A2_Investment

Hanpeng Wang

March 4, 2019

```
knitr::opts_chunk$set(echo = TRUE)
options(warn=-1)
library(openxlsx)
library(ggplot2)
library(formattable)
path <- 'C:/Users/wangh/OneDrive/Desktop/inv_A2/data.xlsx'
df <- as.matrix(read.xlsx(path)[,2:3])
rownames(df) <- read.xlsx(path)[,1]
col_length <- length(df[,1])
return_bns <- (df[2:col_length, 1] - df[1:col_length - 1, 1]) / df[1:col_length - 1,
1]
return_magna <- (df[2:col_length, 2] - df[1:col_length - 1, 2]) / df[1:col_length -
1, 2]
```

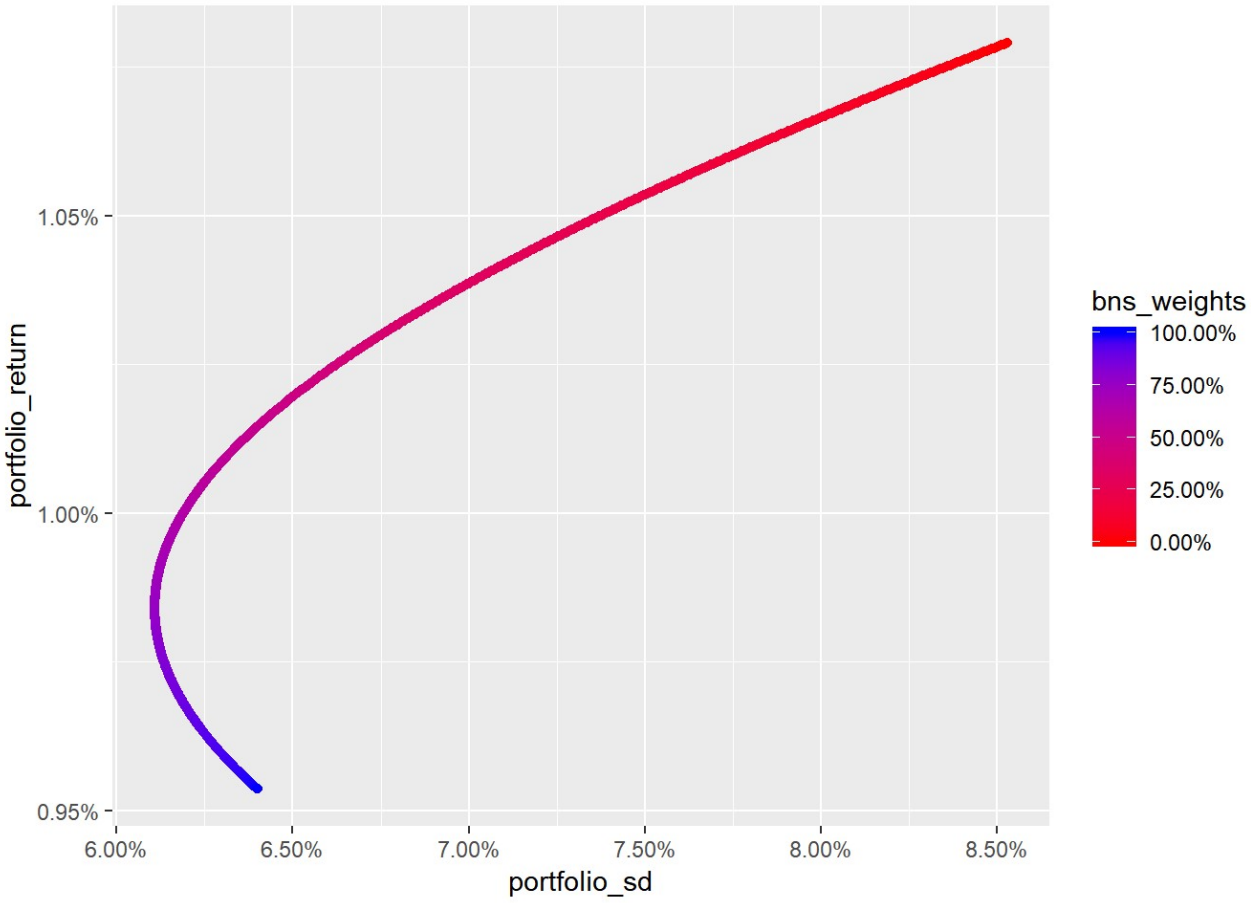
a

```
mean_bns <- mean(return_bns)
mean_magna <- mean(return_magna)
var_bns <- var(return_bns)
var_magna <- var(return_magna)
cov_porfolio <- cov(return_bns, return_magna)
paste('E(R_bns)=',percent(mean_bns),',Var(bns)=',percent(var_bns),
      ',E(R_magna)=',percent(mean_magna),',Var(magna)=',percent(var_magna),
      ',Cov(bns,magana)=',percent(cov_porfolio))
```

```
## [1] "E(R_bns)= 0.95% ,Var(bns)= 0.41% ,E(R_magna)= 1.08% ,Var(magna)= 0.73% ,Cov(bn
s,magana)= 0.26%"
```

