portfolioAnalysis

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Mean Value analysis of portfolio

A. Loading Ticker Data

```
ticks <- c("^GSPC", "CAT", "LLY")

retout <- NULL
retout <- xts(retout)

for(i in 1:length(ticks)){
  prices <-  getSymbols(ticks[i], auto.assign = F)
  returns <- periodReturn(prices, period = "monthly",
                          type = "arithmetic")
  retout <- merge.xts(retout, returns)
}

colnames(retout) <- ticks
retout = retout['2013/2016']
head(retout)
```

```
##                           ^GSPC         CAT         LLY
## 2013-01-30 19:00:00  0.05042810  0.09798011  0.08860501
## 2013-02-27 19:00:00  0.01106065 -0.06118504  0.01806670
## 2013-03-27 20:00:00  0.03598772 -0.05846056  0.03896819
## 2013-04-29 20:00:00  0.01808577 -0.02644594 -0.02482831
## 2013-05-30 20:00:00  0.02076281  0.01334599 -0.04008669
## 2013-06-27 20:00:00 -0.01499930 -0.03857815 -0.07599701
```

B. Calculating mean vector and covariance matrix

```
meanret <- apply(retout,2,mean)
meanret
```

```
##       ^GSPC         CAT         LLY
## 0.009877323 0.002961310 0.009496715
```

```
covar <- var(retout)
covar
```

```
##              ^GSPC           CAT           LLY
## ^GSPC 0.0009021826  1.151629e-03  2.715537e-04
## CAT   0.0011516291  4.592993e-03 -4.992334e-05
## LLY   0.0002715537 -4.992334e-05  2.324964e-03
```

```
weight <- c(0, .4, .6)
```

C. Calculating portfolio mean and variance

```
rp <- weight[2]*meanret[2] + weight[3]*meanret[3]
rp <- unname(rp) # otherwise picks up second ticker as dimname
rp
```

```
## [1] 0.006882553
```

```
sig2p <- weight[2]^2*covar[2,2]+weight[3]^2*covar[3,3]+2*weight[2]*weight[3]*covar[2,3]
sig2p
```

```
## [1] 0.001547903
```

```
sqrt(sig2p)
```

```
## [1] 0.03934339
```

D. Calculating using matrix multiplication

```
weight <- as.matrix(weight)
dim(weight)
```

```
## [1] 3 1
```

```
meanret <- as.matrix(meanret)
dim(meanret)
```

```
## [1] 3 1
```

Use matrix multiplication to calculate portfolio metrics:

```
rp <- t(weight) %*% meanret
rp
```

```
##             [,1]
## [1,] 0.006882553
```

```
sig2p <- t(weight) %*% covar %*% weight
sig2p
```

```
##             [,1]
## [1,] 0.001547903
```

```
sigp <- sqrt(sig2p)   # portfolio sigma
sigp
```

```
##            [,1]
## [1,] 0.03934339
```

Matrix algebra is useful inorder to avoid complex for loops.

E. Feasible Set with these two assets

Now we are ready to do multiple computations. Simulate various portfolios and calculate mean and sigma.

```
# initialize a counter and the results matrix
kount <- 0
Results <- matrix(data = NA, nrow = length(seq(.05,.95,.05)), ncol = 4)

for (i in seq(.05,0.95,.05)){
    kount <- kount + 1 # counter for portfolio number
    Results[kount,1] = weight[2,1] = i        # weight of security 1
    Results[kount,2] = weight[3,1] = 1-i      # weight of security 2
    Results[kount,3] <- t(weight) %*% meanret # portfolio mean
    Results[kount,4] <- sqrt(t(weight) %*% covar %*% weight) # portfolio sigma
}
colnames(Results) <- c(paste0(ticks[2], '%'), paste0(ticks[3], '%'), "Port_Mean", "Port_Sigma")

Results
```

```
##       CAT% LLY%   Port_Mean Port_Sigma
##  [1,] 0.05 0.95 0.009169945 0.04588049
##  [2,] 0.10 0.90 0.008843174 0.04381968
##  [3,] 0.15 0.85 0.008516404 0.04207610
##  [4,] 0.20 0.80 0.008189634 0.04069055
##  [5,] 0.25 0.75 0.007862864 0.03970054
##  [6,] 0.30 0.70 0.007536094 0.03913609
##  [7,] 0.35 0.65 0.007209323 0.03901569
##  [8,] 0.40 0.60 0.006882553 0.03934339
##  [9,] 0.45 0.55 0.006555783 0.04010824
## [10,] 0.50 0.50 0.006229013 0.04128592
## [11,] 0.55 0.45 0.005902242 0.04284243
## [12,] 0.60 0.40 0.005575472 0.04473822
## [13,] 0.65 0.35 0.005248702 0.04693221
## [14,] 0.70 0.30 0.004921932 0.04938467
## [15,] 0.75 0.25 0.004595162 0.05205908
## [16,] 0.80 0.20 0.004268391 0.05492302
## [17,] 0.85 0.15 0.003941621 0.05794841
## [18,] 0.90 0.10 0.003614851 0.06111127
## [19,] 0.95 0.05 0.003288081 0.06439135
```

Plot feasible set

```
plot(x = Results[,4], y = Results[,3], xlab = "Portfolio Sigma", ylab = "Portfolio Mean")
```