HW7 Question 2

Portfolio

3/19/2021

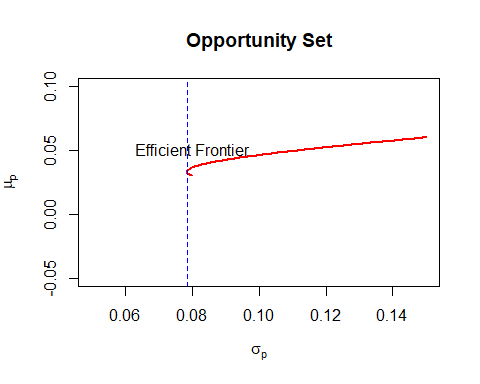
pacman::p\_load(pacman, tidyverse, tseries, knitr)  
knitr::opts\_chunk$set(message = FALSE)

##Question 2

mu1 = 0.06  
mu2 = 0.03  
  
sigma1 = 0.15  
sigma2 = 0.08  
  
rho\_12 = 0.35  
  
wt = seq(from=0, to=1, by=0.01)  
  
N = length(wt) # number of weight values   
var\_p = rep(NA,N) # holding vector  
mu\_p = rep(NA,N)  
#a  
# portfolio mean  
for (i in 1:N){  
 mu\_p[i] = wt[i]\*mu1 + (1-wt[i])\*mu2 }  
  
# portfolio variance  
for (i in 1:N){  
 var\_p[i] = wt[i]^2\*sigma1^2 + (1-wt[i])^2\*sigma2^2 + 2\*wt[i]\*(1-wt[i])\*rho\_12\*sigma1\*sigma2 }  
  
# standard deviation  
sigma\_p = var\_p^0.5  
  
tibble(mean=mu\_p, variance=var\_p, std\_dev=sigma\_p) %>%   
 round(digits=3) %>% kable()

|  |  |  |
| --- | --- | --- |
| mean | variance | std\_dev |
| 0.030 | 0.006 | 0.080 |
| 0.030 | 0.006 | 0.080 |
| 0.031 | 0.006 | 0.079 |
| 0.031 | 0.006 | 0.079 |
| 0.031 | 0.006 | 0.079 |
| 0.032 | 0.006 | 0.079 |
| 0.032 | 0.006 | 0.079 |
| 0.032 | 0.006 | 0.079 |
| 0.032 | 0.006 | 0.079 |
| 0.033 | 0.006 | 0.079 |
| 0.033 | 0.006 | 0.079 |
| 0.033 | 0.006 | 0.079 |
| 0.034 | 0.006 | 0.079 |
| 0.034 | 0.006 | 0.079 |
| 0.034 | 0.006 | 0.079 |
| 0.034 | 0.006 | 0.079 |
| 0.035 | 0.006 | 0.079 |
| 0.035 | 0.006 | 0.079 |
| 0.035 | 0.006 | 0.079 |
| 0.036 | 0.006 | 0.079 |
| 0.036 | 0.006 | 0.080 |
| 0.036 | 0.006 | 0.080 |
| 0.037 | 0.006 | 0.080 |
| 0.037 | 0.006 | 0.080 |
| 0.037 | 0.007 | 0.081 |
| 0.038 | 0.007 | 0.081 |
| 0.038 | 0.007 | 0.081 |
| 0.038 | 0.007 | 0.082 |
| 0.038 | 0.007 | 0.082 |
| 0.039 | 0.007 | 0.083 |
| 0.039 | 0.007 | 0.083 |
| 0.039 | 0.007 | 0.084 |
| 0.040 | 0.007 | 0.084 |
| 0.040 | 0.007 | 0.085 |
| 0.040 | 0.007 | 0.085 |
| 0.040 | 0.007 | 0.086 |
| 0.041 | 0.007 | 0.086 |
| 0.041 | 0.008 | 0.087 |
| 0.041 | 0.008 | 0.088 |
| 0.042 | 0.008 | 0.088 |
| 0.042 | 0.008 | 0.089 |
| 0.042 | 0.008 | 0.090 |
| 0.043 | 0.008 | 0.090 |
| 0.043 | 0.008 | 0.091 |
| 0.043 | 0.008 | 0.092 |
| 0.044 | 0.009 | 0.093 |
| 0.044 | 0.009 | 0.093 |
| 0.044 | 0.009 | 0.094 |
| 0.044 | 0.009 | 0.095 |
| 0.045 | 0.009 | 0.096 |
| 0.045 | 0.009 | 0.097 |
| 0.045 | 0.009 | 0.097 |
| 0.046 | 0.010 | 0.098 |
| 0.046 | 0.010 | 0.099 |
| 0.046 | 0.010 | 0.100 |
| 0.046 | 0.010 | 0.101 |
| 0.047 | 0.010 | 0.102 |
| 0.047 | 0.011 | 0.103 |
| 0.047 | 0.011 | 0.104 |
| 0.048 | 0.011 | 0.105 |
| 0.048 | 0.011 | 0.106 |
| 0.048 | 0.011 | 0.107 |
| 0.049 | 0.012 | 0.107 |
| 0.049 | 0.012 | 0.108 |
| 0.049 | 0.012 | 0.109 |
| 0.050 | 0.012 | 0.110 |
| 0.050 | 0.012 | 0.111 |
| 0.050 | 0.013 | 0.112 |
| 0.050 | 0.013 | 0.114 |
| 0.051 | 0.013 | 0.115 |
| 0.051 | 0.013 | 0.116 |
| 0.051 | 0.014 | 0.117 |
| 0.052 | 0.014 | 0.118 |
| 0.052 | 0.014 | 0.119 |
| 0.052 | 0.014 | 0.120 |
| 0.052 | 0.015 | 0.121 |
| 0.053 | 0.015 | 0.122 |
| 0.053 | 0.015 | 0.123 |
| 0.053 | 0.015 | 0.124 |
| 0.054 | 0.016 | 0.125 |
| 0.054 | 0.016 | 0.126 |
| 0.054 | 0.016 | 0.128 |
| 0.055 | 0.017 | 0.129 |
| 0.055 | 0.017 | 0.130 |
| 0.055 | 0.017 | 0.131 |
| 0.055 | 0.017 | 0.132 |
| 0.056 | 0.018 | 0.133 |
| 0.056 | 0.018 | 0.134 |
| 0.056 | 0.018 | 0.136 |
| 0.057 | 0.019 | 0.137 |
| 0.057 | 0.019 | 0.138 |
| 0.057 | 0.019 | 0.139 |
| 0.058 | 0.020 | 0.140 |
| 0.058 | 0.020 | 0.142 |
| 0.058 | 0.020 | 0.143 |
| 0.058 | 0.021 | 0.144 |
| 0.059 | 0.021 | 0.145 |
| 0.059 | 0.021 | 0.146 |
| 0.059 | 0.022 | 0.148 |
| 0.060 | 0.022 | 0.149 |
| 0.060 | 0.022 | 0.150 |