b

```
bns_weights <- seq(from = 0, to = 1, length.out = 1000)
magna_weights <- 1 - bns_weights
portfolio_return = (mean_bns * bns_weights + mean_magna *  magna_weights)
portfolio_sd = sqrt(bns_weights^2 * var_bns + magna_weights^2 * var_magna +
              2 * bns_weights * magna_weights *  cov_porfolio)
qplot(portfolio_sd, portfolio_return, colour=bns_weights) + scale_colour_gradient(labe
ls = percent, low = 'red', high = 'blue') +
  scale_y_continuous(labels = percent) + scale_x_continuous(labels = percent)
```



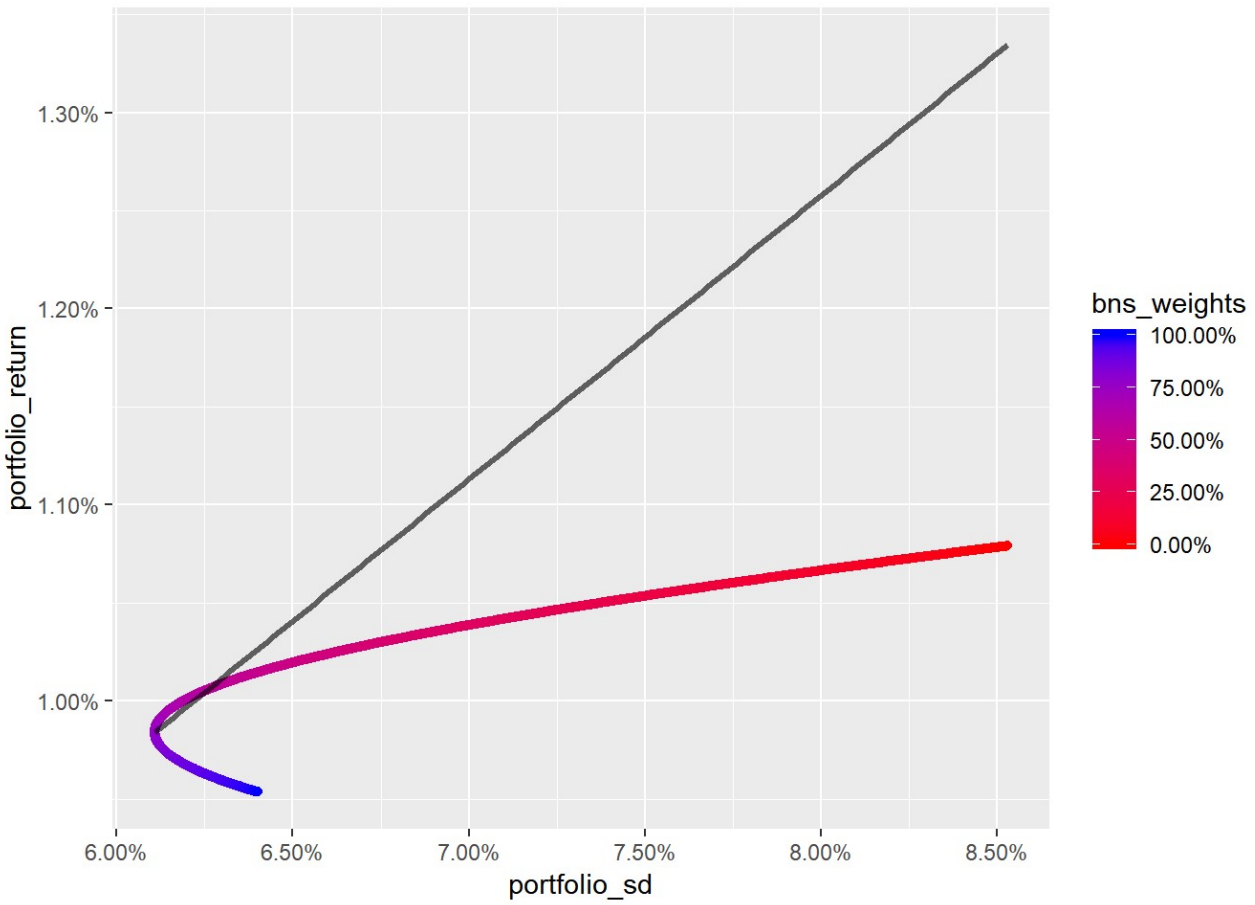
c

```
optimal_weight_bns <- (var_magna - cov_porfolio) / (var_bns + var_magna - 2*cov_porfol
io)
optimal_return <- optimal_weight_bns * mean_bns + (1 - optimal_weight_bns) * mean_magn
a
optimal_sd <- sqrt(optimal_weight_bns^2 * var_bns + (1 - optimal_weight_bns)^2 * var_m
agna +
                     2 * optimal_weight_bns * (1 - optimal_weight_bns) *  cov_porfoli
o)
paste('min var portfolio E(r) and sd are ',percent(optimal_return),' and ',percent(opt
imal_sd))
```

```
## [1] "min var portfolio E(r) and sd are  0.98%  and  6.11%"
```

