Factor

```
library(corrplot)
```

```
## corrplot 0.84 loaded
```

```
library(FactoMineR)
library(factoextra)
```

```
## Loading required package: ggplot2
```

```
## Welcome! Related Books: `Practical Guide To Cluster Analysis in R` at https://goo.gl/13EFCZ
```

```
library("dplyr")
```

```
##
## Attaching package: 'dplyr'
```

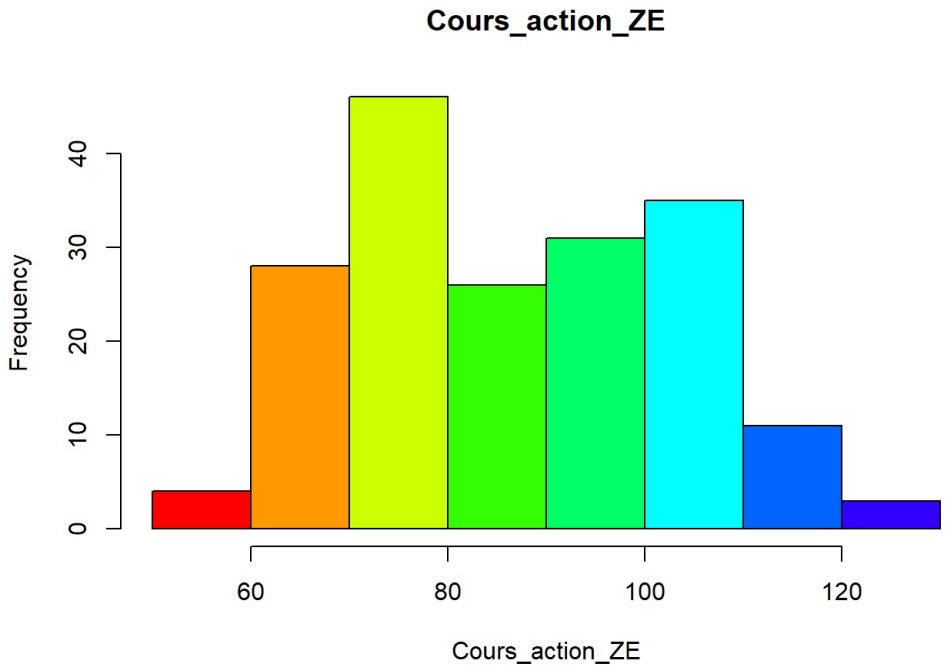
```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

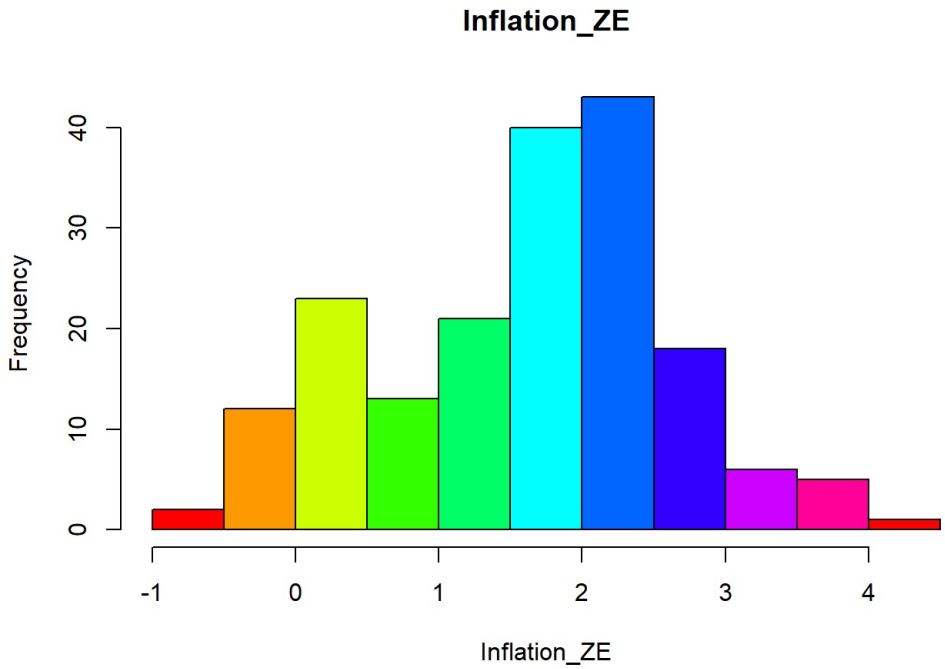
```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

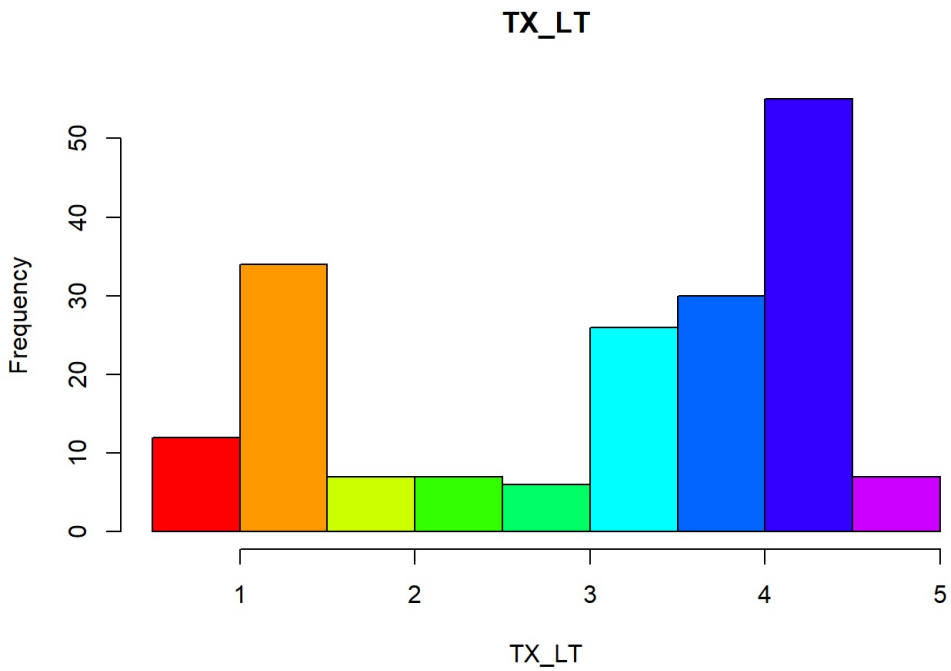
```
setwd('D:/Documents/Cours M2 MoSEF/Projets M2 MoSEF/Finance Base/')
table <- read.csv("DF_Taux.csv", header=TRUE,sep=';')

table$Cours_action_ZE=gsub(",", '.', table$Cours_action_ZE, fixed = T)
table$Inflation_ZE=gsub(",", '.', table$Inflation_ZE, fixed = T)
table$TX_LT=gsub(",", '.', table$TX_LT, fixed = T)
table$Var_CAC40=gsub("%", '', table$Var_CAC40, fixed = T)
table$Var_FTSE100=gsub("%", '', table$Var_FTSE100, fixed = T)
table$Var_DAX=gsub("%", '', table$Var_DAX, fixed = T)
table$Var_EUST50=gsub("%", '', table$Var_EUST50, fixed = T)
table$Var_CAC40=gsub(",", '.', table$Var_CAC40, fixed = T)
table$Var_FTSE100=gsub(",", '.', table$Var_FTSE100, fixed = T)
table$Var_DAX=gsub(",", '.', table$Var_DAX, fixed = T)
table$Var_EUST50=gsub(",", '.', table$Var_EUST50, fixed = T)
table$TX_change_ZE=gsub(",", '.', table$TX_change_ZE, fixed = T)
table$PIB_ZE=gsub(",", '.', table$PIB_ZE, fixed = T)
table$TX_change_ZE=gsub(",", '.', table$TX_change_ZE, fixed = T)
table$PIB_ZE=gsub(",", '.', table$PIB_ZE, fixed = T)
table$PIB_G7=gsub(",", '.', table$PIB_G7, fixed = T)
table$FBCF_EU=gsub(",", '.', table$FBCF_EU, fixed = T)
table$FIDLEUI.LX.Equity=gsub(",", '.', table$FIDLEUI.LX.Equity, fixed = T)


table$Cours_action_ZE= as.numeric(table$Cours_action_ZE)
table$Inflation_ZE= as.numeric(table$Inflation_ZE)
table$TX_LT= as.numeric(table$TX_LT)
table$Var_CAC40= as.numeric(table$Var_CAC40)
table$Var_FTSE100= as.numeric(table$Var_FTSE100)
table$Var_DAX= as.numeric(table$Var_DAX)
table$Var_EUST50= as.numeric(table$Var_EUST50)
table$TX_change_ZE= as.numeric(table$TX_change_ZE)
table$PIB_ZE= as.numeric(table$PIB_ZE)
table$PIB_G7= as.numeric(table$PIB_G7)
table$FBCF_EU= as.numeric(table$FBCF_EU)
table$FIDLEUI.LX.Equity= as.numeric(table$FIDLEUI.LX.Equity)


table2.active <- table[, 2:12]
nume=Filter(is.numeric, table2.active)
```

