# HW4

## 2024-12-06

財務指標資料分析 Analysis of financial indexes

分析財務報表，了解公司企業特性，以降維的方式，找出有意義的指標，衡量績優公司。

資料financialdata_20231113.csv有382間公司的財務指標。此數據集包含了重點財務指標，如ROE、周轉率和研發投資、 SeasonReturn(%)（季度回報率）、TwoMonthReturn(%)（兩月回報率）、MonthReturn(%)（月回報率）和 WeekReturn(%)（周回報）等。

#1.以PCA或SPCA分析，找出前二個主成份共能解釋多少變異？

我用PCA，前兩個主成分共能解釋的累積變異比例為 41.27%，其中： 第一主成分（PC1）解釋了 22.6% 的變異。 第二主成分（PC2）解釋了 18.67% 的變異。 合計前兩個主成分已捕捉到原始數據中 41.27% 的總變異。

#2.找出前三個主成份分別重點變數為何，需說明你的理由。

pca$rotation表中的各個主成分與原變數的相關性，看圖也可以(但是那個圖的變數都疊在一起了我也不會把它改動態QQ，所以我才看數字)

PC1(利潤相關指標)： By pca$rotation： NetProfitMargin (0.4778) OperatingProfitMargin (0.4679) CapitalExpendituresRatio (0.4042) 變數的係數絕對值較大 → 它們在PC1中的權重最高

PC2(股票或投資回報的短期變化)： By pca$rotation： MonthReturn… (-0.5221) TwoMonthReturn… (-0.5262) SeasonReturn… (-0.5175) 變數的係數絕對值較大 → 它們在PC2中的權重最高

PC3(盈利能力與資產負債效率的平衡)： By pca$rotation： GrossMargin (0.5143) ROE (0.4139) AccountsPayableTurnoverRatio (-0.5876) 變數的係數絕對值較大 → 它們在PC3中的權重最高

#3.依第一、二主成份結果說明，找出適合投資的公司。(例如：適合投資資產報酬率高的XX公司) (解答在最底下，我挑PC1_scores、PC2_scores大於0.9的)

```
#Part0. Preparation
library(readr)
finance <- read_csv("C:/Users/Ava/Desktop/R/HW4/financialdata_20231113.csv")
```

```
## Rows: 398 Columns: 18
## ── Column specification ────────────────────────────────────────────────────────
## Delimiter: ","
## chr  (1): Name
## dbl (17): Code, ROE, GrossMargin, OperatingProfitMargin, NetProfitMargin, As...
##
## ℹ Use `spec()` to retrieve the full column specification for this data.
## ℹ Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
View(finance)
fin <- finance[,3:18]
library(summarytools)
```

```
## Warning: 套件 'summarytools' 是用 R 版本 4.4.2 來建造的
```

```
dfSummary(finance) # provides a detailed summary of your data frame
```

```
## Data Frame Summary
## finance
## Dimensions: 398 x 18
## Duplicates: 16
##
## ------------------------------------------------------------------------------------------
----------------------------------------
## No   Variable                          Stats / Values                Freqs (% of Valid)
Graph                 Valid      Missing
## ---- --------------------------------- ----------------------------- --------------------
-------------------- ---------- ---------
## 1    Code                              Mean (sd) : 4368.4 (2329.6)   374 distinct values
: . .     :           398        0
##      [numeric]                         min < med < max:
: : : :   :           (100.0%)   (0.0%)
##                                        1102 < 4143.5 < 9962
: : : : : :
##                                        IQR (CV) : 3738.5 (0.5)
: : : : : :   :
##
: : : : : :   : :
##
## 2    Name                              1. 六方科-KY                   4 ( 1.0%)
398        0
##      [character]                       2. 正能量智能                  4 ( 1.0%)
(100.0%)   (0.0%)
##                                        3. 名軒                        4 ( 1.0%)
##                                        4. 長佳智能                    4 ( 1.0%)
##                                        5. 飛寶企業                    4 ( 1.0%)
##                                        6. 智晶                        4 ( 1.0%)
##                                        7. 濾能                        4 ( 1.0%)
##                                        8. 騰雲                        4 ( 1.0%)
##                                        9. ABC-KY                      1 ( 0.3%)
##                                        10. AES-KY                     1 ( 0.3%)
##                                        [ 364 others ]                364 (91.5%)
IIIIIIIIIIIIIIIII
##
## 3    ROE                               Mean (sd) : 0 (0.1)           382 distinct values
: .       398        0
##      [numeric]                         min < med < max:
: :       (100.0%)   (0.0%)
##                                        -0.4 < 0 < 0.2
: :
##                                        IQR (CV) : 0 (4)
: :
##
. : :
##
## 4    GrossMargin                       Mean (sd) : 0.2 (0.3)         382 distinct values
:           398        0
##      [numeric]                         min < med < max:
:           (100.0%)   (0.0%)
##                                        -2.3 < 0.2 < 0.8
:
##                                        IQR (CV) : 0.2 (1.1)
```

```
:
##
: .
##
## 5    OperatingProfitMargin             Mean (sd) : -0.9 (8)          382 distinct values
:   398        0
##      [numeric]                         min < med < max:
:   (100.0%)   (0.0%)
##                                        -99.4 < 0 < 0.6
:
##                                        IQR (CV) : 0.2 (-8.4)
:
##
:
##
## 6    NetProfitMargin                   Mean (sd) : -0.7 (7)          382 distinct values
:   398        0
##      [numeric]                         min < med < max:
:   (100.0%)   (0.0%)
##                                        -99 < 0.1 < 9.7
:
##                                        IQR (CV) : 0.2 (-10.2)
:
##
:
##
## 7    AssetTurnoverRatio                Mean (sd) : 0.2 (0.1)         382 distinct values
:                    398        0
##      [numeric]                         min < med < max:
. :                  (100.0%)   (0.0%)
##                                        0 < 0.1 < 0.9
: : .
##                                        IQR (CV) : 0.1 (0.8)
: : :
##
: : : : .
##
## 8    FinancialLeverage                 Mean (sd) : 2.1 (2)           382 distinct values
:                    398        0
##      [numeric]                         min < med < max:
:                    (100.0%)   (0.0%)
##                                        1 < 1.7 < 31.9
:
##                                        IQR (CV) : 0.9 (0.9)
:
##
:
##
## 9    QoQ                               Mean (sd) : 0 (3.5)           382 distinct values
:             398        0
##      [numeric]                         min < med < max:
:             (100.0%)   (0.0%)
##                                        -25.9 < -0.1 < 37.6
:
##                                        IQR (CV) : 0.9 (-197.5)
. :
```

```
##
: :
##
## 10   R.DExpenseRatio                   Mean (sd) : 0.6 (5.5)         286 distinct values
:                      398        0
##      [numeric]                         min < med < max:
:                      (100.0%)   (0.0%)
##                                        0 < 0 < 81.2
:
##                                        IQR (CV) : 0.1 (10)
:
##
:
##
## 11   CapitalExpendituresRatio          Mean (sd) : 0 (1.2)           382 distinct values
:                398        0
##      [numeric]                         min < med < max:
:                (100.0%)   (0.0%)
##                                        -9.6 < 0 < 17.7
:
##                                        IQR (CV) : 0 (-41.6)
:
##
:
##
## 12   InventoryTurnover                 Mean (sd) : Inf (NaN)         375 distinct values
398        0
##      [numeric]                         min < med < max:
(100.0%)   (0.0%)
##                                        0 < 0.9 < Inf
##                                        IQR (CV) : 1.1 (NaN)
##
## 13   AccountsPayableTurnoverRatio      Mean (sd) : Inf (NaN)         379 distinct values
398        0
##      [numeric]                         min < med < max:
(100.0%)   (0.0%)
##                                        0 < 1.9 < Inf
##                                        IQR (CV) : 2 (NaN)
##
## 14   AccountsReceivableTurnoverRatio   Mean (sd) : Inf (NaN)         378 distinct values
398        0
##      [numeric]                         min < med < max:
(100.0%)   (0.0%)
##                                        0.1 < 1.3 < Inf
##                                        IQR (CV) : 1.1 (NaN)
##
## 15   SeasonReturn...                   Mean (sd) : -4.5 (28.4)       374 distinct values
:                  398        0
##      [numeric]                         min < med < max:
: .                (100.0%)   (0.0%)
##                                        -73.2 < -1.8 < 181
. : :
##                                        IQR (CV) : 30.7 (-6.4)
: : :
##
: : : : :
```

```
##
## 16   TwoMonthReturn...                Mean (sd) : -9 (27.4)         374 distinct values
:               398        0
##      [numeric]                        min < med < max:
:               (100.0%)   (0.0%)
##                                       -78.1 < -6.9 < 132.4
: :
##                                       IQR (CV) : 32.9 (-3.1)
. : : :
##
. : : : : .
##
## 17   MonthReturn...                   Mean (sd) : -7.8 (29.2)       374 distinct values
:               398        0
##      [numeric]                        min < med < max:
:               (100.0%)   (0.0%)
##                                       -84.6 < -6 < 135
: : .
##                                       IQR (CV) : 32.7 (-3.8)
. : : :
##
: : : : :
##
## 18   WeekReturn...                    Mean (sd) : 3.1 (6.2)         361 distinct values
:             398        0
##      [numeric]                        min < med < max:
:             (100.0%)   (0.0%)
##                                       -40.7 < 2.2 < 49
:
##                                       IQR (CV) : 3.9 (2)
: :
##
: :
## ----------------------------------------------------------------------------------------
----------------------------------------
```

```
view(dfSummary(finance)) # see the results in RStudio’s Viewer; stview(dfSummary(murders))
```

```
## Switching method to 'browser'
## Output file written: C:\Users\Ava\AppData\Local\Temp\RtmpOgfFbt\file1b68642262ac.html
```

```
library(tidyverse)
```

```
## Warning: 套件 'tidyverse' 是用 R 版本 4.4.2 來建造的
```

```
## Warning: 套件 'ggplot2' 是用 R 版本 4.4.2 來建造的
```

```
## ── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──
## ✓ dplyr     1.1.4     ✓ purrr     1.0.2
## ✓ forcats   1.0.0     ✓ stringr   1.5.1
## ✓ ggplot2   3.5.1     ✓ tibble    3.2.1
## ✓ lubridate 1.9.3     ✓ tidyr     1.3.1
## ── Conflicts ────────────────────────────────────────── tidyverse_conflicts() ──
## ✖ dplyr::filter() masks stats::filter()
## ✖ dplyr::lag()    masks stats::lag()
## ✖ tibble::view()  masks summarytools::view()
## ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to be
come errors
```

```
finance <- finance |>
  filter(
    !(InventoryTurnover == Inf |
        AccountsPayableTurnoverRatio == Inf |
        AccountsReceivableTurnoverRatio == Inf)
  ) #!用來移除東東
fin <- finance[,3:18]
```

```
#Part1. Dimension reduction (Correlation)

## understand ur data
M = cor(fin)

## create heatmap for correlation
library(reshape2)
```

```
## Warning: 套件 'reshape2' 是用 R 版本 4.4.2 來建造的
```

