Project 3

Juwon Lee, Economics and Statistics, Yonsei University

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tinytex::install_tinytex()

Project 1.

```
a <- read.table("http://www.stat.ucla.edu/~nchristo/statistics_c183_c283/statc183c283_5stocks.txt", hea

head(a)
```

a.

```
##       date    P1    P2    P3    P4    P5
## 1 20031231 41.00 53.40 22.97 24.83 42.14
## 2 20031128 36.20 42.78 21.74 25.63 38.39
## 3 20031031 36.58 42.67 22.31 25.00 38.49
## 4 20030930 36.60 40.93 19.36 23.54 34.33
## 5 20030829 37.70 41.10 19.93 22.42 37.39
## 6 20030731 35.58 37.43 21.17 23.01 33.12
```

```
tail(a)
```

```
##         date     P1     P2     P3      P4     P5
## 211 19860630 60.875 77.625 41.000  73.125 63.000
## 212 19860530 59.875 79.750 46.250 102.625 58.250
## 213 19860430 56.625 80.000 45.250  99.500 56.250
## 214 19860331 55.750 86.250 44.000  96.375 57.000
## 215 19860228 52.250 77.750 43.875  89.375 53.375
## 216 19860131 51.750 74.000 39.375  79.875 48.250
```

```
library(plyr)

head(arrange(a, a$date))
```

```
##       date     P1     P2     P3      P4     P5
## 1 19860131 51.750 74.000 39.375  79.875 48.250
## 2 19860228 52.250 77.750 43.875  89.375 53.375
## 3 19860331 55.750 86.250 44.000  96.375 57.000
## 4 19860430 56.625 80.000 45.250  99.500 56.250
## 5 19860530 59.875 79.750 46.250 102.625 58.250
## 6 19860630 60.875 77.625 41.000  73.125 63.000
```

```
tail(arrange(a, a$date))
```

```
##         date    P1    P2    P3    P4    P5
## 211 20030731 35.58 37.43 21.17 23.01 33.12
## 212 20030829 37.70 41.10 19.93 22.42 37.39
```

```
## 213 20030930 36.60 40.93 19.36 23.54 34.33
## 214 20031031 36.58 42.67 22.31 25.00 38.49
## 215 20031128 36.20 42.78 21.74 25.63 38.39
## 216 20031231 41.00 53.40 22.97 24.83 42.14
```

```
head(a)
```

```
##       date    P1    P2    P3    P4    P5
## 1 20031231 41.00 53.40 22.97 24.83 42.14
## 2 20031128 36.20 42.78 21.74 25.63 38.39
## 3 20031031 36.58 42.67 22.31 25.00 38.49
## 4 20030930 36.60 40.93 19.36 23.54 34.33
## 5 20030829 37.70 41.10 19.93 22.42 37.39
## 6 20030731 35.58 37.43 21.17 23.01 33.12
```

```
a <- arrange(a, a$date)

a_hw3 <- (a[-1, 2:ncol(a)]-a[-nrow(a), 2:ncol(a)])/a[-nrow(a), 2:ncol(a)]
```

```
ones_hw3 <- c(1,1,1,1,1)

means_hw3 <- colMeans(a_hw3)
covmat_hw3 <- cov(a_hw3)

A_hw3 <- t(ones_hw3) %*% solve(covmat_hw3) %*% means_hw3

B_hw3 <- t(means_hw3) %*% solve(covmat_hw3) %*% means_hw3

C_hw3 <- t(ones_hw3) %*% solve(covmat_hw3) %*% ones_hw3

D_hw3 <- C_hw3 * B_hw3 - A_hw3 * A_hw3

x_hw3 <- seq(-0.2, 0.2, 0.001)

sigma_squared_hw3 <- (C_hw3 * x_hw3 * x_hw3 - 2 * A_hw3 * x_hw3 + B_hw3) / D_hw3
```

b.

