

Project 5

Juwon Lee, Economics and Statistics, UCLA

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```
tinytex::install_tinytex()
```

a.

```
hw <- read.csv("/Users/user/Desktop/Yonsei/Junior/3-2/Statistical Models in Finance/stockData.csv", sep=";", as.is=T)

r_hw5 <- (hw[-1, 3:ncol(hw)] - hw[-nrow(hw), 3:ncol(hw)]) / hw[-nrow(hw), 3:ncol(hw)]

covmat_hw5 <- var(r_hw5)
beta_hw5 <- covmat_hw5[1, -1] / covmat_hw5[1, 1]
```

$\beta < 0$ would be eliminated.

```
rrr_hw5 <- r_hw5[, -c(1, which(beta_hw5 < 0) + 1)]

beta_new_hw5 <- rep(0, ncol(rrr_hw5))
alpha_hw5 <- rep(0, ncol(rrr_hw5))
mse_hw5 <- rep(0, ncol(rrr_hw5))
Ribar_hw5 <- rep(0, ncol(rrr_hw5))
Ratio_hw5 <- rep(0, ncol(rrr_hw5))
stock_hw5 <- rep(0, ncol(rrr_hw5))
```

Setting $R_f = 0.001$.

```
rf_hw5 <- 0.001

for(i in 1:ncol(rrr_hw5)) {
  q_hw5 <- lm(data=rrr_hw5, formula=rrr_hw5[,i] ~ r_hw5[,1])
  beta_new_hw5[i] <- q_hw5$coefficients[2]
  alpha_hw5[i] <- q_hw5$coefficients[1]
  mse_hw5[i] <- summary(q_hw5)$sigma^2
  Ribar_hw5[i] <- q_hw5$coefficients[1] + q_hw5$coefficients[2] * mean(r_hw5[,1])
  Ratio_hw5[i] <- (Ribar_hw5[i] - rf_hw5) / beta_new_hw5[i]
  stock_hw5[i] <- i
}

xx_hw5 <- (cbind(stock_hw5, alpha_hw5, beta_new_hw5, Ribar_hw5, mse_hw5, Ratio_hw5))

head(xx_hw5)
```

```
##      stock_hw5      alpha_hw5 beta_new_hw5      Ribar_hw5      mse_hw5      Ratio_hw5
## [1,]          1  0.008655390      1.292956  0.020022021  0.003900176  0.01471204
## [2,]          2 -0.008402523      1.329101  0.003281867  0.002299243  0.00171685
## [3,]          3  0.008128193      1.039393  0.017265705  0.002303044  0.01564923
```

```
## [4,]      4 0.010120116      1.053093 0.019378066 0.003794271 0.01745151
## [5,]      5 0.021888991      1.466752 0.034783501 0.012180070 0.02303286
## [6,]      6 0.017501358      1.602233 0.031586905 0.003738721 0.01909017
```

Order with C_i , descending.

```
A_hw5 <- xx_hw5[order(-xx_hw5[,6]),]

col1_hw5 <- rep(0,nrow(A_hw5))
col2_hw5 <- rep(0,nrow(A_hw5))
col3_hw5 <- rep(0,nrow(A_hw5))
col4_hw5 <- rep(0,nrow(A_hw5))
col5_hw5 <- rep(0,nrow(A_hw5))

col1_hw5 <- (A_hw5[,4]-rf_hw5)*A_hw5[,3]/A_hw5[,5]
col3_hw5 <- A_hw5[,3]^2 / A_hw5[,5]
for(i in 1:nrow(A_hw5)) {
  col2_hw5[i] <- sum(col1_hw5[1:i])
  col4_hw5[i] <- sum(col3_hw5[1:i])
}