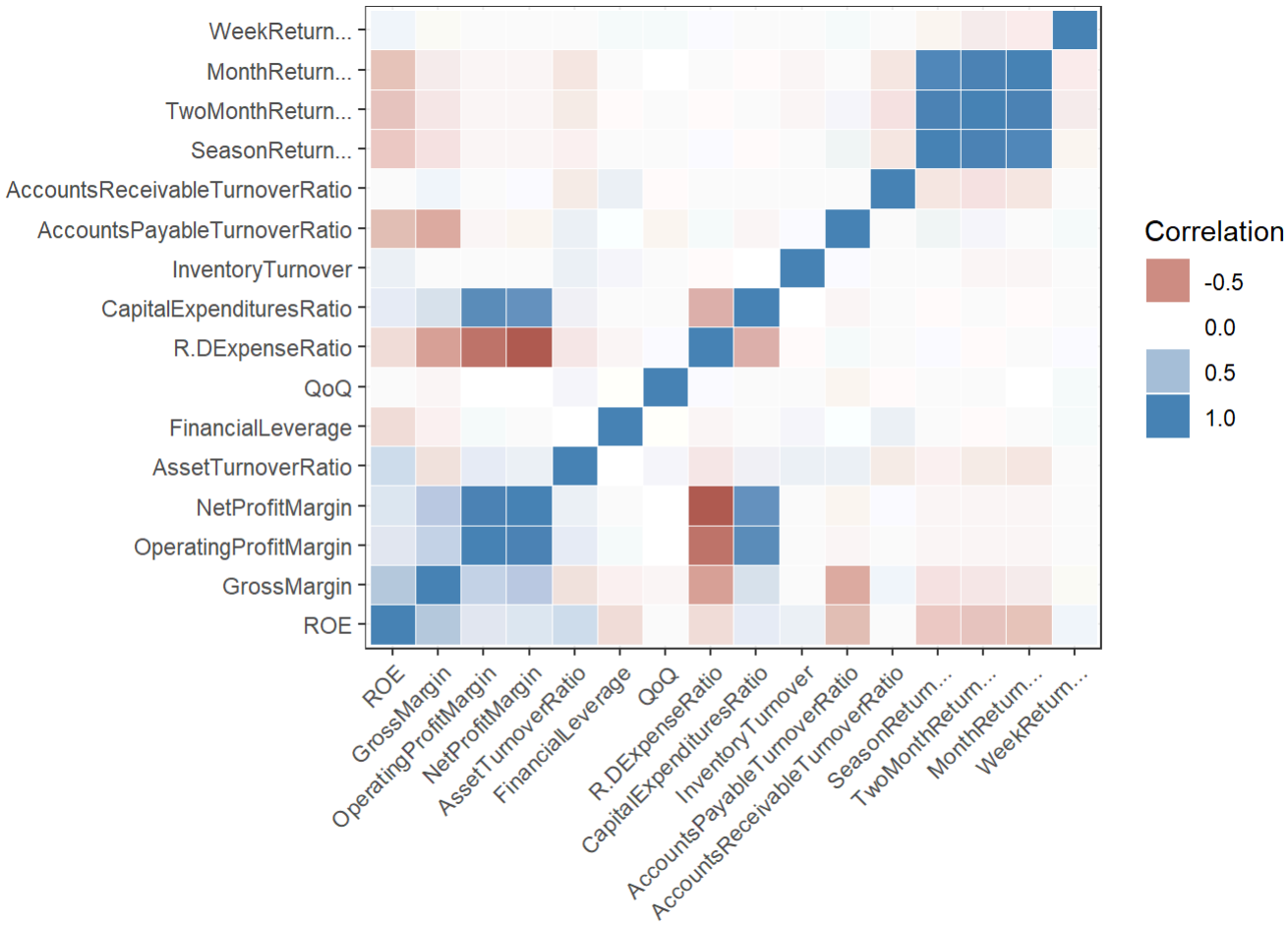
```
##
## 載入套件：'reshape2'
```

```
## 下列物件被遮斷自 'package:tidyr':
##
##     smiths
```

```
melted_cormat <- melt(M)
head(melted_cormat)
```

```
##                    Var1 Var2      value
## 1                   ROE  ROE  1.0000000
## 2           GrossMargin  ROE  0.4275882
## 3 OperatingProfitMargin  ROE  0.1655295
## 4       NetProfitMargin  ROE  0.1932846
## 5    AssetTurnoverRatio  ROE  0.2633898
## 6     FinancialLeverage  ROE -0.1518323
```

```
library(ggplot2)
ggplot(data = melted_cormat,
       aes(Var1, Var2)) +
  geom_tile(aes(fill = value), colour = "white") +
  scale_fill_gradient2(low = "firebrick4", high = "steelblue",
                       mid = "white", midpoint = 0) +
  guides(fill=guide_legend(title="Correlation")) +
  theme_bw() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1, vjust = 1),
        axis.title = element_blank())
```

