446710205
##	2007-09-04	4.7	425224899	358038171
##	portfolio_dailyVolumeChange portfolio_VolumeRatioDaily2Initial			
##	2007-04-02		0	1.0000000
##	2013-04-02		-72914200	0.4511687
##	2015-12-28		222544457	1.7047052
##	2008-06-02		199670608	0.8125779
##	2007-04-021		0	1.0000000
##	2007-08-01		113319412	1.1992282
##	2007-12-03		34357232	1.7576345
##	2007-02-01		124348468	1.6316292
##	2007-01-03		47838654	1.0720492
##	2007-07-02		-197842207	0.8046331
##	2007-06-01		-16550235	0.6663068
##	2007-03-01		17782629	0.3775518
##	2007-05-01		80915330	0.5502151
##	2007-11-01		-95340888	0.8189651
##	2007-10-01		-45475414	0.7014156
##	2007-09-04		67186728	0.7433538
##	portfolio_ValueRatioDaily2Initial portfolio_DailyRatios_X_UE			
##	2007-04-02		1.0000000	4.500000
##	2013-04-02		1.1834435	4.057888
##	2015-12-28		1.7250378	14.703404
##	2008-06-02		1.0754368	4.893707
##	2007-04-021		1.0000000	4.500000
##	2007-08-01		0.9574896	5.281943
##	2007-12-03		0.9387687	8.250061
##	2007-02-01		1.1300522	8.297218
##	2007-01-03		1.0262916	5.061081
##	2007-07-02		1.0232786	3.869810
##	2007-06-01		1.0352692	3.173112
##	2007-03-01		0.9957719	1.654204
##	2007-05-01		1.0192614	2.467577
##	2007-11-01		1.2180652	4.688499
##	2007-10-01		1.2599262	4.153540
##	2007-09-04		1.2307408	4.299916
##	dayOfMonth portfolio_poisson			
##	2007-04-02	2	0.25773	
##	2013-04-02	2	0.33619	

## 2015-12-28	28	0.27468
## 2008-06-02	2	0.06828
## 2007-04-021	2	0.25773
## 2007-08-01	1	0.05008
## 2007-12-03	3	0.05723
## 2007-02-01	1	0.04833
## 2007-01-03	3	0.05008
## 2007-07-02	2	0.26474
## 2007-06-01	1	0.05008
## 2007-03-01	1	0.04659
## 2007-05-01	1	0.25411
## 2007-11-01	1	0.05184
## 2007-10-01	1	0.26474
## 2007-09-04	4	0.26474

I am going to pull the data from these dates with the Google Search for the specific date on Citigroup stock, put it in a table with the date, the article title, reference, article content, and the comments if available.

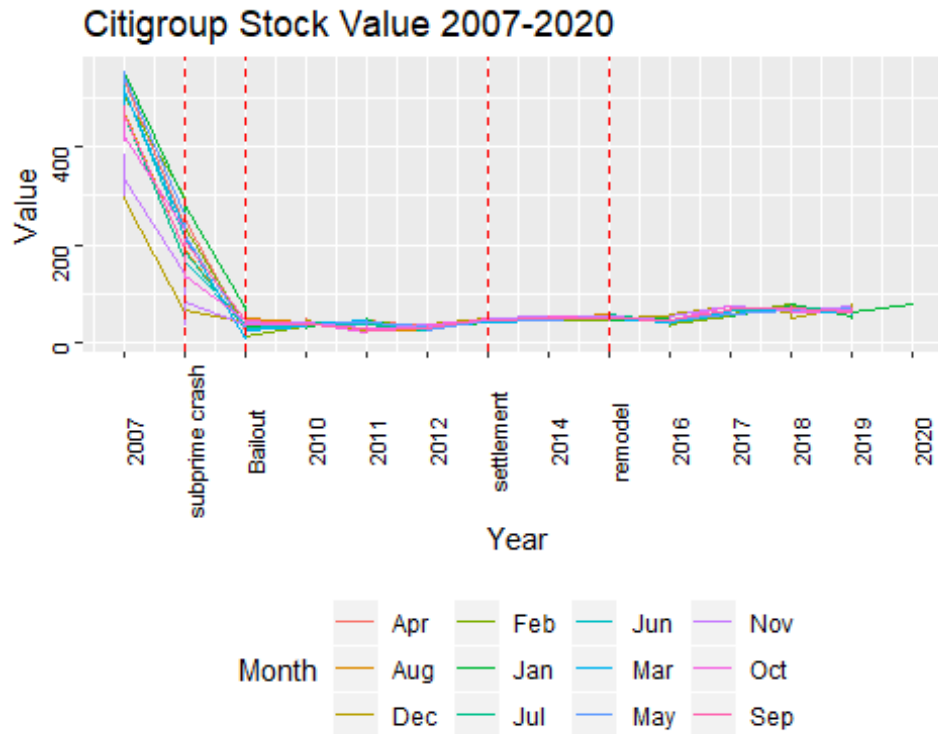
Note: when searching the internet, there were limited articles and [most](#) were about Citi's involvement in the sub-prime mortgage crisis of 2007-2008, and a [bailout](#) of Citigroup by the US. For the month and years of the two dates not in or around 2007-2008, there are only two for April 2013 and December 2015. Where Citi settled a [lawsuit](#) for covering up bad mortgage loans in August 2012 and a [person reported](#) on a forum about FICO scores how he was approved for a 4600 USD credit card with Citi. There isn't enough data to rely on the web for NLP on Citigroup for these time frames.

Lets plot this as a simple line chart of the value of the stock over the years.

```
ggplot(data = C_stock, aes(x=Year, y=C.Close, group=Month)) +
  geom_line(aes(color=Month))+
  scale_y_continuous()+
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom")+

scale_x_continuous(breaks=c(2007,2008,2009,2010,2011,2012,2013,2014,2015,2016
,2017,2018,2019,2020),
                    labels=c(2007,'subprime
crash', 'Bailout', 2010,2011,2012, 'settlement', 2014, 'remodel', 2016,2017,2018,20
19,2020))+
  theme(axis.text = element_text(colour = "black", angle=90, size =
rel(.75)))+
  geom_vline(xintercept=c(2008,2009,2013,2015), linetype='dashed',
color='red')+
  ggtitle('Citigroup Stock Value 2007-2020')+
  ylab('Value')

## Warning in pal_name(palette, type): Unknown palette paired
```



We could pull based on the keywords: ‘settlement’, ‘bail-out’, ‘sub-prime loans’, but we would only get the obvious negative sentiment for these keywords. A New York Times article posted an article in Dec 2015 about the remodeling that Citigroup was doing to their offices, but the full article would have to be purchased. The fact that they spent money on remodeling could have some public sentiment of either they aren’t distributing their profits to shareholders or they are making enough profits to spend money on remodeling, which is also reported at the end of the year in 2015 to write off for that tax year. Although, I was told by an accountant that some corporations and small businesses have a different tax year and a quick search on Google returned the fiscal year is any consecutive 12-month business cycle that usually ends at the end of each quarter.

We can see that the volume of trades is highest in December 2015 from our dates, but we should compare this to which quantile this number is within for the volume of trades of Citi stock.

```
summary(C_stock$C.Volume)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
##	1005100	13019600	19493900	26987469	33280800	377263800

We already know that this is the date that the most trades in stock of Citi occurred as it is the reason we added this date to our NLP data set of dates to pull information from the web for. The above will refresh the comparisons of the trade volume to this date.

It looks like public sentiment thinks Citi is going back to its old bail-out days of 2007-2008 and not a trust-worthy stock for their personal portfolios. But they are still around, and the

fact that people that have a less than trust-worthy credit profile were given a credit card with a high value could indicate some people also consider that they are building a new demographic of people to invest in by earning the trust of those who have sub-par trust worthiness with credit. And, yet some other investors could also think this is a bad move to make as it depends on those same people realizing their mistakes and not making them again. Which really turns into the reason some stocks are volatile to begin with and possibly a reason to understand Game Theory, a class I dropped in my undergrad college. But nonetheless I am a data scientist with other coventional and non-conventional ways of extracting useful information, and this approach uses my math and analytic skills to fully understand the stock market and certain stocks and trends with public sentiment.

On this highest trade day, the daily change in dollars was still within the standard error by only dropping 0.33 USD. Where the standard error is 32.00 USD.

Of note is whether or not those making these trades are doing so to lower their Capital Gains at the end of the year, because there is a slight loss on it to balance out the portfolio. Also, this is the end of the year, possibly the last trading day of the year as it is. Lets look at all monthYear dates equal to Dec-2015 to see if there are any other dates past Dec 28, 2015.

```
dec2015 <- subset(C_stock, C_stock$MonthYear=='Dec-2015')
tail(dec2015)
```

```
##           C.Close  C.Volume C_ROI_dollars C_dailyChange MonthYear
## 2015-12-23   52.63  93423000      -457.87      0.620003  Dec-2015
## 2015-12-24   52.71 119108100      -457.79      0.079998  Dec-2015
## 2015-12-28   52.38 377263800      -458.12     -0.329998  Dec-2015
## 2015-12-29   52.98 281369700      -457.52      0.599999  Dec-2015
## 2015-12-30   52.30  62625000      -458.20     -0.680001  Dec-2015
## 2015-12-31   51.75  49092600      -458.75     -0.549999  Dec-2015
##           portfolio_DailyValue portfolio_prevDay
portfolio_dailyValueChange
## 2015-12-23           4998.690           4968.045
30.64500
## 2015-12-24           4984.970           4998.690      -
13.72002
## 2015-12-28           5005.455           4984.970
20.48501
## 2015-12-29           4738.190           5005.455      -
267.26507
## 2015-12-30           4800.285           4738.190
62.09506
## 2015-12-31           4707.685           4800.285      -
92.59999
##           portfolio_ROI_dollars           Date DayOfWeek Month Year
UE_monthlyRate
## 2015-12-23           2020.751 2015-12-23 Wednesday   Dec 2015
5
## 2015-12-24           2007.031 2015-12-24 Thursday    Dec 2015
```

```

5
## 2015-12-28          2027.516 2015-12-28    Monday    Dec 2015
5
## 2015-12-29          1760.251 2015-12-29    Tuesday    Dec 2015
5
## 2015-12-30          1822.346 2015-12-30   Wednesday   Dec 2015
5
## 2015-12-31          1729.746 2015-12-31   Thursday    Dec 2015
5
##                portfolio_DailyVolume portfolio_prevDayVolume
## 2015-12-23                903674159                619024059
## 2015-12-24                752607802                903674159
## 2015-12-28                975152259                752607802
## 2015-12-29               1248436459                975152259
## 2015-12-30               534260059                1248436459
## 2015-12-31               504630159                534260059
##                portfolio_dailyVolumeChange portfolio_VolumeRatioDaily2Initial
## 2015-12-23                284650100                1.5797513
## 2015-12-24               -151066357                1.3156658
## 2015-12-28                222544457                1.7047052
## 2015-12-29                273284200                2.1824450
## 2015-12-30               -714176400                0.9339628
## 2015-12-31               -29629900                0.8821655
##                portfolio_ValueRatioDaily2Initial portfolio_DailyRatios_X_UE
## 2015-12-23                1.722706                13.607238
## 2015-12-24                1.717978                11.301424
## 2015-12-28                1.725038                14.703404
## 2015-12-29                1.632930                17.818897
## 2015-12-30                1.654330                7.725412
## 2015-12-31                1.622417                7.156201
##                dayOfMonth portfolio_poisson Threshold3
## 2015-12-23                23                0.27468    inside
## 2015-12-24                24                0.05723    inside
## 2015-12-28                28                0.27468    inside
## 2015-12-29                29                0.05723    inside
## 2015-12-30                30                0.27468    inside
## 2015-12-31                31                0.05723    inside

```

We now know that Dec-28-2015 is not the last trading day of the year, because the 29th through 31st for Tuesday through Thursday are also trading days. There was a fluctuation in dollars earned and lost all under a dollar. Some useful information to add in would be who or where are these trades derived. Are they financial advisors, trust fund managers, independent investors, foreign or national investors, are they hobbyists just playing the stock market on an e-trade, are they educated, experienced, and so on?

To get this information we could first find out how much it costs for a hobbyist to make a trade online from e-trade or similar and whether or not this information is shared on demographics of the stock ownership. We could also look at the American Survey on Census data from the census bureau for number of financial workers there are and how

many people graduated with a BS, MS, or Phd in Finance or Economics. If there is location data on where these stock owners live attach this information gathered to it to make a better inference on this stock and what motivates the trades. Any volunteers?

For now, we will just continue with what we have on hand for Citi. We can answer the question of whether or not, historically there are more trades in December than any other month in our data by grouping by month year and getting the median trades per month and year.

```
Citi_trades_monthYear <- C_stock %>% group_by(MonthYear) %>%  
  summarise_at(vars(colnames(C_stock[2])), mean)  
Citi_trades_monthYear <-  
Citi_trades_monthYear[order(Citi_trades_monthYear$C.Volume,decreasing=TRUE),]  
Citi_trades_monthYear  
  