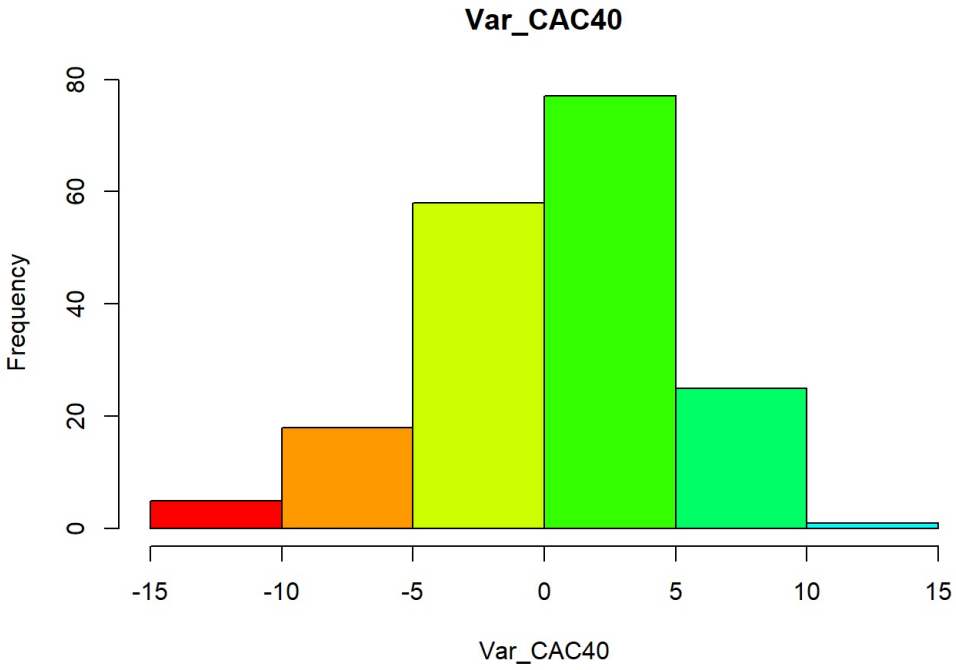
```
database <- table
```

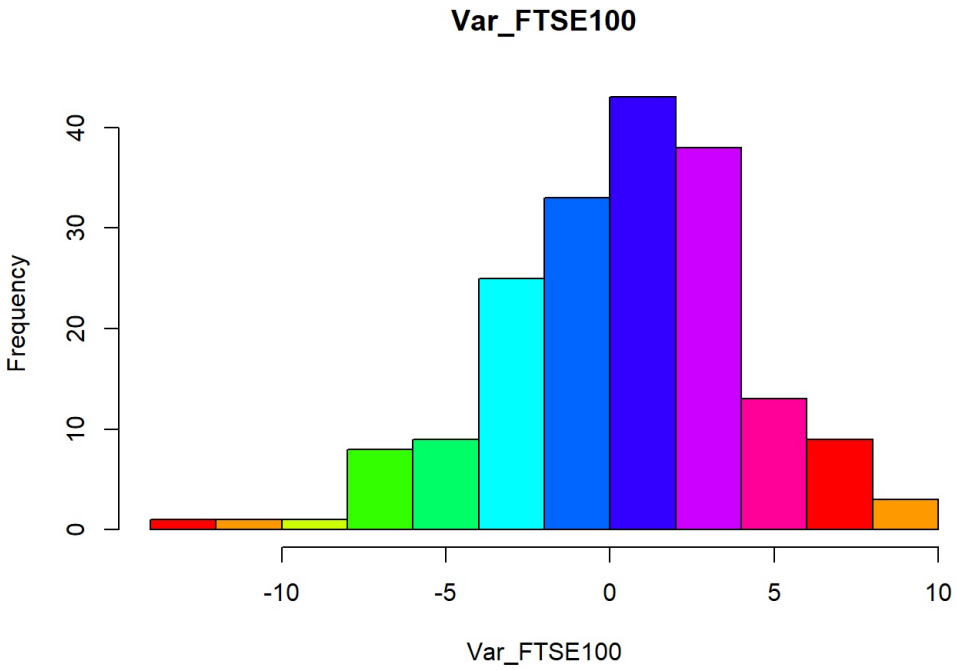
```
#Histo des valeurs quanti

par(mfrow=c(1,1))#Pour mettre les 6 histos... sur le meme graph
for(x in seq(1, length(nume)))hist(nume[,x], xlab=names(nume[x]),
                                   col=rainbow(10), main=names(nume[x]))
```