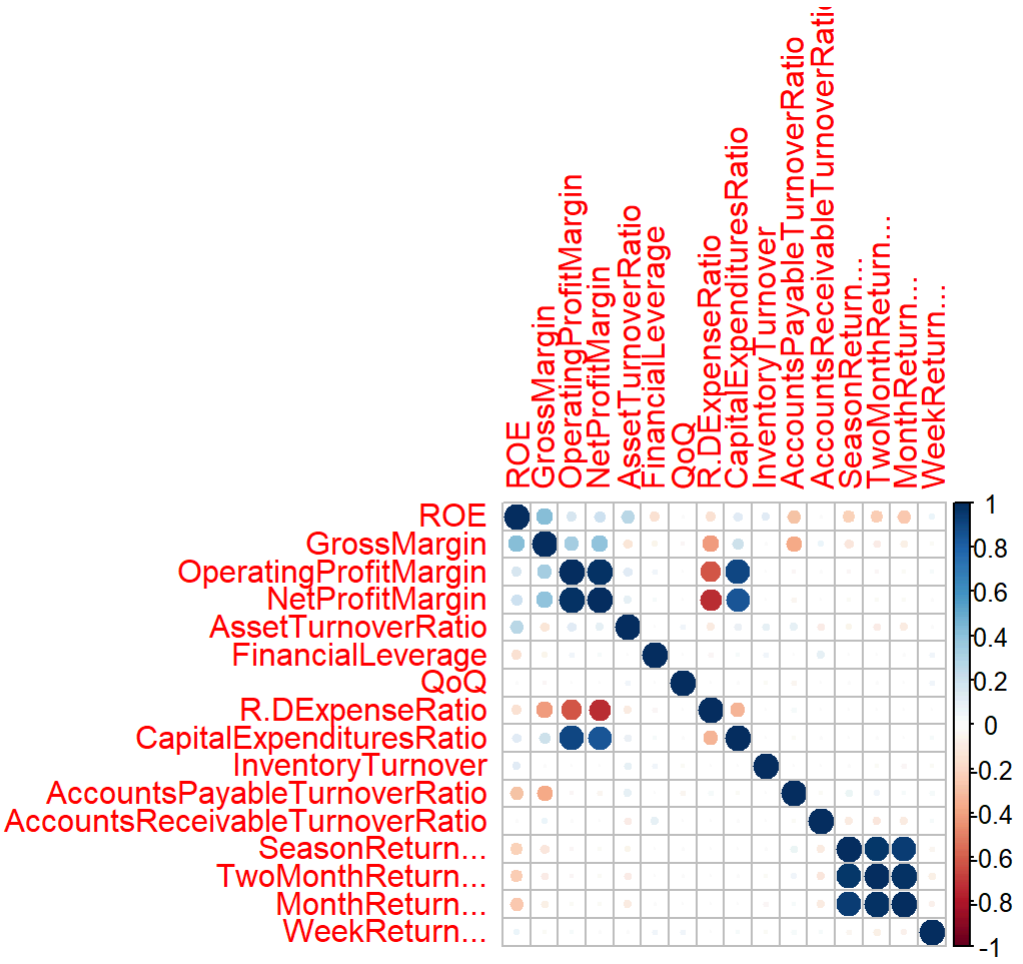



```
library(corrplot)
```

```
## Warning: 套件 'corrplot' 是用 R 版本 4.4.2 來建造的
```

```
## corrplot 0.95 loaded
```

```
corrplot(M, method="circle")
```



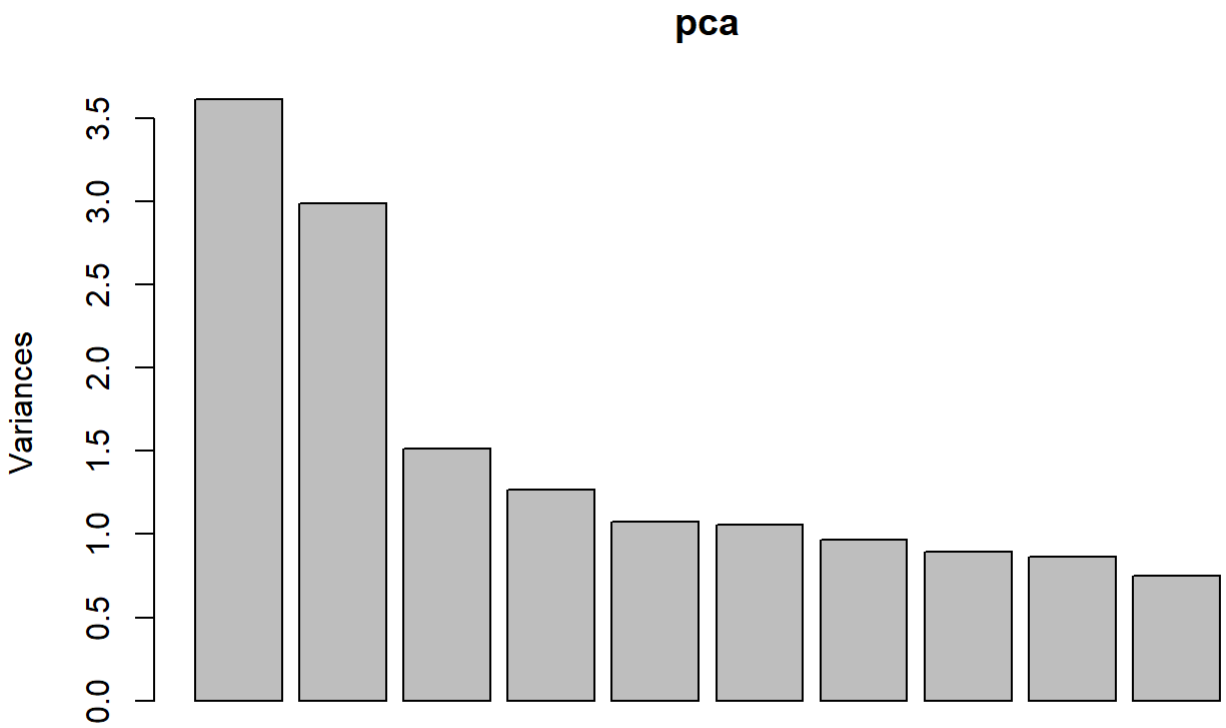

```
#Part2.PCA
#install.packages("stats")
library(stats)
pca<- prcomp(fin, center = TRUE, scale = TRUE)

names(pca)
```

```
## [1] "sdev"     "rotation" "center"   "scale"    "x"
```

```
summary(pca)
```