## # A tibble: 157 x 2  
##   MonthYear    C.Volume  
##   <fct>         <dbl>  
## 1 Dec-2011  102284343.  
## 2 Dec-2012   97253820  
## 3 Feb-2007   94010711.  
## 4 Feb-2008   80151765  
## 5 Dec-2019   79458262.  
## 6 Aug-2019   72849682.  
## 7 Feb-2015   70393405.  
## 8 Dec-2015   67380332.  
## 9 Jan-2010   64943774.  
## 10 Jan-2012  63211745  
## # ... with 147 more rows
```

From the above table ordered from most trades to least trades per month and year by mean number of trades per month, we see that December is in the top 10 month years of high trades in 2011,2012, 2015, and 2019. February has the next highest trades but the years are the same years of the sub-prime mortgage crisis that Citigroup was involved in, but also in 2015. looking at the next top ten months we see that Dec, Jan, and Feb are in the highest mean of the trades per day grouped by month and year. What do we know about Jan and Feb outside of the assumption about December being the last day of the tax year to offset capital gains with capital losses?

Well, I know that being a student, some people get their student loans around winter quarter in January and that many people expecting tax refunds get their refunds in February. We would have to see if there are any other assumptions about these months. But we would be able to ascertain if students receiving an education are investing, and if consumers with tax refunds are using some of that money to invest. There are certainly other assumptions that could be made for why the last month of the year and the first two months of the first quarter are high trade volume days. But for now lets stick with these assumptions.

Citigroup Mean Month-Year Trade Volume 2007-2020

The chart displays the mean monthly trade volume for Citigroup from 2007 to 2020. The y-axis represents Trade Volume, ranging from 0.0e+00 to 1.0e+08. The x-axis represents the Month, with labels: Apr, Aug, Dec, Feb, Jan, Jul, Jun, Mar, May, Nov, Oct, Sep. The legend indicates the years 2007 through 2020, each represented by a different colored line. The chart shows significant volatility, with a major peak in 2008 (around 1.0e+08) and another peak in 2020 (around 7.5e+07). Trade volume generally declines after 2010, with a notable dip in 2013 and a recovery in 2014 and 2015.

We can see that December is definitely the highest trading month, then February as the next highest, and January as the third highest trading month.

Lets look at the daily change mean values per month, by grouping by MonthYear and taking the mean value of the daily change, order by highest to smallest, and plot.

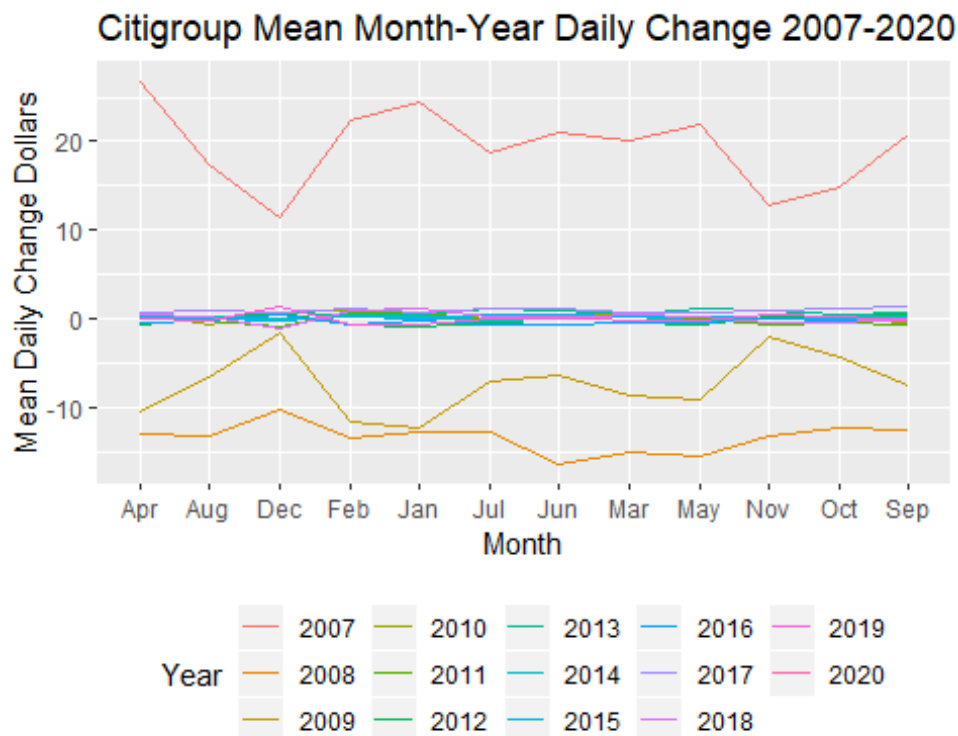
```
Citi_meanMonthly_dailyChange <- C_stock %>% group_by(MonthYear) %>%
  summarise_at(vars(as.vector(colnames(C_stock))[4]), mean)
```

```
Citi_meanMonthly_dailyChange$Year <-
  gsub('[a-zA-Z]{3}-',' ',Citi_meanMonthly_dailyChange$MonthYear)
```

```
Citi_meanMonthly_dailyChange$Month <-
  gsub('-[0-9]{4}',' ',Citi_meanMonthly_dailyChange$MonthYear)
```

```
ggplot(data = Citi_meanMonthly_dailyChange, aes(x=Month,
y=C_dailyChange,group=Year)) +
  geom_line(aes(color=Year))+
  scale_y_continuous()+
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom")+
  ggtitle('Citigroup Mean Month-Year Daily Change 2007-2020')+
  ylab('Mean Daily Change Dollars')
```

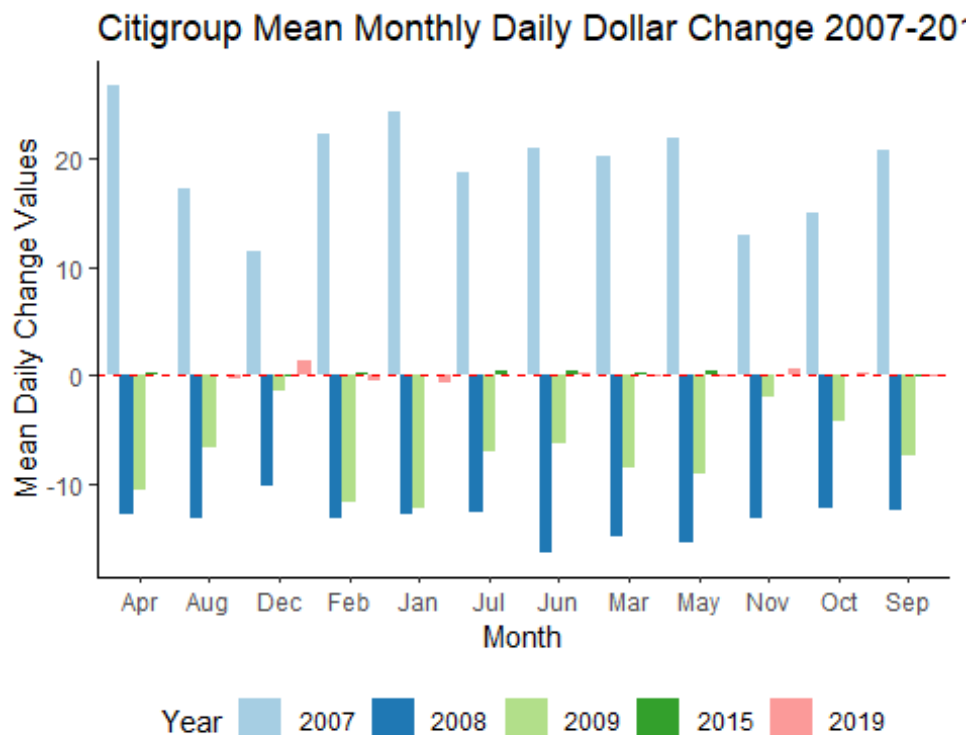
```
## Warning in pal_name(palette, type): Unknown palette paired
```



From the above line chart, it is not obvious what years those years having almost no change are. The year 2007 is at the top with the highest positive mean daily change values fluctuating to around 20 USD per day. While the years 2008 and 2009 have the highest negative mean of daily change values per month with average daily decreases around a daily loss of 5-15 USD.

Lets make a bar chart of 2007, 2008, 2009, 2015, and 2019 of this data on mean daily value changes per month.

```
y4 <- subset(Citi_meanMonthly_dailyChange,
              Citi_meanMonthly_dailyChange$Year==2008 |
              Citi_meanMonthly_dailyChange$Year==2009 |
              Citi_meanMonthly_dailyChange$Year==2007 |
              Citi_meanMonthly_dailyChange$Year==2015 |
              Citi_meanMonthly_dailyChange$Year==2019)
ggplot(data = y4, aes(x=Month, y=C_dailyChange, fill=Year)) +
  geom_bar(stat='identity', position=position_dodge()) +
  scale_y_continuous() +
  scale_fill_brewer(palette='Paired') +
  geom_hline(yintercept=0, linetype="dashed", color = "red") +
  theme_classic() +
  theme(legend.position="bottom") +
  ggtitle('Citigroup Mean Monthly Daily Dollar Change 2007-2019') +
  ylab('Mean Daily Change Values')
```



From the above, we can see the Citigroup stock had increases per day in value from the previous day in 2007, but that in 2008 and 2009 those daily increases turned to daily

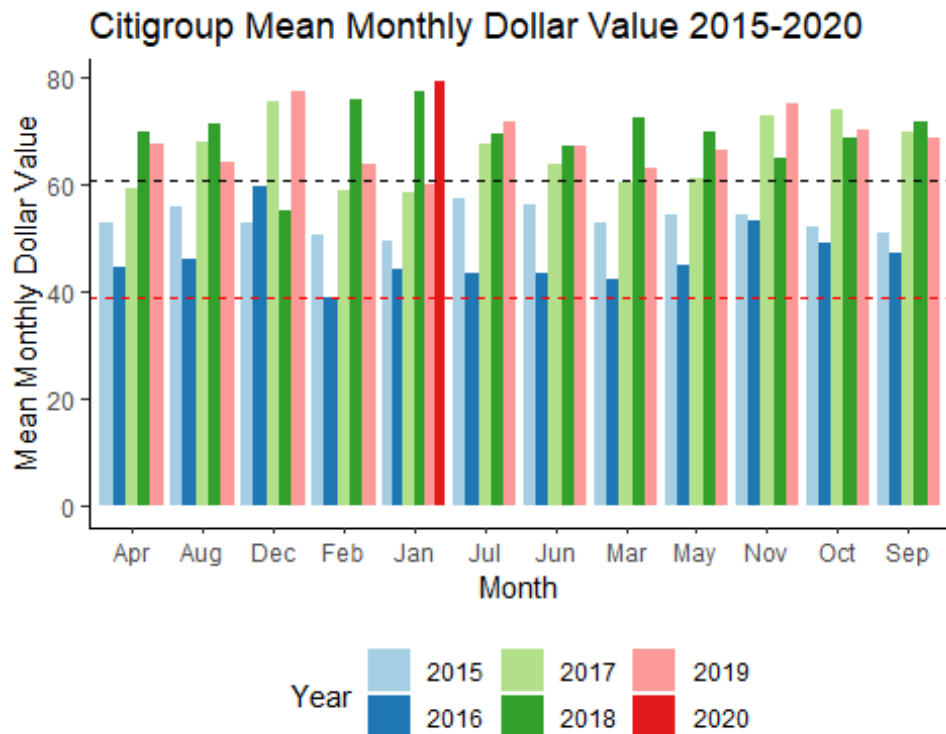
decreases from day to day as the sub-prime loans collapsed that Citigroup held. And in 2015 and 2019 years after Citigroup's bailout there was a mean monthly daily change value next to nothing as the daily change from day to day fluctuated around zero dollars for the month.

This could mean it is gaining strength and remains as is safe to buy as it increases. But lets look at the years 2015-2019 to see how the value of the Citigroup stock has faired by month year to confirm this assertion just made.

```
y4value <- subset(C_stock, C_stock$Year>2014)
y4valMY <- y4value %>% group_by(MonthYear) %>%
  summarise_at(vars(as.vector(colnames(y4value)[1])), mean)

y4valMY$Year <- gsub('[a-zA-Z]{3}-',' ', y4valMY$MonthYear)
y4valMY$Month <- gsub('-[0-9]{4}',' ', y4valMY$MonthYear)

ggplot(data = y4valMY, aes(x=Month, y=C.Close, fill=Year)) +
  geom_bar(stat='identity', position=position_dodge()) +
  scale_y_continuous() +
  scale_fill_brewer(palette='Paired') +
  geom_hline(yintercept=min(y4valMY$C.Close), linetype="dashed", color =
"red") +
  geom_hline(yintercept=mean(y4valMY$C.Close), linetype="dashed", color =
"black") +
  theme_classic() +
  theme(legend.position="bottom") +
  ggtitle('Citigroup Mean Monthly Dollar Value 2015-2020') +
  ylab('Mean Monthly Dollar Value')
```

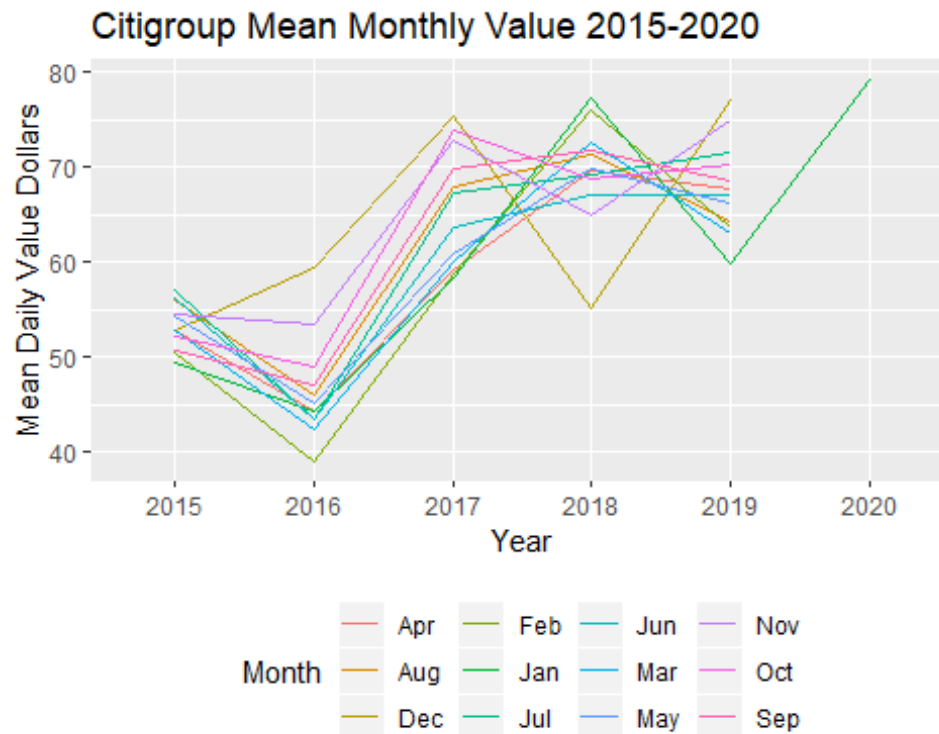


From the above bar chart, we can see that the minimum value is the dashed red line which occurred in February 2016. And that every month since 2016 has been above this minimum value. It has almost double from its minimum value in January and February 2020. The mean value from 2015-2020 (Jan-Feb) is just above 60 USD which is 1 1/2 times its minimum value.

Lets look at the line chart of this by years 2015-2020.

```
ggplot(data = y4valMY, aes(x=Year, y=C.Close, group=Month)) +
  geom_line(aes(color=Month)) +
  scale_y_continuous() +
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom") +
  ggtitle('Citigroup Mean Monthly Value 2015-2020') +
  ylab('Mean Daily Value Dollars')
```

```
## Warning in pal_name(palette, type): Unknown palette paired
```



The above line chart of the mean monthly dollar value of the Citigroup stock show that all months move the same direction of decreasing in 2015, increasing in 2016, except for in 2017 and 2018 where 3-6 months decreased and 6-9 months increased monthly mean values. The span of 2019 through 2020 can't be analyzed yet, but January increased since the year prior. Overall, since 2015 the value has increased from 50-60 USD to between 75-80 USD. This could make it a good stock to have in your portfolio as it has steadily been increasing since it's historical rough patches of the sub-prime mortgage loan accounts, the public bailout, and the lawsuit settlement payout. But nothing has been in the news about them to discourage investors from dropping this stock from their stock folder.

We saw that Citigroup is maintaining its current value and slightly increasing over the last four years. Lets start subset sampling stocks and look at the changes they have made in value over the last four years. And see if we notice anything we want to further exploit.