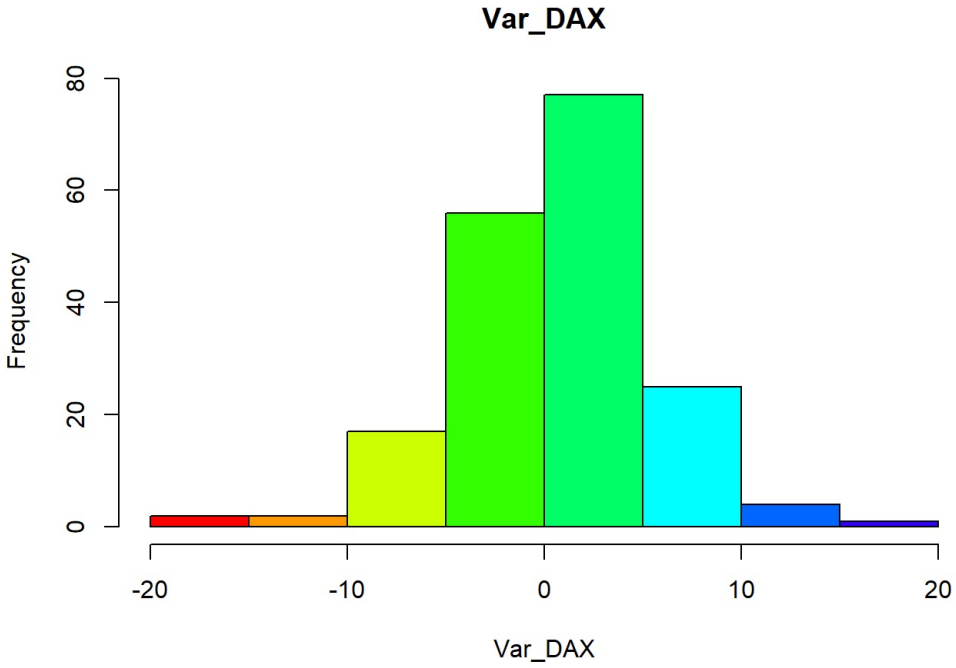

Cours_action_ZE
Frequency
0
10
20
30
40
60
80
100
120
Cours_action_ZE

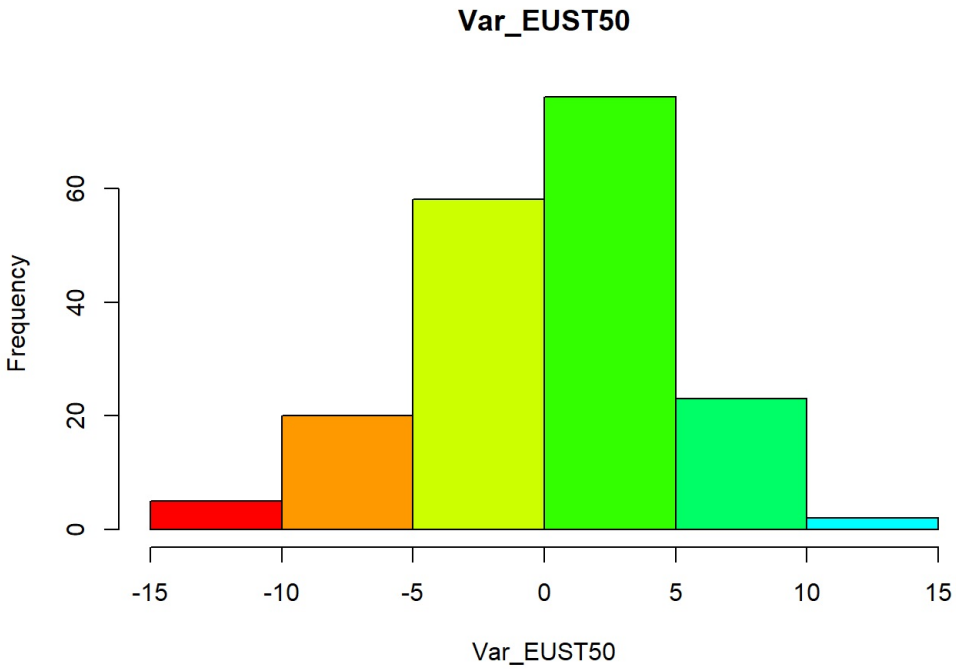

Inflation_ZE
Frequency
0
10
20
30
40
-1
0
1
2
3
4
Inflation_ZE

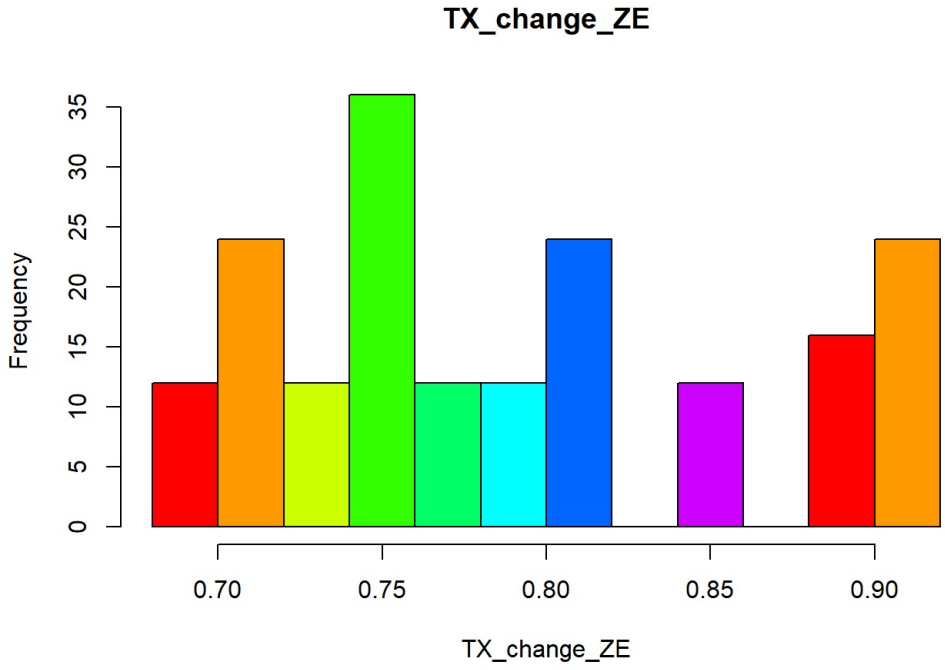

TX_LT
Frequency
0
10
20
30
40
50
1
2
3
4
5
TX_LT

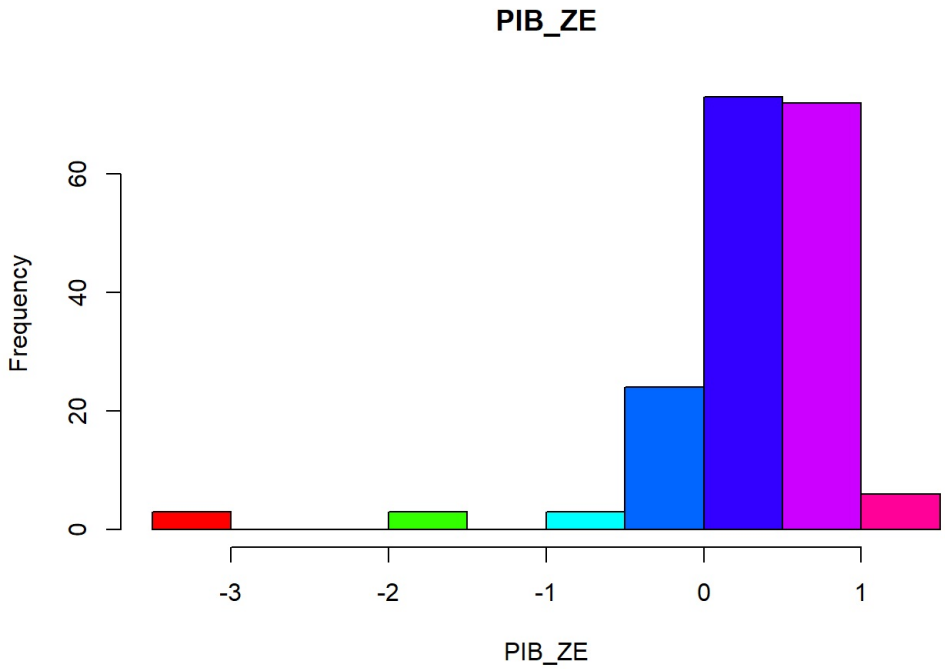

Var_CAC40
Frequency
0
20
40
60
80
-15
-10
-5
0
5
10
15
Var_CAC40

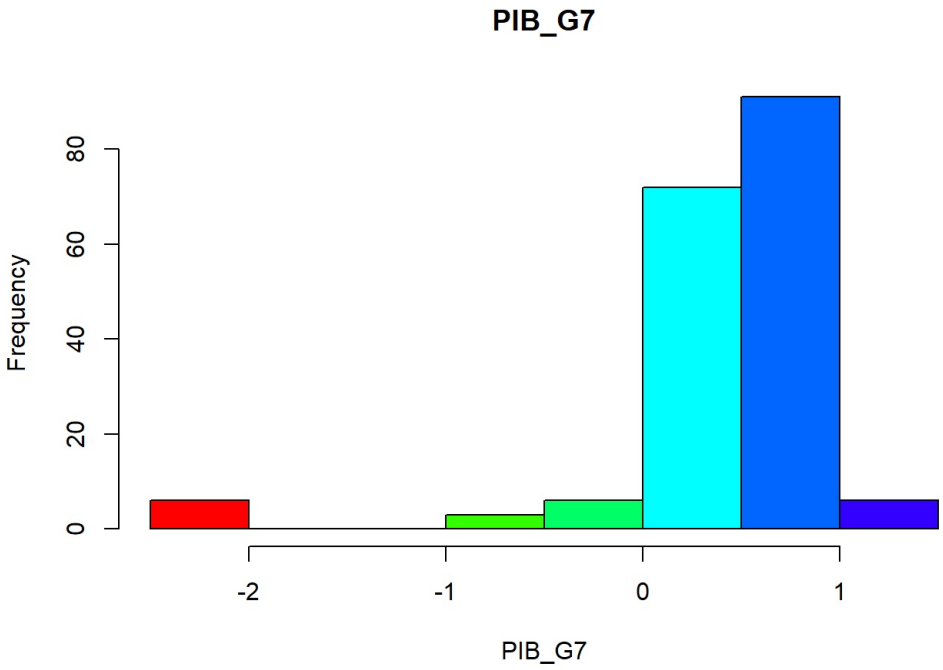

Var_FTSE100
Frequency
0
10
20
30
40
-10
-5
0
5
10
Var_FTSE100

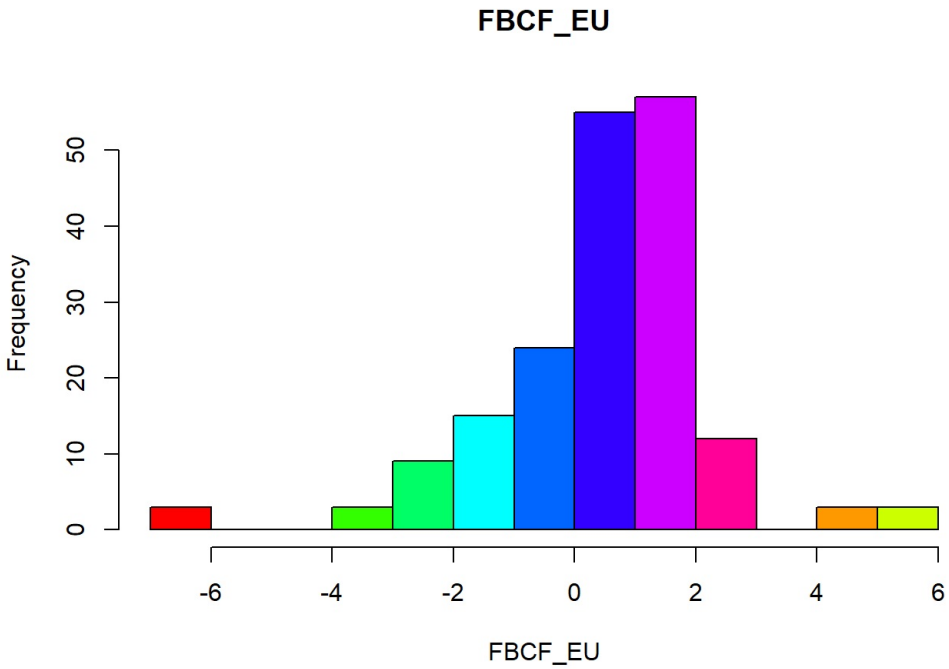

Var_DAX
Frequency
0
20
40
60
80
-20
-10
0
10
20
Var_DAX


Var_EUST50
Frequency
0
20
40
60
-15
-10
-5
0
5
10
15
Var_EUST50

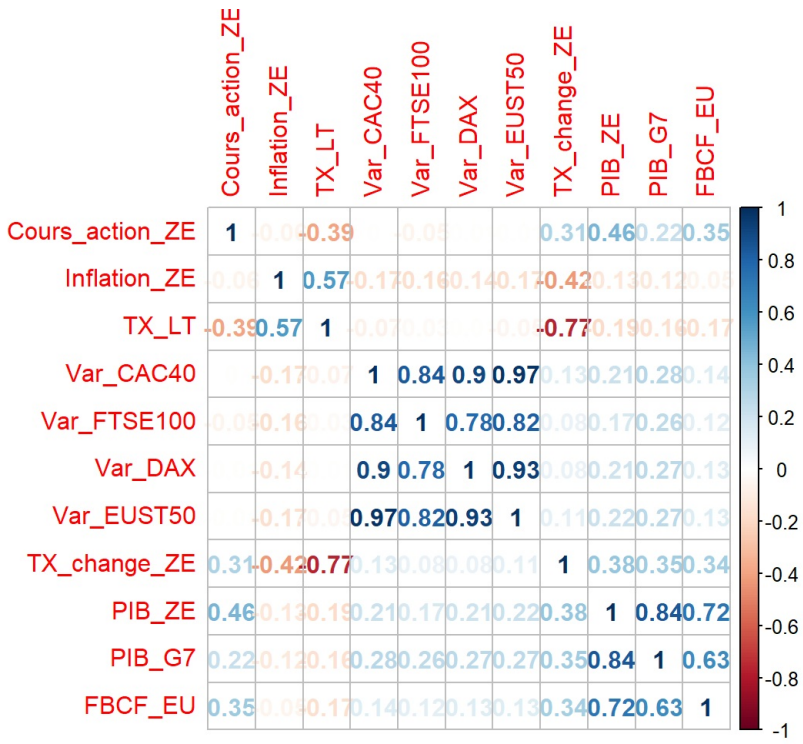

TX_change_ZE
Frequency
0
5
10
15
20
25
30
35
0.70
0.75
0.80
0.85
0.90
TX_change_ZE


PIB_ZE
Frequency
0
20
40
60
-3
-2
-1
0
1
PIB_ZE






```
M <- cor(nume)
corrplot(M, method='number')
```