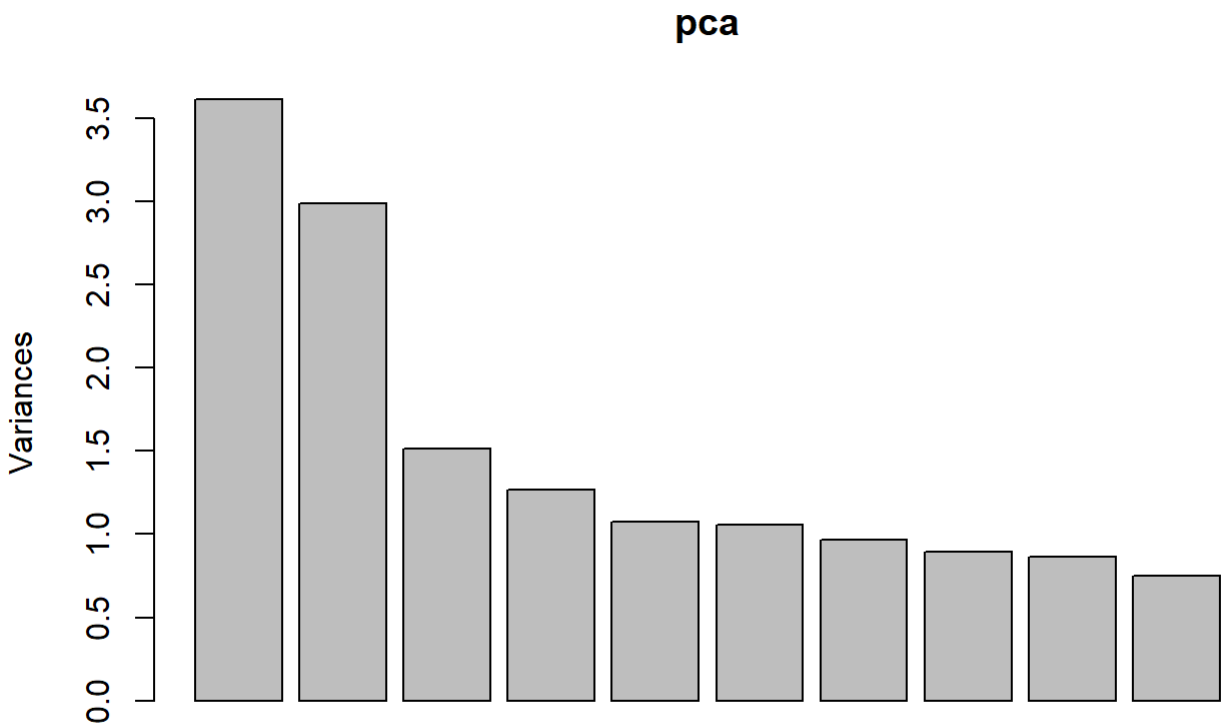
```
## Importance of components:
##                           PC1    PC2     PC3     PC4     PC5     PC6     PC7
## Standard deviation     1.901 1.7283 1.22973 1.12692 1.03640 1.02810 0.98257
## Proportion of Variance 0.226 0.1867 0.09451 0.07937 0.06713 0.06606 0.06034
## Cumulative Proportion  0.226 0.4127 0.50716 0.58653 0.65366 0.71973 0.78007
##                           PC8     PC9    PC10    PC11    PC12    PC13    PC14
## Standard deviation     0.94637 0.92963 0.86573 0.72578 0.59143 0.24246 0.20599
## Proportion of Variance 0.05598 0.05401 0.04684 0.03292 0.02186 0.00367 0.00265
## Cumulative Proportion  0.83604 0.89006 0.93690 0.96982 0.99168 0.99536 0.99801
##                           PC15   PC16
## Standard deviation     0.14363 0.1060
## Proportion of Variance 0.00129 0.0007
## Cumulative Proportion  0.99930 1.0000
```

```
plot(pca)
```

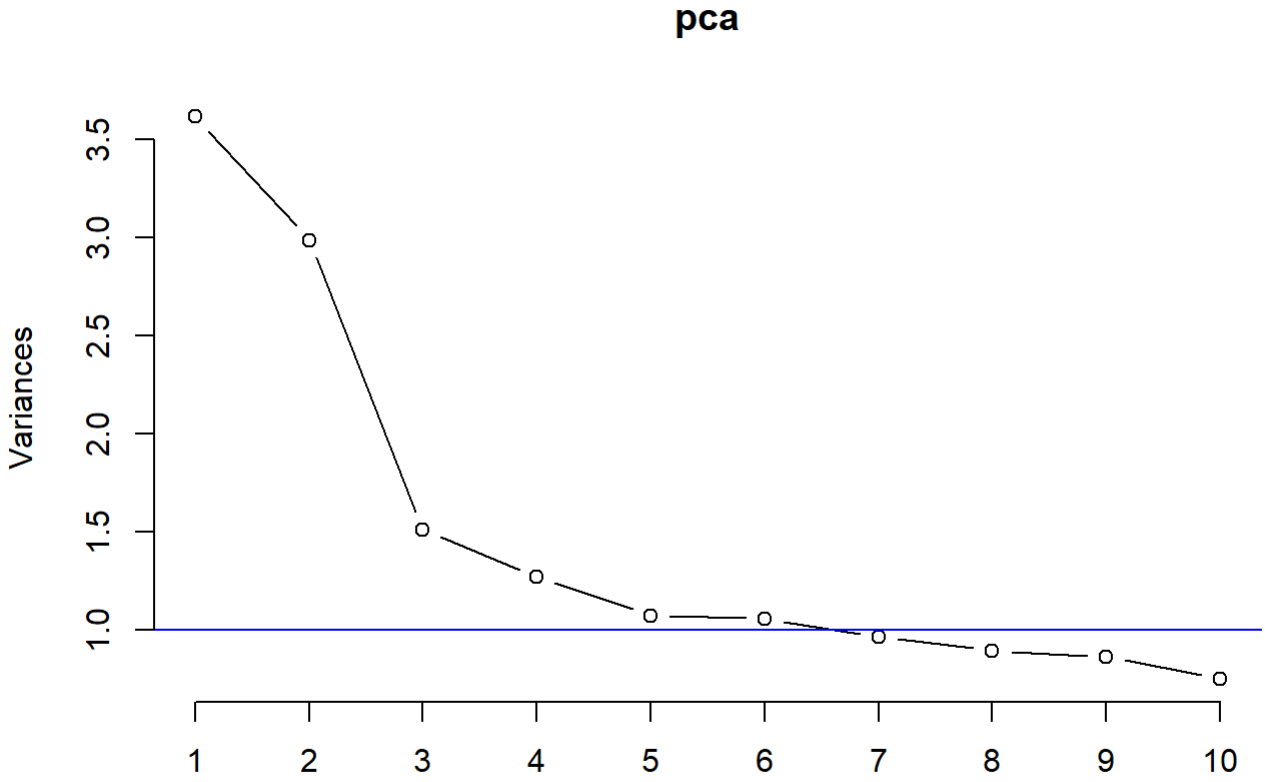



```
## how to get the results of summary(pca)
var = pca$sdev^2 #該主成份解釋變異數的數值
prop = (pca$sdev)^2 / sum((pca$sdev)^2) #該主成份解釋變異數的比率
cum_prop = cumsum((pca$sdev)^2 / sum((pca$sdev)^2)) #該主成份解釋變異數的累積比率
```

```
## scree plot: variance
screeplot(pca) #same as plot(pca)
```




```
plot(pca, type="line")
abline(h=1, col="blue") #Kaiser eigenvalue-greater-than-one rule, choose pc1~pc5 by Kaiser
```



```
summary(pca)
```