head(cbind(A_hw5, col1_hw5, col2_hw5, col3_hw5, col4_hw5))
```

```
##      stock_hw5  alpha_hw5 beta_new_hw5  Ribar_hw5      mse_hw5  Ratio_hw5
## [1,]        10 0.012302336    0.4415913 0.016184453 0.001534396 0.03438576
## [2,]         7 0.014207885    0.6063894 0.019538775 0.014905473 0.03057239
## [3,]         5 0.021888991    1.4667521 0.034783501 0.012180070 0.02303286
## [4,]        21 0.014978015    1.0119216 0.023874019 0.001159385 0.02260454
## [5,]        11 0.005838142    0.3725544 0.009113341 0.002604566 0.02177760
## [6,]        19 0.011967695    0.9192540 0.020049039 0.000981385 0.02072228
##      col1_hw5  col2_hw5  col3_hw5  col4_hw5
## [1,]  4.3700073  4.370007 127.08771 127.0877
## [2,]  0.7542006  5.124208  24.66934 151.7570
## [3,]  4.0682871  9.192495 176.62967  328.3867
## [4,] 19.9646503 29.157145 883.21434 1211.6011
## [5,]  1.1605237 30.317669  53.28979 1264.8908
## [6,] 17.8430528 48.160722 861.05639 2125.9472
```

```
for(i in 1:nrow(A_hw5)) {
  col5_hw5[i] <- var(r_hw5[,1])*col2_hw5[i]/(1+var(r_hw5[,1])*col4_hw5[i])
}
```

1. Short Sales are Allowed

```
z_short_hw5 <- (A_hw5[,3]/A_hw5[,5])*(A_hw5[,6]-col5_hw5[nrow(A_hw5)])
x_short_hw5 <- z_short_hw5/sum(z_short_hw5)
```

```
Weights_with_short_hw5 <- cbind(A_hw5, col1_hw5, col2_hw5, col3_hw5, col4_hw5, col5_hw5, z_short_hw5, x,
```