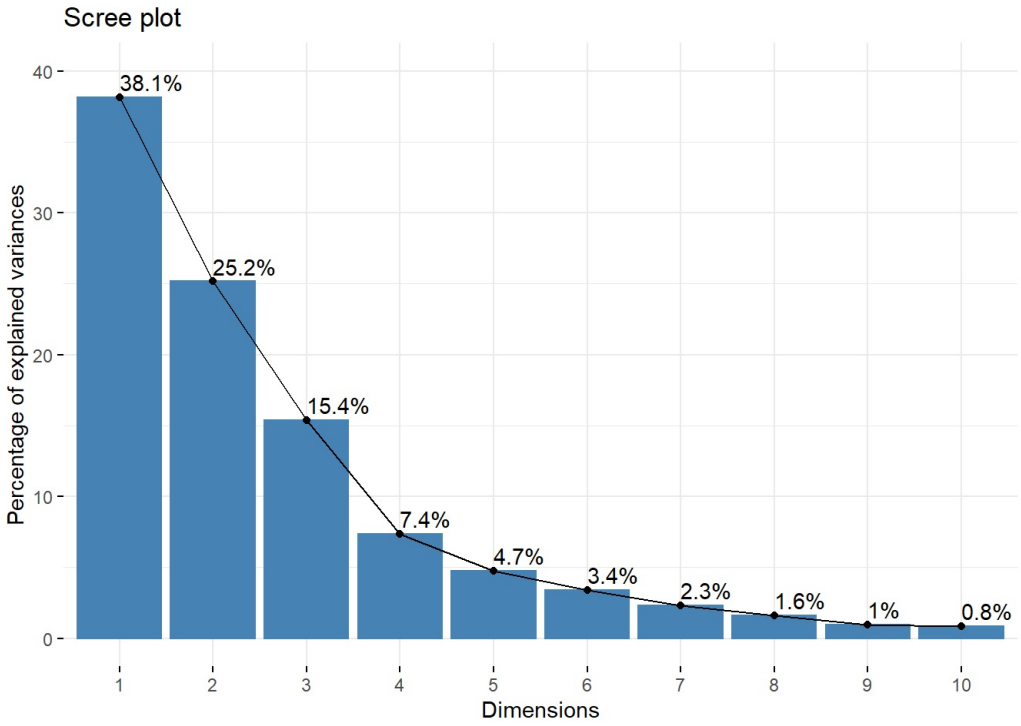

```
summary(nume)
```

```
##  Cours_action_ZE   Inflation_ZE        TX_LT          Var_CAC40
##  Min.   : 51.83   Min.   :-0.600   Min.   :0.6133   Min.   :-13.5200
##  1st Qu.: 72.88   1st Qu.: 0.800   1st Qu.:1.5179   1st Qu.: -2.3400
##  Median : 87.03   Median : 1.900   Median :3.5086   Median :  0.8400
##  Mean   : 86.70   Mean   : 1.661   Mean   :3.0439   Mean   :  0.2968
##  3rd Qu.:100.61   3rd Qu.: 2.400   3rd Qu.:4.1040   3rd Qu.:  3.2025
##  Max.   :121.66   Max.   : 4.100   Max.   :4.8145   Max.   : 12.5600
##   Var_FTSE100          Var_DAX           Var_EUST50       TX_change_ZE
##  Min.   :-13.0200   Min.   :-19.1900   Min.   :-14.690   Min.   :0.6827
##  1st Qu.: -1.9000   1st Qu.: -2.2850   1st Qu.: -2.650   1st Qu.:0.7306
##  Median :  0.8000   Median :  1.3200   Median :  0.715   Median :0.7783
##  Mean   :  0.3276   Mean   :  0.7329   Mean   :  0.199   Mean   :0.7914
##  3rd Qu.:  2.6900   3rd Qu.:  3.8625   3rd Qu.:  3.170   3rd Qu.:0.8472
##  Max.   :  8.4500   Max.   : 16.7600   Max.   : 14.690   Max.   :0.9040
##      PIB_ZE            PIB_G7           FBCF_EU
##  Min.   :-3.1571   Min.   :-2.2794   Min.   :-6.0413
##  1st Qu.: 0.2166   1st Qu.: 0.3027   1st Qu.:-0.3942
##  Median : 0.4441   Median : 0.5072   Median : 0.7982
##  Mean   : 0.3100   Mean   : 0.3923   Mean   : 0.4947
##  3rd Qu.: 0.6183   3rd Qu.: 0.6179   3rd Qu.: 1.3582
##  Max.   : 1.1937   Max.   : 1.0930   Max.   : 5.2133
```

```
#PCA
res.pca <- PCA(nume , scale.unit=TRUE,graph=FALSE)

#Calcul des "eigenvalue"
eig.val <- get_eigenvalue(res.pca)
eig.val
```

```
##        eigenvalue variance.percent cumulative.variance.percent
## Dim.1  4.19365804       38.1241640                    38.12416
## Dim.2  2.76701092       25.1546447                    63.27881
## Dim.3  1.68975928       15.3614480                    78.64026
## Dim.4  0.80874967        7.3522697                    85.99253
## Dim.5  0.52105112        4.7368284                    90.72935
## Dim.6  0.37329881        3.3936255                    94.12298
## Dim.7  0.25470851        2.3155319                    96.43851
## Dim.8  0.17470566        1.5882333                    98.02675
## Dim.9  0.10498894        0.9544449                    98.98119
## Dim.10 0.09232855        0.8393504                    99.82054
## Dim.11 0.01974050        0.1794591                   100.00000
```

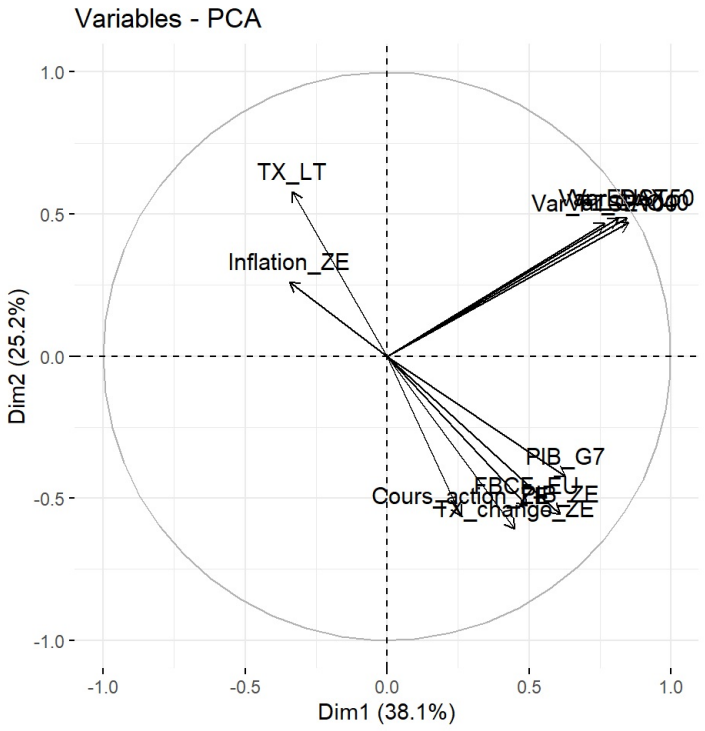
```
#Graph de la vairance expliquée par dimension
fviz_eig(res.pca, addlabels= TRUE , ylim = c(0,40))
```



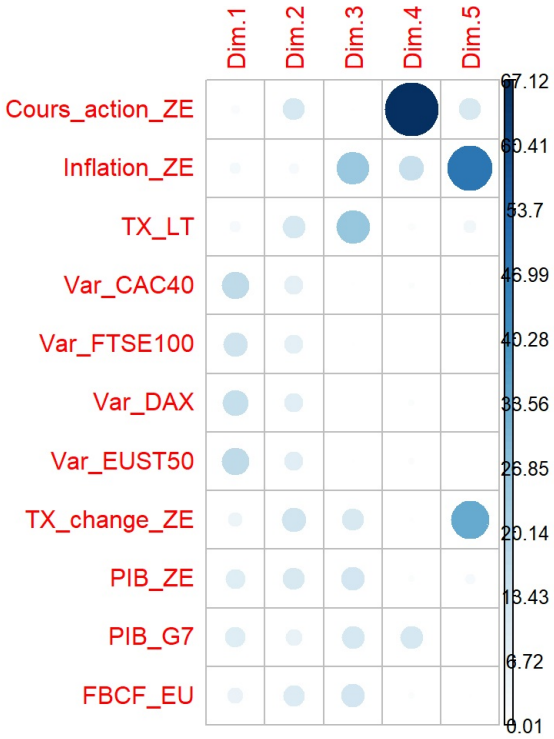

```
#Extraction des résultats
var <- get_pca_var(res.pca)
head(var$coord, 5)
```

```
##                     Dim.1      Dim.2       Dim.3        Dim.4       Dim.5
## Cours_action_ZE  0.2588638 -0.5631194  0.06366975  0.736768539 -0.23817722
## Inflation_ZE    -0.3435153  0.2608874  0.65464775  0.347644143  0.50317550
## TX_LT           -0.3332497  0.5782036  0.66029710 -0.098639924 -0.14126532
## Var_CAC40        0.8504850  0.4701966 -0.07097303  0.079073058  0.03048987
## Var_FTSE100      0.7659483  0.4679324 -0.05368413  0.008991446  0.00920523
```

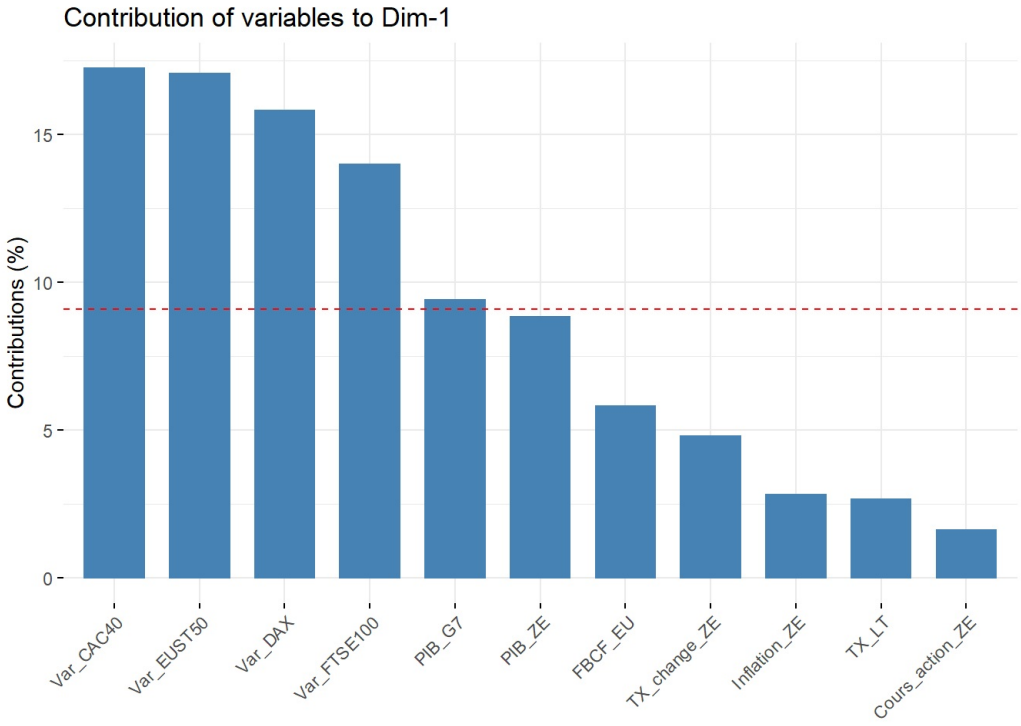
```
#Graph PCA
fviz_pca_var(res.pca, col.var = "black")
```