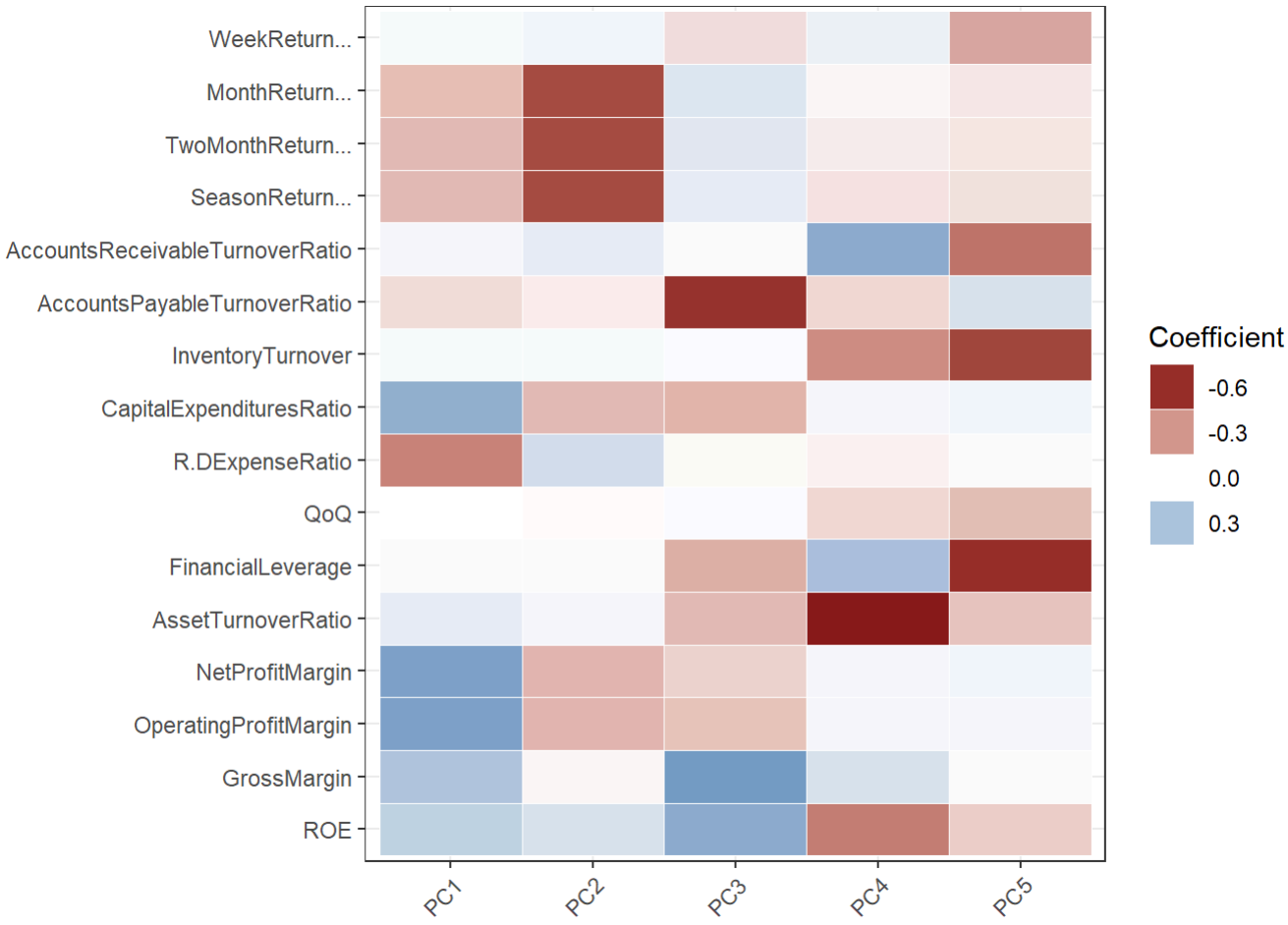
```
## Importance of components:
##                           PC1    PC2     PC3     PC4     PC5     PC6     PC7
## Standard deviation     1.901 1.7283 1.22973 1.12692 1.03640 1.02810 0.98257
## Proportion of Variance 0.226 0.1867 0.09451 0.07937 0.06713 0.06606 0.06034
## Cumulative Proportion  0.226 0.4127 0.50716 0.58653 0.65366 0.71973 0.78007
##                           PC8     PC9    PC10    PC11    PC12    PC13    PC14
## Standard deviation     0.94637 0.92963 0.86573 0.72578 0.59143 0.24246 0.20599
## Proportion of Variance 0.05598 0.05401 0.04684 0.03292 0.02186 0.00367 0.00265
## Cumulative Proportion  0.83604 0.89006 0.93690 0.96982 0.99168 0.99536 0.99801
##                           PC15   PC16
## Standard deviation     0.14363 0.1060
## Proportion of Variance 0.00129 0.0007
## Cumulative Proportion  0.99930 1.0000
```

```
## Rotation matrix: Loadings are the percent of variance explained by the variable
pca$rotation
```

```
##                                         PC1          PC2          PC3
## ROE                              2.262005e-01  0.142487701  0.413897893
## GrossMargin                      2.879591e-01 -0.017808599  0.514340008
## OperatingProfitMargin            4.679090e-01 -0.204713662 -0.170422275
## NetProfitMargin                  4.778089e-01 -0.208629456 -0.123764949
## AssetTurnoverRatio               8.854537e-02  0.038220221 -0.188093311
## FinancialLeverage                7.112274e-03 -0.010491617 -0.228634007
## QoQ                             -8.705163e-05 -0.003838033  0.002496763
## R.DExpenseRatio                 -3.615357e-01  0.161373630 -0.014675974
## CapitalExpendituresRatio         4.041766e-01 -0.193878555 -0.210816427
## InventoryTurnover                2.090362e-02  0.026925329  0.004197998
## AccountsPayableTurnoverRatio    -9.682597e-02 -0.043707775 -0.587578955
## AccountsReceivableTurnoverRatio  3.597014e-02  0.081323477  0.006498225
## SeasonReturn...                 -1.875851e-01 -0.517524150  0.088541499
## TwoMonthReturn...               -1.880722e-01 -0.526217952  0.107040051
## MonthReturn...                  -1.853420e-01 -0.522076568  0.123181187
## WeekReturn...                    2.641860e-02  0.046699795 -0.087658057
##                                         PC4          PC5          PC6
## ROE                             -0.37533737 -0.142127787  0.061882518
## GrossMargin                      0.13709488 -0.004921220 -0.045775340
## OperatingProfitMargin            0.02755694  0.037711675  0.009057411
## NetProfitMargin                  0.03399788  0.042747201 -0.006231988
## AssetTurnoverRatio              -0.65367097 -0.168819837  0.024526001
## FinancialLeverage                0.30626401 -0.602389907 -0.117112155
## QoQ                             -0.11422617 -0.186393522  0.690810789
## R.DExpenseRatio                 -0.03453150 -0.005126072  0.063132960
## CapitalExpendituresRatio         0.02993186  0.046402482  0.044050081
## InventoryTurnover               -0.33057783 -0.541095219 -0.400376950
## AccountsPayableTurnoverRatio    -0.11118133  0.138112788 -0.054611875
## AccountsReceivableTurnoverRatio  0.41093221 -0.398300901 -0.019620042
## SeasonReturn...                 -0.07405672 -0.084769337  0.028189188
## TwoMonthReturn...               -0.04646411 -0.067722253  0.013029032
## MonthReturn...                  -0.02471309 -0.059755801  0.010927604
## WeekReturn...                    0.05856588 -0.249768982  0.575967783
##                                         PC7          PC8          PC9
## ROE                             -0.155495054 -0.161805901  0.14656694
## GrossMargin                     -0.043023912  0.029002604  0.04179571
## OperatingProfitMargin            0.014117346  0.007967187 -0.06323164
## NetProfitMargin                  0.010984678  0.012568232 -0.04391029
## AssetTurnoverRatio               0.058801909 -0.241580958  0.47857308
## FinancialLeverage                0.186787414  0.383007332  0.47711075
## QoQ                              0.602980269  0.001582045 -0.27653229
## R.DExpenseRatio                 -0.009975822 -0.008428532 -0.10310608
## CapitalExpendituresRatio         0.019982489  0.004485504 -0.13554546
## InventoryTurnover               -0.064023061  0.165640923 -0.62482265
## AccountsPayableTurnoverRatio    -0.162748324 -0.230182591 -0.10549303
## AccountsReceivableTurnoverRatio -0.016847998 -0.804027776 -0.05772969
## SeasonReturn...                 -0.055947046 -0.063278452  0.03150695
## TwoMonthReturn...               -0.028874181 -0.053031741  0.03606786
## MonthReturn...                  -0.038442227 -0.048317789  0.02411452
## WeekReturn...                   -0.731373793  0.177690414 -0.03105732
##                                        PC10         PC11         PC12
## ROE                              0.0636631973 -0.491345705 -0.520897471
## GrossMargin                     -0.3014970541 -0.287749604  0.670178441
## OperatingProfitMargin            0.1534468238 -0.006475297  0.016626037
```

```
## NetProfitMargin                -0.0006763723  0.049767633 -0.076183128
## AssetTurnoverRatio              0.0521316460  0.268430378  0.364045107
## FinancialLeverage              -0.0182352186 -0.254039237 -0.053814844
## QoQ                            -0.1676458926 -0.080246646  0.014201648
## R.DExpenseRatio                 0.6435088099 -0.389891960  0.329401296
## CapitalExpendituresRatio        0.4756625704 -0.173350500  0.091349949
## InventoryTurnover              -0.0566184938  0.084620944  0.063756211
## AccountsPayableTurnoverRatio   -0.4491723499 -0.556072712  0.078623550
## AccountsReceivableTurnoverRatio 0.0578309077  0.103123230  0.001198627
## SeasonReturn...                 0.0110515658 -0.044603006 -0.058315188
## TwoMonthReturn...              -0.0036100169 -0.038330736 -0.018570139
## MonthReturn...                  0.0294940955 -0.010737392  0.034635624
## WeekReturn...                  -0.0259875633  0.132583644  0.076004641
##                                         PC13          PC14         PC15
## ROE                            -0.0550290009 -0.0003995044 -0.010751710
## GrossMargin                     0.0555917062 -0.0300421710  0.005533112
## OperatingProfitMargin          -0.0460271418  0.4937060911 -0.013937587
## NetProfitMargin                -0.0647217138  0.3866134333 -0.042602934
## AssetTurnoverRatio             -0.0031193930 -0.0164612613  0.004446372
## FinancialLeverage              -0.0085858469 -0.0012145879 -0.010308094
## QoQ                            -0.0092414477  0.0033994549 -0.008241349
## R.DExpenseRatio                -0.0318493747  0.3622396105 -0.011113261
## CapitalExpendituresRatio        0.0876007585 -0.6747234845  0.052696495
## InventoryTurnover              -0.0069719602 -0.0033471783  0.004628121
## AccountsPayableTurnoverRatio   -0.0296452792 -0.0141991069 -0.014376970
## AccountsReceivableTurnoverRatio 0.0005967016  0.0065499145  0.005145363
## SeasonReturn...                 0.7552918214  0.0798428909 -0.291802321
## TwoMonthReturn...              -0.1392014494  0.0404982978  0.800850288
## MonthReturn...                 -0.6227171661 -0.1041250082 -0.517479924
## WeekReturn...                  -0.0130227178 -0.0039497217  0.014152911
##                                         PC16
## ROE                             0.0227542125
## GrossMargin                    -0.0002459434
## OperatingProfitMargin           0.6585304695
## NetProfitMargin                -0.7374759959
## AssetTurnoverRatio             -0.0218937108
## FinancialLeverage              -0.0038162070
## QoQ                             0.0005167231
## R.DExpenseRatio                -0.1415953238
## CapitalExpendituresRatio       -0.0217852342
## InventoryTurnover              -0.0011606287
## AccountsPayableTurnoverRatio    0.0022687755
## AccountsReceivableTurnoverRatio -0.0054186820
## SeasonReturn...                -0.0069104131
## TwoMonthReturn...              -0.0140906804
## MonthReturn...                  0.0250398029
## WeekReturn...                  -0.0046706641
```

```
#visualize
ggplot(melt(pca$rotation[,1:5]), aes(Var2, Var1)) +
  geom_tile(aes(fill = value), colour = "white") +
  scale_fill_gradient2(low = "firebrick4", high = "steelblue",
                       mid = "white", midpoint = 0) +
  guides(fill=guide_legend(title="Coefficient")) +
  theme_bw() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1, vjust = 1),
        axis.title = element_blank())
```