```
Value1 <- StocksSTATS[,c(1:53,160:230)]
Value2 <- subset(Value1, Year>2014)

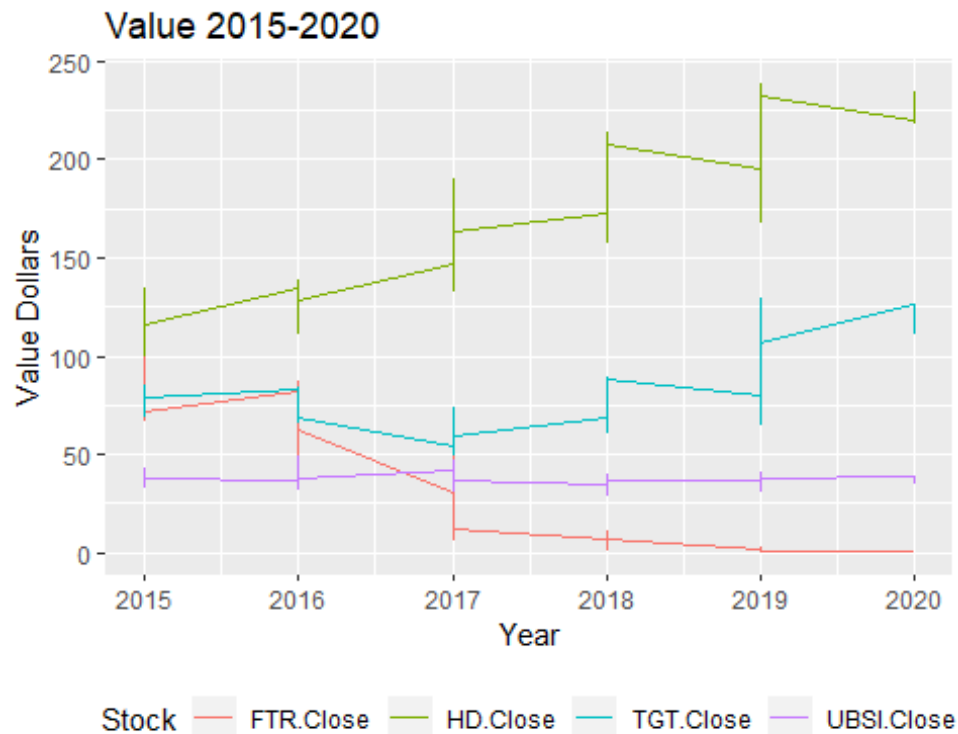
sub1 <- Value2[,c(1:4,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:4)

ggplot(data = sub1tidy, aes(x=Year, y=Value,group=Stock)) +
  geom_line(aes(color=Stock))+
```



```
scale_y_continuous()+
scale_fill_brewer(palette="paired") +
theme(legend.position="bottom")+
ggtitle('Value 2015-2020')+
ylab('Value Dollars')
```

```
## Warning in pal_name(palette, type): Unknown palette paired
```



The first four stocks in our set of 53 is shown in the line chart above from 2015-2020.

From the above line chart, it is obvious that over the last five years, the pink line for FTR is a terrible stock as it has been on the decline, but we would have to look at it further to see why it has been decreasing in value since 2015.

The olive color line for HD indicates it has been on a steady increase from the 120-125 USD range in 2015 to the 220-225 USD range in 2020.

Also, increasing steadily is the blue line for TGT, which started at 75-80 in 2015 and is at 125 in 2020 in value.

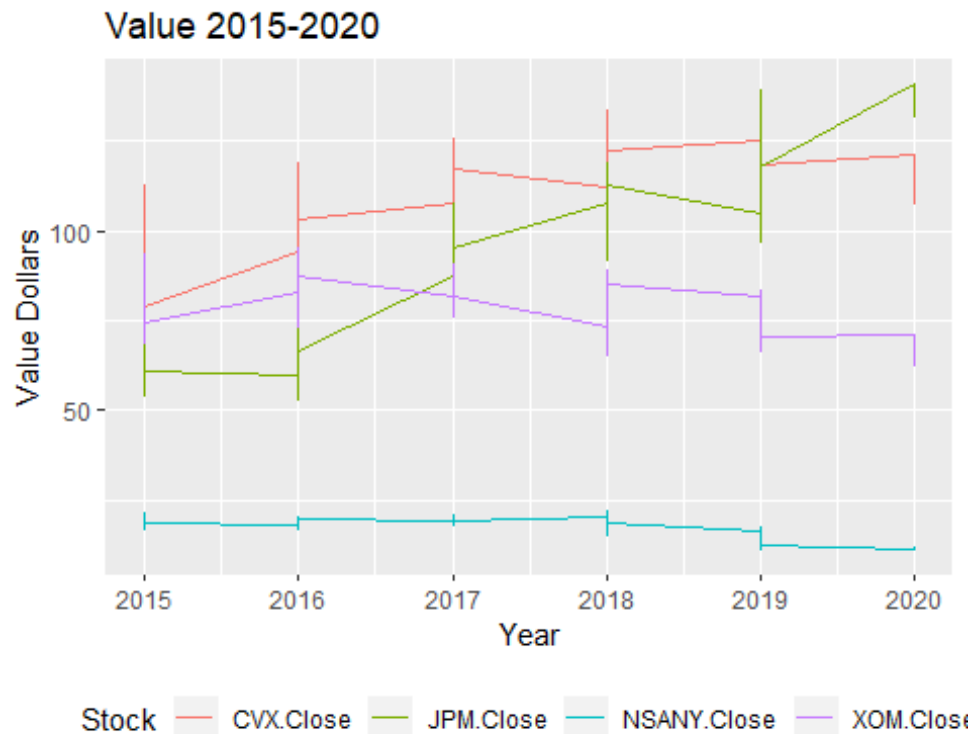
The purple line for UBSI has been maintaining steadily from 45 range to 45 range over five years. ***

Lets look at the next four stocks.

```
sub1 <- Value2[,c(5:8,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:4)
```

```
ggplot(data = sub1tidy, aes(x=Year, y=Value,group=Stock)) +
  geom_line(aes(color=Stock))+
  scale_y_continuous()+
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom")+
  ggtitle('Value 2015-2020')+
  ylab('Value Dollars')

## Warning in pal_name(palette, type): Unknown palette paired
```



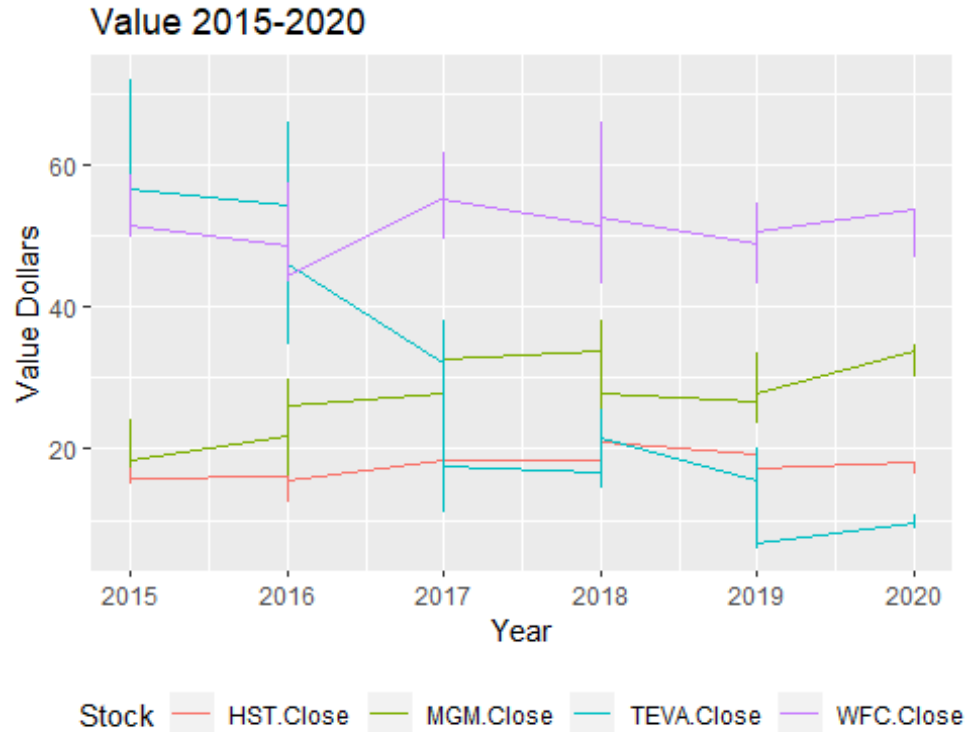
From the above subset of the next four stock in our 53 stocks, we can see that there are two stocks increasing significantly for JPM and CVX. We also note that the XOM and NSANY stocks have decreased over the last five years. ***

Now for the next four stocks.

```
sub1 <- Value2[,c(9:12,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:4)

ggplot(data = sub1tidy, aes(x=Year, y=Value,group=Stock)) +
  geom_line(aes(color=Stock))+
  scale_y_continuous()+
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom")+
  ggtitle('Value 2015-2020')+
  ylab('Value Dollars')
```

```
## Warning in pal_name(palette, type): Unknown palette paired
```



The above line chart shows the third subset of four stocks of our 53 stocks.

The MGM stock has increased significantly since 2005, and slight increases are shown for WFC and HST though not significantly. There is some cyclical movements in the WFC with 2016 giving a steady increase all year, then declining 2017-2019, and ending with a steady increase in 2019.

The TEVA stock has had a huge loss over the last five years, with the last year showing an increase slightly. It started at the 55 range in 2015 and is at the 10 range in 2020. This could indicate that it is a good time to buy TEVA, since it is priced low and shows an increase in the last year, where the last four years it has been decreasing annually for each year. This would require further analysis for why it has been decreasing over the last five years. ***

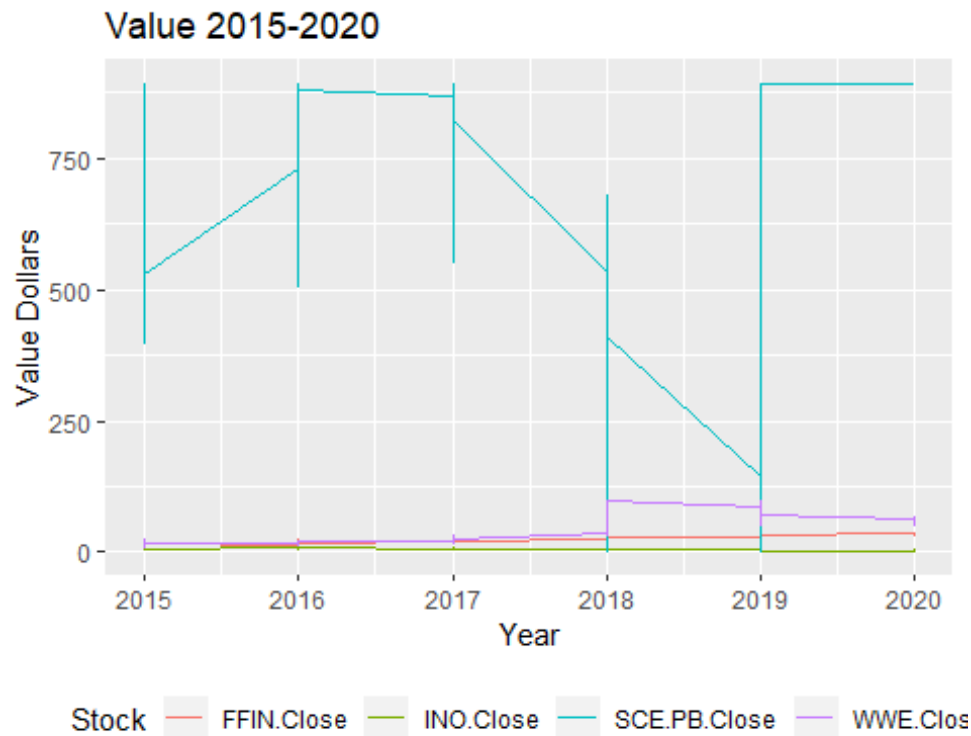
Now for the next four stocks in our subset four.

```
sub1 <- Value2[,c(13:16,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:4)

ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock)) +
  scale_y_continuous() +
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom") +
```

```
ggtitle('Value 2015-2020')+
ylab('Value Dollars')
```

```
## Warning in pal_name(palette, type): Unknown palette paired
```



The above line chart shows that SCE.PB is on its own scale that outweighs the scale of the other smaller valued stocks, there is also volatility and cyclical movements in SCE.PB which makes it a good choice to further analyze with timelines of web article events that could have triggered these changes in value of a steady increase in 2015, a high jump increase in 2016, then a steep decline throughout 2017 and 2018, then a huge jump of an increase to the same level at 2019. This is a utility company so government contracts could be involved with all that entails, and possible fires causing damage and settlements in the declining years. But for now it is just speculation and assumptions.

The other stocks are getting limited spotlight above, and they need their own scale as SCE.PB pushed down their scaled visual line charts.

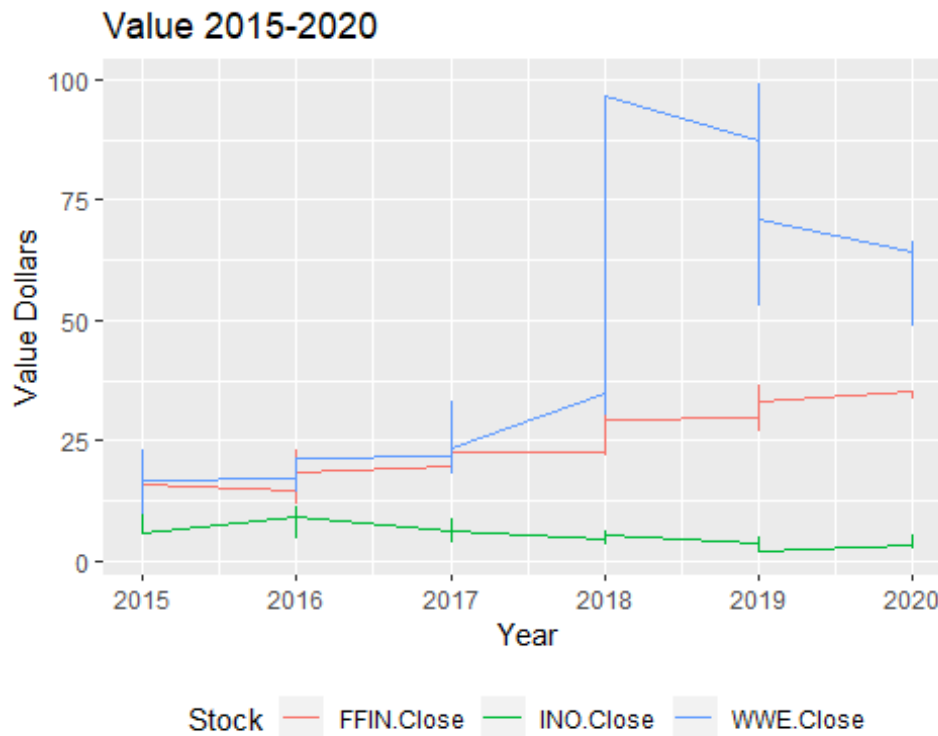
Now for the next four stocks in our subset four.