d

```
risk_free <- 0.001
cal_slope <- (optimal_return - risk_free) / optimal_sd
cal <- function(sd_3assets){risk_free + sd_3assets * cal_slope }
qplot(portfolio_sd, portfolio_return, colour=bns_weights) + scale_colour_gradient(labe
ls = percent, low = 'red', high = 'blue') +
  scale_y_continuous(labels = percent) + scale_x_continuous(labels = percent)  + stat_
function(fun = cal, size = 1.2, alpha = 0.6)
```

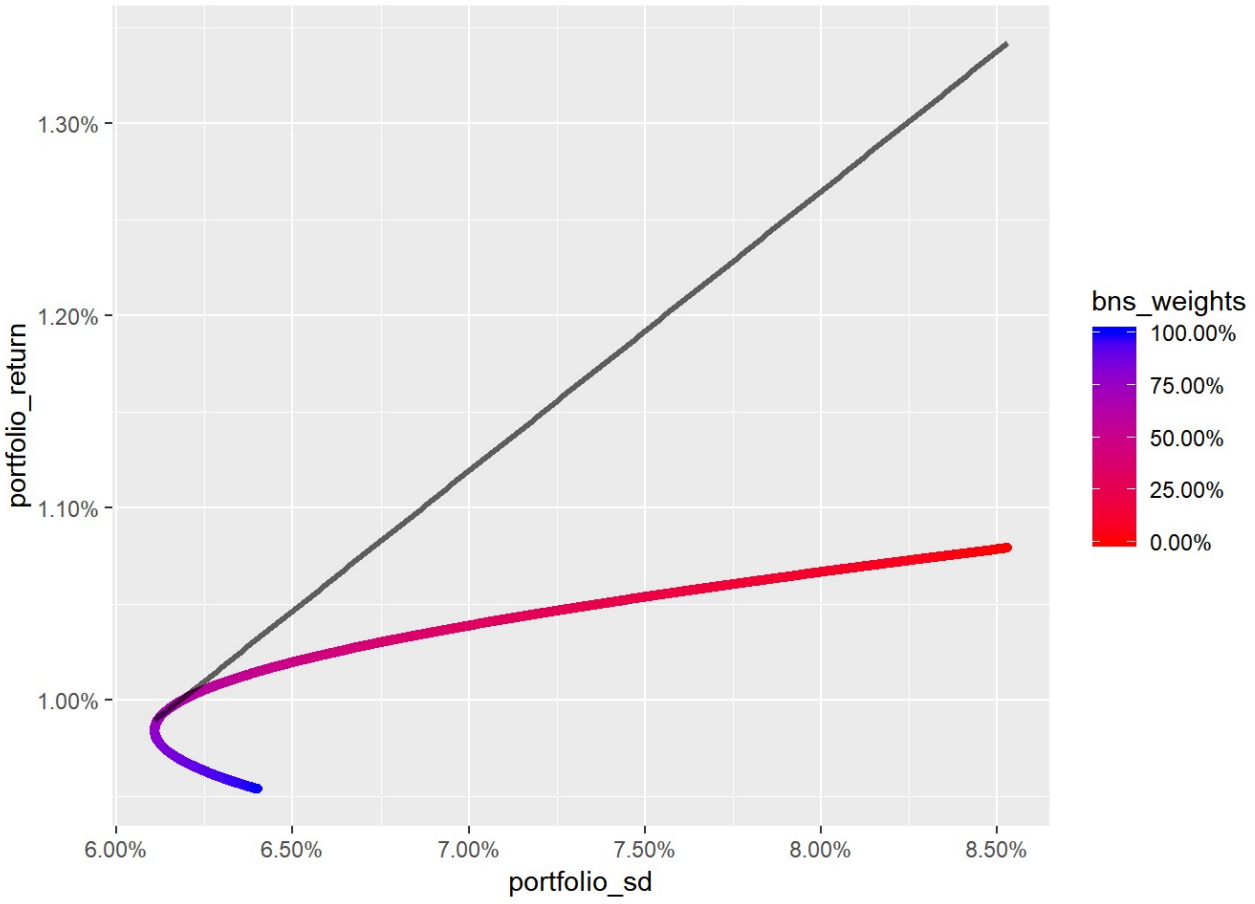



```
paste('slope is ',cal_slope)
```

```
## [1] "slope is  0.144728451275254"
```