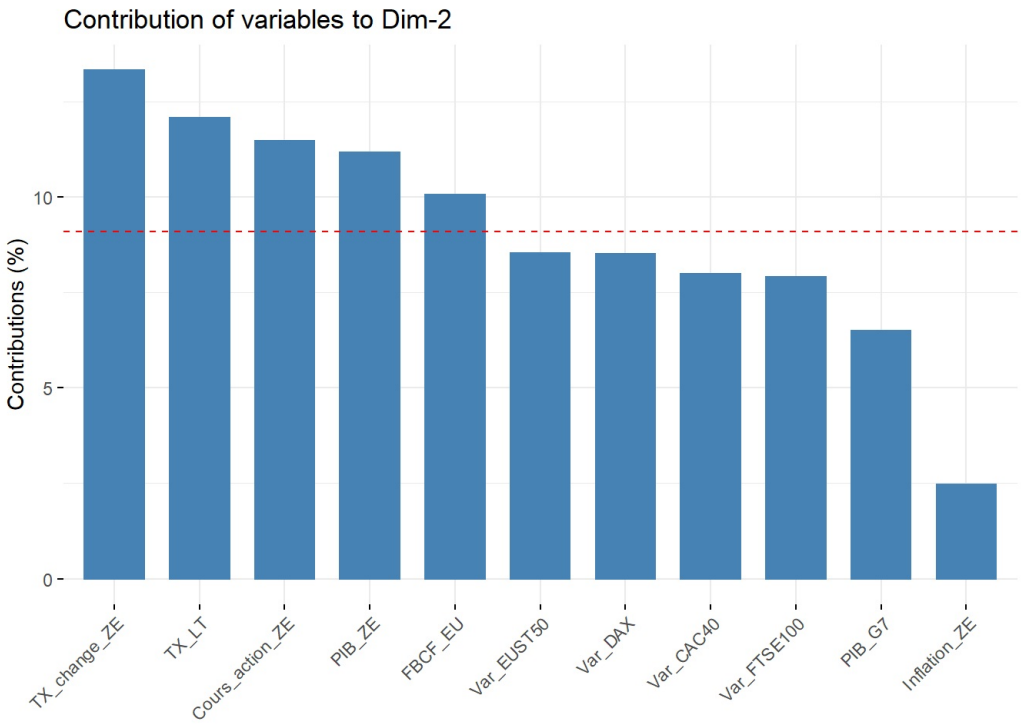

```
#Corrélation des variables pour les différentes dimensions
corrplot(var$contrib, is.corr=FALSE)
```



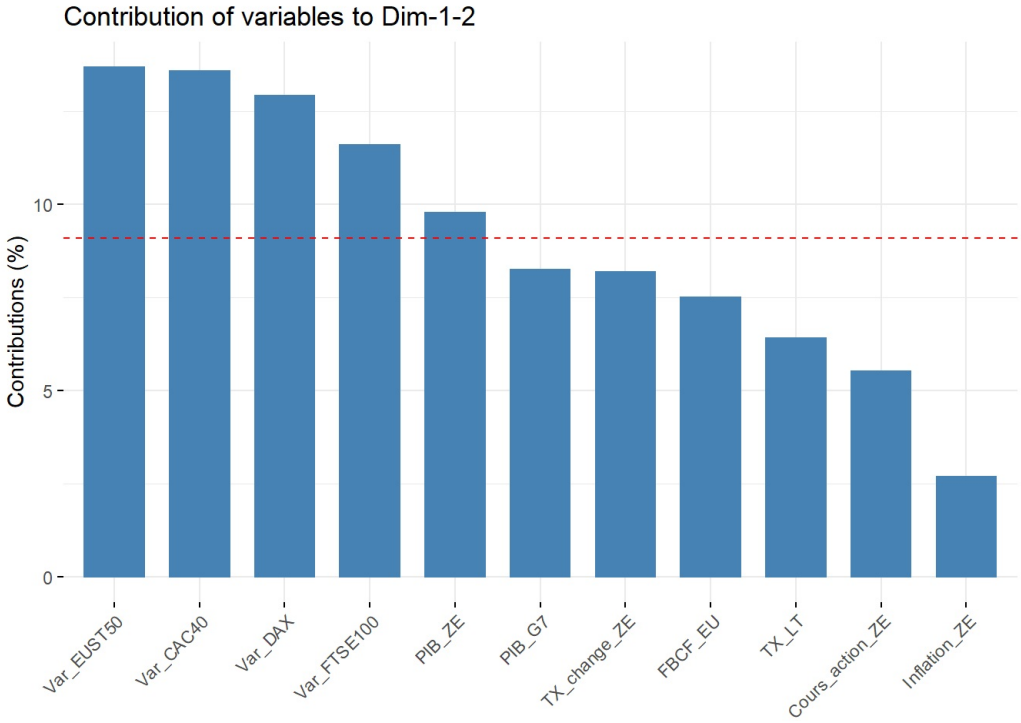

```
#Contributions pour les différents axes
fviz_contrib(res.pca, choice = "var", axes = 1)
```




```
fviz_contrib(res.pca, choice = "var", axes = 2)
```



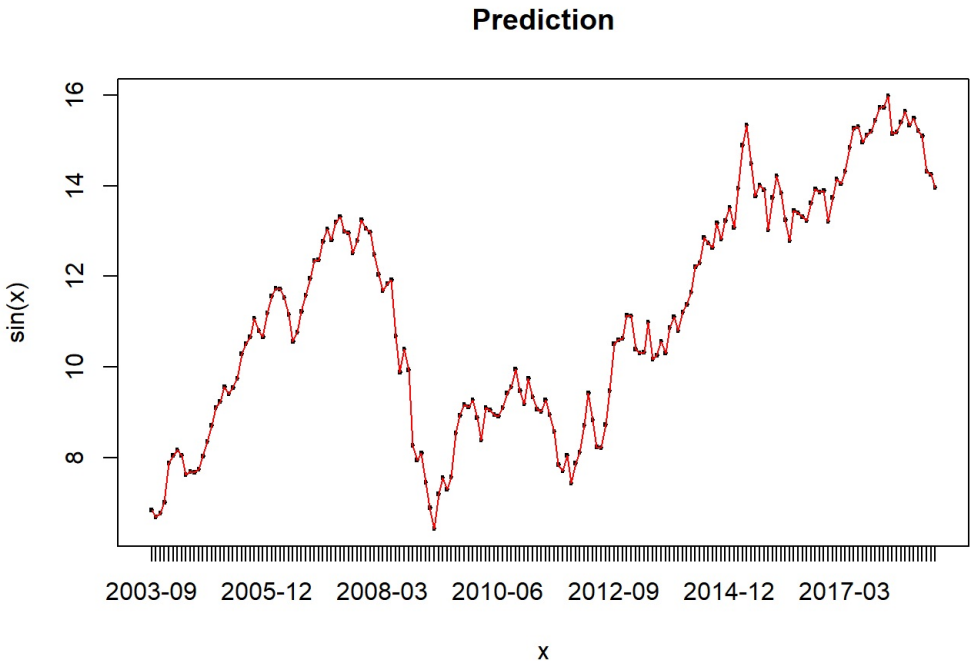

```
fviz_contrib(res.pca, choice = "var", axes = 1:2)
```



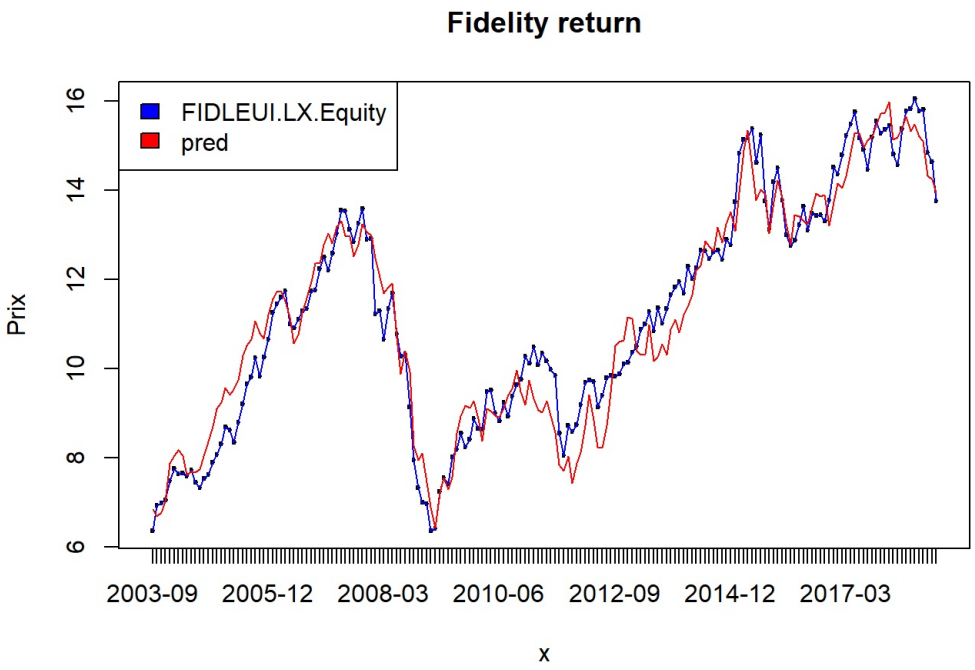

```
table2=table
table$'TIME'=NULL

#intercept <- table$
#rdt.lm <- lm(I(FIDLEUI.LX.Equity - intercept)~ 0 + ., data=table)


rdt.lm <- lm(FIDLEUI.LX.Equity~ ., data=table)
summary(rdt.lm)
```

```
##
## Call:
## lm(formula = FIDLEUI.LX.Equity ~ ., data = table)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.16418 -0.42227 -0.04238  0.40358  1.37550
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     10.376818   1.166677   8.894 7.88e-16 ***
## Cours_action_ZE  0.101753   0.003699  27.507  < 2e-16 ***
## Inflation_ZE     0.140343   0.057629   2.435   0.0159 *
## TX_LT           -1.300540   0.068980 -18.854  < 2e-16 ***
## Var_CAC40        0.025675   0.048700   0.527   0.5987
## Var_FTSE100     -0.023495   0.023442  -1.002   0.3176
## Var_DAX          0.017065   0.025782   0.662   0.5089
## Var_EUST50      -0.007063   0.053083  -0.133   0.8943
## TX_change_ZE    -5.437055   1.160539  -4.685 5.67e-06 ***
## PIB_ZE          -0.140636   0.171661  -0.819   0.4138
## PIB_G7           0.085921   0.164912   0.521   0.6030
## FBCF_EU          0.038320   0.038660   0.991   0.3230
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.6151 on 172 degrees of freedom
## Multiple R-squared:  0.9477, Adjusted R-squared:  0.9444
## F-statistic: 283.4 on 11 and 172 DF,  p-value: < 2.2e-16
```

```
table2['pred']= 10.376818 + 0.101753 * table$Cours_action_ZE + 0.140343 * table$Inflation_ZE + (-1.300540) * table
$TX_LT + (-5.437055) * table$TX_change_ZE

#library(ggplot2)
#par(mfrow=c(1,1))
plot(table2$TIME, table2$pred,
     main="Prediction",col='red',
     ylab="sin(x)")
lines(table2$TIME, table2$pred,
      main="Prediction",col='red',
      ylab="sin(x)")
```



```
plot(table2$TIME, table$FIDLEUI.LX.Equity,
     main="Fidelity return",col='red',
     ylab="Prix")
lines(table2$TIME, table$FIDLEUI.LX.Equity,
      main="Fidelity return",col='red',
      ylab="Prix")

lines(table2$TIME, table2$FIDLEUI.LX.Equity,
     main="Overlaying Graphs",
     ylab="",
     type="l",
     col="blue")
lines(table2$TIME,table2$pred, col="red")
legend("topleft",
       c("FIDLEUI.LX.Equity","pred"),
       fill=c("blue","red")
)
```