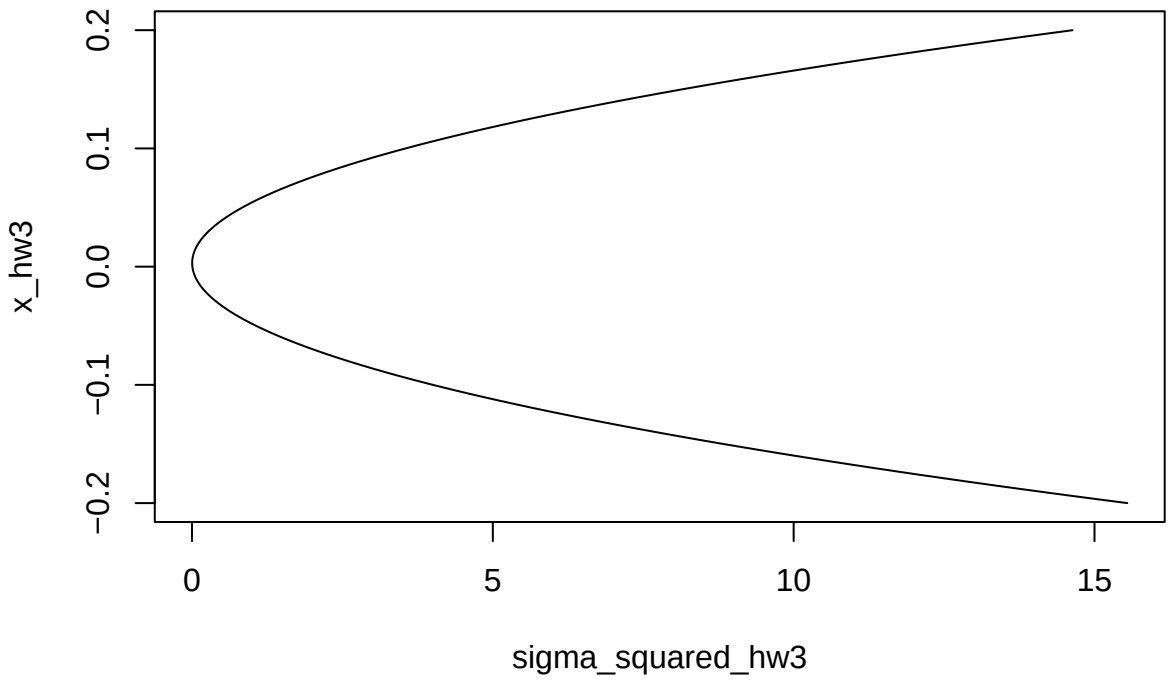
```
## Warning in C_hw3 * x_hw3: Recycling array of length 1 in array-vector arithmetic is deprecated.
##   Use c() or as.vector() instead.
```

```
## Warning in 2 * A_hw3 * x_hw3: Recycling array of length 1 in array-vector arithmetic is deprecated.
##   Use c() or as.vector() instead.
```

```
## Warning in C_hw3 * x_hw3 * x_hw3 - 2 * A_hw3 * x_hw3 + B_hw3: Recycling array of length 1 in vector-
##   Use c() or as.vector() instead.
```

```
## Warning in (C_hw3 * x_hw3 * x_hw3 - 2 * A_hw3 * x_hw3 + B_hw3)/D_hw3: Recycling array of length 1 in
##   Use c() or as.vector() instead.
```

