Portfolio Managment: Homework 1

Gal Skarishevsky, Nathan Matare, Lior, Sahaf

March 30, 2017

1. Load Data

We write the function '`getReturns`' that loads the data into our R environment.

```
getReturns <- function(name){
returns <- read.csv(name, skip = 4, sep = "\t", header = FALSE)

if(name == 'returns_annual.txt')
    returns <- as.xts(returns[ ,-1],
                          order.by = as.Date(as.character(returns[,1]), format = "%Y"))
else
    returns <- as.xts(returns[ ,-1],
                      order.by = as.Date(as.character(returns[,1]), format = "%Y%m%d"))

colnames(returns) <- c("SP500_rtrn", "BOND_rtrn")
return(returns)
}

daily <- getReturns('returns_daily.txt')
monthly <- getReturns('returns_monthly.txt')
annually <- getReturns('returns_annual.txt')
```

2 and 3. Estimate basic statistics

We write the function '`getStats`' that computes the means, variances, standard deviations, covariances, correlations, skewness, and kurtosis of each time series at all three frequences.

Table 1: Daily

	stock	bond
mean	0.0004	0.0000
var	0.0001	0.0000
sd	0.0102	0.0052
skew	-0.5717	0.0968
kurt	19.5690	8.3359

cov	cor
0.000001	0.0208

Table 3: Monthly

	stock	bond
mean	0.0101	0.0048
var	0.0018	0.0007
sd	0.0421	0.0268
skew	-0.4221	0.5548
kurt	1.5166	4.1133