```
Weights_with_short_hw5
```

```
##      stock_hw5  alpha_hw5 beta_new_hw5  Ribar_hw5      mse_hw5
## [1,]        10 0.012302336    0.4415913 0.016184453 0.001534396
## [2,]         7 0.014207885    0.6063894 0.019538775 0.014905473
## [3,]         5 0.021888991    1.4667521 0.034783501 0.012180069
## [4,]        21 0.014978014    1.0119216 0.023874019 0.001159384
## [5,]        11 0.005838141    0.3725544 0.009113341 0.002604562
```

## [6,]	19	0.0119676949	0.9192540	0.020049039	0.0009813850	
## [7,]	6	0.0175013580	1.6022329	0.031586905	0.0037387208	
## [8,]	9	0.0087282627	0.8325653	0.016047510	0.0025530829	
## [9,]	22	0.0034927433	0.2703064	0.005869061	0.0004154065	
## [10,]	12	0.0047991903	0.4144258	0.008442489	0.0010992542	
## [11,]	4	0.0101201161	1.0530930	0.019378066	0.0037942714	
## [12,]	20	0.0097526759	1.1652413	0.019996544	0.0018201982	
## [13,]	13	0.0047973438	0.5458007	0.009595586	0.0012944845	
## [14,]	3	0.0081281929	1.0393931	0.017265705	0.0023030445	
## [15,]	1	0.0086553902	1.2929557	0.020022021	0.0039001757	
## [16,]	25	0.0077748368	1.2715311	0.018953119	0.0043443846	
## [17,]	27	0.0034913903	0.6918690	0.009573748	0.0011392389	
## [18,]	28	0.0023034128	0.6549028	0.008060794	0.0018692960	
## [19,]	18	0.0012257745	0.8254525	0.008482492	0.0007699461	
## [20,]	17	0.0011692396	0.8307181	0.008472248	0.0007589588	
## [21,]	8	0.0008588360	2.2070856	0.020261764	0.0060171497	
## [22,]	23	-0.0003583592	1.3342432	0.011371238	0.0029731850	
## [23,]	15	-0.0008562845	0.9826892	0.007782731	0.0021138563	
## [24,]	16	-0.0007152736	0.8343952	0.006620060	0.0028848995	
## [25,]	24	-0.0019388661	0.7124890	0.004324766	0.0031221621	
## [26,]	2	-0.0084025226	1.3291008	0.003281867	0.0022992429	
## [27,]	29	-0.0090743876	1.1615438	0.001136975	0.0056590552	
## [28,]	14	-0.0078580236	0.9869324	0.000818295	0.0015995332	
## [29,]	30	-0.0195785627	1.7986942	-0.003765884	0.0072581265	
## [30,]	26	-0.0166063667	1.1917612	-0.006129357	0.0063462533	
##	Ratio_hw5	col1_hw5	col2_hw5	col3_hw5	col4_hw5	col5_hw5
## [1,]	0.0343857582	4.37000725	4.370007	127.08771	127.0877	0.004509034
## [2,]	0.0305723920	0.75420063	5.124208	24.66934	151.7570	0.005155987
## [3,]	0.0230328633	4.06828705	9.192495	176.62967	328.3867	0.007853704
## [4,]	0.0226045359	19.96465033	29.157145	883.21434	1211.6011	0.014197508
## [5,]	0.0217776019	1.16052373	30.317669	53.28979	1264.8908	0.014389225
## [6,]	0.0207222813	17.84305280	48.160722	861.05639	2125.9472	0.016226513
## [7,]	0.0190901749	13.10805163	61.268773	686.63863	2812.5859	0.016764537
## [8,]	0.0180736690	4.90702222	66.175796	271.50117	3084.0870	0.016855066
## [9,]	0.0180131145	3.16831482	69.344110	175.88934	3259.9764	0.016904721
## [10,]	0.0179585592	2.80586522	72.149976	156.24111	3416.2175	0.016943388
## [11,]	0.0174515124	5.10079848	77.250774	292.28404	3708.5015	0.016976025
## [12,]	0.0163026696	12.16106973	89.411844	745.95573	4454.4572	0.016881190
## [13,]	0.0157485802	3.62420510	93.036049	230.12901	4684.5863	0.016834029
## [14,]	0.0156492321	7.34091861	100.376968	469.09130	5153.6776	0.016741334
## [15,]	0.0147120436	6.30603143	106.682999	428.63056	5582.3081	0.016605941
## [16,]	0.0141192925	5.25458758	111.937587	372.15658	5954.4647	0.016469780
## [17,]	0.0123921556	5.20690624	117.144493	420.17760	6374.6423	0.016232369
## [18,]	0.0107814372	2.47372988	119.618223	229.44342	6604.0857	0.016064406
## [19,]	0.0090647148	8.02191428	127.640137	884.96047	7489.0462	0.015320875
## [20,]	0.0089949256	8.17874657	135.818884	909.26228	8398.3085	0.014698396
## [21,]	0.0087272393	7.06519929	142.884083	809.55719	9207.8657	0.014217399
## [22,]	0.0077731241	4.65418562	147.538268	598.75355	9806.6192	0.013855052
## [23,]	0.0069022143	3.15315499	150.691423	456.83238	10263.4516	0.013569043
## [24,]	0.0067354898	1.62548152	152.316905	241.33086	10504.7824	0.013423703
## [25,]	0.0046664107	0.75872404	153.075629	162.59264	10667.3751	0.013299990
## [26,]	0.0017168500	1.31905635	154.394685	768.30027	11435.6754	0.012575156
## [27,]	0.0001179246	0.02811458	154.422800	238.41152	11674.0869	0.012337867
## [28,]	-0.0001841109	-0.11211431	154.310686	608.94987	12283.0368	0.011756901