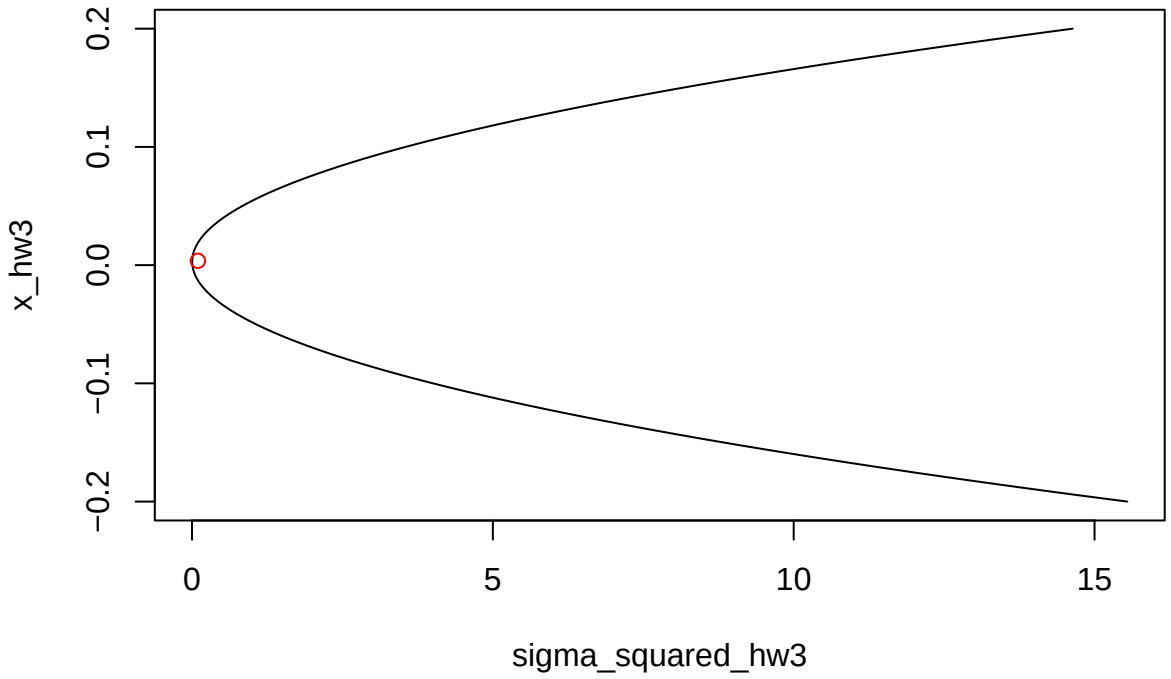
```r
plot(sigma_squared_hw3, x_hw3, type='l')
```




```r
two_means_hw3 <- colMeans(a_hw3[c(1,5)])
two_covmat_hw3 <- cov(a_hw3[c(1,5)])
two_corrmat_hw3 <- cor(a_hw3[c(1,5)])
two_variances_hw3 <- diag(two_covmat_hw3)
two_stdev_hw3 <- diag(two_covmat_hw3)^(0.5)
two_means <- mean(two_means_hw3)
two_stdev <- (1/(2-1)*mean(two_stdev_hw3)^2 + (2-1)/2*mean(two_covmat_hw3))^(1/2)
```

c.

```r
plot(sigma_squared_hw3, x_hw3, type='l')
points(two_stdev, two_means, col='red')
```



d.

```
a2 <- read.table("http://www.stat.ucla.edu/~nchristo/datac183c283/statc183c283_abc.txt", header=T)

a2[4] <- seq(2499,1)

head(a2)
```

e.

```
##           a         b        c   V4
## 1 -1.692984 -1.896542 4.589526 2499
## 2 -1.421522 -1.985199 4.406720 2498
## 3 -1.676046 -1.842524 4.518571 2497
## 4 -1.990539 -1.609668 4.600208 2496
## 5 -1.799036 -1.678793 4.477828 2495
## 6 -1.309519 -1.908750 4.218268 2494
```

```
head(arrange(a2, a2$V4))
```

```
##           a         b          c V4
## 1  0.2373119 1.5409101 -0.7782220  1
## 2  1.8015381 0.7565844 -1.5581225  2
## 3  0.2414014 1.5359966 -0.7773980  3
## 4 -0.5988037 1.9560533 -0.3572497  4
## 5  2.6522416 0.3294778 -1.9817194  5
## 6  1.6716819 0.8191473 -1.4908292  6
```

```
a2 <- arrange(a2, a2$V4)

mean_exxon_hw3 <- mean(a_hw3$P1)
mean_mcdonalds_hw3 <- mean(a_hw3$P4)
mean_boeing_hw3 <- mean(a_hw3$P5)

var_exxon_hw3 <- var(a_hw3$P1)
```