cov	cor
0.000132	0.117

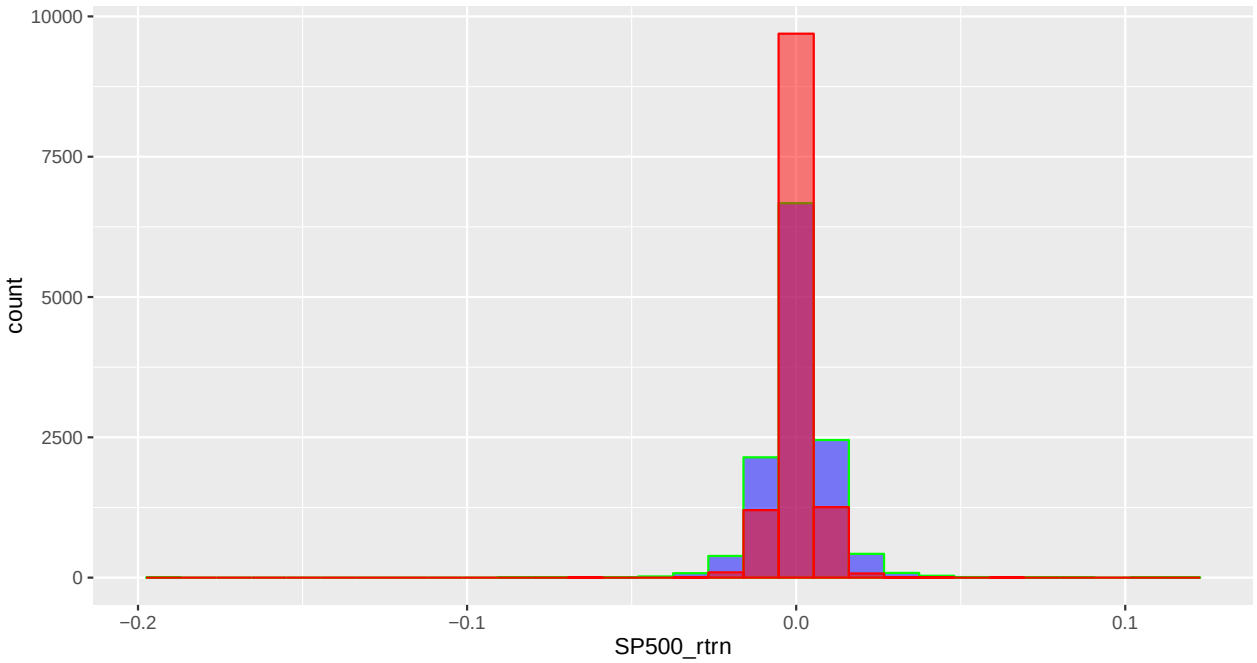
Table 5: Annually

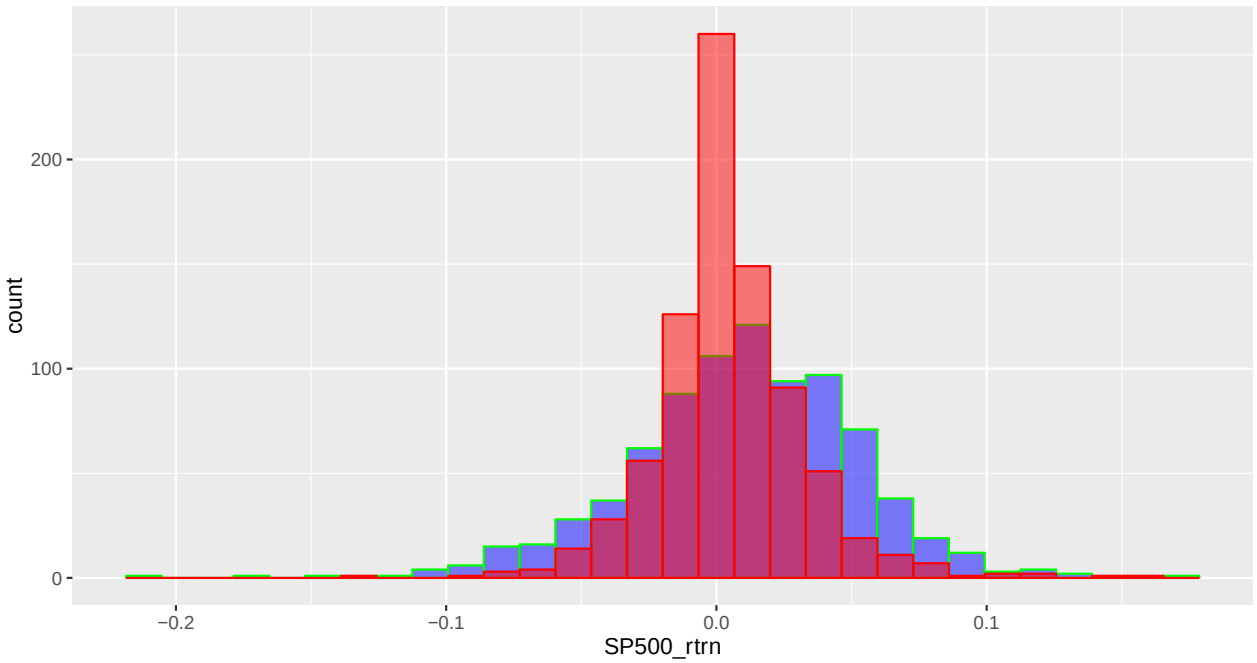
	stock	bond
mean	0.1303	0.0602
var	0.0303	0.0122
sd	0.1741	0.1105
skew	-0.4141	0.8307
kurt	-0.0918	0.8945

