Daniel Saldaña

A00829752

2023-09-29

Parte 1

```
M = read.csv('paises_mundo.csv')
```

```
cov(M)
```

```
##                  CrecPobl       MortInf   PorcMujeres         PNB95
## CrecPobl     1.538298e+00  2.195026e+01 -6.078026e+00 -8.933379e+04
## MortInf      2.195026e+01  1.032859e+03 -9.249342e+00 -2.269332e+06
## PorcMujeres -6.078026e+00 -9.249342e+00  7.698322e+01  2.813114e+05
## PNB95       -8.933379e+04 -2.269332e+06  2.813114e+05  4.999786e+10
## ProdElec    -4.973964e+04 -1.043435e+06  2.260248e+05  2.247791e+10
## LinTelf     -1.369079e+02 -4.381366e+03  4.499750e+02  2.039550e+07
## ConsAgua    -4.827092e+01 -1.288211e+03 -1.568313e+03  1.097481e+07
## PropBosq    -3.887018e+00 -1.466316e+01  6.517895e+01  2.474311e+05
## PropDefor    3.361974e-01  1.276296e+01  2.680592e-01 -5.806203e+04
## ConsEner    -8.384169e+02 -4.442568e+04  2.855207e+02  1.415628e+08
## EmisCO2     -1.137877e+00 -9.485500e+01 -2.150132e+00  2.501673e+05
##                  ProdElec       LinTelf      ConsAgua      PropBosq
## CrecPobl    -4.973964e+04 -1.369079e+02 -4.827092e+01     -3.887018
## MortInf     -1.043435e+06 -4.381366e+03 -1.288211e+03    -14.663158
## PorcMujeres  2.260248e+05  4.499750e+02 -1.568313e+03     65.178947
## PNB95        2.247791e+10  2.039550e+07  1.097481e+07 247431.122807
## ProdElec     1.821909e+10  7.583050e+06  1.399817e+07  70359.785965
## LinTelf      7.583050e+06  3.841247e+04  1.193110e+04    248.715789
## ConsAgua     1.399817e+07  1.193110e+04  3.301981e+05  -2220.757895
## PropBosq     7.035979e+04  2.487158e+02 -2.220758e+03    401.003509
## PropDefor   -3.180340e+04 -9.940461e+01 -6.743793e+01      2.625263
## ConsEner     6.801296e+07  3.426262e+05  2.092242e+05  -5153.438596
## EmisCO2      1.392779e+05  6.385700e+02  4.869328e+02    -12.897193
##                 PropDefor      ConsEner       EmisCO2
## CrecPobl     3.361974e-01 -8.384169e+02     -1.137877
## MortInf      1.276296e+01 -4.442568e+04    -94.855000
## PorcMujeres  2.680592e-01  2.855207e+02     -2.150132
## PNB95       -5.806203e+04  1.415628e+08 250167.323509
## ProdElec    -3.180340e+04  6.801296e+07 139277.888640
## LinTelf     -9.940461e+01  3.426262e+05    638.570000
## ConsAgua    -6.743793e+01  2.092242e+05    486.932763
## PropBosq     2.625263e+00 -5.153439e+03    -12.897193
## PropDefor    1.817253e+00 -1.051522e+03     -2.632487
## ConsEner    -1.051522e+03  5.014395e+06  10286.159781
## EmisCO2     -2.632487e+00  1.028616e+04     27.268614
```

```r
cor(M)
```

```
##                CrecPobl     MortInf PorcMujeres       PNB95    ProdElec
## CrecPobl     1.00000000  0.55067948 -0.55852711 -0.32212154 -0.29711119
## MortInf      0.55067948  1.00000000 -0.03280139 -0.31579250 -0.24053689
## PorcMujeres -0.55852711 -0.03280139  1.00000000  0.14338826  0.19085114
## PNB95       -0.32212154 -0.31579250  0.14338826  1.00000000  0.74476081
## ProdElec    -0.29711119 -0.24053689  0.19085114  0.74476081  1.00000000
## LinTelf     -0.56321228 -0.69558922  0.26167018  0.46539599  0.28664508
## ConsAgua    -0.06772953 -0.06975563 -0.31106243  0.08541500  0.18047653
## PropBosq    -0.15650281 -0.02278415  0.37096694  0.05525919  0.02603078
## PropDefor    0.20107881  0.29459348  0.02266339 -0.19262327 -0.17478434
## ConsEner    -0.30187731 -0.61731132  0.01453216  0.28272492  0.22501894
## EmisCO2     -0.17568860 -0.56520778 -0.04692837  0.21425123  0.19760017
##                 LinTelf    ConsAgua    PropBosq   PropDefor    ConsEner
## CrecPobl    -0.56321228 -0.06772953 -0.15650281  0.20107881 -0.30187731
## MortInf     -0.69558922 -0.06975563 -0.02278415  0.29459348 -0.61731132
## PorcMujeres  0.26167018 -0.31106243  0.37096694  0.02266339  0.01453216
## PNB95        0.46539599  0.08541500  0.05525919 -0.19262327  0.28272492
## ProdElec     0.28664508  0.18047653  0.02603078 -0.17478434  0.22501894
## LinTelf      1.00000000  0.10593934  0.06337138 -0.37623801  0.78068385
## ConsAgua     0.10593934  1.00000000 -0.19299225 -0.08705811  0.16259804
## PropBosq     0.06337138 -0.19299225  1.00000000  0.09725032 -0.11492480
## PropDefor   -0.37623801 -0.08705811  0.09725032  1.00000000 -0.34833836
## ConsEner     0.78068385  0.16259804 -0.11492480 -0.34833836  1.00000000
## EmisCO2      0.62393719  0.16227447 -0.12333592 -0.37396154  0.87965517
##                EmisCO2
## CrecPobl    -0.17568860
## MortInf     -0.56520778
## PorcMujeres -0.04692837
## PNB95        0.21425123
## ProdElec     0.19760017
## LinTelf      0.62393719
## ConsAgua     0.16227447
## PropBosq    -0.12333592
## PropDefor   -0.37396154
## ConsEner     0.87965517
## EmisCO2      1.00000000
```

```r
eigen(cor(M))
```

```
## eigen() decomposition
## $values
##  [1] 4.02987902 1.92999195 1.37041115 0.86451597 0.79414057 0.72919997
##  [7] 0.57130511 0.32680096 0.16806846 0.14632819 0.06935866
##
## $vectors
##               [,1]        [,2]        [,3]        [,4]        [,5]        [,6]
##  [1,] -0.314119414  0.34835747 -0.07352541 -0.44028717 -0.32972147 -0.18392437
##  [2,] -0.392395442 -0.04136238 -0.17759254 -0.13398483  0.08340489 -0.08656390
##  [3,]  0.116546319 -0.58283641  0.16686305  0.05865031  0.18654100  0.16835650
##  [4,]  0.295393771 -0.17690839 -0.53343025 -0.26248209 -0.14110658  0.04653378
##  [5,]  0.258964724 -0.17356372 -0.61438847 -0.17389644 -0.07521971  0.02821905
##  [6,]  0.446082934 -0.02719077  0.15177250  0.04959796 -0.05416498  0.02442175
```

```
##  [7,]  0.092410503  0.32060987 -0.37024258  0.73603097  0.02671021 -0.30940890
##  [8,]  0.005692925 -0.45742697  0.16480339  0.04024882 -0.41531702 -0.75356463
##  [9,] -0.243652293 -0.15408201 -0.02961449  0.33650345 -0.73261463  0.50894232
## [10,]  0.415029554  0.23286257  0.20608749 -0.06730166 -0.23100421  0.05806466
## [11,]  0.374531032  0.29168698  0.20631751 -0.14843513 -0.24028756 -0.02809233
##                [,7]        [,8]        [,9]       [,10]       [,11]
##  [1,]  0.1628974320 -0.09481963 -0.52181220  0.34674573 -0.10062784
##  [2,]  0.6398040762 -0.32307802  0.29031618 -0.38959240  0.17487096
##  [3,]  0.5310867107  0.05209889 -0.23599758  0.42854658 -0.16786800
##  [4,] -0.1490207046 -0.44913216  0.36995675  0.34911534 -0.15247432
##  [5,]  0.1082745817  0.50343911 -0.30681318 -0.33770404  0.12366382
##  [6,] -0.0008501608 -0.56975094 -0.44733110 -0.20997673  0.44992596
##  [7,]  0.2357666690 -0.05962470 -0.08358225  0.20561803 -0.07067780
##  [8,] -0.0806036686  0.04275404  0.07438520 -0.08671232 -0.01493710
##  [9,]  0.0112333588 -0.01607505  0.01868615 -0.03209758  0.07259619
## [10,]  0.2711228006 -0.05023582  0.04339752 -0.36147417 -0.67912543
## [11,]  0.3352822144  0.30978009  0.37666244  0.28779437  0.46737561
```