e

```
optimal_weight_bns_2 <- ((mean_bns - risk_free)*var_magna - (mean_magna - risk_free)*c
ov_porfolio) / ((mean_bns - risk_free)*var_magna + (mean_magna - risk_free)*var_bns -
(mean_bns+mean_magna - 2*risk_free)*cov_porfolio )
optimal_return2 <- optimal_weight_bns_2 * mean_bns + (1 - optimal_weight_bns_2) * mean
_magna
optimal_sd2 <- sqrt(optimal_weight_bns_2^2 * var_bns + (1 - optimal_weight_bns_2)^2 *
var_magna +
                      2 * optimal_weight_bns_2 * (1 - optimal_weight_bns_2) *  cov_porf
olio)
cal_slope2 <- (optimal_return2 - risk_free) / optimal_sd2
cal <- function(sd_3assets){risk_free + sd_3assets * cal_slope2 }
qplot(portfolio_sd, portfolio_return, colour=bns_weights) + scale_colour_gradient(labe
ls = percent, low = 'red', high = 'blue') +
  scale_y_continuous(labels = percent) + scale_x_continuous(labels = percent)  + stat_
function(fun = cal, size = 1.2, alpha = 0.6)
```



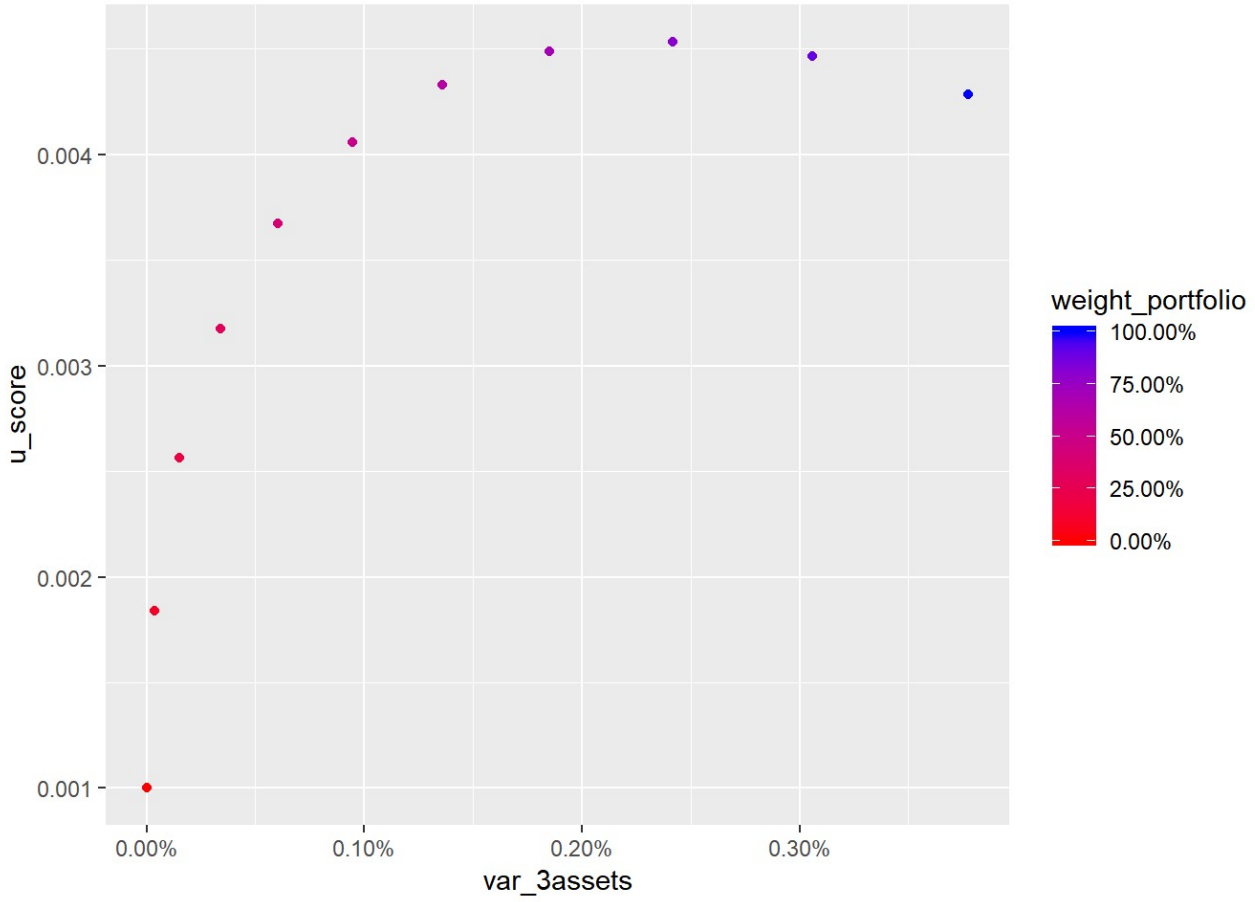

```
paste('optimal risky portfolio E(r) and sd are ',percent(optimal_return2),' and ',perc
ent(optimal_sd2))
```

```
## [1] "optimal risky portfolio E(r) and sd are  0.99%  and  6.15%"
```