#b  
  
plot(sigma\_p,mu\_p, type="l",lwd=2,  
 col=2, ylim = c(-0.05,0.10),  
 xlim = c(0.05,0.15),  
 xlab = expression(sigma[p]),   
 ylab = expression(mu[p]),  
 main = "Opportunity Set")  
abline(v=min(sigma\_p),lty=2,col=4)  
text(0.06,0.05,"Efficient Frontier",pos=4)



#c  
# Weight of minimum-variance portfolio  
w = function(s1, s2, rho){  
 w1 = (s2^2-rho\*s1\*s2)/(s1^2+s2^2 - 2\*rho\*s1\*s2)  
}  
  
# Portfolio mean   
mp = function(w,m1,m2){  
 m = w\*m1 + (1-w)\*m2}  
  
# Portfolio variance   
vp = function(w, s1, s2, rho){  
 v = w^2\*s1^2 + (1-w)^2\* s2^2 + 2\*w\*(1-w)\*rho\*s1\*s2  
}  
  
  
# Weights  
wt1 = w(sigma1,sigma2,rho\_12)  
   
# Mean  
m = mp(wt1,mu1,mu2)  
   
  
# Portfolio's minimum variance  
v = vp(wt1,sigma1,sigma2,rho\_12)  
  
# Minimum-variance portfolio standard deviation  
sd = sqrt(v)  
  
tibble(w\_1 = wt1, w\_2 = 1 - wt1, mean=m, StdDev = sd, minimum\_variance = v) %>%  
 round(4)

## # A tibble: 1 x 5  
## w\_1 w\_2 mean StdDev minimum\_variance  
## <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 0.107 0.893 0.0332 0.0785 0.0062

#d  
tangWt = function(rf, m1, m2, s1, s2, rho){  
 num = (m1-rf)\*s2^2 - (m2-rf)\*rho\*s1\*s2  
 denom = (m2-rf)\*s1^2 + (m1-rf)\*s2^2 - ((m1-rf) + (m2-rf))\*rho\*s1\*s2  
 w = num/denom  
}  
  
rf = 0.003  
  
wt\_tan = tangWt(rf,mu1,mu2,sigma1,sigma2,rho\_12)  
tibble(asset1\_wt = wt\_tan, asset2\_wt = (1-wt\_tan)) %>% round(3)

## # A tibble: 1 x 2  
## asset1\_wt asset2\_wt  
## <dbl> <dbl>  
## 1 0.406 0.594