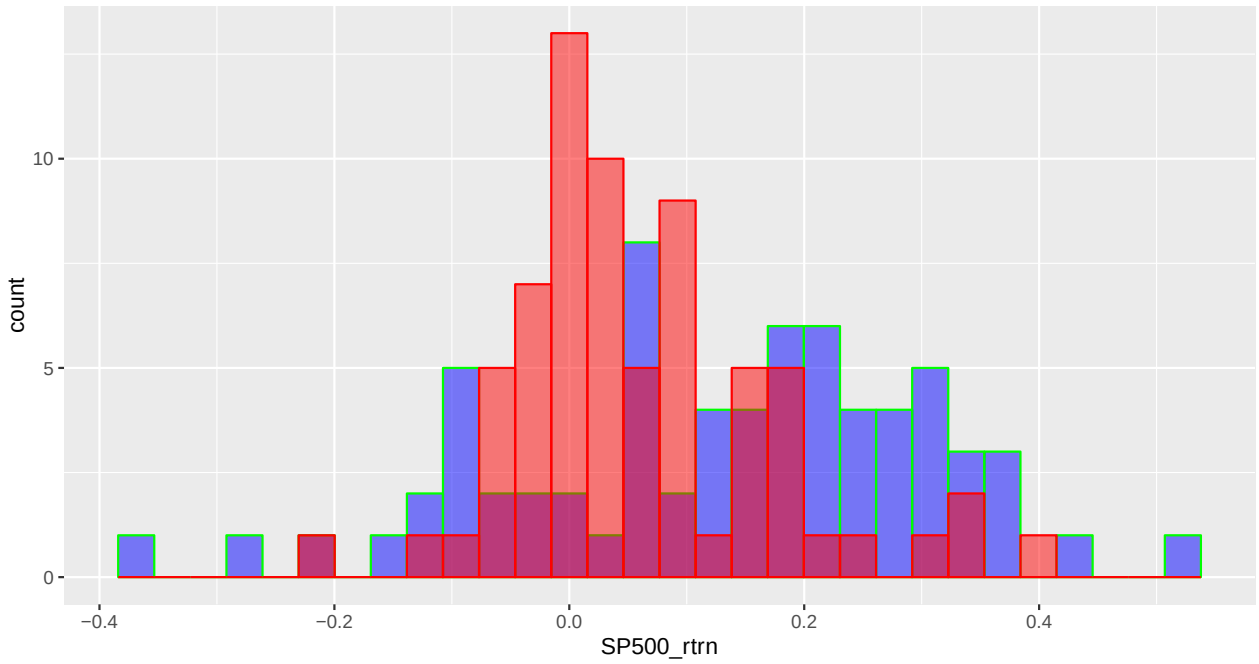
cov	cor
-0.000233	-0.0121

4. Histograms

None of frequencies (daily, monthly or annually) are normally distributed. We observe greater non-normality the larger the time frequencies become. See the below histograms. The S&P500 returns are graphed in blue while bonds are graphed in red.







5. Compute CIs

We write the function '`getADVStats`' that computes the upper and lower confidence intervals for a period of one, and a rolling arithmetic period of thirty.

```
getADVStats <- function(DF){
stock <- DF$SP500_rtrn
bond <- DF$BOND_rtrn

error <- qnorm(0.975) * sd(stock) / sqrt(NROW(stock))
CI_1 <- c(lower = mean(stock) - error, upper = mean(stock) + error)

stock_30 <- na.omit(rollapply(stock, width = 30, mean))
error_30 <- qnorm(0.975) * sd(stock_30) / sqrt(NROW(stock_30))
CI_30 <- c(lower = mean(stock_30) - error_30, upper = mean(stock_30) + error_30)
return(data.frame(period_1 = CI_1, period_30 = CI_30))
}
```

Table 7: Daily

	period_1	period_30
lower	0.000231	0.000381
upper	0.000591	0.000444

Table 8: Monthly

	period_1	period_30
lower	0.00721	0.00925

	period_1	period_30
upper	0.01294	0.01037

Table 9: Annually

	period_1	period_30
lower	0.0892	0.122
upper	0.1714	0.130

6. Compute Absolute Shortfalls

We write the function '`getABSshortfall`' that computes the probability that the return over the next period will be lower than a specified threshold parameters, k.

```
getABSshortfall <- function(DF){
    stock <- DF$SP500_rtrn
    bond <- DF$BOND_rtrn

    ks <- c(-0.20, -0.10, 0, 0.10, 0.20)
    out <- matrix(NA, 5, 2, dimnames = list(ks, c("stock", "bond")))

    for(k in 1:NROW(out)){
            p <- as.numeric(rownames(out)[k])
            out[k, 1] <- pnorm(p, mean = mean(stock), sd = sd(stock))
            out[k, 2] <- pnorm(p, mean = mean(bond), sd = sd(bond))
    }

    return(out)
}
```

Table 10: Daily

	stock	bond
-0.2	0.000	0.000
-0.1	0.000	0.000
0	0.484	0.498
0.1	1.000	1.000
0.2	1.000	1.000

Table 11: Monthly

	stock	bond
-0.2	0.00000	0.000000
-0.1	0.00445	0.000045
0	0.40536	0.428752
0.1	0.98369	0.999813
0.2	1.00000	1.000000

Table 12: Annually

	stock	bond
-0.2	0.0289	0.00925
-0.1	0.0930	0.07350
0	0.2271	0.29284
0.1	0.4309	0.64059
0.2	0.6556	0.89709

7. Stock Return Probability

We write the function '`getStockBondProb`' that computes the probability that the stock return is lower than the bond return for a given frequency.

```
getStockBondProb <- function(DF){
                stock <- DF$SP500_rtrn
                bond <- DF$BOND_rtrn

                # number of times stock return is lower than bond return
                num_times <- length(which(stock < bond))
                # number of times event happened over number of observations
                prob <- num_times / NROW(DF)
                return(prob)
}
```

```
Daily
0.479

Monthly
   0.43

Annually
   0.362
```