```
eigen(cov(M))
```

```
## eigen() decomposition
## $values
##  [1] 6.163576e+10 6.581612e+09 4.636256e+06 3.107232e+05 1.216015e+04
##  [6] 5.137767e+02 3.627885e+02 4.542082e+01 5.800868e+00 1.438020e+00
## [11] 4.768083e-01
##
## $vectors
##                [,1]          [,2]          [,3]          [,4]          [,5]
##  [1,] -1.658168e-06  4.706785e-07  0.0001263736 -1.928408e-05 -0.0055373971
##  [2,] -4.048139e-05 -1.774254e-05  0.0082253821 -2.493257e-03 -0.0944030204
##  [3,]  5.739096e-06 -1.084543e-05  0.0001318149  5.538307e-03  0.0314036410
##  [4,]  8.880376e-01  4.597632e-01  0.0026022071 -3.893588e-04 -0.0003327409
##  [5,]  4.597636e-01 -8.880405e-01  0.0005694896  1.096305e-03  0.0002207819
##  [6,]  3.504341e-04  4.016179e-04 -0.0619424889  7.641174e-03  0.9921404486
##  [7,]  2.625508e-04 -1.122118e-03 -0.0401453227 -9.991411e-01  0.0057795144
##  [8,]  4.089564e-06  7.790843e-06  0.0012719918  6.435797e-03  0.0419331615
##  [9,] -1.073825e-06  2.350808e-07  0.0001916177  4.043796e-05 -0.0018090751
## [10,]  2.547156e-03  7.126782e-04 -0.9972315499  3.973568e-02 -0.0625729475
## [11,]  4.643724e-06 -1.315731e-06 -0.0020679047 -5.626049e-05 -0.0042367120
##                [,6]          [,7]          [,8]          [,9]         [,10]
##  [1,]  1.243456e-02  5.359089e-03 -8.390810e-02 -6.778358e-02 -1.158091e-01
##  [2,]  9.917515e-01  2.258019e-02 -7.891128e-02 -1.637836e-02  4.264872e-04
##  [3,]  8.552991e-02 -1.136481e-01  9.856498e-01 -1.468464e-02  8.241465e-03
##  [4,] -8.621005e-06 -7.566477e-06  1.217248e-05 -3.971469e-07  4.274451e-07
##  [5,]  1.955408e-05  1.544658e-05 -2.558998e-05  1.059471e-06 -1.353881e-06
##  [6,]  9.109622e-02  4.748682e-02 -3.416812e-02 -5.379549e-03 -3.409423e-03
##  [7,] -1.087229e-03 -6.863294e-03  4.698731e-03  7.965261e-05  3.621425e-05
##  [8,]  1.721948e-02 -9.920538e-01 -1.169638e-01  1.416566e-03  5.891758e-03
##  [9,]  1.758667e-03 -7.455427e-03  1.811443e-02  1.283039e-01 -9.859317e-01
## [10,]  2.639673e-03 -3.764707e-03  1.267052e-03  2.262931e-03  2.672618e-04
## [11,] -1.877994e-02 -1.709137e-03 -5.204823e-03 -9.891529e-01 -1.200519e-01
##               [,11]
##  [1,]  9.872887e-01
##  [2,] -2.092491e-02
##  [3,]  8.344324e-02
```

```
##  [4,]  2.723996e-07
##  [5,] -2.086857e-07
##  [6,]  4.944397e-04
##  [7,]  4.780416e-04
##  [8,] -3.748976e-03
##  [9,] -1.052934e-01
## [10,]  5.906241e-05
## [11,] -8.221371e-02
```

```
eigen(cov(M))[1]
```

```
## $values
##  [1] 6.163576e+10 6.581612e+09 4.636256e+06 3.107232e+05 1.216015e+04
##  [6] 5.137767e+02 3.627885e+02 4.542082e+01 5.800868e+00 1.438020e+00
## [11] 4.768083e-01
```

```
sum(diag(cov(M)))
```

```
## [1] 68222335253
```

```
my.sum = 0
for (x in eigen(cov(M))[1]) {
  y = x/sum(diag(cov(M)))
  print(y)
  my.sum = my.sum + y
}
```

```
##  [1] 9.034543e-01 9.647298e-02 6.795804e-05 4.554567e-06 1.782429e-07
##  [6] 7.530917e-09 5.317738e-09 6.657763e-10 8.502887e-11 2.107843e-11
## [11] 6.989035e-12
```

```
cat('sum:', sum(my.sum))
```

```
## sum: 1
```

Los componentes más importantes son CrecPobl y MortInf, estos dos componentes nos dieron los valores más altos en el análisis anterior.