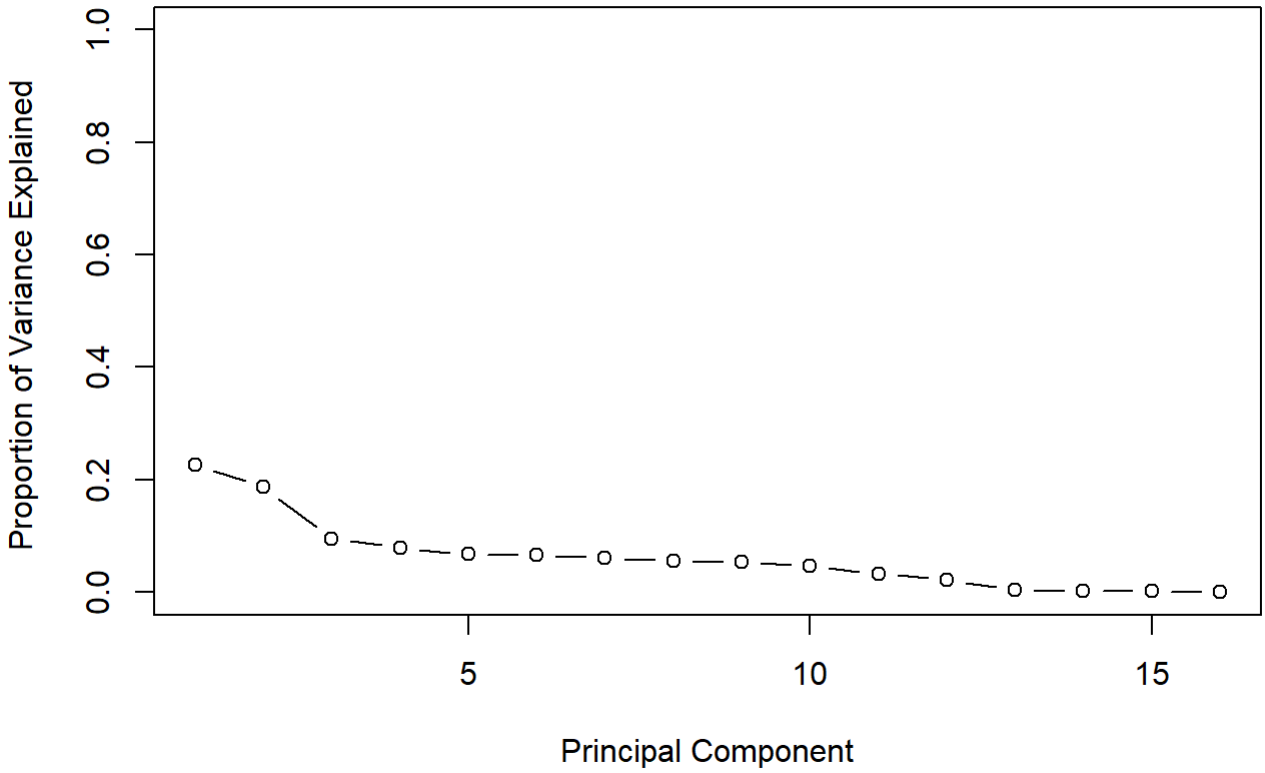

```
## The actual principal components
head(pca$x)
```

```
##             PC1        PC2         PC3         PC4         PC5          PC6
## [1,] -0.2179161 -0.4958004  0.09741213  0.43071007  0.21045545  0.198149145
## [2,]  0.4041217  0.8273805  0.13908858  0.35198273  0.56628896  0.007694882
## [3,]  0.5842738  1.1445990 -0.03636913  0.08269959  0.28451378 -0.003999731
## [4,]  0.6254776  0.8158198 -0.03312042  0.02593911 -0.06817037  0.976322560
## [5,]  0.5474971  0.5971453 -0.57152988 -1.85406706 -0.29346797  0.028894456
## [6,] -0.3525386 -1.1646217 -0.35806402 -1.06630820  0.03718275  0.237179371
##              PC7        PC8         PC9         PC10         PC11        PC12
## [1,] -0.07886506  0.2235960 -0.48197943  0.155755570  0.103017978 -0.62427327
## [2,]  0.19727547  0.1725293 -0.63531515  0.091790167  0.014255253 -0.56621537
## [3,] -0.05019703  0.1799548 -0.06097521  0.174360173 -0.002500336 -0.54135873
## [4,] -1.20256673  0.2762163 -0.13234820 -0.037640348  0.165450453  0.10281265
## [5,]  0.17720328 -0.6527534  1.19473337  0.267272818  0.427352992  0.21700767
## [6,] -0.25432349 -0.5794436  0.34032103  0.007641086  0.193956410  0.02474381
##              PC13        PC14         PC15          PC16
## [1,] -0.010957317  0.06549290  0.069545713  0.0288333144
## [2,]  0.007951359  0.05863049 -0.020541306  0.0030372866
## [3,]  0.015198745  0.02870554  0.007677974  0.0229239309
## [4,]  0.019846280 -0.04195950  0.127781399  0.0112154586
## [5,] -0.054213612 -0.05128238  0.107475468 -0.0224144112
## [6,] -0.019225458  0.02852078  0.092241786 -0.0005266384
```