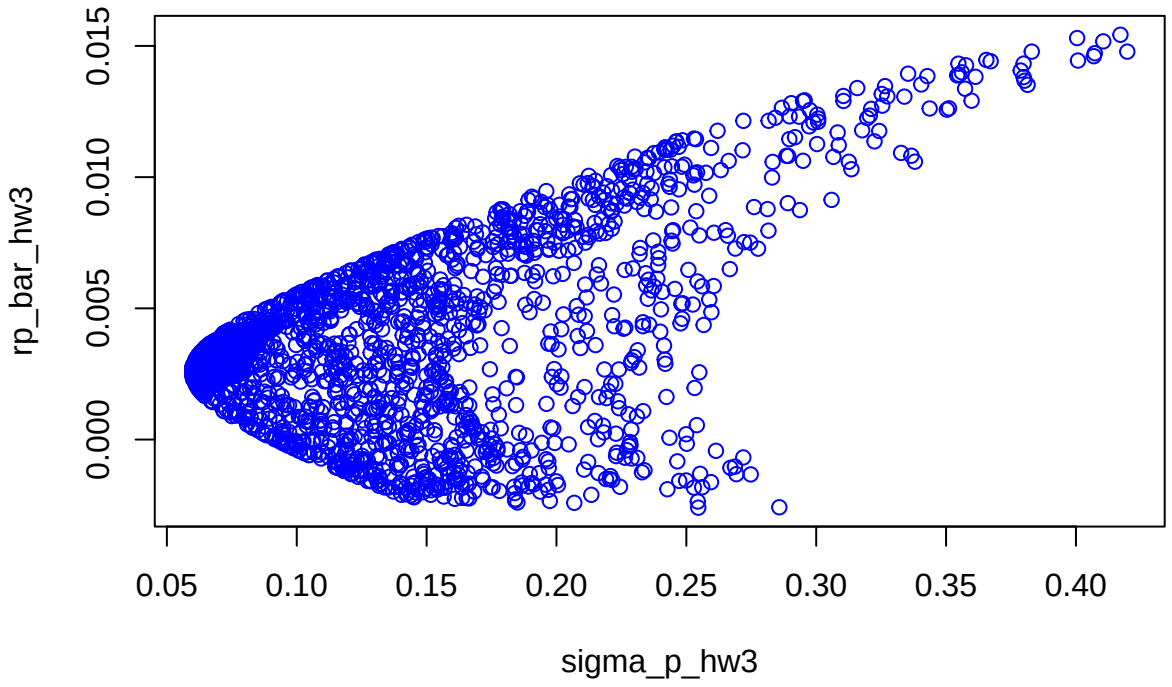
```
var_mcdonalds_hw3 <- var(a_hw3$P4)
var_boeing_hw3 <- var(a_hw3$P5)

cov12_hw3 <- cov(a_hw3$P1, a_hw3$P4)
cov13_hw3 <- cov(a_hw3$P1, a_hw3$P5)
cov23_hw3 <- cov(a_hw3$P4, a_hw3$P5)

rp_bar_hw3 <- a2$a * mean_exxon_hw3 + a2$b * mean_mcdonalds_hw3 + a2$c * mean_boeing_hw3

sigma_p_hw3 <- ((a2$a)^2*var_exxon_hw3 +(a2$b)^2* var_mcdonalds_hw3+(a2$c)^2*var_boeing_hw3
            +2*a2$a*a2$b*cov12_hw3+2*a2$a*a2$c*cov13_hw3+2*a2$b*a2$c*cov23_hw3)^.5

plot(sigma_p_hw3, rp_bar_hw3, col='blue')
```




```
r_f1_hw3 <- 0.001

lambda1_hw3 <- (C_hw3 * r_f1_hw3 - A_hw3) / D_hw3
lambda2_hw3 <- (B_hw3 - A_hw3 * r_f1_hw3) / D_hw3

Xa_hw3 <- solve(covmat_hw3) %*% (lambda1_hw3 * means_hw3 + lambda2_hw3 * ones_hw3)
```

f.

