STA380\_Exercise1

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# Question 1

# Question 2

You can also embed plots, for example:

# Question 3

## Bootstrapping

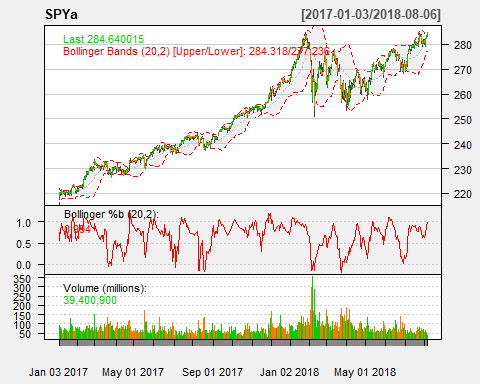
First, we select the stocks that are of interest to us from the quantmod package

library(mosaic)  
library(quantmod)  
library(foreach)  
  
mystocks = c("SPY", "TLT", "LQD", "EEM", "VNQ")  
myprices = getSymbols(mystocks)  
  
for(ticker in mystocks) {  
 expr = paste0(ticker, "a = adjustOHLC(", ticker, ")")  
 eval(parse(text=expr))  
 }  
  
  
# Combine all the returns in a matrix  
all\_returns = cbind(ClCl(SPYa),  
 ClCl(TLTa),  
 ClCl(LQDa),  
 ClCl(EEMa),  
 ClCl(VNQa))  
head(all\_returns)

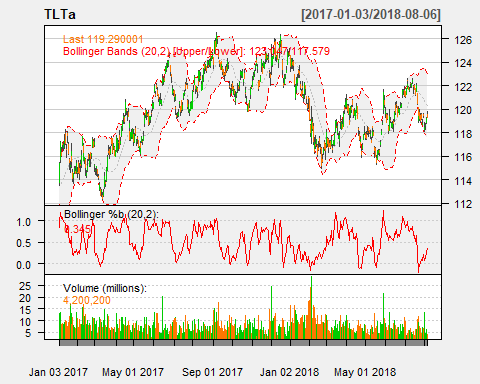
## ClCl.SPYa ClCl.TLTa ClCl.LQDa ClCl.EEMa  
## 2007-01-03 NA NA NA NA  
## 2007-01-04 0.0021221123 0.006063328 0.0075152938 -0.013809353  
## 2007-01-05 -0.0079763183 -0.004352668 -0.0006526807 -0.029238205  
## 2007-01-08 0.0046250821 0.001793566 -0.0002798843 0.007257535  
## 2007-01-09 -0.0008498831 0.000000000 0.0001866169 -0.022336235  
## 2007-01-10 0.0033315799 -0.004475797 -0.0013063264 -0.002303160  
## ClCl.VNQa  
## 2007-01-03 NA  
## 2007-01-04 0.001296655  
## 2007-01-05 -0.018518518  
## 2007-01-08 0.001451392  
## 2007-01-09 0.012648208  
## 2007-01-10 0.012880523

As we can see above, all\_returns has the closing returns for the 5 stocks we want to invest in. To determine which out of these are risky and stable, we will plot their returns and check their trend

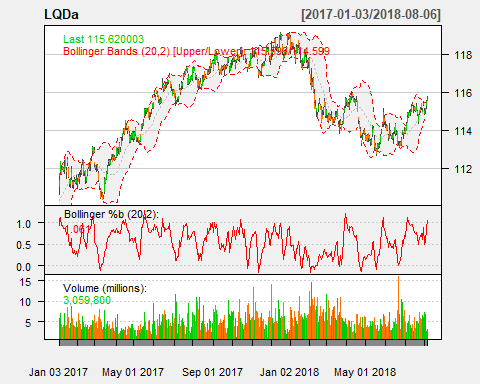
#plotting since 2007 and since 2017 to compare  
  
chartSeries(SPYa,TA='addBBands();  
 addBBands(draw="p");  
 addVo()',   
 subset='2017-01::2018',  
 theme="white"  
 )



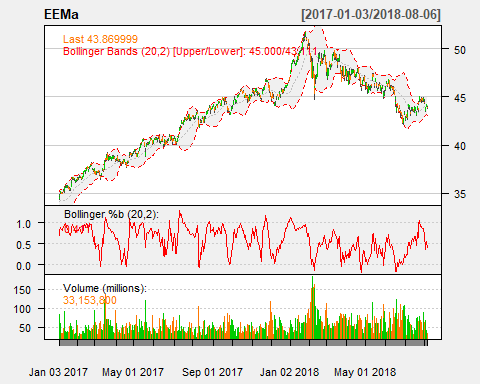
chartSeries(TLTa,TA='addBBands();  
 addBBands(draw="p");  
 addVo()',   
 subset='2017-01::2018',  
 theme="white"  
 )



