STAT 360: Computational Statistics and Data Analysis

Project - EDA

Matt Lao & Adam Bihi

Load Relevant R Libraries

```r
library(rmarkdown); library(knitr); library(moments);
library(scatterplot3d); library(corrplot); library(pso)
library(psych); library(GPArotation); library(lavaan); library(readxl); library(dplyr)
```

Matrix Construction

```r
data_matrix_csv <- read.csv("C:/Users/User/OneDrive - University of St. Thomas/Classes/STAT360/STAT360 
life_expectancy <- as.matrix(data_matrix_csv)

col_names_unedited <- c(
  "Life expectancy at birth, total (years)",
  "CO2 emissions (metric tons per capita)",
  "Access to electricity (% of population)",
  "Current health expenditure (% of GDP)",
  "Out-of-pocket expenditure (% of current health expenditure)",
  "Domestic private health expenditure per capita, PPP (current international $)",
  "Domestic general government health expenditure per capita, PPP (current international $)",
  "Renewable internal freshwater resources per capita (cubic meters)",
  "Prevalence of HIV, total (% of population ages 15-49)",
  "Unemployment, total (% of total labor force) (national estimate)",
  "Government Effectiveness: Estimate",
  "Income share held by highest 10%",
  "Prevalence of current tobacco use (% of adults)",
  "Total alcohol consumption per capita (liters of pure alcohol, projected estimates, 15+ years of age)"
  "Political Stability and Absence of Violence/Terrorism: Estimate",
  "Population density (people per sq. km of land area)"
)

# Better for displaying
col_names <- c(
  "Life_expectancy",
  "CO2_emissions",
  "Electricity",
  "Health_expenditure",
  "Out_of_pocket",
  "Private_health_expenditure",
  "Govt_health_expenditure",
  "Freshwater_resources",
  "HIV_prevalence",
  "Unemployment",
  "Govt_effectiveness",
  "Income_share",
  "Tobacco_use",
```

```
  "Alcohol_consumption",
  "Political_stability",
  "Population_density"
)

colnames(life_expectancy) <- col_names
```

Central Tendency

The following are the means for all our countries across each dimension.

```
mean_values <- apply(life_expectancy, 2, mean, na.rm = TRUE)
mean_values
```

```
##            Life_expectancy                CO2_emissions
##               7.293061e+01                 4.073362e+00
##                Electricity          Health_expenditure
##               8.615784e+01                 6.504190e+00
##              Out_of_pocket Private_health_expenditure
##               3.114537e+01                 5.083869e+02
##      Govt_health_expenditure          Freshwater_resources
##               1.037831e+03                 1.467286e+04
##              HIV_prevalence                 Unemployment
##               1.696454e+00                 7.304173e+00
##           Govt_effectiveness                 Income_share
##              -3.457301e-02                 2.737286e+01
##                Tobacco_use          Alcohol_consumption
##               2.070368e+01                 5.411544e+00
##          Political_stability          Population_density
##              -3.458588e-02                 4.421951e+02
```

Dispersion

The following are our standard deviations for all our dimensions.

```
sd_values <- apply(life_expectancy, 2, sd, na.rm = TRUE)
sd_values
```

```
##            Life_expectancy                CO2_emissions
##               7.524201e+00                 4.685835e+00
##                Electricity          Health_expenditure
##               2.450012e+01                 3.012619e+00
##              Out_of_pocket Private_health_expenditure
##               1.915046e+01                 6.836306e+02
##      Govt_health_expenditure          Freshwater_resources
##               1.383151e+03                 4.512422e+04
```

```
##           HIV_prevalence              Unemployment
##             4.173615e+00              5.179558e+00
##         Govt_effectiveness             Income_share
##             9.932636e-01              5.105692e+00
##               Tobacco_use       Alcohol_consumption
##             9.875615e+00              3.974219e+00
##         Political_stability        Population_density
##             1.000091e+00              1.984682e+03
```

Shape

<u>Kurtosis</u>

```r
kurtosis_values <- apply(life_expectancy, 2, kurtosis, na.rm = TRUE)
kurtosis_values
```

```
##           Life_expectancy               CO2_emissions
##                  2.446652                   11.037460
##               Electricity         Health_expenditure
##                  4.796350                    5.686912
##              Out_of_pocket Private_health_expenditure
##                  2.678729                   28.528810
##     Govt_health_expenditure        Freshwater_resources
##                  5.216114                   67.935920
##             HIV_prevalence                Unemployment
##                 23.072125                    5.082456
##         Govt_effectiveness                Income_share
##                  2.462198                    3.500899
##               Tobacco_use         Alcohol_consumption
##                  2.413591                    2.072660
##         Political_stability          Population_density
##                  2.980892                   77.657754
```

<u>Skewness</u>

```r
skewness_values <- apply(life_expectancy, 2, skewness, na.rm = TRUE)
skewness_values
```

```
##           Life_expectancy               CO2_emissions
##                -0.4937146                   2.4104904
##               Electricity         Health_expenditure
##                -1.7349186                   1.2303785
##              Out_of_pocket Private_health_expenditure
##                 0.5991231                   4.1768408
##     Govt_health_expenditure        Freshwater_resources
##                 1.7346779                   7.4436728
##             HIV_prevalence                Unemployment
##                 4.3210884                   1.4514366
##         Govt_effectiveness                Income_share
##                 0.1128533                   0.9951699
```

```
##             Tobacco_use        Alcohol_consumption
##              0.3718218                   0.3329518
##       Political_stability        Population_density
##             -0.6245128                   8.4062661
```