```
sub1 <- Value2[,c(13,14,16,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:3)

ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock))+
  scale_y_continuous()+
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom")+
```

```
ggtitle('Value 2015-2020')+
ylab('Value Dollars')
```

```
## Warning in pal_name(palette, type): Unknown palette paired
```



From the above line chart, we see that WWE had a huge jump in 2018 of an increase from the 40 range to the 90 range but then decreased during 2018 and 2019 to a price still much higher at the 60 range than its starting value in 2015 of the 20 range.

The FFIN stock has been steadily increasing over the last five years with a flat line on the value in 2017 and 2018.

The INO stock has declined since 2016 after an increasing year in 2015, but lost only slightly in value over a five year span returning no profits over that time span.

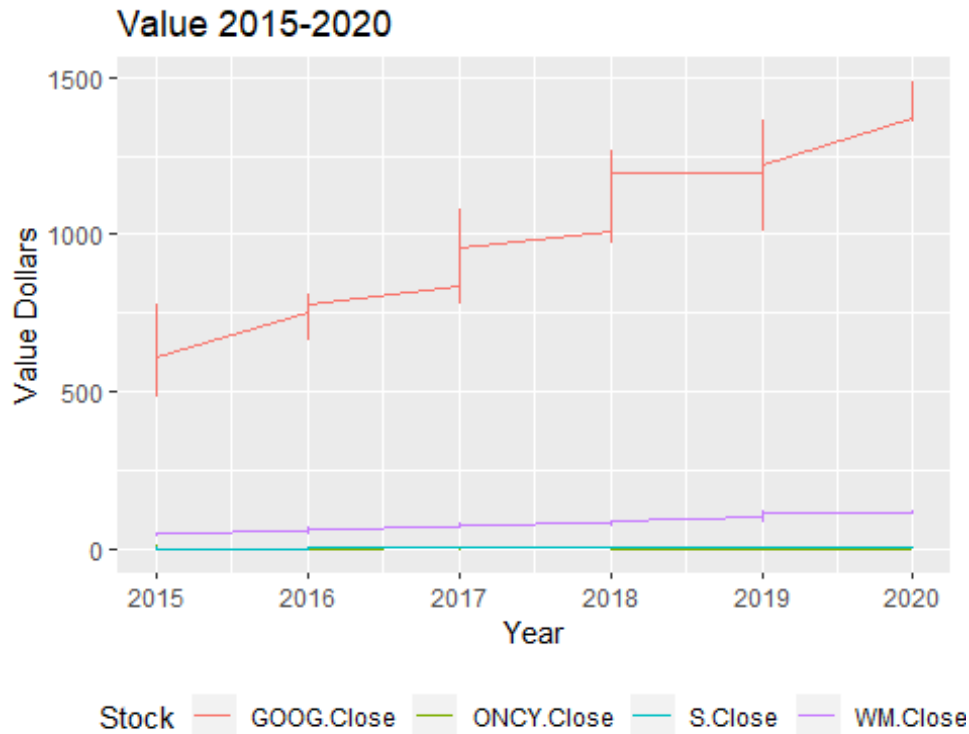
Now for the next stocks in our subset.

```
sub1 <- Value2[,c(17:20,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:4)

ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock))+
  scale_y_continuous()+
  scale_fill_brewer(palette="paired") +
```

```
theme(legend.position="bottom")+
ggtitle('Value 2015-2020')+
ylab('Value Dollars')
```

```
## Warning in pal_name(palette, type): Unknown palette paired
```



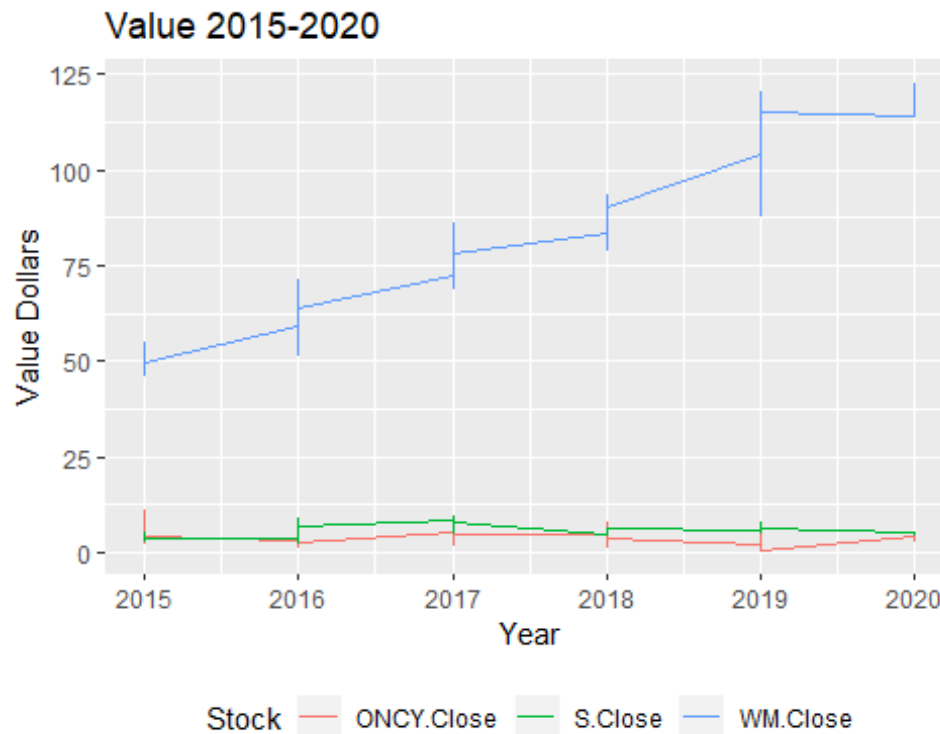
In the above subset of stocks, Google out scales the other three stocks and shows that it has been increasing steadily every year, except 2018 where it is almost the same price all year.

Lets look at the other three stocks that our on a lower scaled value to analyze them.

```
sub1 <- Value2[,c(18:20,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:3)
```

```
ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock))+
  scale_y_continuous()+
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom")+
  #geom_hline(yintercept=m15, color='red')
  ggtitle('Value 2015-2020')+
  ylab('Value Dollars')
```

```
## Warning in pal_name(palette, type): Unknown palette paired
```



The line chart above shows that WM has increased significantly every year since 2015, with a slight decrease in 2019, but overall has increased from the 50 range in 2015 to the 113 range in 2020.

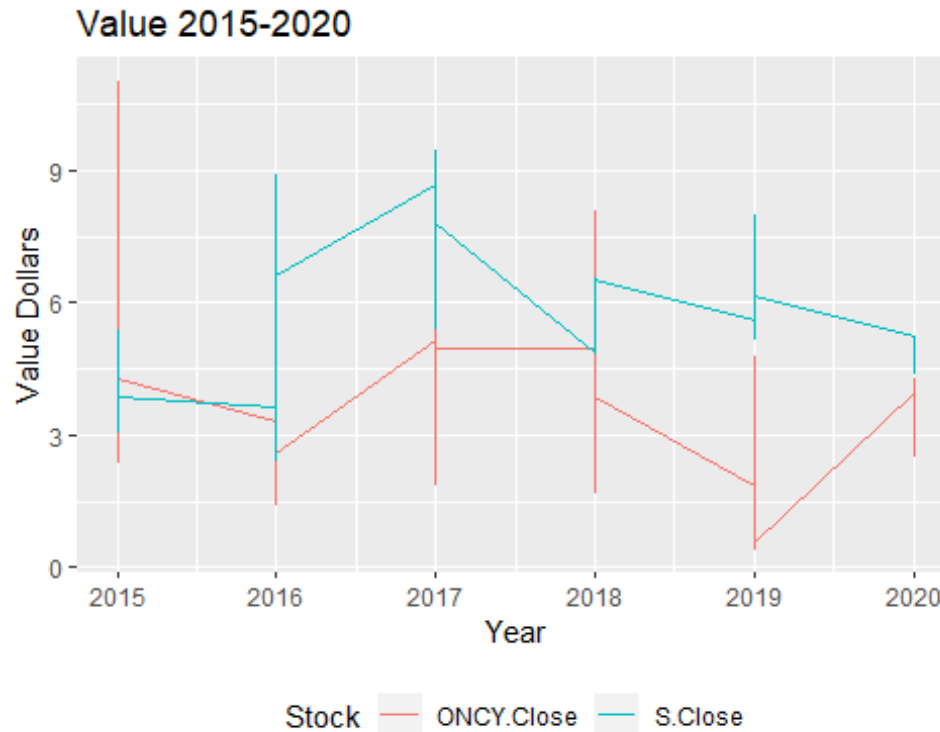
The ONCY and S stocks have had slight increases and decreases in the last five years but look like they have increased slightly overall from 2015-2020.

Lets look at S and ONCY stocks more closely.

```
sub1 <- Value2[,c(19:20,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:2)

ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock))+
  scale_y_continuous()+
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom")+
  ggtitle('Value 2015-2020')+
  ylab('Value Dollars')

## Warning in pal_name(palette, type): Unknown palette paired
```



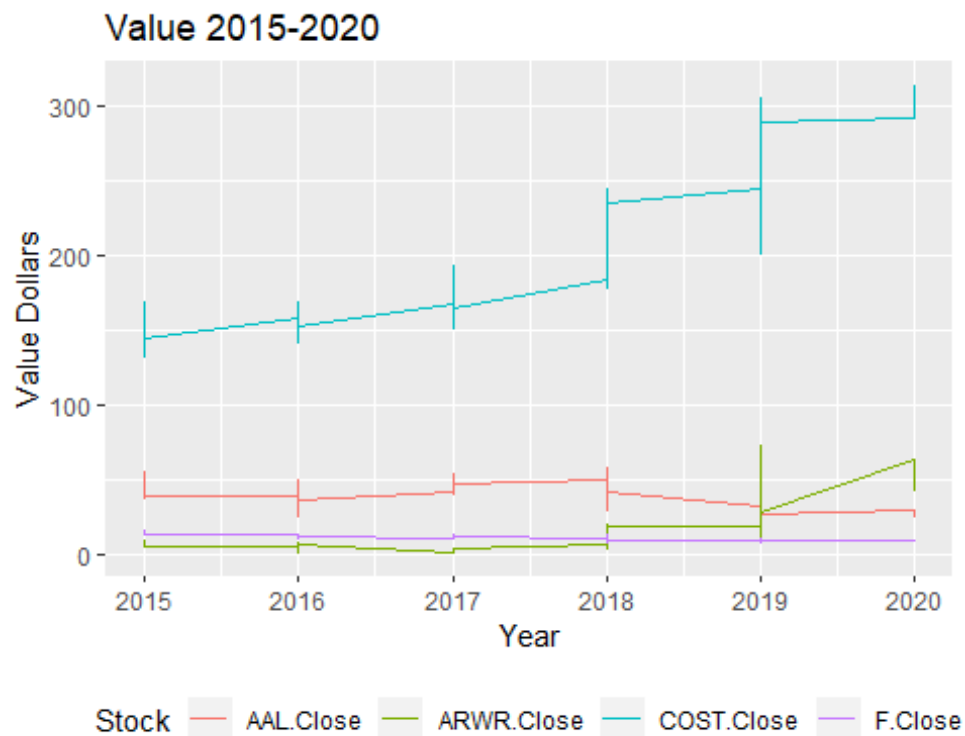
It looks like these two stocks, ONCY and S, have had cyclical patterns in the last five years, and if that is true, then S stock hasn't reached its cyclical minimum and ONCY stock hasn't reached its cyclical maximum. And if this is not the case then there are some triggers in the value of this stock in 2016, where they both increased, then steadily decreased in 2017. A global minimum in the last five years is seen in 2019 for ONCY stock, while the global maximums for both stock is in 2017. The start of 2016 showed both stocks had a local minima while S stock had its global minima this year, but only for this last five year period.

Now for the next stocks in our subset.

```
sub1 <- Value2[,c(21:24,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:4)

ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock)) +
  scale_y_continuous() +
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom") +
  ggtitle('Value 2015-2020') +
  ylab('Value Dollars')

## Warning in pal_name(palette, type): Unknown palette paired
```

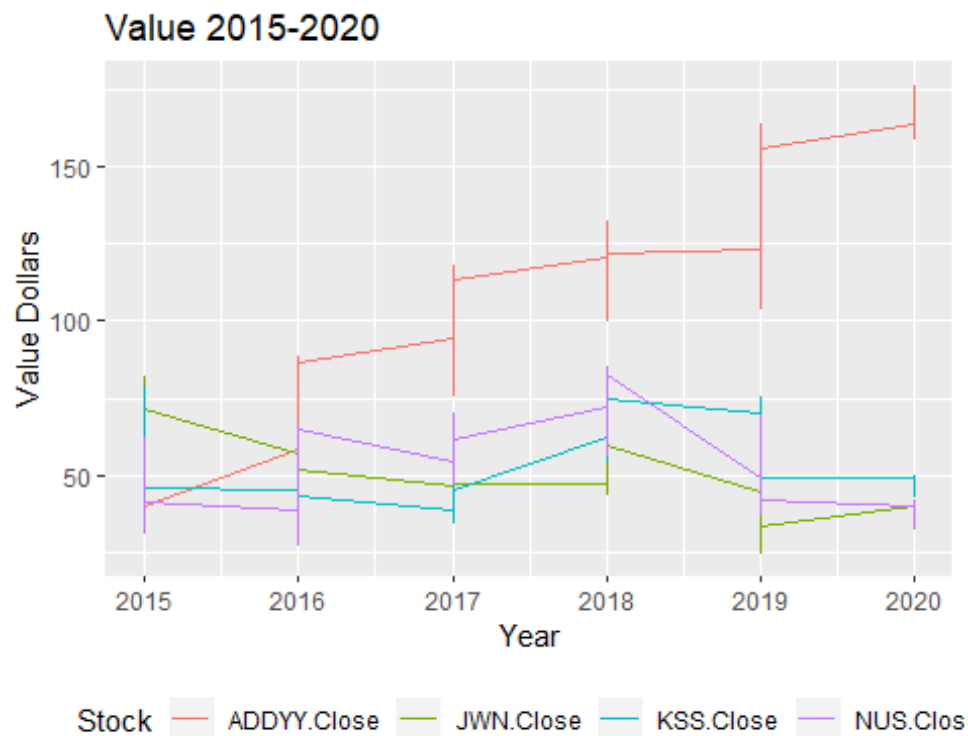
The above subset shows that ARWR and COST stock have been increasing the last two years, but ARWR stock had some near flat changes in value for years 2015, 2016, and 2017. The purple line for Ford is relatively maintaining value, but no increases or decreases of note for Ford in the last five years. The AAL stock had a global maxima in 2018 but overall decreased in value slightly in the last five years. ***

Now for the next stocks in our subset.