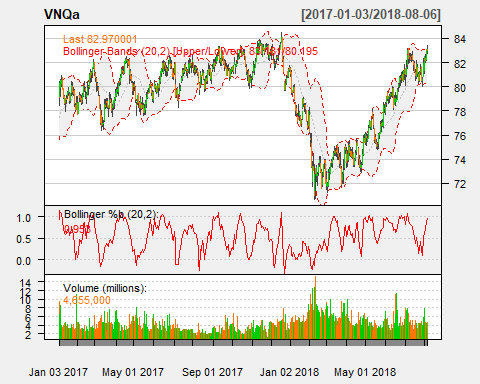
chartSeries(LQDa,TA='addBBands();  
 addBBands(draw="p");  
 addVo()',   
 subset='2017-01::2018',  
 theme="white"  
 )



chartSeries(EEMa,TA='addBBands();  
 addBBands(draw="p");  
 addVo()',   
 subset='2017-01::2018',  
 theme="white"  
 )



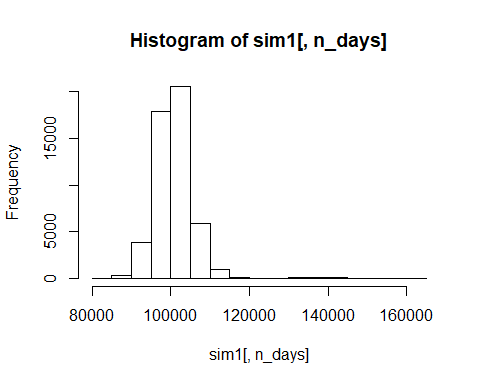
chartSeries(VNQa,TA='addBBands();  
 addBBands(draw="p");  
 addVo()',   
 subset='2017-01::2018',  
 theme="white"  
 )



From the charts we can conclude that Emerging markets and Real estate exchange-traded funds have been rather unstable with higher returns

### (a) Simulating for even split

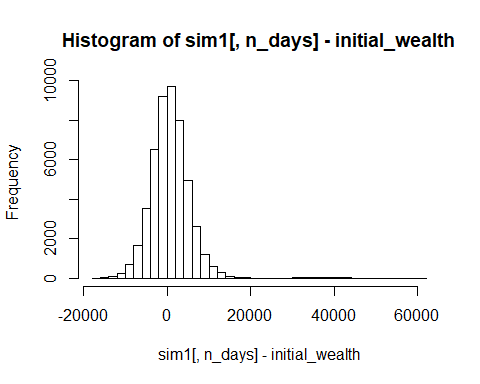
all\_returns = as.matrix(na.omit(all\_returns))  
  
n\_days = 20  
initial\_wealth = 100000  
sim1 = foreach(i=1:50000, .combine='rbind') %do% {  
 total\_wealth = initial\_wealth  
 weights = c(0.2, 0.2, 0.2, 0.2, 0.2)  
 holdings = weights \* total\_wealth  
 wealthtracker = rep(0, n\_days)  
 for(today in 1:n\_days) {  
 return.today = resample(all\_returns, 1, orig.ids=FALSE)  
 holdings = holdings + holdings\*return.today  
 total\_wealth = sum(holdings)  
 wealthtracker[today] = total\_wealth  
 holdings = total\_wealth \* weights  
 }  
 wealthtracker  
}  
  
  
hist(sim1[,n\_days], 25)



# Profit/loss  
mean(sim1[,n\_days])

## [1] 100899.1

hist(sim1[,n\_days]- initial\_wealth, breaks=30)

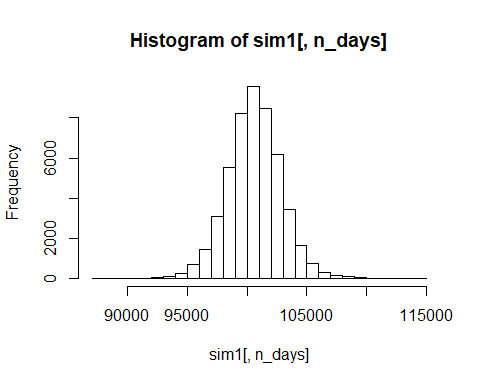


# Calculate 5% value at risk  
quantile(sim1[,n\_days], 0.05) - initial\_wealth

## 5%   
## -6186.421

### (b) Simulating for safe split

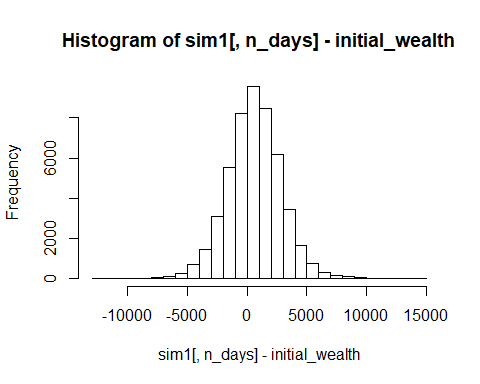
all\_returns = as.matrix(na.omit(all\_returns))  
  
n\_days = 20  
initial\_wealth = 100000  
sim1 = foreach(i=1:50000, .combine='rbind') %do% {  
 total\_wealth = initial\_wealth  
 weights = c(1/3, 1/3, 1/3, 0,0)  
 holdings = weights \* total\_wealth  
 wealthtracker = rep(0, n\_days)  
 for(today in 1:n\_days) {  
 return.today = resample(all\_returns, 1, orig.ids=FALSE)  
 holdings = holdings + holdings\*return.today  
 total\_wealth = sum(holdings)  
 wealthtracker[today] = total\_wealth  
 holdings = total\_wealth \* weights  
 }  
 wealthtracker  
}  
  
  
hist(sim1[,n\_days], 25)