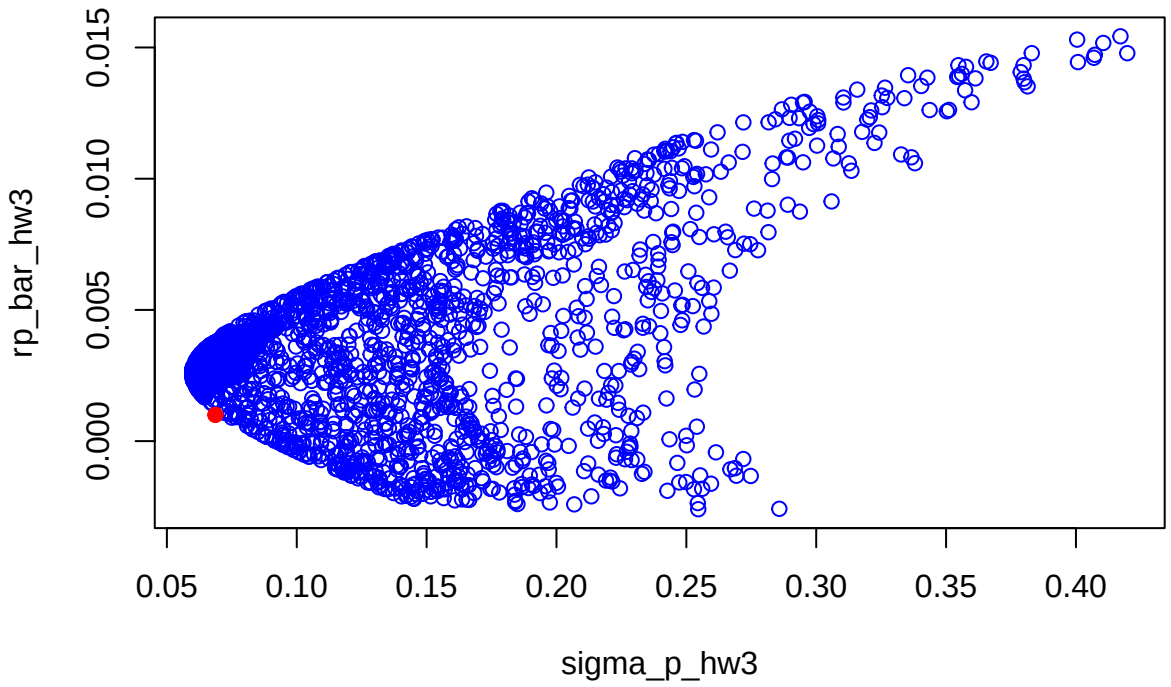
```
## Warning in lambda1_hw3 * means_hw3: Recycling array of length 1 in array-vector arithmetic is deprec
##   Use c() or as.vector() instead.
```

```
## Warning in lambda2_hw3 * ones_hw3: Recycling array of length 1 in array-vector arithmetic is deprecat
##   Use c() or as.vector() instead.
```

```
R1bar_hw3 <- t(Xa_hw3) %*% means_hw3
var1_hw3 <- t(Xa_hw3) %*% covmat_hw3 %*% Xa_hw3
```

```
sd1_hw3 <- var1_hw3^.5

plot(sigma_p_hw3, rp_bar_hw3, col='blue')
points(sd1_hw3, R1bar_hw3, pch=19, col='red')
```




```
sd1_hw3 * 0.6
```

g.

```
##             [,1]
## [1,] 0.04120067
```

```
R1bar_hw3*0.6 + 0.001 * 0.4
```

```
##       [,1]
## [1,] 0.001
```

```
covmat_hw3^(-1)
```

h.

```
##           P1       P2        P3        P4       P5
## P1  172.3199 719.8058 599.93266 1266.4944 740.1686
## P2  719.8058 105.7216 253.50839  438.3658 387.7563
## P3  599.9327 253.5084  61.37386  349.2127 680.2890
## P4 1266.4944 438.3658 349.21273  104.2187 311.4463
## P5  740.1686 387.7563 680.28900  311.4463 108.1965
```

```
means_hw3
```

```
##           P1           P2           P3           P4           P5
## 0.0027625075 0.0035831363 0.0066229478 0.0004543727 0.0045679106
```

```
r_f_vec <- 0.001 * c(1,1,1,1,1)

r_f_vec
```

```
## [1] 0.001 0.001 0.001 0.001 0.001
```

```
x_hw3 <- ((mean(means_hw3) - 0.001) * covmat_hw3^(-1) %*% as.matrix(means_hw3 - r_f_vec))  / as.numeric

x_hw3
```

```
##         [,1]
## P1 0.2897676
## P2 0.1591423
## P3 0.1662058
## P4 0.2470447
## P5 0.2456898
```