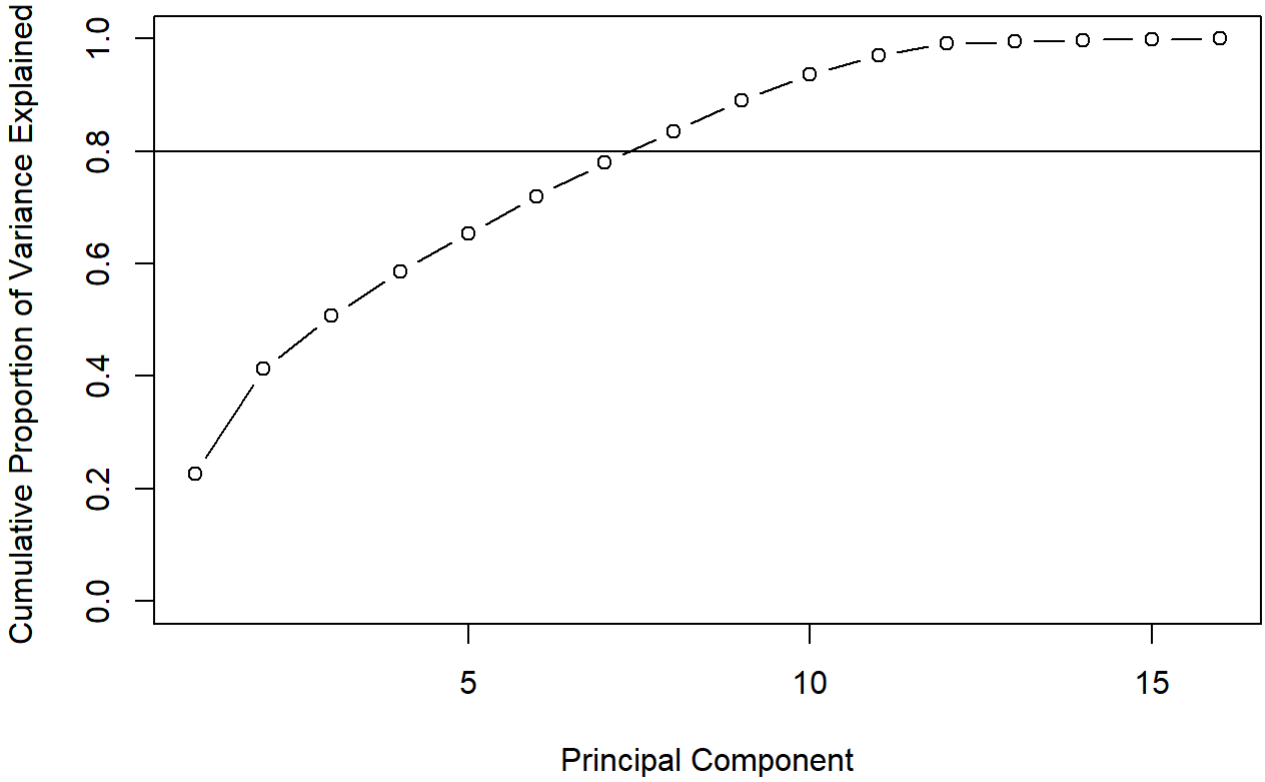
```
## Standard deviation of components is represents the percent of variation each component exp
lains
pca$sdev
```

```
##  [1] 1.9013593 1.7283384 1.2297269 1.1269246 1.0363962 1.0281014 0.9825667
##  [8] 0.9463667 0.9296317 0.8657294 0.7257815 0.5914285 0.2424554 0.2059949
## [15] 0.1436337 0.1060037
```