```
sub1 <- Value2[,c(25:28,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:4)

ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock)) +
  scale_y_continuous() +
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom") +
  ggtitle('Value 2015-2020') +
  ylab('Value Dollars')

## Warning in pal_name(palette, type): Unknown palette paired
```



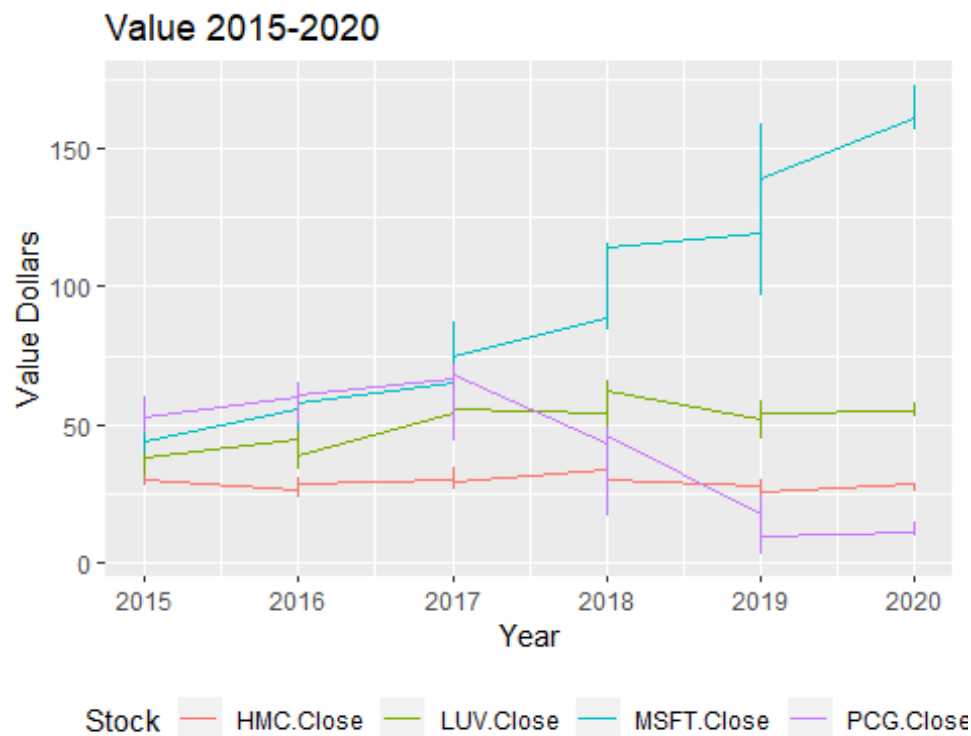
The above line chart shows that ADDYY has been significantly increasing over the last five years it jumped from the 40 USD range to the 165 USD range in 2020. The other three stocks all moved together with slightly different rates of increase and decrease. But the JWN stock lost value over the last five years, while KSS and NUS stocks both increased only marginally after some cyclical rise and falls in value. ***

Now for the next stocks in our subset.

```
sub1 <- Value2[,c(29:32,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:4)

ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock)) +
  scale_y_continuous() +
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom") +
  ggtitle('Value 2015-2020') +
  ylab('Value Dollars')

## Warning in pal_name(palette, type): Unknown palette paired
```



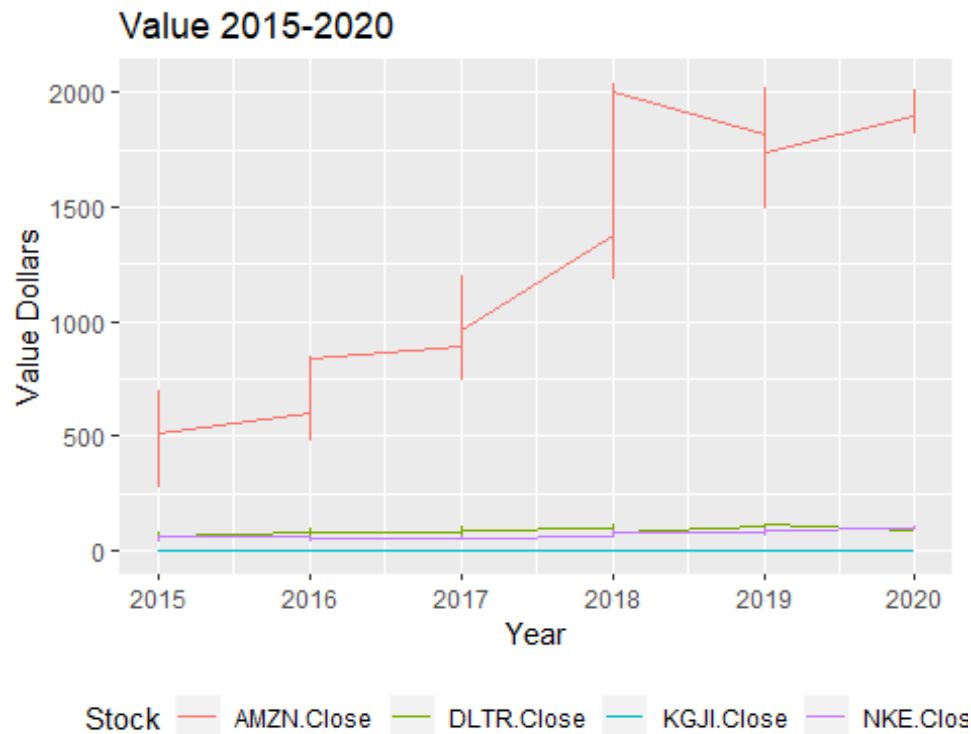
The above line chart shows that MSFT increased steadily the last five years with none of the years having declining values in stock. PCG stock had a local maxima in 2017 but a local minima in 2019 which led to an overall loss in value from 2015-2020. The LUV stock is the olive colored stock that had an increase overall in value by about 10 USD. And the HMC stock slightly stayed the same and may have decreased marginally in the last five years. ***

Now for the next stocks in our subset.

```
sub1 <- Value2[,c(33:36,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:4)

ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock)) +
  scale_y_continuous() +
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom") +
  ggtitle('Value 2015-2020') +
  ylab('Value Dollars')

## Warning in pal_name(palette, type): Unknown palette paired
```



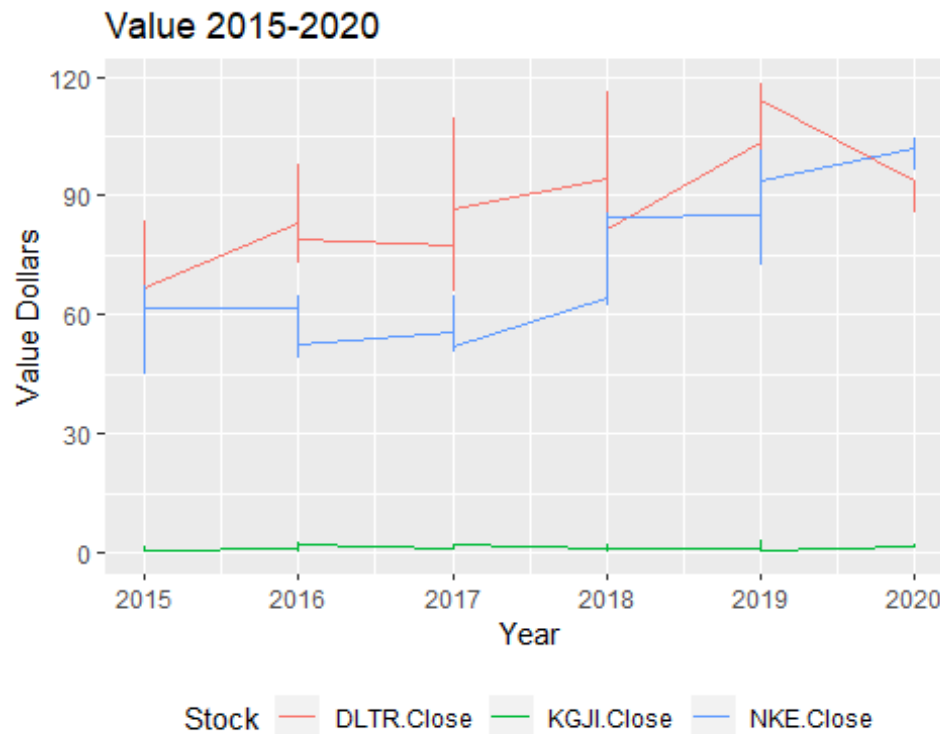
The above line chart shows that AMZN stock is on its own scale and has seen an overall huge jump in value in the last five years, with every year increasing, except in 2018 where it decreased from its local maxima at the start of 2018. Its value in 2015 was in the 500 USD range and at the start of 2020 was in the 1700-1800 USD range.

Let's look at the scale more appropriate for the other three stocks of DLTR, KGJI, and NKE.

```
sub1 <- Value2[,c(33:35,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:3)

ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock)) +
  scale_y_continuous() +
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom") +
  ggtitle('Value 2015-2020') +
  ylab('Value Dollars')

## Warning in pal_name(palette, type): Unknown palette paired
```



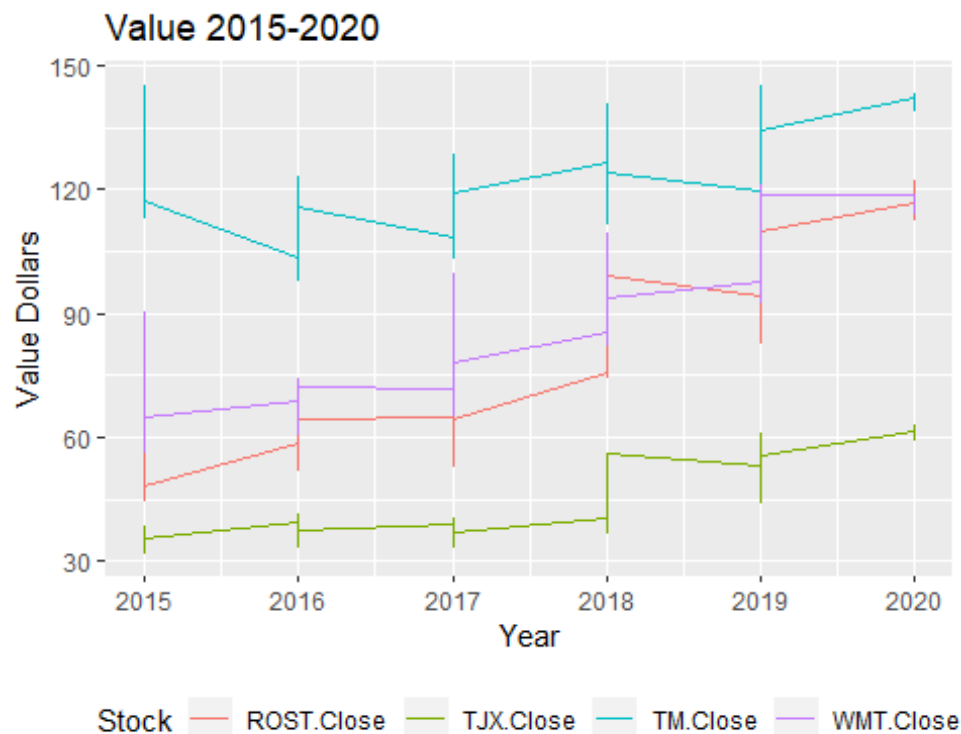
The above line chart shows the smaller scale value changes by year for DLTR, KGJI, and NKE. Both NKE and DLTR stocks have increased in value over the last five years, while DLTR did see a decreasing value throughout the last year of 2019. The KGJI stock showed marginal changes in value over the last five years, with no significant local minimas or local maximas. It does look like a slight increase overall from 2015-2020 for KGJI stock. ***

Now for the next stocks in our subset.

```
sub1 <- Value2[,c(37:40,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:4)

ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock)) +
  scale_y_continuous() +
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom") +
  ggtitle('Value 2015-2020') +
  ylab('Value Dollars')

## Warning in pal_name(palette, type): Unknown palette paired
```



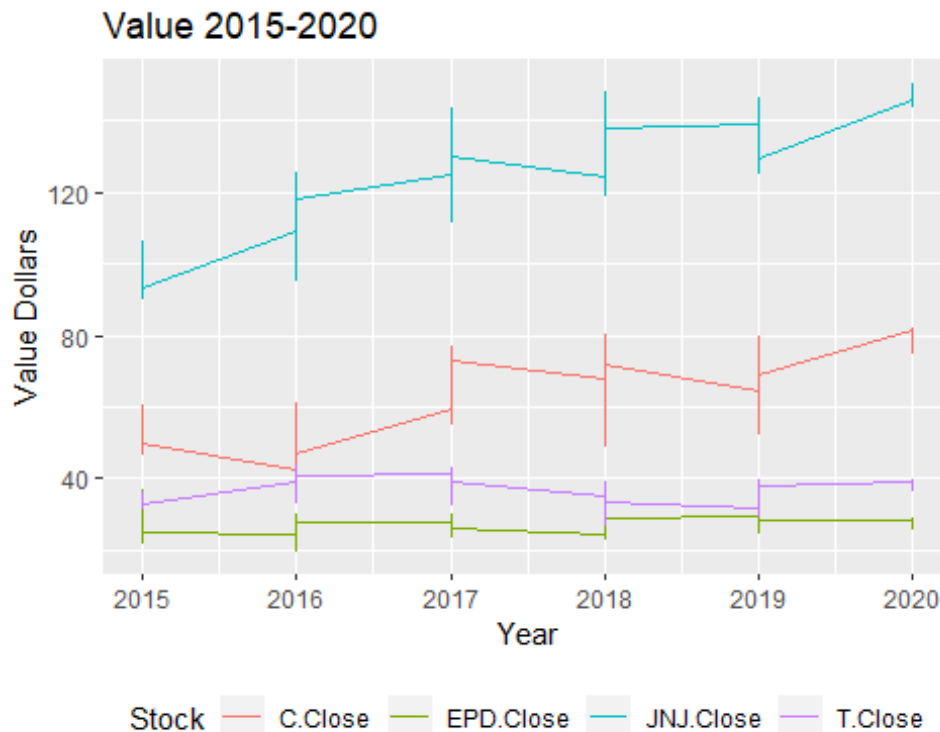
In the above line chart we see that all of the stocks increased noticeably in the last five years. The TM stock had some years that decreased in 2015, 2016, and 2018, but always starts the new year at a higher value than the year before. In 2018 WMT increased, while the other three stocks of TJX, TM, and ROST saw slight decreases. ***

Now for the next stocks in our subset.