```
my.sum = 0
for (x in eigen(cor(M))[1]) {
  y = x/sum(diag(cor(M)))
  print(y)
  my.sum = my.sum + y
}
```

```
##  [1] 0.366352638 0.175453813 0.124582832 0.078592361 0.072194597 0.066290906
##  [7] 0.051936828 0.029709178 0.015278951 0.013302563 0.006305332
```

```
cat('sum: ',sum(my.sum))
```

```
## sum:  1
```

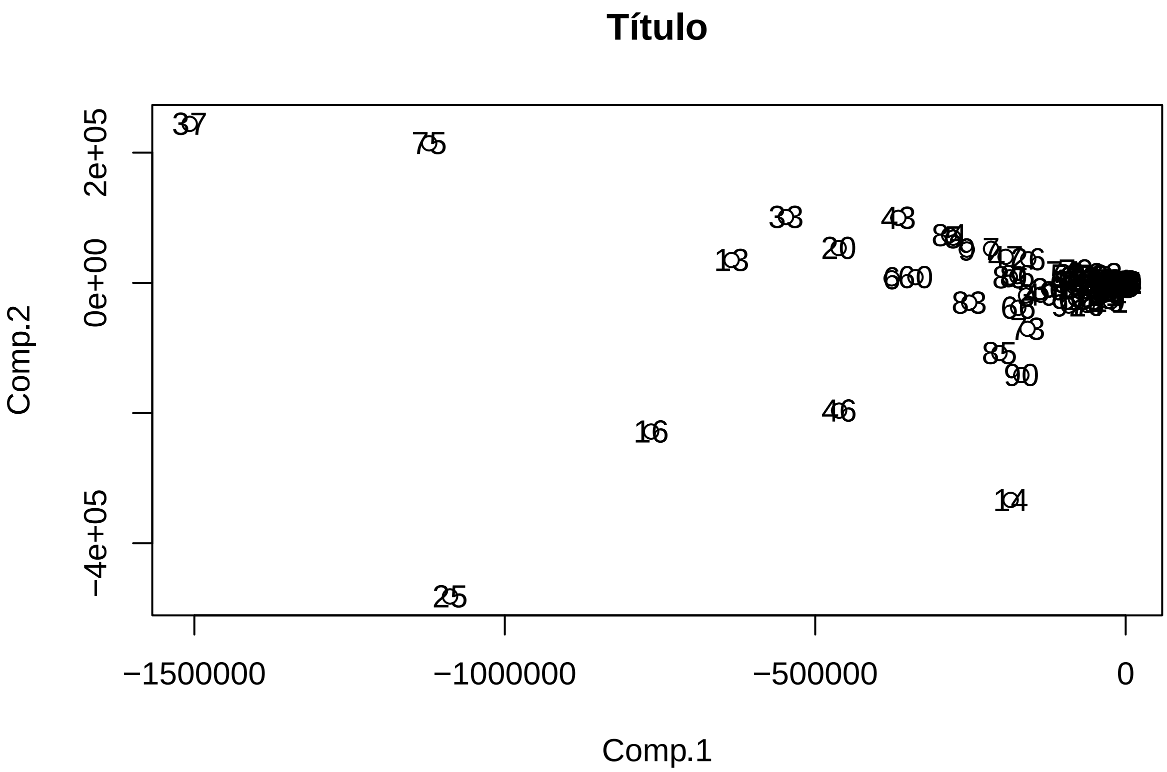
Los componentes más importantes son CrecPobl, MortInf y PorcMujeres, estos tres componentes nos dieron valores mayores al 0.1 en el análisis anterior.