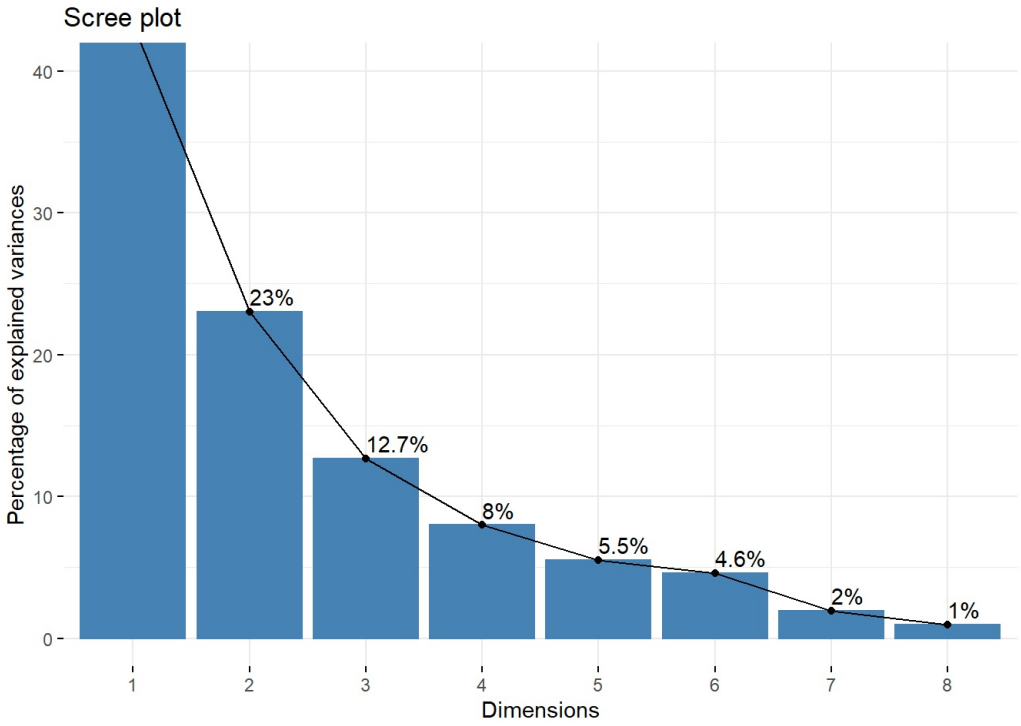

```
table <- database
```

```
table$'TIME'=NULL
table$'Var_CAC40'=NULL
table$'Var_FTSE100'=NULL
table$'Var_DAX'=NULL
```

```
# Suppression des variables fortement corrélées.
table2.active <- table[, 2:9]

#PCA
res.pca <- PCA(table2.active , scale.unit=TRUE,graph=FALSE)

#Calcul des "eigenvalue"
eig.val <- get_eigenvalue(res.pca)
eig.val
```

```
##       eigenvalue variance.percent cumulative.variance.percent
## Dim.1 3.46737642       43.3422052                    43.34221
## Dim.2 1.84017917       23.0022397                    66.34444
## Dim.3 1.01430137       12.6787671                    79.02321
## Dim.4 0.63815382        7.9769228                    87.00013
## Dim.5 0.43925308        5.4906635                    92.49080
## Dim.6 0.36752144        4.5940180                    97.08482
## Dim.7 0.15605231        1.9506538                    99.03547
## Dim.8 0.07716239        0.9645299                   100.00000
```

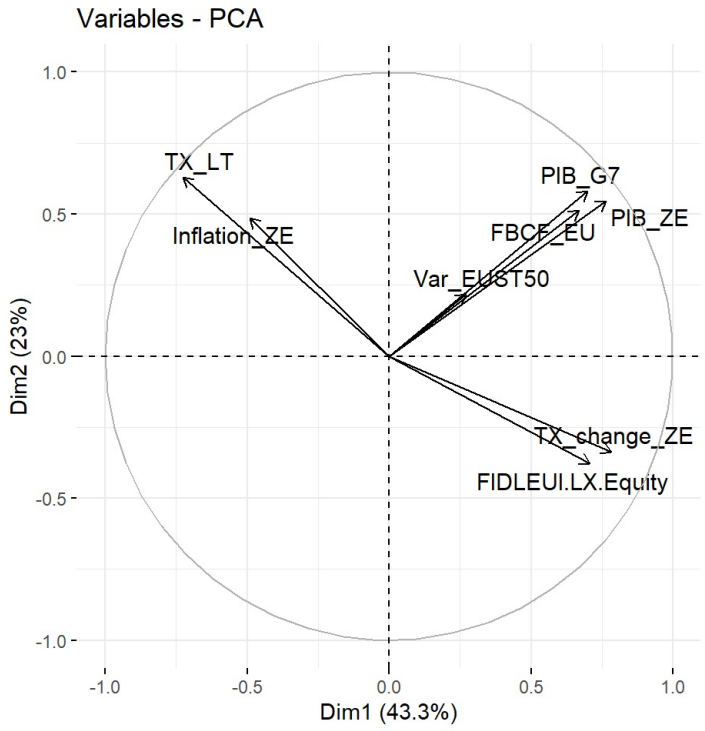
```
#Graph de la vairance expliquée par dimension
fviz_eig(res.pca, addlabels= TRUE , ylim = c(0,40))
```



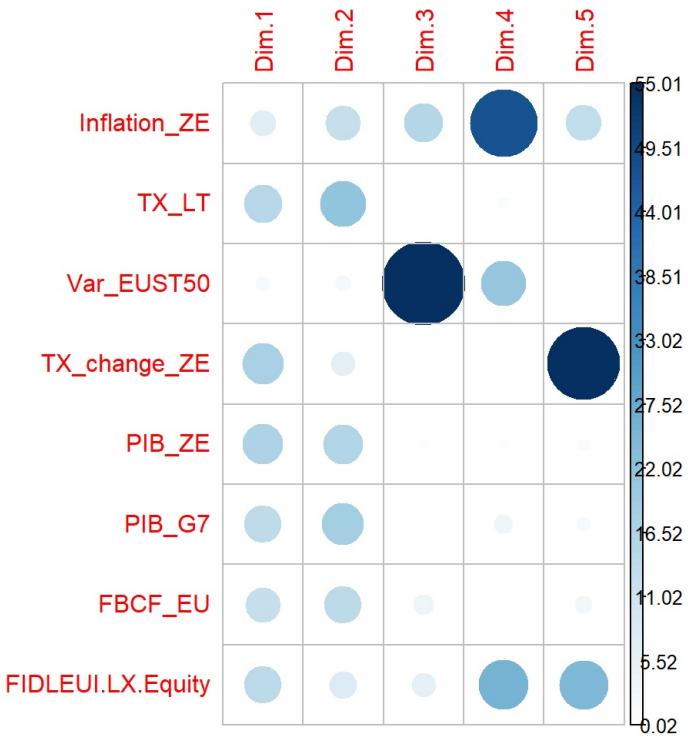

```
#Extraction des résultats
var <- get_pca_var(res.pca)
head(var$coord, 5)
```

```
##                  Dim.1      Dim.2       Dim.3        Dim.4       Dim.5
## Inflation_ZE -0.4895080  0.4858939  0.39758462  0.549854775  0.24236164
## TX_LT        -0.7261310  0.6304489 -0.05109121 -0.086943865 -0.04858616
## Var_EUST50    0.2702586  0.2187107 -0.86038687  0.366985992  0.00917353
## TX_change_ZE  0.7824803 -0.3371534  0.04667271 -0.002774574  0.49157384
## PIB_ZE        0.7631523  0.5467799  0.08507616 -0.071126739 -0.07848079
```

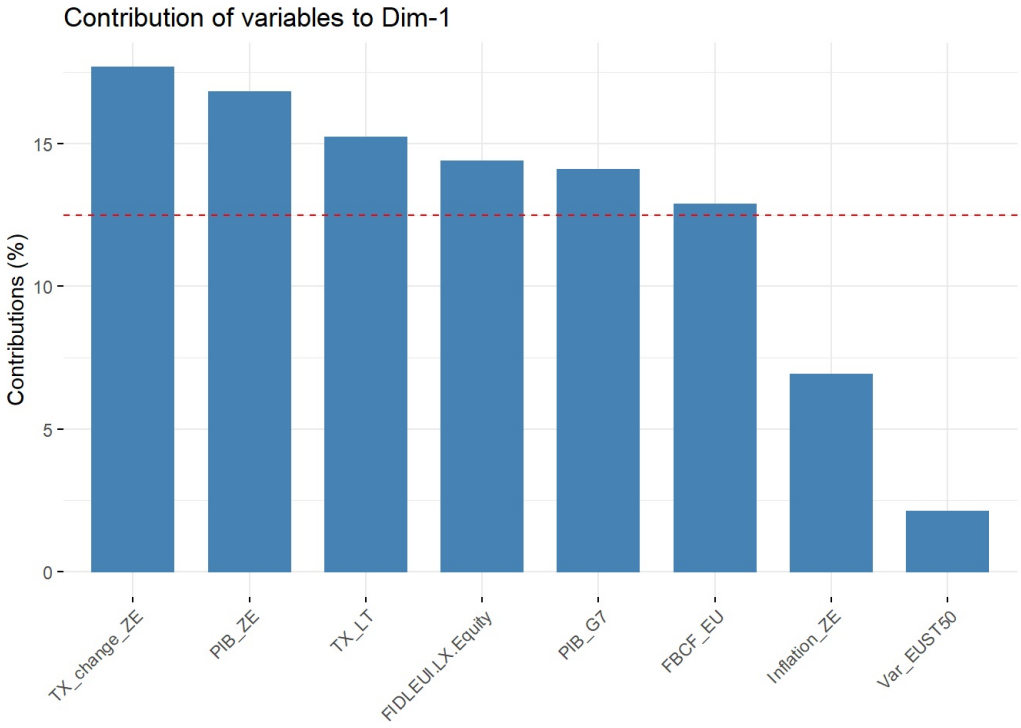
```
#Graph PCA
fviz_pca_var(res.pca, col.var = "black",repel=TRUE)
```