```
sub1 <- Value2[,c(41:44,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:4)

ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock)) +
  scale_y_continuous() +
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom") +
  ggtitle('Value 2015-2020') +
  ylab('Value Dollars')

## Warning in pal_name(palette, type): Unknown palette paired
```



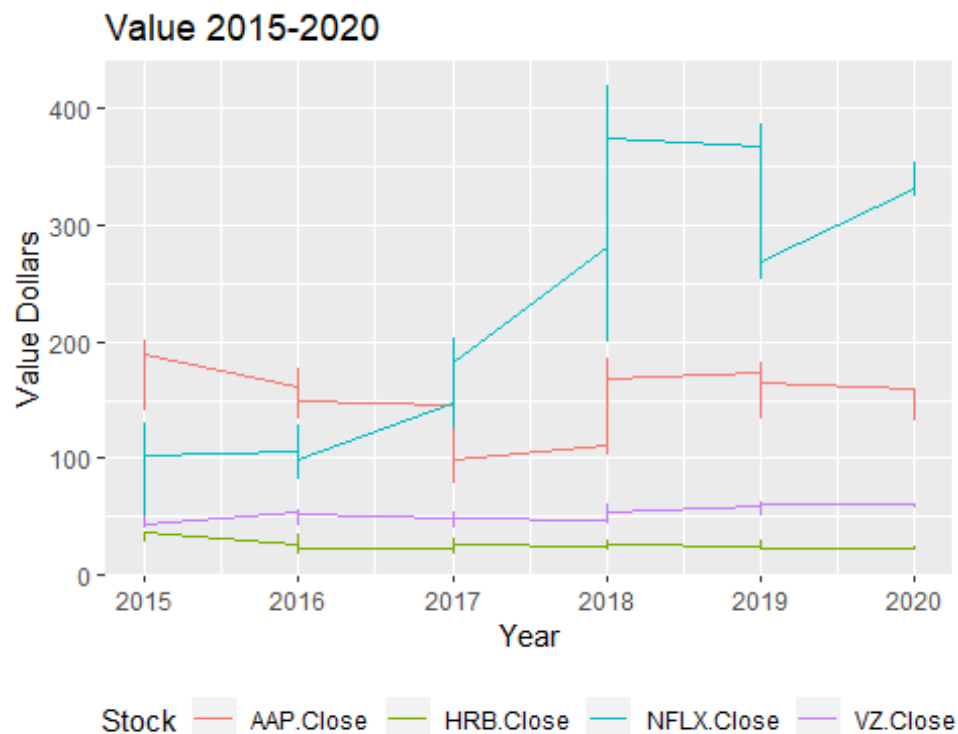
The above line chart also shows an overall increase in value over the last five years with significant jumps in value for C and JNJ stocks. In 2017, there were some decreases in value throughout the year for all these stocks of C, EPD, JNJ, and T stocks, but in two years they all started 2019 at the same values of 2017 and saw increasing values throughout 2019. ***

Now for the next stocks in our subset.

```
sub1 <- Value2[,c(45:48,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:4)

ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock)) +
  scale_y_continuous() +
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom") +
  ggtitle('Value 2015-2020') +
  ylab('Value Dollars')

## Warning in pal_name(palette, type): Unknown palette paired
```



The above line chart shows that NFLX increased significantly while HRB and AAP saw losses over the last five years. VZ stock saw a slight increase in value over the last five years. In 2017 Netflix saw a huge increase, while in 2018 it stayed somewhat stagnant with a sharp drop in value at the start of 2019 that saw an increasing year throughout 2019.

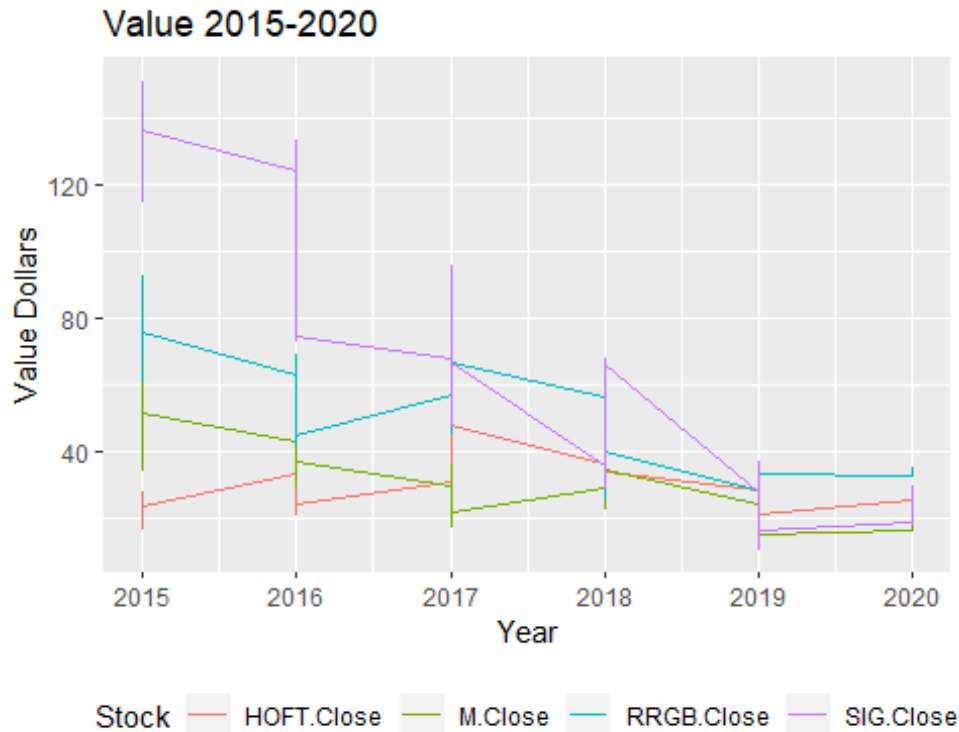
In 2017, there was a sharp drop in value for AAP, but by the start of 2018 the value increased to a value above the start of 2017.

Now for the last five stocks in our subset.

```
sub1 <- Value2[,c(49:53,115)]
sub1tidy <- gather(sub1, 'Stock', 'Value', 1:4)

ggplot(data = sub1tidy, aes(x=Year, y=Value, group=Stock)) +
  geom_line(aes(color=Stock)) +
  scale_y_continuous() +
  scale_fill_brewer(palette="paired") +
  theme(legend.position="bottom") +
  ggtitle('Value 2015-2020') +
  ylab('Value Dollars')

## Warning in pal_name(palette, type): Unknown palette paired
```

Our last set of stock show that RRGB and SIG saw significant losses over the last five years, while M stock showed a smaller loss. HOFT stock saw an increase over the last five years, but only marginally or slightly. In 2017 M stock saw an increasing year for its value after having two years from 2015-2016 see decreasing values throughout those years. M stock and HOFT stock seemed to be negatively correlated for years 2015-2018, with both stocks having different rates of decrease in 2018 and an increase in value of similar rates of increase in 2019. All of these stocks decreased at different rates in 2018, and increased at different rates in 2019. ***

Lets group by the year and get the mean values over the last five years for each stock value.

```
Value3 <- Value2[,c(1:53,112,115)]

yearMeans <- Value3 %>% group_by(Year) %>%
  summarise_at(vars(as.vector(colnames(Value3)[1:53])), mean)

yearMeansTidy <- gather(yearMeans, 'Stock', 'YearMeanValue', 2:54)

stock5yrMeans <- yearMeansTidy %>% group_by(Stock) %>%
  summarise_at(vars(as.vector(colnames(yearMeansTidy)[3])), mean)
colnames(stock5yrMeans)[2] <- 'stock5yrMeans'

Stock5year <- merge(stock5yrMeans, yearMeansTidy, by.x='Stock', by.y='Stock')

stock5yrOrdered <- Stock5year[with(Stock5year, order(Stock, Year)),]
```

Lets add a field that shows if the stock had an increase of 10% during the year and a field that shows if it decreased

```
ymn <- stock5yrOrdered$YearMeanValue
YMN <- c(ymn[1],ymn[1:length(ymn)-1])

stc2 <- stock5yrOrdered$Stock
STC2 <- c('xyz',stc2[1:length(stc2)-1])

STC3 <- ifelse(stc2==STC2, 1,0)

stock5yrOrdered$Direction5yr10PercentChange <- ifelse(STC3==1 &
stock5yrOrdered$YearMeanValue-YMN > .10*YMN, 'up10',
ifelse(STC3==1 &
stock5yrOrdered$YearMeanValue-YMN <= -0.10*YMN, 'down10',
ifelse(STC3==1 &
stock5yrOrdered$YearMeanValue-YMN <= 0, 'down', ifelse(STC3==1 &
stock5yrOrdered$YearMeanValue-YMN > 0, 'up', ''))))

show1 <- cbind(head(stock5yrOrdered), tail(stock5yrOrdered))
show1

##      Stock stock5yrMeans Year YearMeanValue Direction5yr10PercentChange
## 2 AAL.Close      38.67371 2015      45.12210
## 3 AAL.Close      38.67371 2016      38.18385                down10
## 4 AAL.Close      38.67371 2017      47.49072                up10
## 1 AAL.Close      38.67371 2018      42.80195                down
## 5 AAL.Close      38.67371 2019      30.87933                down10
## 6 AAL.Close      38.67371 2020      27.56429                down10
##      Stock stock5yrMeans Year YearMeanValue Direction5yr10PercentChange
## 2 XOM.Close      78.737 2015      82.82845
## 3 XOM.Close      78.737 2016      86.21968                up
## 4 XOM.Close      78.737 2017      81.86159                down
## 1 XOM.Close      78.737 2018      79.95570                down
## 5 XOM.Close      78.737 2019      73.73464                down
## 6 XOM.Close      78.737 2020      67.82191                down

length(unique(stock5yrOrdered$Stock))

## [1] 53
```

Lets get these subsets of stocks that within the time span of 2015-2020 increased by more than 10% annually, decreased by 10% or more annually, decreased, or increased.

```
Stocks10PercentAnnualDecrease2015_2020 <- subset(stock5yrOrdered,
stock5yrOrdered$Direction5yr10PercentChange=='down10')

stocks10Decr <- Stocks10PercentAnnualDecrease2015_2020 %>% group_by(Stock)
%>% count(n=n())
colnames(stocks10Decr)[2] <- 'nTimesDecr10_5yr'
```

```

stocks10Decr <- stocks10Decr[, -3]

Stocks10PercentAnnualIncrease2015_2020 <- subset(stock5yrOrdered,
stock5yrOrdered$Direction5yr10PercentChange=='up10')

stocks10Incr <- Stocks10PercentAnnualIncrease2015_2020 %>% group_by(Stock)
%>% count(n=n())
colnames(stocks10Incr)[2] <- 'nTimesIncr10_5yr'
stocks10Incr <- stocks10Incr[, -3]

StocksAnnualIncrease2015_2020 <- subset(stock5yrOrdered,
stock5yrOrdered$Direction5yr10PercentChange=='up')

StocksIncrZerobase <- StocksAnnualIncrease2015_2020 %>% group_by(Stock) %>%
count(n=n())
colnames(StocksIncrZerobase)[2] <- 'nTimesIncrFromZero_5yrs'
StocksIncrZerobase <- StocksIncrZerobase[, -3]

StocksAnnualDecrease2015_2020 <- subset(stock5yrOrdered,
stock5yrOrdered$Direction5yr10PercentChange=='down')

StocksDecrZerobase <- StocksAnnualDecrease2015_2020 %>% group_by(Stock) %>%
count(n=n())
colnames(StocksDecrZerobase)[2] <- 'nTimesDecrFromZero_5yrs'
StocksDecrZerobase <- StocksDecrZerobase[, -3]

```

Lets merge these sets together with outer joins.

```

Stocks5yrChanges_outerJoin <- merge(stocks10Decr, stocks10Incr, by.x='Stock',
by.y='Stock', all=TRUE)

Stocks5yrChanges_outerJoin1 <-
merge(Stocks5yrChanges_outerJoin, StocksDecrZerobase, by.x='Stock',
by.y='Stock', all=TRUE)

Stocks5yrChanges_outerJoin2 <-
merge(Stocks5yrChanges_outerJoin1, StocksIncrZerobase, by.x='Stock',
by.y='Stock', all=TRUE)

stock_5yr_stats_2015_2020 <-
merge(stock5yrOrdered, Stocks5yrChanges_outerJoin2, by.x='Stock',
by.y='Stock', all=TRUE)

length(unique(stock_5yr_stats_2015_2020$Stock))

## [1] 53

```

Write this file out to analyze those stocks having decreased and increased the most in the last 5 years.

```
write.csv(stock_5yr_stats_2015_2020, 'stocks_STATS_N_Changes.csv',
row.names=FALSE)
```

Lets attach the stock name to this data set above by reading in the file with the names on it when hand picking these stocks by searching manually in finance.yahoo.com.

```
stockNames <- read.csv('yahooStockBasket.csv', header=T, sep=',',
na.strings=c('', ' '))
stock_5yr_stats_2015_2020$Stock <- gsub('[.]Close', '',
stock_5yr_stats_2015_2020$Stock)
stockNames$stock <- gsub('-', '.', stockNames$stock)

stock_5yr_stats_2015_2020$Stock <- as.factor(stock_5yr_stats_2015_2020$Stock)
StockNames_STATS_2015_2020 <- merge(stockNames, stock_5yr_stats_2015_2020,
by.x='stock', by.y='Stock')

StockNames_STATS_2015_2020$nTimesDecr10_5yr <-
  ifelse(is.na(StockNames_STATS_2015_2020$nTimesDecr10_5yr==TRUE),
0, StockNames_STATS_2015_2020$nTimesDecr10_5yr)

StockNames_STATS_2015_2020$nTimesIncr10_5yr <-
  ifelse(is.na(StockNames_STATS_2015_2020$nTimesIncr10_5yr==TRUE),
0, StockNames_STATS_2015_2020$nTimesIncr10_5yr)

StockNames_STATS_2015_2020$nTimesDecrFromZero_5yrs <-
  ifelse(is.na(StockNames_STATS_2015_2020$nTimesDecrFromZero_5yrs==TRUE),
0, StockNames_STATS_2015_2020$nTimesDecrFromZero_5yrs)

StockNames_STATS_2015_2020$nTimesIncrFromZero_5yrs <-
  ifelse(is.na(StockNames_STATS_2015_2020$nTimesIncrFromZero_5yrs==TRUE),
0, StockNames_STATS_2015_2020$nTimesIncrFromZero_5yrs)

StockNames_STATS_2015_2020$Direction5yr10PercentChange <-
  ifelse(StockNames_STATS_2015_2020$Direction5yr10PercentChange=='', 0, StockName
s_STATS_2015_2020$Direction5yr10PercentChange)

write.csv(StockNames_STATS_2015_2020, 'StockNames_STATS_2015_2020.csv',
row.names=FALSE)

show2 <-
rbind(head(StockNames_STATS_2015_2020, 3), tail(StockNames_STATS_2015_2020, 3))
show2

##      stock
## 1      AAL
## 2      AAL
## 3      AAL
```

```

## 316    XOM
## 317    XOM
## 318    XOM
##
stockInfo
## 1    American Airlines Group Inc. (AAL)\nNasdaqGS - NasdaqGS Real Time
Price. Currency in USD
## 2    American Airlines Group Inc. (AAL)\nNasdaqGS - NasdaqGS Real Time
Price. Currency in USD
## 3    American Airlines Group Inc. (AAL)\nNasdaqGS - NasdaqGS Real Time
Price. Currency in USD
## 316                Exxon Mobil Corporation (XOM)\nNYSE - NYSE Delayed
Price. Currency in USD
## 317                Exxon Mobil Corporation (XOM)\nNYSE - NYSE Delayed
Price. Currency in USD
## 318                Exxon Mobil Corporation (XOM)\nNYSE - NYSE Delayed
Price. Currency in USD
##      stockExchange stock5yrMeans Year YearMeanValue
Direction5yr10PercentChange
## 1            Nasdaq      38.67371 2018      42.80195
down
## 2            Nasdaq      38.67371 2017      47.49072
up10
## 3            Nasdaq      38.67371 2020      27.56429
down10
## 316           NYSE      78.73700 2017      81.86159
down
## 317           NYSE      78.73700 2019      73.73464
down
## 318           NYSE      78.73700 2015      82.82845
0
##      nTimesDecr10_5yr nTimesIncr10_5yr nTimesDecrFromZero_5yrs
## 1                3                1                1
## 2                3                1                1
## 3                3                1                1
## 316              0                0                4
## 317              0                0                4
## 318              0                0                4
##      nTimesIncrFromZero_5yrs
## 1                0
## 2                0
## 3                0
## 316              1
## 317              1
## 318              1

length(unique(StockNames_STATS_2015_2020$stock))

## [1] 53

```

Lets the mean annual unemployment rates using the original table to combine with this table of the n times a stock increases/decreases per year in the last five years.