```
library(stats)
library(factoextra)
```

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

```
## Welcome! Want to learn more? See two factoextra-related books at https://goo.gl/ve3WBa
```

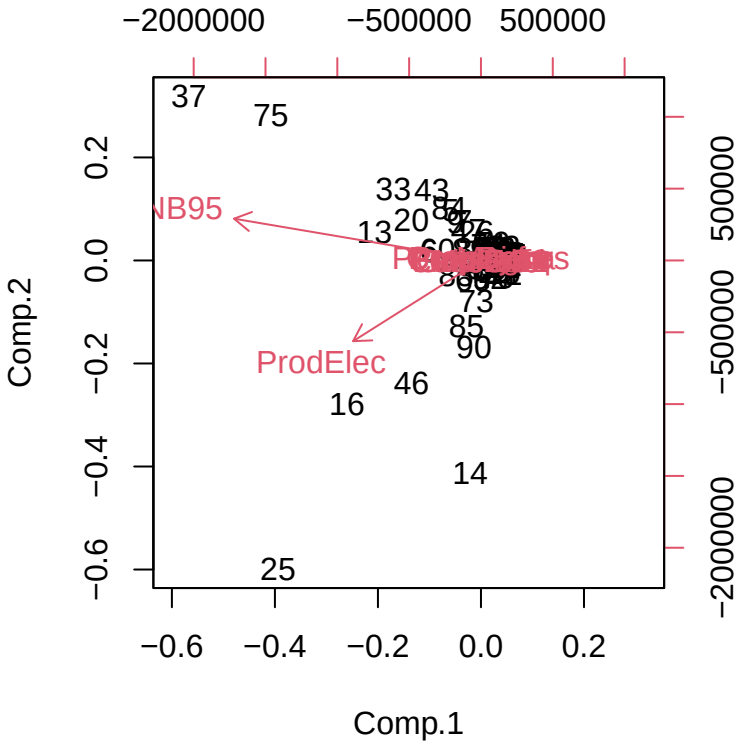
```r
library(ggplot2)
datos= M
cpS=princomp(datos,cor=FALSE)
cpaS=as.matrix(datos)%*%cpS$loadings
plot(cpaS[,1:2],type="p", main = "Título")
text(cpaS[,1],cpaS[,2],1:nrow(cpaS))
```



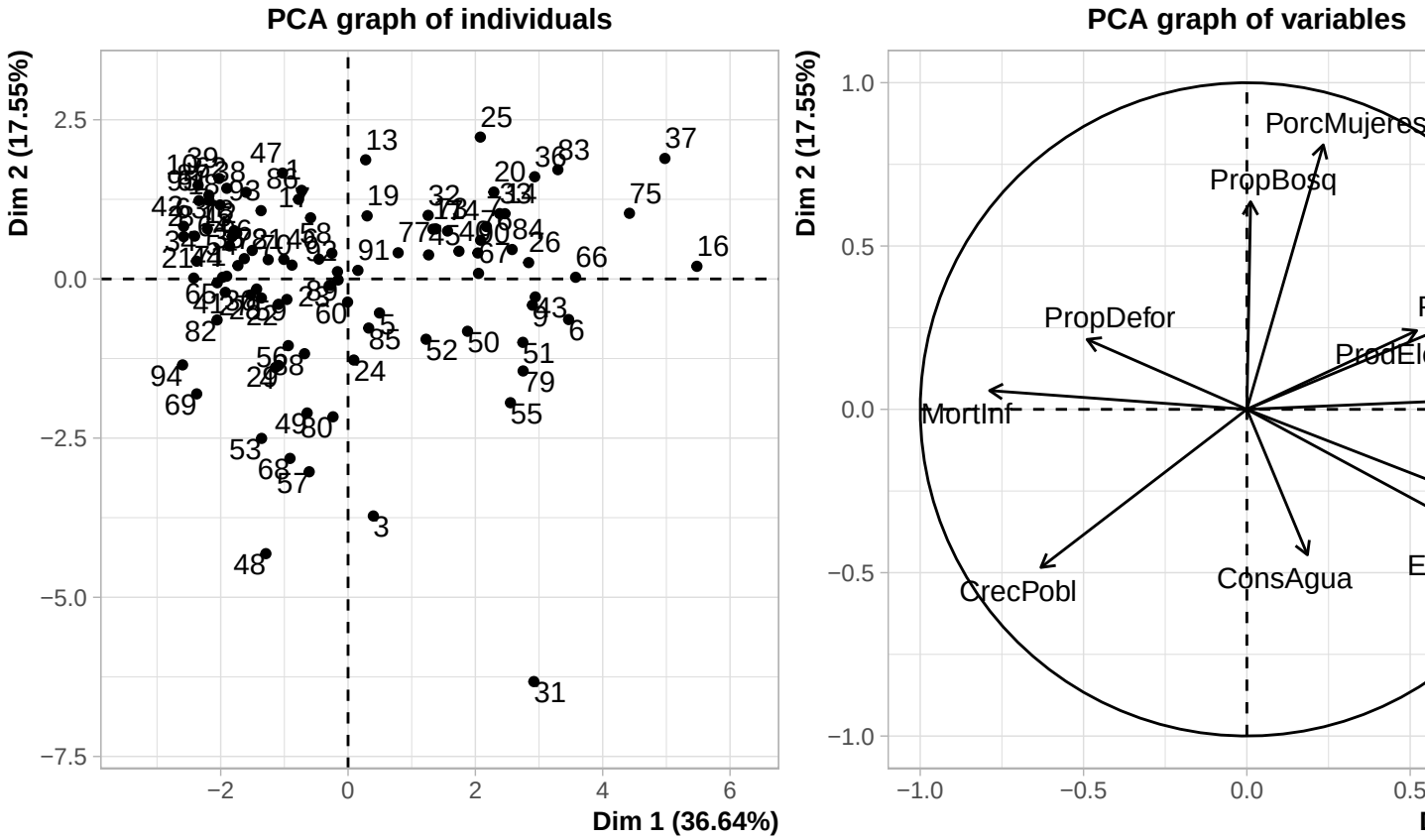

```r
biplot(cpS)
```

```