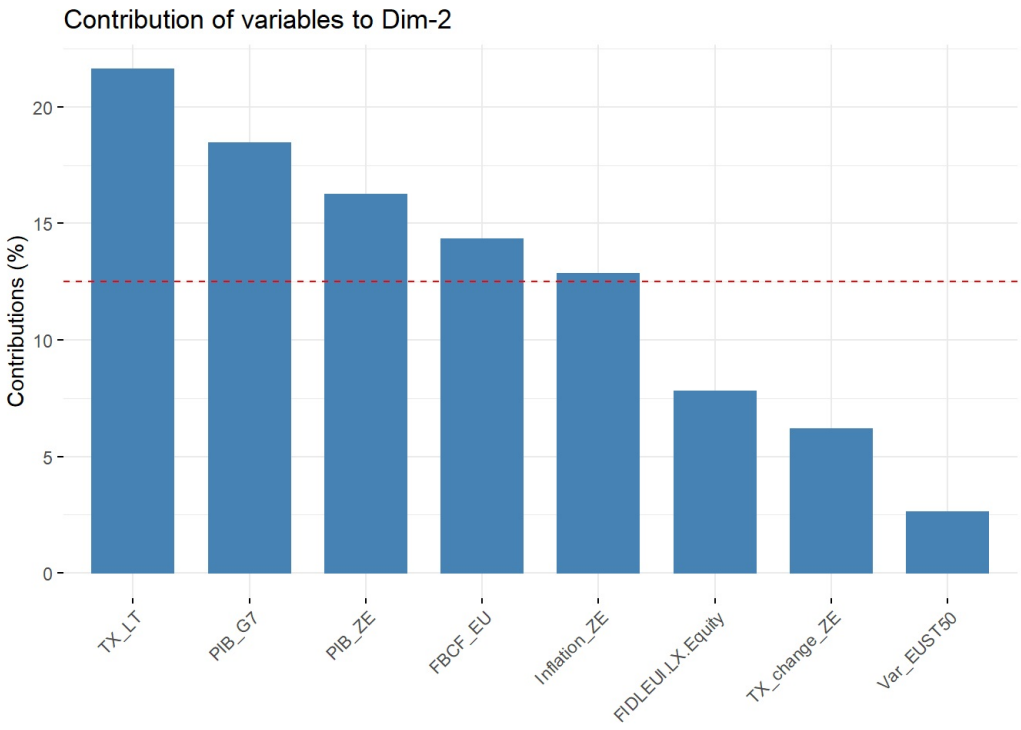

```
#Corrélation des variables pour les différentes dimensions
corrplot(var$contrib, is.corr=FALSE)
```



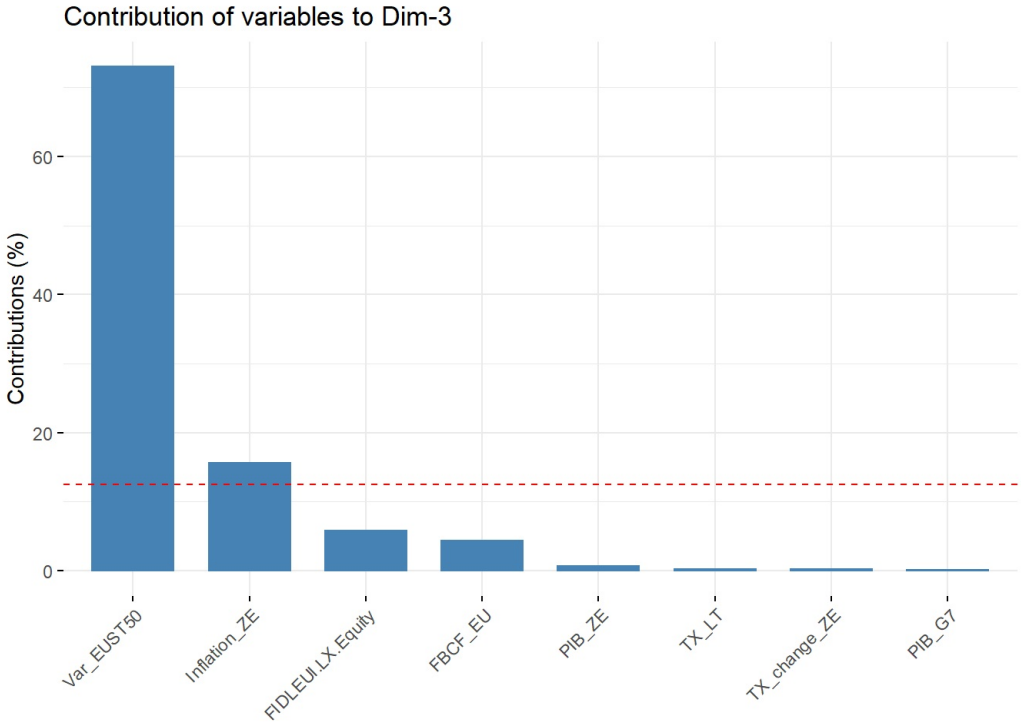

```
#Contributions pour les différents axes
fviz_contrib(res.pca, choice = "var", axes = 1)
```



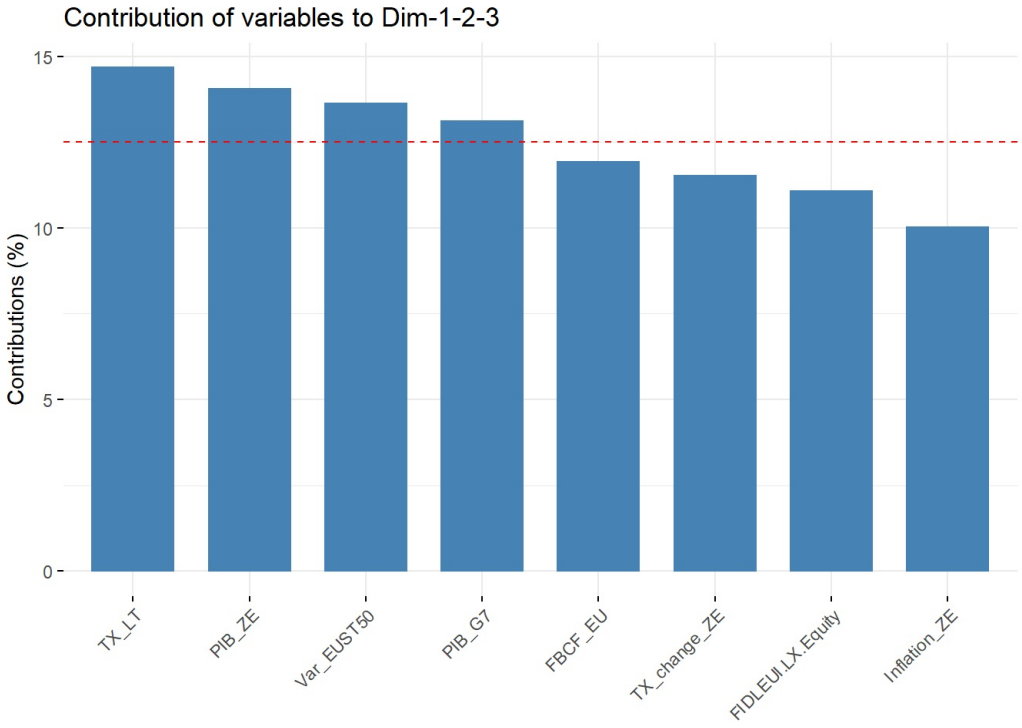

```
fviz_contrib(res.pca, choice = "var", axes = 2)
```




```
fviz_contrib(res.pca, choice = "var", axes = 3)
```




```
fviz_contrib(res.pca, choice = "var", axes = 1:3)
```

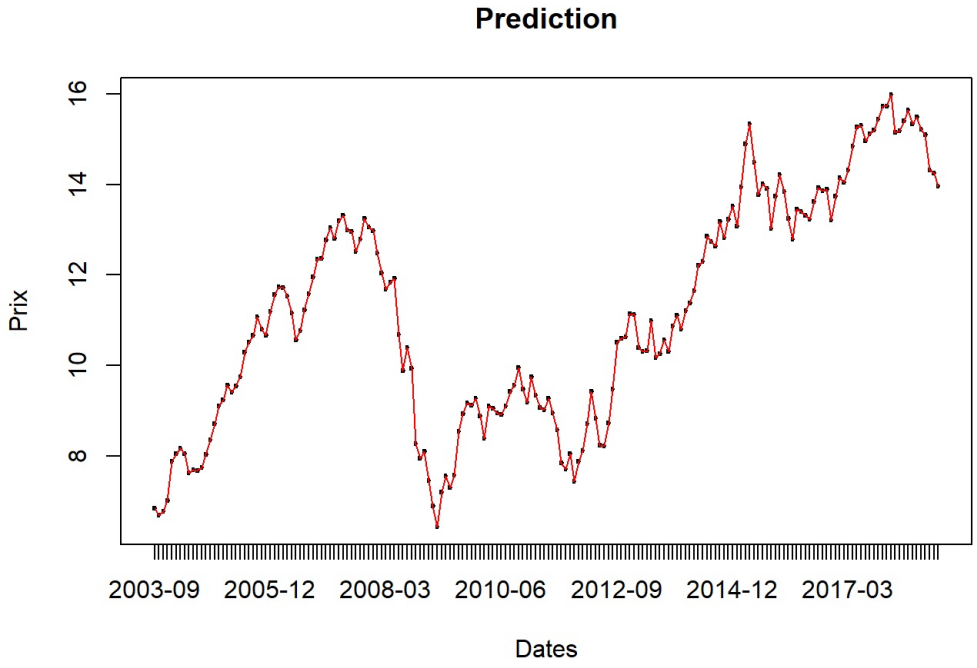



```
#table2=table
rdt.lm <- lm(FIDLEUI.LX.Equity~ ., data=table)
summary(rdt.lm)
```