```
ue$Annual <- round(rowMeans(ue[,2:13], na.rm=T),2)
ue_15_20 <- ue[9:14,c(1,14)]
colnames(ue_15_20)[2] <- 'Annual_UE'
```

Now, combine the unemployment and the newest stats with counts table.

```
stock_5yrs_ue <- merge(ue_15_20, StockNames_STATS_2015_2020, by.x='Year',
by.y='Year')
```

Add in a boolean field to show if the YearMeanValue is greater than the Stock5yrMeans column as a 1 if true and a 0 if not.

```
stock_5yrs_ue$YearMeanGreaterThan5yrMean <-
ifelse(stock_5yrs_ue$YearMeanValue >
stock_5yrs_ue$stock5yrMeans,1,0)
write.csv(stock_5yrs_ue, 'stock_2015-2020_ue.csv', row.names=FALSE)
```

Make separate portfolios for each of the stocks that increased by more than 10% annually more than at least 1 time, decreased more than 10% annually more than at least 1 time, then get the mean value of the YearMeanValue column. Compare this to the portfolio of the stocks that never decreased more than 10% annually.

```
sub_D10 <- subset(StockNames_STATS_2015_2020,
StockNames_STATS_2015_2020$nTimesDecr10_5yr > 0)

D10_2015 <- subset(sub_D10, sub_D10$Year==2015)
D10_2020 <- subset(sub_D10, sub_D10$Year==2020)

md10_2015 <- mean(D10_2015$YearMeanValue)
md10_2020 <- mean(D10_2020$YearMeanValue)
md10_2015
## [1] 67.18499
md10_2020
## [1] 65.57645
ROI_D10 <- md10_2020/md10_2015
ROI_D10
## [1] 0.9760581
```

```

d10_startValue <- md10_2015*length(unique(D10_2015$stock))
d10_endValue <- md10_2020*length(unique(D10_2020$stock))
d10_startValue

## [1] 2149.92

d10_endValue

## [1] 2098.446

```

The above values show the 2015 average stock value of those stocks that decreased more than 10 percent in the last five years more than once was 67 USD. And in 2020 those stocks decreased in value to 66 USD giving it a five year ROI in the last five years of 0.976, or a decline of 2.4 percent in value. The 2015 value of this portfolio of stocks was 2150 USD, and in 2020 the portfolio value of the stocks was 2098 USD showing the dollar decrease over five years.

```

sub_nvr_D10 <- subset(StockNames_STATS_2015_2020,
StockNames_STATS_2015_2020$nTimesDecr10_5yr == 0)

nD10_2015 <- subset(sub_nvr_D10, sub_nvr_D10$Year==2015)
nD10_2020 <- subset(sub_nvr_D10, sub_nvr_D10$Year==2020)

mnD10_2015 <- mean(nD10_2015$YearMeanValue)
mnD10_2020 <- mean(nD10_2020$YearMeanValue)
mnD10_2015

## [1] 109.2018

mnD10_2020

## [1] 272.5558

ROI_nD10 <- mnD10_2020/mnD10_2015
ROI_nD10

## [1] 2.495891

nD10_startValue <- mnD10_2015*length(unique(nD10_2015$stock))
nD10_endValue <- mnD10_2020*length(unique(nD10_2020$stock))
nD10_startValue

## [1] 2293.238

nD10_endValue

## [1] 5723.671

```

The above numbers show the mean stock value of those stocks that never decreased by more than 10 percent in 2015-2020. The 2015 average stock price of these stocks was 109 USD, and in 2020 the average price was 273 USD. This was a ROI of 2.49 or 249 percent, which means it more than doubled in value over the last five years. The 2015 portfolio

price of these specific stock were 2293 USD and in 2020 the portfolio price was 5724 USD. This shows that having a stock that never decreases by more than 10 percent in five years could be a good stock to buy.

Lets now do the reverse and look at those stocks that increased more than 10% at least three times in the last five years of 2015-2020 and compare the means.

```
sub_I10 <- subset(StockNames_STATS_2015_2020,
                  StockNames_STATS_2015_2020$nTimesIncr10_5yr > 3)

sub_nvr_I10 <- subset(StockNames_STATS_2015_2020,
                     StockNames_STATS_2015_2020$nTimesIncr10_5yr == 0)

m2015 <- subset(sub_I10, sub_I10$Year==2015)
m2020 <- subset(sub_I10, sub_I10$Year==2020)

pm_2015 <- mean(m2015$YearMeanValue)
pm_2020 <- mean(m2020$YearMeanValue)

ROI_incr10_3x <- pm_2020/pm_2015
ROI_incr10_3x

## [1] 2.553548

I10_3_startValue <- pm_2015*length(unique(m2015$stock))
I10_3_endValue <- pm_2020*length(unique(m2020$stock))
I10_3_startValue

## [1] 823.0797

I10_3_endValue

## [1] 2101.773

mn_2015 <- subset(sub_nvr_I10, sub_nvr_I10$Year==2015)
mn_2020 <- subset(sub_nvr_I10, sub_nvr_I10$Year==2020)

pmn_2015 <- mean(mn_2015$YearMeanValue)
pmn_2020 <- mean(mn_2020$YearMeanValue)

ROI_nvr10 <- pmn_2020/pmn_2015
ROI_nvr10

## [1] 0.5342204

nI10_startValue <- pmn_2015*length(unique(mn_2015$stock))
nI10_endValue <- pmn_2020*length(unique(mn_2020$stock))
nI10_startValue

## [1] 502.048
```



```
nI10_endValue
```

```
## [1] 268.2043
```

From the above, we can see that those stocks that never increased by more than 10 percent during the last five years lost almost half their 2015 start value of 502 USD in 2015 and 268 USD in 2020 and having a ROI ratio of 0.53. On the other hand, the stocks that increased by more than 10 percent at least three times during the last five years had a ROI ratio of 2.55, a 2015 portfolio value of 823 USD and a 2020 portfolio value of 2102 USD.

Now lets look at those stocks that increased at least one time in the last five years but never by more than 10 percent.

```
sub_Iz <- subset(StockNames_STATS_2015_2020,  
StockNames_STATS_2015_2020$nTimesIncrFromZero_5yr > 0)
```

```
Iz_2015 <- subset(sub_Iz, sub_Iz$Year==2015)
```

```
Iz_2020 <- subset(sub_Iz, sub_Iz$Year==2020)
```

```
Iz_2015 <- subset(sub_Iz, sub_Iz$Year==2015)
```

```
Iz_2020 <- subset(sub_Iz, sub_Iz$Year==2020)
```

```
m_Iz_2015 <- mean(Iz_2015$YearMeanValue)
```

```
m_Iz_2020 <- mean(Iz_2020$YearMeanValue)
```

```
m_Iz_2015
```

```
## [1] 100.1005
```

```
m_Iz_2020
```

```
## [1] 194.7926
```

```
ROI_Iz <- m_Iz_2020/m_Iz_2015
```

```
ROI_Iz
```

```
## [1] 1.945971
```

```
p_Iz_2015 <- m_Iz_2015*length(unique(sub_Iz$stock))
```

```
p_Iz_2020 <- m_Iz_2020*length(unique(sub_Iz$stock))
```

```
p_Iz_2015
```

```
## [1] 3503.518
```

```
p_Iz_2020
```

```
## [1] 6817.742
```

From the data above, the 2015 average stock price of 100 USD for the stock that had an increasing year at least one time in the last five years but not by more than 10 percent of the last year value. The 2020 average stock price increased to 195 USD, with an ROI of 1.95

or 195 percent. The 2015 portfolio value was 3504 USD and in 2020 the portfolio value increased to 6818 USD. This makes sense that those stocks that increase are good to have as they are making you money, but even if they don't increase by more than 10 percent in any year, when combined with other increasing stock they can nearly double your investment over five years.

Here are the stocks that never increased in the last five years.

```
sub_nvr_Iz <- subset(StockNames_STATS_2015_2020,
StockNames_STATS_2015_2020$nTimesIncrFromZero_5yr == 0)

nIz_2015 <- subset(sub_nvr_Iz, sub_nvr_Iz$Year==2015)
nIz_2020 <- subset(sub_nvr_Iz, sub_nvr_Iz$Year==2020)

m_nIz_2015 <- mean(nIz_2015$YearMeanValue)
m_nIz_2020 <- mean(nIz_2020$YearMeanValue)
m_nIz_2015

## [1] 52.2022

m_nIz_2020

## [1] 55.79861

ROI_nIz <- m_nIz_2020/m_nIz_2015
ROI_nIz

## [1] 1.068894

nIz_startValue <- m_nIz_2015*length(unique(nIz_2015$stock))
nIz_endValue <- m_nIz_2020*length(unique(nIz_2020$stock))
nIz_startValue

## [1] 939.6396

nIz_endValue

## [1] 1004.375
```

From the above we have a portfolio of stock that never increased from zero, but might have increased by more than 10 percent. This variable was designed to capture exactly those stocks that did not increase by more than 10 percent but did increase some. This portfolio has a 2015 average stock value of 52 USD and this value increases to 56 USD in 2020 with an ROI of 1.07 or a five year interest of 7 percent. The 2015 portfolio value was 940 USD and in 2020 the portfolio value was 1004 USD. ***

Lets get the entire 53 stock portfolio mean value in 2015 and compare to the same 53 stock portfolio mean value in 2020.

```

p2015 <- subset(StockNames_STATS_2015_2020,
StockNames_STATS_2015_2020$Year==2015)
p2020 <- subset(StockNames_STATS_2015_2020,
StockNames_STATS_2015_2020$Year==2020)

pm2015 <- mean(p2015$YearMeanValue)
pm2020 <- mean(p2020$YearMeanValue)

pm2015
## [1] 83.83316

pm2020
## [1] 147.5871

ROI_all <- pm2020/pm2015
ROI_all
## [1] 1.760486

pm2015*length(unique(StockNames_STATS_2015_2020$stock))
## [1] 4443.157

pm2020*length(unique(StockNames_STATS_2015_2020$stock))
## [1] 7822.117

```

The portfolio mean was 84 USD in 2015 and 147 USD in 2020. The 2015 portfolio was valued at 4443 USD and in 2020 at 7822 USD for all stocks. The ROI is 1.76, which is good because you almost doubled the loan with all 53 of these stocks in five years spanning 2015-2020.

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```
## [1] 15.2
```

So, with a return of 76% on top of the value invested in 2015 figuratively for this example, that is 15.2% annual interest earned each of five years. This is called pooling, that the wins over compensate for the losses and it is used in health insurance companies as well as financial portfolios like 401k investment tools.

What would the ROI be for all stocks that increased during the last five years by more than 10 per cent?

```

incr_10_2015 <- subset(sub_I10, sub_I10$Year==2015)
mean_incr_10_2015 <- mean(incr_10_2015$YearMeanValue)

incr_10_2020 <- subset(sub_I10, sub_I10$Year==2020)

```

```

mean_incr_10_2020 <- mean(incr_10_2020$YearMeanValue)

mean_incr_10_2015

## [1] 117.5828

mean_incr_10_2020

## [1] 300.2533

ROI_Incr_10 <- mean_incr_10_2020/mean_incr_10_2015
ROI_Incr_10

## [1] 2.553548

value2015 <- mean_incr_10_2015*length(unique(sub_I10$stock))
value2020 <- mean_incr_10_2020*length(unique(sub_I10$stock))

value2015

## [1] 823.0797

value2020

## [1] 2101.773

```

The **return on investment** is more than doubled to 2102 USD over five years from a value of 823 USD in 2015 by selecting only the stocks in this portfolio of stocks that increased by more than 10% at least once in the last 5 years. The return of the ratio of the mean value in 2020 to 2015 is 2.55, which means the portfolio more than doubled.

But how do we or how can we know what stocks to select now that will increase many times as long as we have the investment? Can machine learning be built from this data set to find the stocks in this sample that produce good indicating features of other stocks that could be profitable to buy? We will develop this as we progress through this portfolio. We would also want indicators that would tell if certain stocks look like a good prospect but are actually going to be on a steady decline that translates to financial loss as long as you own them.

There are four sets of counts for those that increased more than 10%, decreased more than 10%, increased more than zero but less than 10%, and decreased more than zero but less than 10% within the five year span from 2015-2020. Lets see if there is a better subset of choices for a better market portfolio.