# Profit/loss  
mean(sim1[,n\_days])

## [1] 100602.2

hist(sim1[,n\_days]- initial\_wealth, breaks=30)



# Calculate 5% value at risk  
quantile(sim1[,n\_days], 0.05) - initial\_wealth

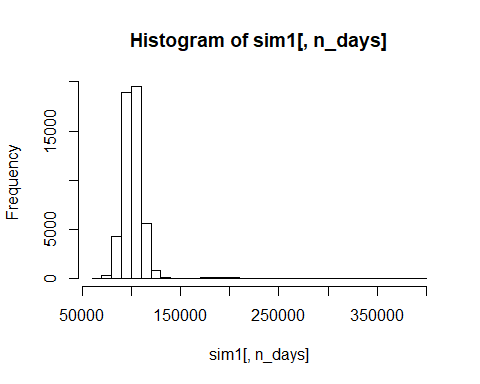
## 5%   
## -3026.445

### (b) Simulating for aggressive split

all\_returns = as.matrix(na.omit(all\_returns))  
  
n\_days = 20  
initial\_wealth = 100000  
sim1 = foreach(i=1:50000, .combine='rbind') %do% {  
 total\_wealth = initial\_wealth  
 weights = c(0, 0, 0, 0.5, 0.5)  
 holdings = weights \* total\_wealth  
 wealthtracker = rep(0, n\_days)  
 for(today in 1:n\_days) {  
 return.today = resample(all\_returns, 1, orig.ids=FALSE)  
 holdings = holdings + holdings\*return.today  
 total\_wealth = sum(holdings)  
 wealthtracker[today] = total\_wealth  
 holdings = total\_wealth \* weights  
 }  
 wealthtracker  
}  
  
head(sim1)

## [,1] [,2] [,3] [,4] [,5] [,6]  
## result.1 99678.73 101436.58 100940.66 102290.81 102833.82 103890.95  
## result.2 101128.96 101890.07 104875.79 105505.44 105313.56 105516.97  
## result.3 100069.64 99907.47 98296.75 97748.80 99062.55 98289.37  
## result.4 96968.28 97781.78 97516.26 100236.86 99630.96 97430.42  
## result.5 99933.49 100306.63 99010.57 100166.57 100237.48 99920.76  
## result.6 102089.86 100301.02 97665.18 95082.24 96895.11 97591.34  
## [,7] [,8] [,9] [,10] [,11] [,12]  
## result.1 103512.10 105909.54 104756.79 105979.89 106045.02 105200.24  
## result.2 106014.25 107878.51 107290.75 109507.09 109223.52 108758.04  
## result.3 98682.10 99299.51 100458.89 98491.08 96773.93 95671.81  
## result.4 95881.07 96671.80 98314.02 98906.63 98964.88 98979.44  
## result.5 98956.00 99453.21 100429.00 100552.03 100892.81 99328.59  
## result.6 96875.24 95430.15 94979.63 93507.08 90340.41 91140.45  
## [,13] [,14] [,15] [,16] [,17] [,18]  
## result.1 104868.54 105136.90 105006.31 102214.58 100425.83 99972.34  
## result.2 108614.14 106040.62 105977.12 106291.72 106873.13 109836.89  
## result.3 96443.44 97502.18 94617.53 94435.47 95582.47 96272.20  
## result.4 93987.31 99024.42 98632.79 99864.76 102092.45 101502.28  
## result.5 98718.95 99104.44 98903.26 99266.37 98793.44 99243.02  
## result.6 91977.84 91959.29 89406.10 88741.96 89633.36 87794.32  
## [,19] [,20]  
## result.1 98284.59 97501.64  
## result.2 110400.36 111494.19  
## result.3 96518.87 96221.78  
## result.4 106305.41 105647.94  
## result.5 99013.97 95582.06  
## result.6 86159.93 85627.88

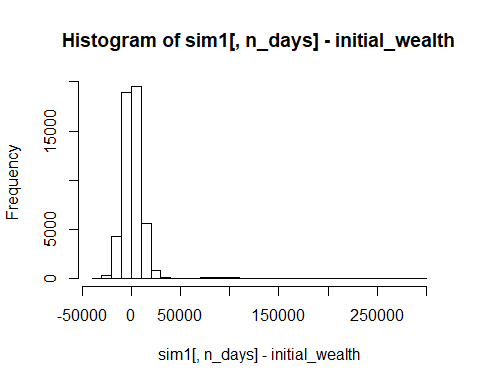
hist(sim1[,n\_days], 25)



# Profit/loss  
mean(sim1[,n\_days])

## [1] 101433.6

hist(sim1[,n\_days]- initial\_wealth, breaks=30)



# Calculate 5% value at risk  
quantile(sim1[,n\_days], 0.05) - initial\_wealth

## 5%   
## -12683.92

## Question 4