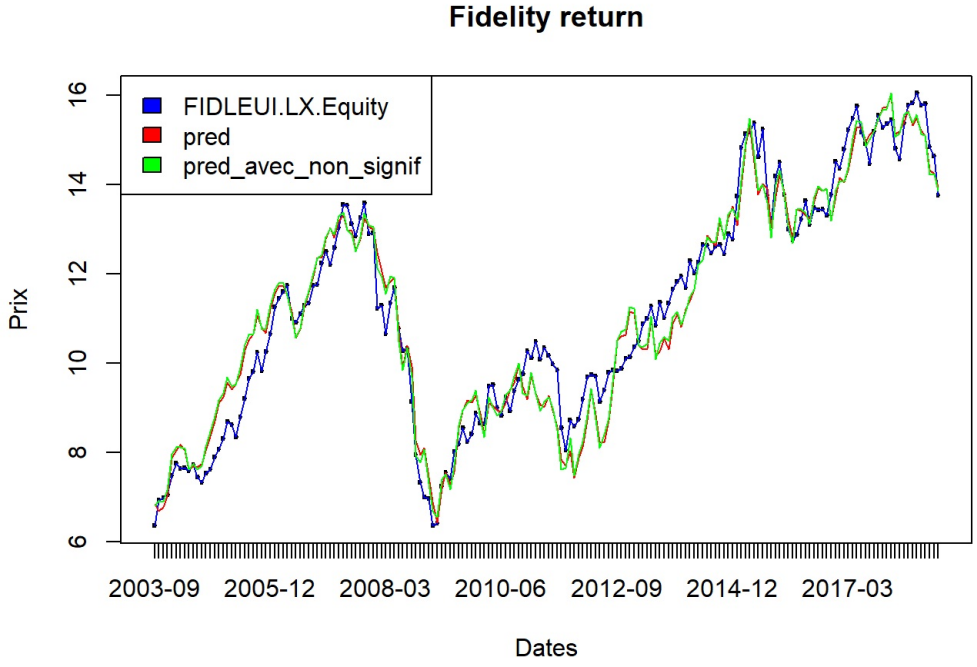
```
##
## Call:
## lm(formula = FIDLEUI.LX.Equity ~ ., data = table)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1.1992 -0.4289 -0.0262  0.4187  1.3385
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     10.276661   1.155379   8.895 7.14e-16 ***
## Cours_action_ZE  0.102008   0.003673  27.774  < 2e-16 ***
## Inflation_ZE     0.143172   0.057235   2.501   0.0133 *
## TX_LT           -1.297489   0.068348 -18.984  < 2e-16 ***
## Var_EUST50       0.019479   0.010144   1.920   0.0565 .
## TX_change_ZE    -5.344815   1.148825  -4.652 6.45e-06 ***
## PIB_ZE          -0.136919   0.169174  -0.809   0.4194
## PIB_G7           0.079337   0.161983   0.490   0.6249
## FBCF_EU          0.037506   0.038456   0.975   0.3308
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.6122 on 175 degrees of freedom
## Multiple R-squared:  0.9473, Adjusted R-squared:  0.9449
## F-statistic: 393.1 on 8 and 175 DF,  p-value: < 2.2e-16
```

```
table2['pred_variables_signi']= 10.276661 + 0.102008 * table$Cours_action_ZE   + 0.143172 * table$Inflation_ZE +
-1.297489 * table$TX_LT + -5.344815 * table$TX_change_ZE
table2['pred_avec_non_signif']= 10.276661 + 0.102008 * table$Cours_action_ZE   + 0.143172 * table$Inflation_ZE +
-1.297489 * table$TX_LT + -5.344815 * table$TX_change_ZE + 0.019479 * table$Var_EUST50 + -0.136919 * table$PIB_ZE
+ 0.079337 * table$PIB_G7 + 0.037506 * table$FBCF_EU
```

```
plot(table2$TIME, table2$pred,
     main="Prediction",col='red',xlab="Dates",
     ylab="Prix")

lines(table2$TIME, table2$pred,
      main="Prediction",col='red',xlab="Dates",
      ylab="Prix")
```




```
plot(table2$TIME, table2$FIDLEUI.LX.Equity,
     main="Fidelity return",col='red',xlab="Dates",
     ylab="Prix")
lines(table2$TIME, table2$FIDLEUI.LX.Equity,
      main="Fidelity return",col='red',xlab="Dates",
      ylab="Prix")

lines(table2$TIME, table2$FIDLEUI.LX.Equity,
      main="Overlaying Graphs",
      ylab="",
      xlab="Dates",
      type="l",
      col="blue")
lines(table2$TIME,table2$pred, col="red")
lines(table2$TIME,table2$pred_avec_non_signif, col="green")
legend("topleft",
       c("FIDLEUI.LX.Equity","pred","pred_avec_non_signif"),
       fill=c("blue","red","green")
)
```



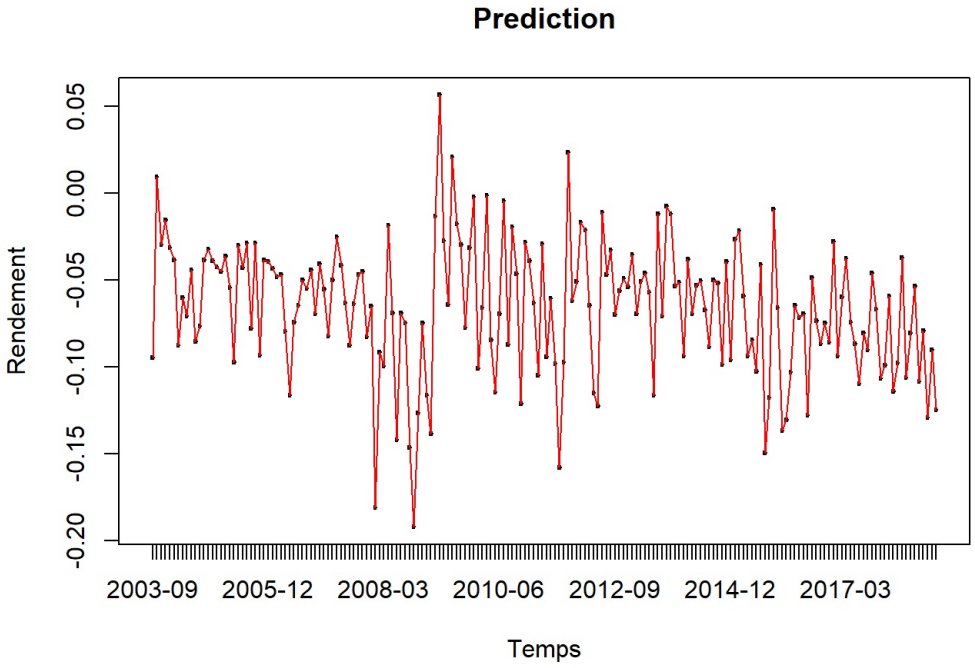
Rendements

```
table <- database
table$Shift <- lag(table$FIDLEUI.LX.Equity ,1,na.pad = TRUE)
table$Variation = (table$FIDLEUI.LX.Equity - table$Shift) /table$Shift
```

```
table2=table

table$'TIME'=NULL
table$'Var_CAC40'=NULL
table$'Var_FTSE100'=NULL
table$'Var_DAX'=NULL
table$'Shift'=NULL
# Suppression des variables fortement corrélées

rdt.lm <- lm(Variation~ ., data=table)
summary(rdt.lm)
```

```
##
## Call:
## lm(formula = Variation ~ ., data = table)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.040044 -0.011127  0.000192  0.010640  0.067046
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)       -8.810e-02  4.240e-02  -2.078   0.0392 *
## Cours_action_ZE   -8.915e-05  2.577e-04  -0.346   0.7298
## Inflation_ZE      -4.038e-03  1.757e-03  -2.299   0.0227 *
## TX_LT              7.938e-03  3.612e-03   2.197   0.0293 *
## Var_EUST50         7.495e-03  3.121e-04  24.016  < 2e-16 ***
## TX_change_ZE       6.053e-02  3.750e-02   1.614   0.1083
## PIB_ZE            -2.064e-02  5.128e-03  -4.025 8.51e-05 ***
## PIB_G7             2.494e-02  4.918e-03   5.071 1.01e-06 ***
## FBCF_EU            4.922e-04  1.163e-03   0.423   0.6726
## FIDLEUI.LX.Equity  2.706e-03  2.283e-03   1.185   0.2376
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.01846 on 173 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.8172, Adjusted R-squared:  0.8076
## F-statistic: 85.91 on 9 and 173 DF,  p-value: < 2.2e-16
```

```
# Supression des variables non significatives
table2['pred']= -8.810e-02 + 7.495e-03 * table$Var_EUST50 + -4.038e-03 * table$Inflation_ZE + 7.938e-03 * table$TX
_LT + -2.064e-02 * table$PIB_ZE + 2.494e-02 * table$PIB_G7


#library(ggplot2)
#par(mfrow=c(1,1))
plot(table2$TIME, table2$pred,
     main="Prediction",col='red',
     xlab="Temps",
     ylab="Rendement")
lines(table2$TIME, table2$pred,
      main="Prediction",col='red',
      xlab="Temps",
      ylab="Rendement")
```




```
plot(table2$TIME, table2$Variation,
     main="Fidelity return",col='red',
     xlab="Temps",
     ylab="Rendement")
lines(table2$TIME, table2$Variation,
      main="Fidelity return",col='red',
      xlab="Temps",
      ylab="Rendement")

lines(table2$TIME, table2$Variation,
      main="Overlaying Graphs",
      ylab="",
      type="l",
      col="blue")
lines(table2$TIME,table2$pred, col="red")
legend("topleft",
       c("FIDLEUI.LX.Equity","pred"),
       fill=c("blue","red")
)
```