## Warning in arrows(0, 0, y[, 1L] * 0.8, y[, 2L] * 0.8, col = col[2L], length =
## arrow.len): zero-length arrow is of indeterminate angle and so skipped

## Warning in arrows(0, 0, y[, 1L] * 0.8, y[, 2L] * 0.8, col = col[2L], length =
## arrow.len): zero-length arrow is of indeterminate angle and so skipped

## Warning in arrows(0, 0, y[, 1L] * 0.8, y[, 2L] * 0.8, col = col[2L], length =
## arrow.len): zero-length arrow is of indeterminate angle and so skipped

## Warning in arrows(0, 0, y[, 1L] * 0.8, y[, 2L] * 0.8, col = col[2L], length =
## arrow.len): zero-length arrow is of indeterminate angle and so skipped

## Warning in arrows(0, 0, y[, 1L] * 0.8, y[, 2L] * 0.8, col = col[2L], length =
## arrow.len): zero-length arrow is of indeterminate angle and so skipped

## Warning in arrows(0, 0, y[, 1L] * 0.8, y[, 2L] * 0.8, col = col[2L], length =
## arrow.len): zero-length arrow is of indeterminate angle and so skipped

## Warning in arrows(0, 0, y[, 1L] * 0.8, y[, 2L] * 0.8, col = col[2L], length =
## arrow.len): zero-length arrow is of indeterminate angle and so skipped
```

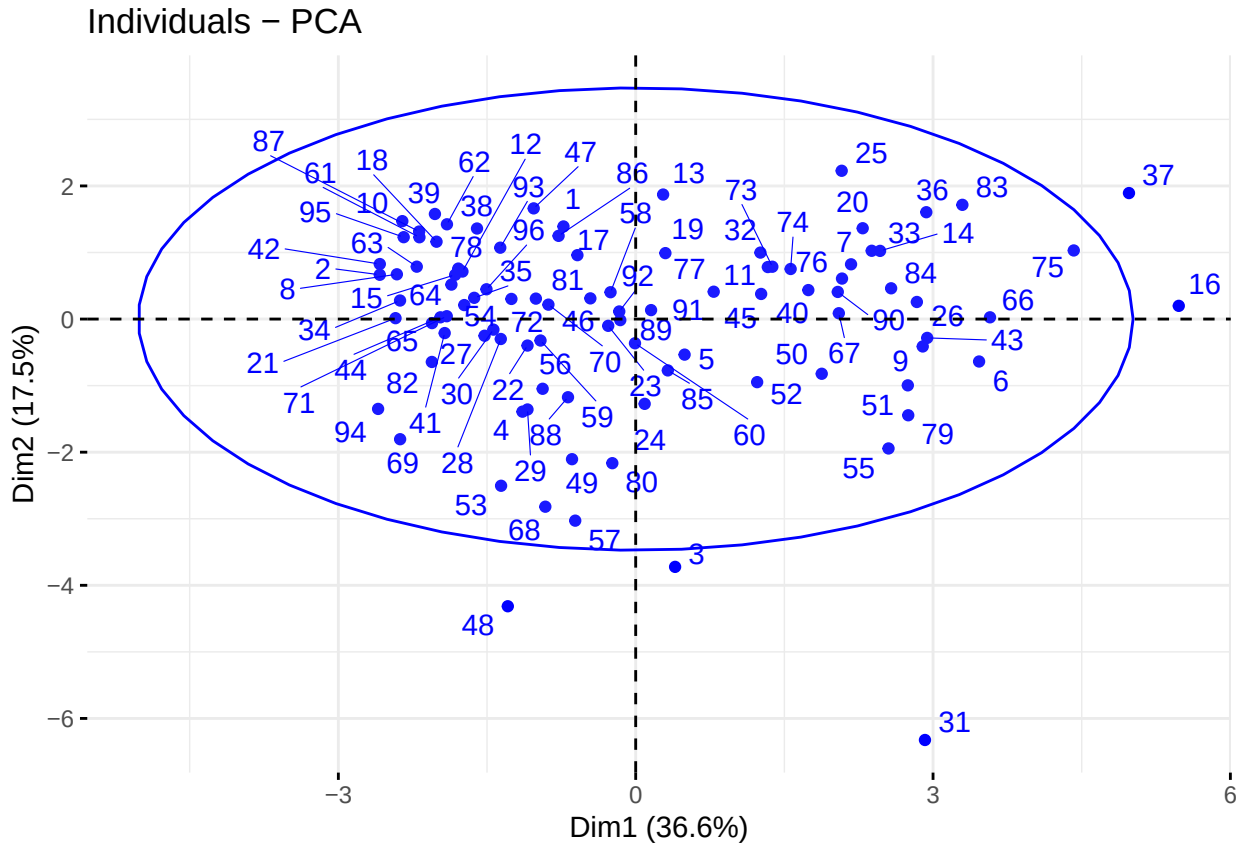
```