Lets add a five year poisson column using $\lambda = (\text{unemployment rate})$, $\text{time} = (\text{nTimesIncr}_{10_5\text{yr}})$, and $k = (\text{YearMeanGreaterThan}_{5\text{yrMean}})$. We will use the best subset so far of the stocks that increased by more than 10% annually in at least 3 out of the last five years.

```

ue2 <- stock_5yrs_ue$Annual_UE
t <- stock_5yrs_ue$nTimesIncr10_5yr
k <- stock_5yrs_ue$YearMeanGreaterThan5yrMean
stock_5yrs_ue$poisson5yrUE <- round((exp(-ue2*t)*(ue2*t)^k)/(factorial(k)),5)

```

Lets get a subset of those stocks that have cyclical patterns within five years, so that we have three years the stock increases more than 10% exactly 3 times, and two years where the stock decreases less than 10% exactly 2 times. Separately, get the stocks it increases greater than 10% exactly 3 times, and decreases more than 10% exactly 2 times. Also get the reverse of these values

```

cyclical <- subset(stock_5yrs_ue, stock_5yrs_ue$nTimesIncr10_5yr==3 &
(stock_5yrs_ue$nTimesDecr10_5yr==2 |
stock_5yrs_ue$nTimesDecrFromZero_5yrs==2))

cyclical2 <- subset(stock_5yrs_ue, stock_5yrs_ue$nTimesIncrFromZero_5yrs >=2
& (stock_5yrs_ue$nTimesDecr10_5yr >= 2 |
stock_5yrs_ue$nTimesDecrFromZero_5yrs >= 2))

c1 <- as.character(unique(cyclical$stock))
c2 <- as.character(unique(cyclical2$stock))
cycle <- c(c1,c2)
cycle1 <- as.data.frame(cycle)
colnames(cycle1) <- 'Stock'

portCycle <- merge(cycle1,stock_5yrs_ue, by.x='Stock', by.y='stock')
portCycle_2015 <- subset(portCycle, Year==2015)
portCycle_2020 <- subset(portCycle, Year==2020)

pc_mean2015 <- mean(portCycle_2015$YearMeanValue)
pc_mean2020 <- mean(portCycle_2020$YearMeanValue)

pc_mean2015
## [1] 36.228

pc_mean2020
## [1] 37.91673

ROI_pc <- pc_mean2020/pc_mean2015
ROI_pc
## [1] 1.046614

startValue <- pc_mean2015*length(unique(portCycle_2015$Stock))
endValue <- pc_mean2020*length(unique(portCycle_2020$Stock))

startValue
## [1] 434.736

```

```
endValue
```

```
## [1] 455.0007
```

The above shows that the **cyclical stocks that have highs and lows the time span of the loan aren't great investments**, as these stocks started at 435 USD in 2015 but ended with a portfolio value of 455 USD over a five year time span from 2015-2020. The ratio of average stock in 2020 to average stock in 2015 is 1.04, which means it earned 4 percent interest over 5 years or less than 1 percent interest a year. This is equivalent to most bank savings accounts. It is good they at least stayed the same and didn't cause the portfolio to lose money, and we can assume those stocks that do decrease continuously will be the stocks that lose money. We should look at the columns we added earlier that calculated the ROI dollars for each stock and see the average number of times the stock closes at a decreasing value over the span of the original data. Then use those outcomes to rank the stock a poor, average, good, or great stock to buy.

Lets use the StocksSTATS table with the 230 columns of ROI for each stock from the start in 2007 throughout 2020 and the daily changes for each stock for the same time span. We could add cumulative sum columns to each stock or just plot the daily changes for each of the 53 stocks and see if we notice any patterns and compare the the final recording ROI from the initial investment. Maybe see if some of these stocks are good to jump on, like a wave to increase value of the portfolio, or drop the stock at some point to keep the portfolio from dropping in value.

```
dailyChange <- grep('dailyChange', colnames(StocksSTATS))
DailyChanges <- StocksSTATS[, c(dailyChange, 218:222, 229)]
summary(DailyChanges)
```

```
##  TGT_dailyChange      FTR_dailyChange      UBSI_dailyChange
##  Min.   :-66.41001    Min.   :-81.00000    Min.   :-16.2500
##  1st Qu.: -0.51000    1st Qu.: -0.90000    1st Qu.: -0.3500
##  Median :  0.03000    Median :  0.00000    Median :  0.0000
##  Mean   :  0.03247    Mean   :  0.00026    Mean   :  0.0115
##  3rd Qu.:  0.57000    3rd Qu.:  0.75000    3rd Qu.:  0.3300
##  Max.   :  59.93000    Max.   : 235.68000    Max.   :  34.8000
##  HD_dailyChange      JPM_dailyChange      XOM_dailyChange
##  Min.   :-199.42000   Min.   :-88.18999   Min.   :-23.84000
##  1st Qu.: -0.43999   1st Qu.: -0.51000   1st Qu.: -0.58000
##  Median :  0.06000   Median :  0.02000   Median :  0.00000
##  Mean   :  0.07046   Mean   :  0.03574   Mean   :  0.02144
##  3rd Qu.:  0.67000   3rd Qu.:  0.58000   3rd Qu.:  0.61000
##  Max.   :  57.01999   Max.   :  48.24000   Max.   :  76.16000
##  CVX_dailyChange     NSANY_dailyChange    MGM_dailyChange
##  Min.   :-56.84000   Min.   :-15.63999   Min.   :-73.43000
##  1st Qu.: -0.78000   1st Qu.: -0.17000   1st Qu.: -0.30000
##  Median :  0.08000   Median :  0.00000    Median :  0.01000
##  Mean   :  0.03602   Mean   :  0.003793   Mean   :  0.00842
##  3rd Qu.:  0.88000   3rd Qu.:  0.17000   3rd Qu.:  0.32000
```

## Max. : 74.83000	Max. : 21.540001	Max. : 71.58000
## TEVA_dailyChange	HST_dailyChange	WFC_dailyChange
## Min. : -30.11000	Min. : -13.010280	Min. : -18.84000
## 1st Qu.: -0.38000	1st Qu.: -0.190000	1st Qu.: -0.37000
## Median : -0.02000	Median : 0.010000	Median : 0.00000
## Mean : 0.00209	Mean : 0.005251	Mean : 0.01532
## 3rd Qu.: 0.34000	3rd Qu.: 0.200000	3rd Qu.: 0.38000
## Max. : 38.18000	Max. : 26.206558	Max. : 34.01000
## WWE_dailyChange	INO_dailyChange	SCE.PB_dailyChange
## Min. : -69.75000	Min. : -11.520000	Min. : -890.0000
## 1st Qu.: -0.18000	1st Qu.: -0.120000	1st Qu.: -19.0000
## Median : 0.01000	Median : 0.000000	Median : 0.0000
## Mean : 0.02161	Mean : 0.000623	Mean : 0.2712
## 3rd Qu.: 0.21000	3rd Qu.: 0.080000	3rd Qu.: 22.0000
## Max. : 67.69000	Max. : 13.320000	Max. : 886.0000
## FFIN_dailyChange	GOOG_dailyChange	WM_dailyChange
## Min. : -28.191665	Min. : -1170.0303	Min. : -84.98000
## 1st Qu.: -0.120000	1st Qu.: -3.1314	1st Qu.: -0.23000
## Median : 0.006667	Median : 0.2989	Median : 0.05000
## Mean : 0.010121	Mean : 0.3702	Mean : 0.03492
## 3rd Qu.: 0.155000	3rd Qu.: 4.4200	3rd Qu.: 0.34000
## Max. : 9.840002	Max. : 344.4899	Max. : 34.65000
## ONCY_dailyChange	S_dailyChange	F_dailyChange
## Min. : -25.08000	Min. : -14.830000	Min. : -6.200001
## 1st Qu.: -0.28500	1st Qu.: -0.100000	1st Qu.: -0.120000
## Median : 0.00000	Median : 0.000000	Median : 0.000000
## Mean : 0.00017	Mean : 0.001874	Mean : 0.002782
## 3rd Qu.: 0.19000	3rd Qu.: 0.090000	3rd Qu.: 0.120000
## Max. : 41.23000	Max. : 19.299999	Max. : 9.780000
## ARWR_dailyChange	COST_dailyChange	AAL_dailyChange
## Min. : -49.50000	Min. : -245.26999	Min. : -42.66000
## 1st Qu.: -0.20000	1st Qu.: -0.60000	1st Qu.: -0.36000
## Median : 0.00000	Median : 0.10000	Median : 0.00000
## Mean : 0.00856	Mean : 0.08749	Mean : 0.00819
## 3rd Qu.: 0.20000	3rd Qu.: 0.90000	3rd Qu.: 0.37000
## Max. : 50.91000	Max. : 93.68001	Max. : 45.05000
## JWN_dailyChange	NUS_dailyChange	HMC_dailyChange
## Min. : -38.08000	Min. : -96.59000	Min. : -13.20000
## 1st Qu.: -0.54000	1st Qu.: -0.41000	1st Qu.: -0.31000
## Median : 0.03000	Median : 0.02000	Median : 0.00000
## Mean : 0.01022	Mean : 0.01292	Mean : 0.00792
## 3rd Qu.: 0.58000	3rd Qu.: 0.52000	3rd Qu.: 0.30000
## Max. : 53.74000	Max. : 95.71001	Max. : 34.69000
## AMZN_dailyChange	T_dailyChange	HRB_dailyChange
## Min. : -1939.1100	Min. : -15.26000	Min. : -14.630001
## 1st Qu.: -2.4300	1st Qu.: -0.22000	1st Qu.: -0.220001
## Median : 0.3200	Median : 0.02000	Median : 0.010000
## Mean : 0.5272	Mean : 0.01149	Mean : 0.007173
## 3rd Qu.: 4.1200	3rd Qu.: 0.24000	3rd Qu.: 0.230001
## Max. : 1078.1600	Max. : 39.46000	Max. : 21.260000

## RRGB_dailyChange	ADDYY_dailyChange	PCG_dailyChange	
## Min. : -43.2600	Min. : -138.60000	Min. : -36.91000	
## 1st Qu.: -0.5200	1st Qu.: -0.45000	1st Qu.: -0.34000	
## Median : 0.0000	Median : 0.04000	Median : 0.03000	
## Mean : 0.0101	Mean : 0.04728	Mean : 0.00304	
## 3rd Qu.: 0.5600	3rd Qu.: 0.57001	3rd Qu.: 0.35000	
## Max. : 42.7500	Max. : 48.06000	Max. : 49.44000	
## ROST_dailyChange	JNJ_dailyChange	NFLX_dailyChange	
## Min. : -109.62500	Min. : -87.02000	Min. : -368.0886	
## 1st Qu.: -0.19000	1st Qu.: -0.38000	1st Qu.: -0.4286	
## Median : 0.02750	Median : 0.03000	Median : 0.0143	
## Mean : 0.03336	Mean : 0.03929	Mean : 0.0813	
## 3rd Qu.: 0.32500	3rd Qu.: 0.50000	3rd Qu.: 0.6243	
## Max. : 35.09000	Max. : 60.10000	Max. : 216.5200	
## M_dailyChange	KSS_dailyChange	DLTR_dailyChange	
## Min. : -35.46000	Min. : -31.74000	Min. : -98.37333	
## 1st Qu.: -0.40000	1st Qu.: -0.59000	1st Qu.: -0.32667	
## Median : 0.02000	Median : 0.01000	Median : 0.02333	
## Mean : 0.00472	Mean : 0.01508	Mean : 0.03467	
## 3rd Qu.: 0.44000	3rd Qu.: 0.61000	3rd Qu.: 0.46000	
## Max. : 45.06000	Max. : 77.49000	Max. : 37.19000	
## WMT_dailyChange	C_dailyChange	AAP_dailyChange	
## Min. : -74.62000	Min. : -298.300	Min. : -131.92001	
## 1st Qu.: -0.39000	1st Qu.: -0.680	1st Qu.: -0.74000	
## Median : 0.04000	Median : -0.010	Median : 0.04000	
## Mean : 0.03604	Mean : 0.021	Mean : 0.05023	
## 3rd Qu.: 0.46000	3rd Qu.: 0.650	3rd Qu.: 0.85001	
## Max. : 47.40000	Max. : 510.500	Max. : 87.86001	
## JBLU_dailyChange	MSFT_dailyChange	KGJI_dailyChange	
## Min. : -10.390000	Min. : -140.49000	Min. : -7.820000	
## 1st Qu.: -0.139999	1st Qu.: -0.29000	1st Qu.: -0.020000	
## Median : 0.000000	Median : 0.03000	Median : 0.000000	
## Mean : 0.005087	Mean : 0.04222	Mean : 0.000182	
## 3rd Qu.: 0.140000	3rd Qu.: 0.39000	3rd Qu.: 0.020000	
## Max. : 14.690000	Max. : 56.19000	Max. : 9.090000	
## EPD_dailyChange	TJX_dailyChange	HOFT_dailyChange	
## Min. : -14.510001	Min. : -53.93750	Min. : -23.229999	
## 1st Qu.: -0.170000	1st Qu.: -0.14250	1st Qu.: -0.240000	
## Median : 0.015000	Median : 0.02000	Median : 0.000000	
## Mean : 0.008679	Mean : 0.01693	Mean : 0.006511	
## 3rd Qu.: 0.195000	3rd Qu.: 0.21250	3rd Qu.: 0.250000	
## Max. : 15.875000	Max. : 21.21500	Max. : 22.400002	
## LUV_dailyChange	NKE_dailyChange	TM_dailyChange	VZ_dailyChange
## Min. : -42.8500	Min. : -88.72500	Min. : -47.61000	Min. : -
25.92523			
## 1st Qu.: -0.2100	1st Qu.: -0.23250	1st Qu.: -0.84000	1st Qu.: -
0.29000			
## Median : 0.0100	Median : 0.02750	Median : -0.02000	Median :
0.02814			
## Mean : 0.0164	Mean : 0.02852	Mean : 0.04084	Mean :


```

0.01833
## 3rd Qu.: 0.2500 3rd Qu.: 0.31750 3rd Qu.: 0.85999 3rd Qu.:
0.31888
## Max. : 25.0600 Max. : 29.47000 Max. :126.92000 Max. :
35.31607
## SIG_dailyChange Date DayOfWeek Month
## Min. : -75.22000 Min. :2007-01-03 Length:3293 Length:3293
## 1st Qu.: -0.61000 1st Qu.:2010-04-12 Class :character Class
:character
## Median : 0.03000 Median :2013-07-18 Mode :character Mode
:character
## Mean : 0.00509 Mean :2013-07-16
## 3rd Qu.: 0.61000 3rd Qu.:2016-10-21
## Max. : 50.72000 Max. :2020-01-31
## Year UE_monthlyRate dayOfMonth
## Min. :2007 Min. : 3.500 Min. : 1.00
## 1st Qu.:2010 1st Qu.: 4.600 1st Qu.: 8.00
## Median :2013 Median : 5.600 Median :16.00
## Mean :2013 Mean : 6.282 Mean :15.74
## 3rd Qu.:2016 3rd Qu.: 8.200 3rd Qu.:23.00
## Max. :2020 Max. :10.000 Max. :31.00

dailyChangesColSums <- as.data.frame(colSums(DailyChanges[1:53]))
colnames(dailyChangesColSums) <- 'avgDailyChange_2007_2020'
row.names(dailyChangesColSums) <-
gsub('_dailyChange', '', row.names(dailyChangesColSums))
head(dailyChangesColSums, 5)

## avgDailyChange_2007_2020
## TGT 106.91
## FTR 0.87
## UBSI 37.87
## HD 232.02
## JPM 117.69

```