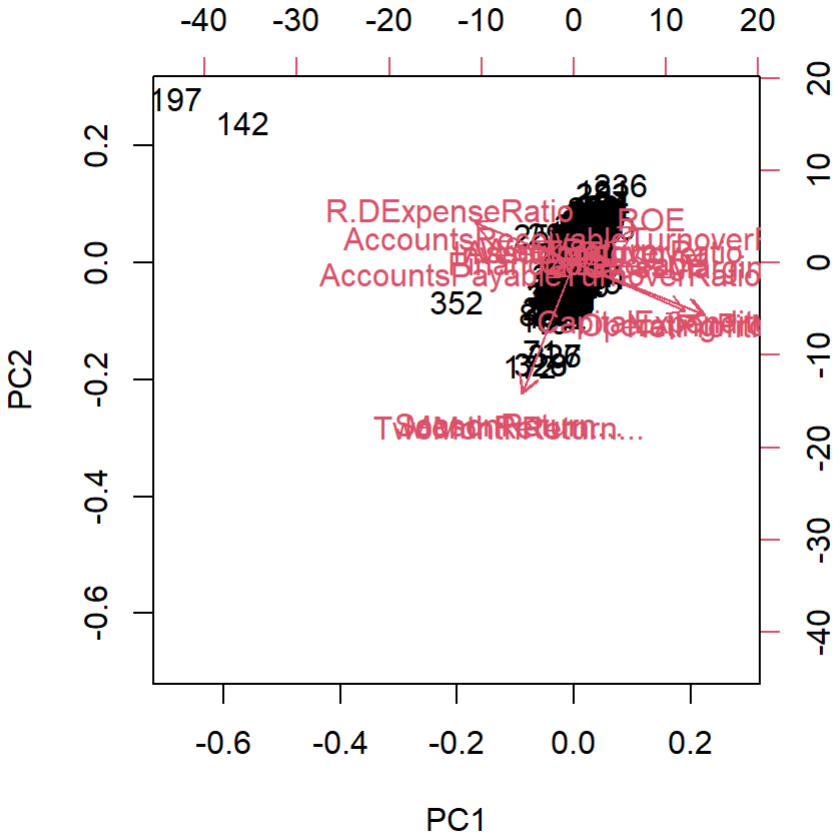
```
## Compute variance explained
pve=(pca$sdev)^2 / (sum(pca$sdev^2))
plot(pve, xlab="Principal Component", ylab="Proportion of Variance Explained ", ylim=c(0,1),t
ype='b')#scree plot
```



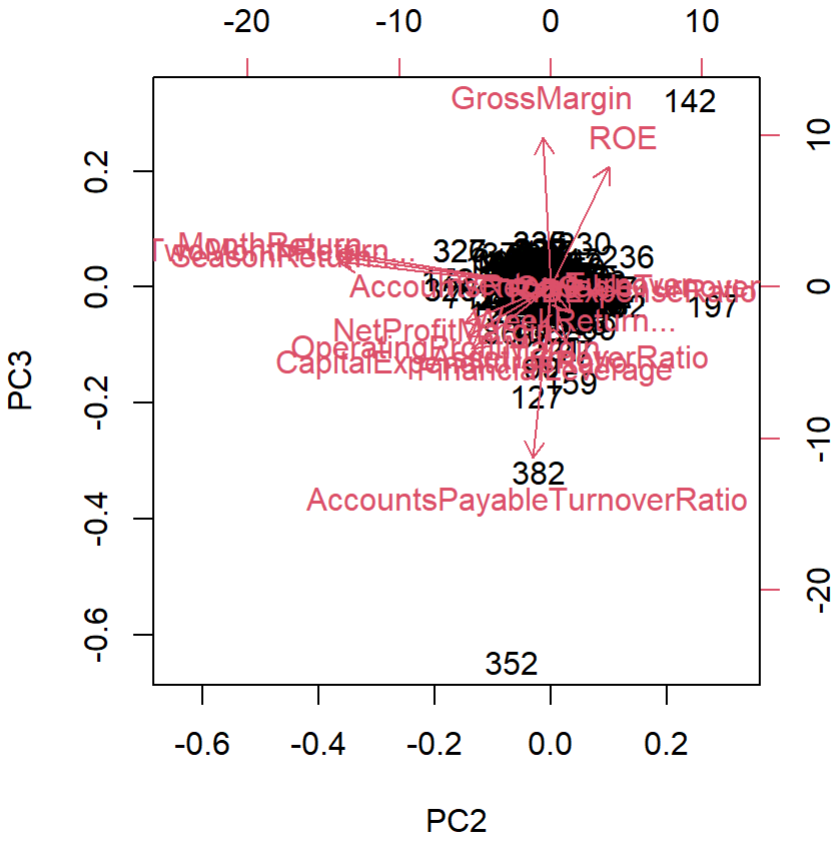

```
plot(cumsum(pve), xlab="Principal Component", ylab="Cumulative Proportion of Variance Explain
ed ", ylim=c(0,1),type='b')
abline(h=0.8)
```




```
## pc1 vs pc2 plot
biplot(pca,scale=T) #first two components
```



```
biplot(pca,scale=T,choices=2:3)
```




```
company_names <- finance$Name
```

```
PC1_scores <- pca$x[, 1]
PC2_scores <- pca$x[, 2]

threshold_PC1 <- quantile(PC1_scores, 0.9)
threshold_PC2 <- quantile(PC2_scores, 0.9)

selected_indices <- PC1_scores > threshold_PC1 & PC2_scores > threshold_PC2

selected_companies <- company_names[selected_indices]

selected_companies
```

```
##  [1] "新麥"       "金像電"     "三商電"     "偉訓"       "僑威"
##  [6] "弘塑"       "聯德"       "佳穎"       "先進光"     "聯上"
## [11] "協易機"     "科嶠"       "強生"       "材料-KY"    "虹堡"
## [16] "正能量智能" "正能量智能" "正能量智能" "正能量智能" "新門"
## [21] "富驊"       "亞翔"       "驊宏資"     "華孚"       "勁豐"
## [26] "德勝"       "森田"       "國統"
```