## Warning in arrows(0, 0, y[, 1L] * 0.8, y[, 2L] * 0.8, col = col[2L], length =
## arrow.len): zero-length arrow is of indeterminate angle and so skipped
```



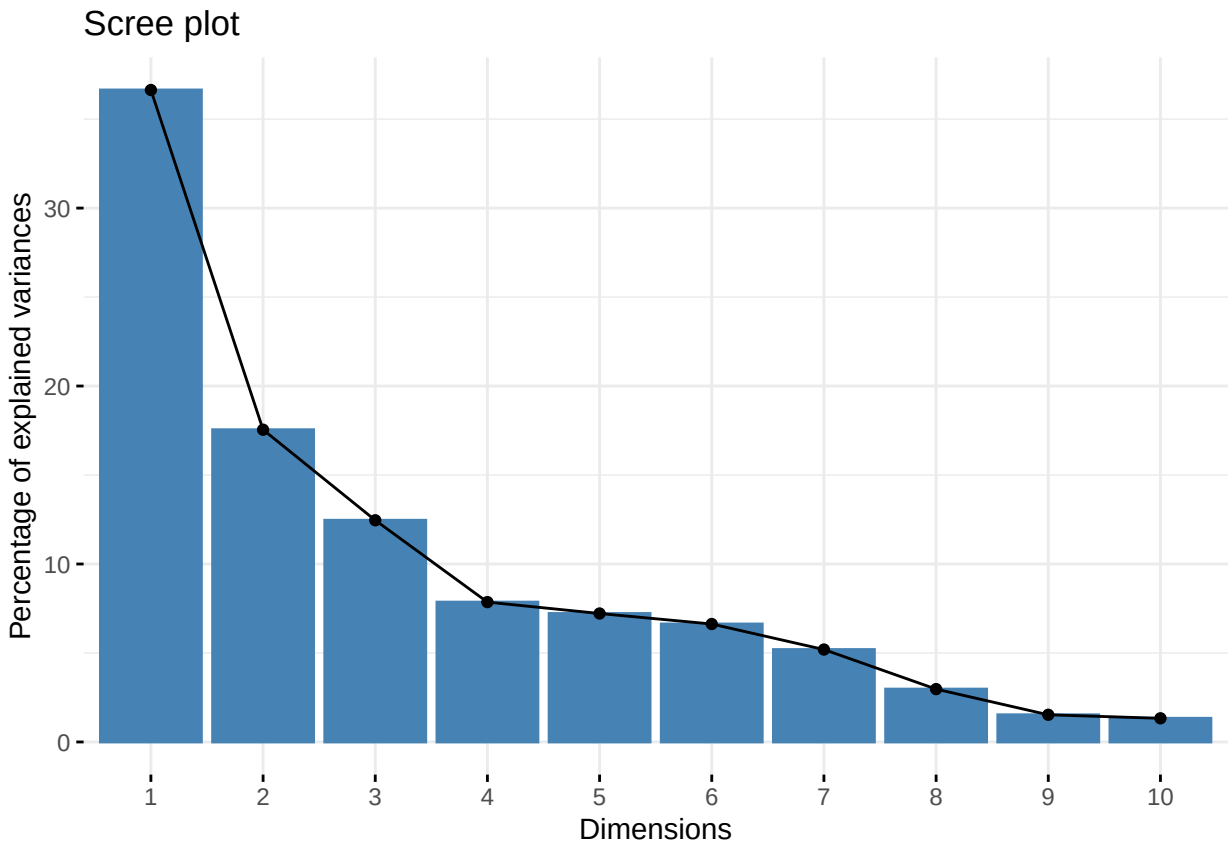

```
library(FactoMineR)
cp3 = PCA(datos)
```



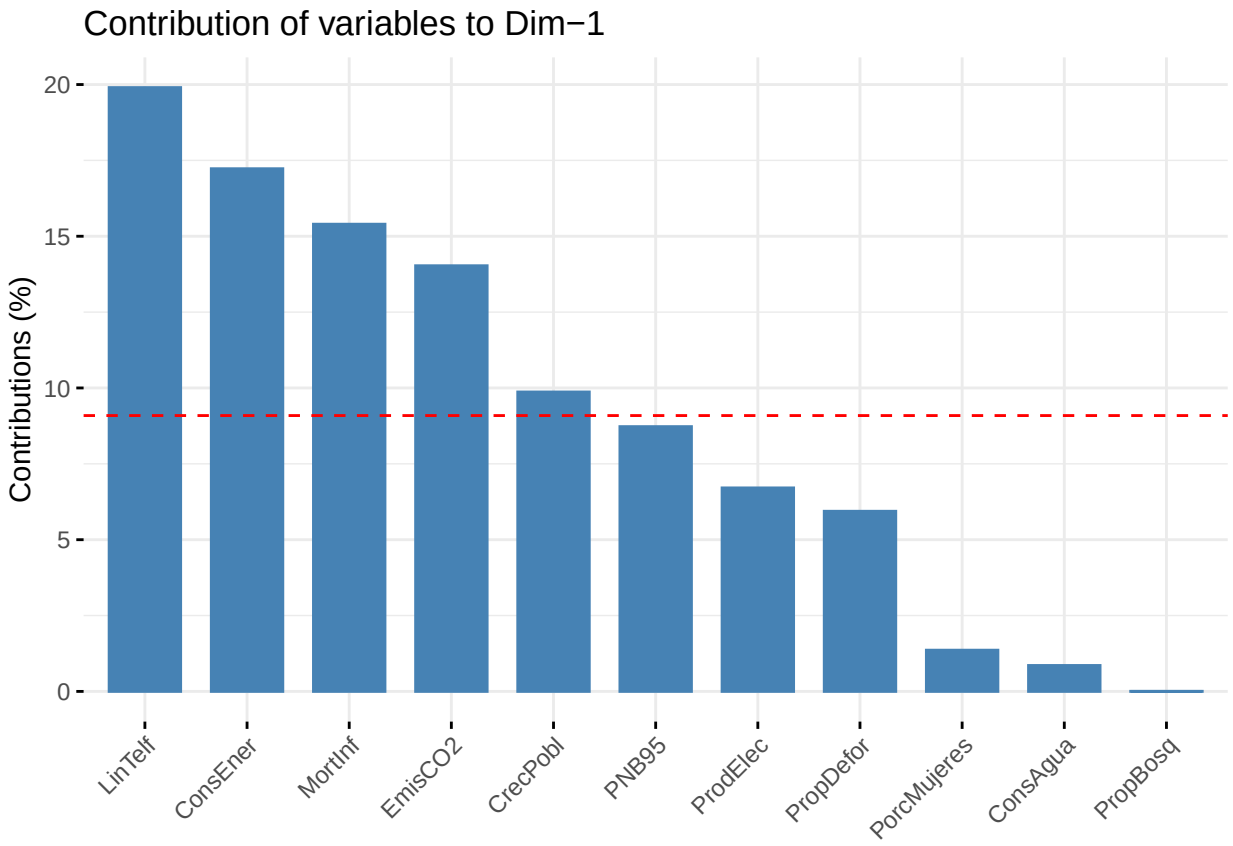

```
fviz_pca_ind(cp3, col.ind = "blue", addEllipses = TRUE, repel = TRUE)
```




```
fviz_screeplot(cp3)
```




```
fviz_contrib(cp3, choice = c("var"))
```


Contribution of variables to Dim−1
Contributions (%)
20
15
10
5
0
LinTelf
ConsEner
MortInf
EmisCO2
CrecPobl
PNB95
ProdElec
PropDefor
PorcMujeres
ConsAgua
PropBosq