x represent the weight(or percentage) of each stocks.

```
r_f2_hw3 <- 0.002

lambda1_f2_hw3 <- (C_hw3 * r_f2_hw3 - A_hw3) / D_hw3
lambda2_f2_hw3 <- (B_hw3 - A_hw3 * r_f2_hw3) / D_hw3

Xb_hw3 <- solve(covmat_hw3) %*% (lambda1_f2_hw3 * means_hw3 + lambda2_f2_hw3 * ones_hw3)
```

i.

```
## Warning in lambda1_f2_hw3 * means_hw3: Recycling array of length 1 in array-vector arithmetic is depr
##   Use c() or as.vector() instead.
```

```
## Warning in lambda2_f2_hw3 * ones_hw3: Recycling array of length 1 in array-vector arithmetic is depre
##   Use c() or as.vector() instead.
```

```
R2bar_hw3 <- t(Xb_hw3) %*% means_hw3
var2_hw3 <- t(Xb_hw3) %*% covmat_hw3 %*% Xb_hw3

sd2_hw3 <- sqrt(var2_hw3)

a <- seq(-30, 30, 0.1)
b <- 1-a

sigma_ab_hw3 <- t(Xa_hw3) %*% covmat_hw3 %*% Xb_hw3

R_pbar_hw3 <- a*R1bar_hw3 + b*R2bar_hw3
```

```
## Warning in a * R1bar_hw3: Recycling array of length 1 in vector-array arithmetic is deprecated.
##   Use c() or as.vector() instead.
```

```
## Warning in b * R2bar_hw3: Recycling array of length 1 in vector-array arithmetic is deprecated.
##   Use c() or as.vector() instead.
```

```
var_p_hw3 <-  a^2*var1_hw3 + b^2*var2_hw3 + 2*a*b* sigma_ab_hw3
```

```
## Warning in a^2 * var1_hw3: Recycling array of length 1 in vector-array arithmetic is deprecated.
##   Use c() or as.vector() instead.
```

```
## Warning in b^2 * var2_hw3: Recycling array of length 1 in vector-array arithmetic is deprecated.
```

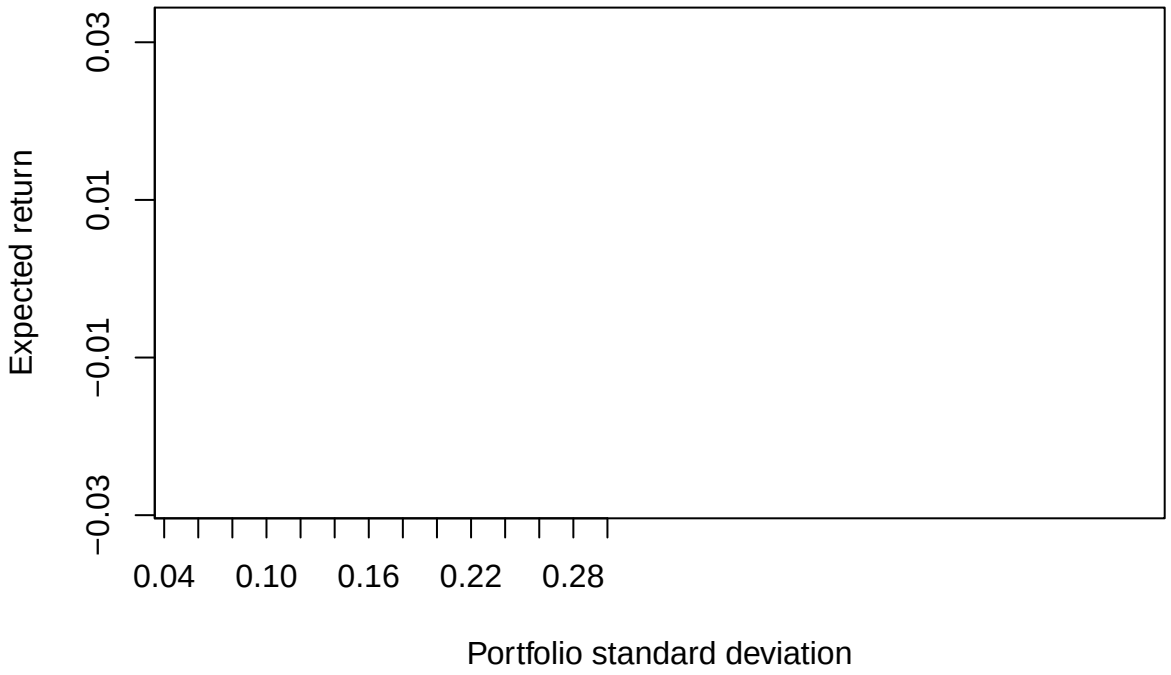
```
##   Use c() or as.vector() instead.
```

```
## Warning in 2 * a * b * sigma_ab_hw3: Recycling array of length 1 in vector-array arithmetic is depre
##   Use c() or as.vector() instead.
```