f

```
weight_portfolio <- seq(0,1,by = 0.1)
var_3assets <- (seq(0,1,by = 0.1)**2)*(optimal_sd2**2)
u_score<- seq(0,1,by = 0.1)*optimal_return2 +  (1 - seq(0,1,by = 0.1))*risk_free - 0.5
*3*var_3assets

qplot(var_3assets, u_score, colour=weight_portfolio) + scale_colour_gradient(labels =
percent, low = 'red', high = 'blue')  + scale_x_continuous(labels = percent)
```



g

```
optimal_weight_p <- (optimal_return2 - risk_free)/ (3*optimal_sd2**2)
optimal_return3 <- optimal_weight_p * optimal_return2 + (1 - optimal_weight_p)* risk_f
ree
optimal_sd3 <- optimal_weight_p * optimal_sd2
paste('optimal complete portfolio E(r) and sd are ',percent(optimal_return3),' and ',p
ercent(optimal_sd3))
```

```
## [1] "optimal complete portfolio E(r) and sd are  0.81%  and  4.85%"
```

h

```
weights_3assets <- c(1 - optimal_weight_p, optimal_weight_p*optimal_weight_bns_2, opti
mal_weight_p*(1-optimal_weight_bns_2))
assets_labels <- c('risk free', 'bns','magna')
assets_labels <- paste(assets_labels, round(weights_3assets*100,digits = 2))
assets_labels <- paste(assets_labels,"%",sep="")
pie(weights_3assets, labels = assets_labels)
```