Homework 4

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Homework 4

```
setwd("C:/Users/cheny/Desktop/study/second term/Statistical Method In Finance/homework/homework four")
data <- read.table("FamaFrench_mon_69_98.txt",header = TRUE,col.names = c('date','Mkt-RF','SMB','HML','RF'))
library("Ecdat")
```

```
## Warning: package 'Ecdat' was built under R version 3.4.3
```

```
## Loading required package: Ecfun
```

```
## Warning: package 'Ecfun' was built under R version 3.4.3
```

```
##
## Attaching package: 'Ecfun'
```

```
## The following object is masked from 'package:base':
##
##     sign
```

```
##
## Attaching package: 'Ecdat'
```

```
## The following object is masked from 'package:datasets':
##
##     Orange
```

```
data(CRSPmon)
```

a. Perform principal component analysis (PCA) on the monthly returns of GE, IBM and Mobil. Report the following quantities.

```
# fristly, calculate the month return so that we can use the CPA
data2 <- as.data.frame(CRSPmon[,1:3])
pca <- prcomp(data2)
summary(pca)
```

```
## Importance of components%s:
##                            PC1     PC2     PC3
## Standard deviation     0.08623 0.05808 0.04682
## Proportion of Variance 0.57190 0.25950 0.16860
## Cumulative Proportion  0.57190 0.83140 1.00000
```

(i)The proportion of total variance explained by the first principal component.

```
cat(" proportion of total variance explained by the first principal component is:0.5719")
```

```
##  proportion of total variance explained by the first principal component is:0.5719
```

(ii)The loading vectors (the eigenvectors).

```
pca$rotation
```

```
##             PC1        PC2        PC3
## ge    0.5939894 -0.1422511 -0.7917962
## ibm   0.6337925 -0.5234321  0.5694961
## mobil 0.4954630  0.8401092  0.2207555
```

(iii)The principal components for the first two observations.

```
pca$x[1:2,]
```

```
##              PC1         PC2         PC3
## [1,] -0.07346887  0.01687775 -0.02446121
## [2,] -0.10082888 -0.05782190  0.02955211
```

b. Now, for each of following cases, fit the Fama-French three factor model on GE, IBM and Mobil respectively. Comment on any difference between the two cases.

```
FF_data = read.table("FamaFrench_mon_69_98.txt",header=T)
attach(FF_data)
library("Ecdat")
library("robust")
```

```
## Warning: package 'robust' was built under R version 3.4.3
```

```
## Loading required package: fit.models
```

```
## Warning: package 'fit.models' was built under R version 3.4.3
```

```
Mkt.RF = FF_data[,2]
SMB = FF_data[,3]
HML = FF_data[,4]
RF = FF_data[,5]
data(CRSPmon)
ge = 100*CRSPmon[,1] - RF
ibm = 100*CRSPmon[,2] - RF
mobil = 100*CRSPmon[,3] - RF
stocks=cbind(ge,ibm,mobil)
```

i. Using data in the first 180 months only;

```
data_first_180 <- stocks[1:180,]
fit1 = lm(data_first_180~Mkt.RF[1:180]+SMB[1:180]+HML[1:180])
options(digits=3)
fit1
```

```
##
## Call:
## lm(formula = data_first_180 ~ Mkt.RF[1:180] + SMB[1:180] + HML[1:180])
##
## Coefficients:
##                ge      ibm     mobil
## (Intercept)     0.322   0.226   0.390
## Mkt.RF[1:180]   1.133   0.807   1.146
## SMB[1:180]     -0.334  -0.172  -0.586
## HML[1:180]      0.107  -0.158   0.315
```

ii. Using data in the last 180 months only

```
data_last_180 <- stocks[181:360,]
fit2 = lm(data_last_180~Mkt.RF[181:360]+SMB[181:360]+HML[181:360])
options(digits=3)
fit2
```

```
##
## Call:
## lm(formula = data_last_180 ~ Mkt.RF[181:360] + SMB[181:360] +
##     HML[181:360])
##
## Coefficients:
##                  ge        ibm       mobil
## (Intercept)       0.33936  -0.00054   0.14640
## Mkt.RF[181:360]   1.12173   0.74824   0.86945
## SMB[181:360]     -0.46179  -0.61333  -0.15081
## HML[181:360]     -0.16594  -0.61853   0.50187
```

Answer: (i) Firstly, the coefficients on the variable “Mkt.RF” decrease a little, which means that the excessive return of the market portfolio contributes less to those of three stocks. (ii) Secondly, according to the coefficient for SMB, in general, all of the three companies are more behave like the big company.(which is obviously true in the reality). But in detail, for the change in the coefficient for SMB, we can see that, the mobile are more like a small company

in the last 180 compaired with the first 180 days. while the other two companies just tends to behave more like a big company. (iii) Thirdly, changes in coefficients for HML suggest that the GE and IBM are more likely to be recognized as Growth Stock while Mobil is regarded as Value Stock.