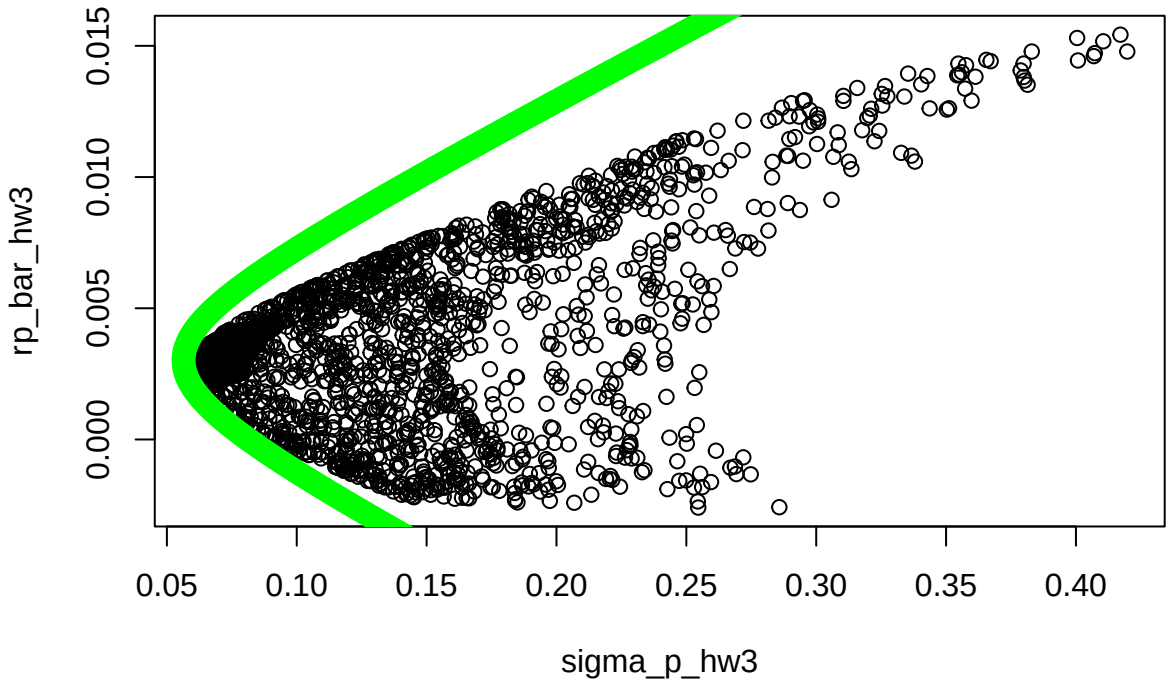
```
sd_p_hw3 <- var_p_hw3^.5

plot(sd_p_hw3, R_pbar_hw3, type = "n", xlab="Portfolio standard deviation", ylab="Expected return", xax

axis(1, at=seq(0, 0.3, 0.02))
axis(2, at=seq(-0.05,0.10, 0.02))
```




```
plot(sigma_p_hw3, rp_bar_hw3, col='black')
lines(sd_p_hw3, R_pbar_hw3, col="green", type="l", lwd=12)
```




```
plot(sigma_p_hw3, rp_bar_hw3, xlim=c(-0.05, 0.4), col='black')
lines(sd_p_hw3, R_pbar_hw3, col="green", type="l", lwd=12)
points(sd1_hw3, R1bar_hw3, pch=19, col='red')
```