```
## [29,] -0.0026496357 -1.18107181 153.129614 445.74876 12728.7855 0.011283703
## [30,] -0.0059822030 -1.33882007 151.790794 223.80051 12952.5860 0.011003586
##      z_short_hw5  x_short_hw5
## [1,]  6.72926855  0.297016862
## [2,]  0.79610466  0.035138516
## [3,]  1.44859325  0.063938097
## [4,] 10.12541359  0.446916117
## [5,]  1.54110377  0.068021331
## [6,]  9.10340862  0.401806800
## [7,]  3.46551629  0.152961167
## [8,]  2.30556770  0.101763286
## [9,]  4.56112412  0.201319172
## [10,] 2.62206839  0.115733013
## [11,] 1.78961000  0.078989914
## [12,] 3.39232869  0.149730809
## [13,] 2.00065822  0.088305173
## [14,] 2.09663875  0.092541568
## [15,] 1.22939868  0.054263273
## [16,] 0.91191674  0.040250236
## [17,] 0.84328925  0.037221152
## [18,] -0.07782938 -0.003435238
## [19,] -2.07864748 -0.091747468
## [20,] -2.19857918 -0.097041021
## [21,] -0.83496229 -0.036853616
## [22,] -1.44969876 -0.063986891
## [23,] -1.90664521 -0.084155621
## [24,] -1.23445518 -0.054486457
## [25,] -1.44616708 -0.063831010
## [26,] -5.36829265 -0.236946025
## [27,] -2.23432577 -0.098618806
## [28,] -6.90295208 -0.304682916
## [29,] -3.38351386 -0.149341739
## [30,] -3.18975678 -0.140789677
```

Thus, the last column is the percentage of each stock.

2. Short Sales are NOT Allowed

```
table1_hw5 <- cbind(A_hw5, col1_hw5, col2_hw5, col3_hw5, col4_hw5, col5_hw5)
table2_hw5 <- table1_hw5[1:which(col5_hw5==max(col5_hw5)),]

z_no_short_hw5 <- (table2_hw5[,3]/table2_hw5[,5]) * (table2_hw5[,6] - max(col5_hw5))

x_no_short_hw5 <- z_no_short_hw5 / sum(z_no_short_hw5)

Weights_no_short_hw5 <- cbind(table2_hw5, z_no_short_hw5, x_no_short_hw5)

Weights_no_short_hw5
```

```
##      stock_hw5  alpha_hw5 beta_new_hw5  Ribar_hw5      mse_hw5  Ratio_hw5
## [1,]        10 0.012302336   0.4415913 0.016184453 0.0015343962 0.03438576
## [2,]         7 0.014207885   0.6063894 0.019538775 0.0149054735 0.03057239
## [3,]         5 0.021888991   1.4667521 0.034783501 0.0121800699 0.02303286
## [4,]        21 0.014978015   1.0119216 0.023874019 0.0011593849 0.02260454
## [5,]        11 0.005838142   0.3725544 0.009113341 0.0026045662 0.02177760
## [6,]        19 0.011967695   0.9192540 0.020049039 0.0009813850 0.02072228
```

```
## [7,]      6 0.017501358      1.6022329 0.031586905 0.0037387208 0.01909017
## [8,]      9 0.008728263      0.8325653 0.016047510 0.0025530829 0.01807367
## [9,]     22 0.003492743      0.2703064 0.005869061 0.0004154065 0.01801311
## [10,]    12 0.004799190      0.4144258 0.008442489 0.0010992542 0.01795856
## [11,]      4 0.010120116      1.0530930 0.019378066 0.0037942714 0.01745151
##      col1_hw5 col2_hw5 col3_hw5 col4_hw5 col5_hw5 z_no_short_hw5
## [1,]  4.3700073 4.370007 127.08771 127.0877 0.004509034      5.0104316
## [2,]  0.7542006 5.124208 24.66934 151.7570 0.005155987      0.5531319
## [3,]  4.0682871 9.192495 176.62967 328.3867 0.007853704      0.7293785
## [4,] 19.9646503 29.157145 883.21434 1211.6011 0.014197508      4.9126156
## [5,]  1.1605237 30.317669 53.28979 1264.8908 0.014389225      0.6868125
## [6,] 17.8430528 48.160722 861.05639 2125.9472 0.016226513      3.5090829
## [7,] 13.1080516 61.268773 686.63863 2812.5859 0.016764537      0.9060214
## [8,]  4.9070222 66.175796 271.50117 3084.0870 0.016855066      0.3579440
## [9,]  3.1683148 69.344110 175.88934 3259.9764 0.016904721      0.6748380
## [10,] 2.8058652 72.149976 156.24111 3416.2175 0.016943388      0.3704217
## [11,] 5.1007985 77.250774 292.28404 3708.5015 0.016976025      0.1319708
##      x_no_short_hw5
## [1,]  0.280812095
## [2,]  0.031000551
## [3,]  0.040878374
## [4,]  0.275329947
## [5,]  0.038492745
## [6,]  0.196668269
## [7,]  0.050778414
## [8,]  0.020061146
## [9,]  0.037821624
## [10,] 0.020760467
## [11,] 0.007396367
```

b.

```
blume1_hw5 <- read.csv("/Users/user/Desktop/Yonsei/Junior/3-2/Statistical Models in Finance/stockData_h
blume2_hw5 <- read.csv("/Users/user/Desktop/Yonsei/Junior/3-2/Statistical Models in Finance/stockData_h

vasicek_hw5 <- read.csv("/Users/user/Desktop/Yonsei/Junior/3-2/Statistical Models in Finance/stockData_h

blume1_adj_hw5 <- (blume1_hw5[-1, 3:ncol(blume1_hw5)]-blume1_hw5[-nrow(blume1_hw5),3:ncol(blume1_hw5)]),
blume2_adj_hw5 <- (blume2_hw5[-1, 3:ncol(blume2_hw5)]-blume2_hw5[-nrow(blume2_hw5),3:ncol(blume2_hw5)]),

vasicek_adj_hw5 <- (vasicek_hw5[-1, 3:ncol(vasicek_hw5)]-vasicek_hw5[-nrow(vasicek_hw5),3:ncol(vasicek_h

covmat_vasicek_hw5 <- cov(vasicek_adj_hw5)

beta_vasicek_hw5 <- covmat_vasicek_hw5[1,-1] / covmat_vasicek_hw5[1,1]

var_beta_vasicek_hw5 <- rep(0,29)

for (i in 1:29) {
  q_vasicek_hw5 <- lm(data=vasicek_adj_hw5, formula=vasicek_adj_hw5[,i+1]~vasicek_adj_hw5[,1])
  var_beta_vasicek_hw5[i] <- vcov(q_vasicek_hw5)[2,2]
}

beta_adj_vasicek_hw5 <- var_beta_vasicek_hw5*mean(beta_vasicek_hw5)/(var(beta_vasicek_hw5)+var_beta_vas
```

```

+ var(beta_vasicek_hw5)*beta_vasicek_hw5/(var(beta_vasicek_hw5)+var_beta_vasicek_hw5)

##      AAPL      IBM      GOOGL      META      NFLX      AMZN      TSLA      NKE
## 0.6853000 0.7587961 0.7564781 0.4403143 0.3200798 0.8936009 0.2161433 0.4357601
##      MCD      WMT      KO      PEP      XOM      CVX      SHEL      BRK.A
## 0.4356265 0.2152959 0.4750701 0.5615389 0.6651619 0.7009526 0.5436994 0.7578331
##      BRK.B      V      JPM      MA      C.PJ      MS      HSBC      BA
## 0.7618083 0.8738200 0.8660196 0.8835770 0.3138952 0.8158667 0.4417706 0.7621666
##      GE      JNJ      PFE      PKX      BIDU
## 0.3925367 0.5680888 0.6943486 0.5381654 0.6942291
beta_adj_vasicek_hw5

## [1] 0.36845126 0.26943304 0.26492260 0.33569204 0.66831869 0.40924025
## [7] 0.63646220 0.28401303 0.17951606 0.30202968 0.14894242 0.15644440
## [13] 0.18939160 0.27380531 0.31493018 0.10891350 0.10705420 0.15104667
## [19] 0.23116284 0.17225626 0.06057136 0.31118376 0.30671126 0.32321459
## [25] 0.35527820 0.14932560 0.16545571 0.45484034 0.50542767

```

c.

```

PRESS_vasicek_hw5 <- sum((beta_adj_vasicek_hw5-beta_vasicek_hw5)^2) / 29

PRESS_vasicek_hw5

## [1] 0.4693639

```