Stripcharts

```
for (col in colnames(life_expectancy)) {
  stripchart(life_expectancy[, col], method = "stack", xlab = col)
}
```

CO2_emissions

Electricity

Health_expenditure

Out_of_pocket

Private_health_expenditure

Govt_health_expenditure

Freshwater_resources

HIV_prevalence

Unemployment

Govt_effectiveness

Income_share

Tobacco_use

Alcohol_consumption

Political_stability

Population_density
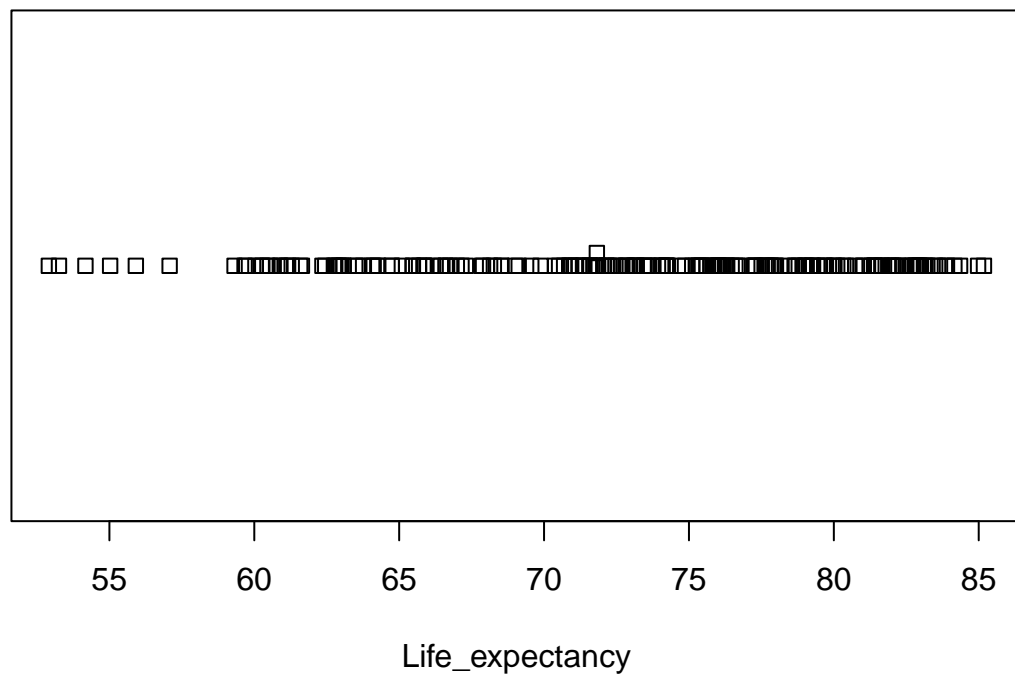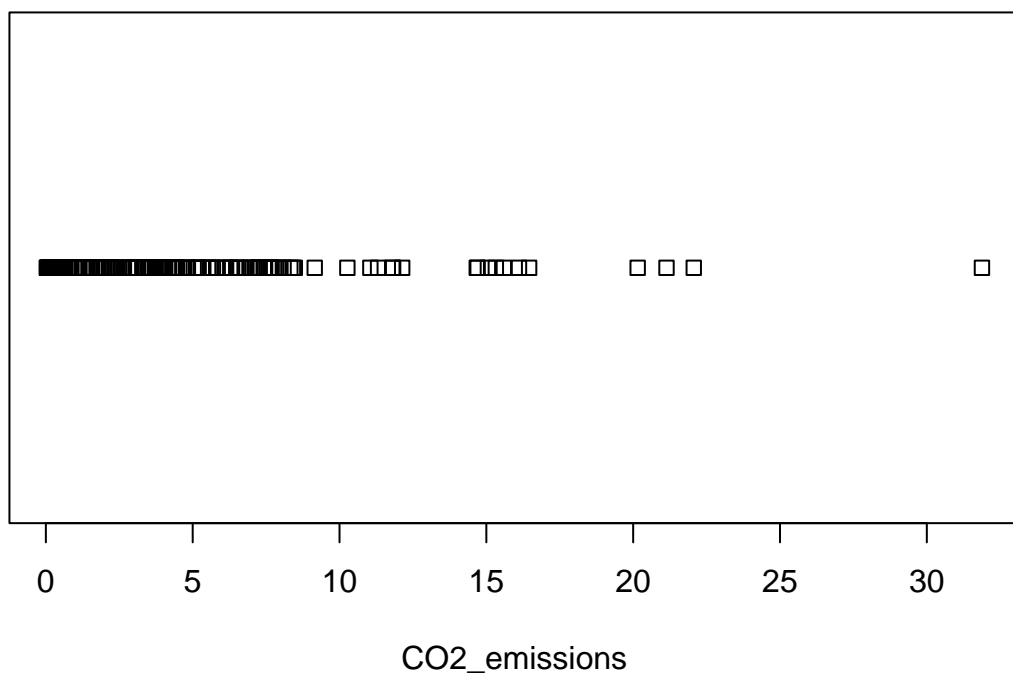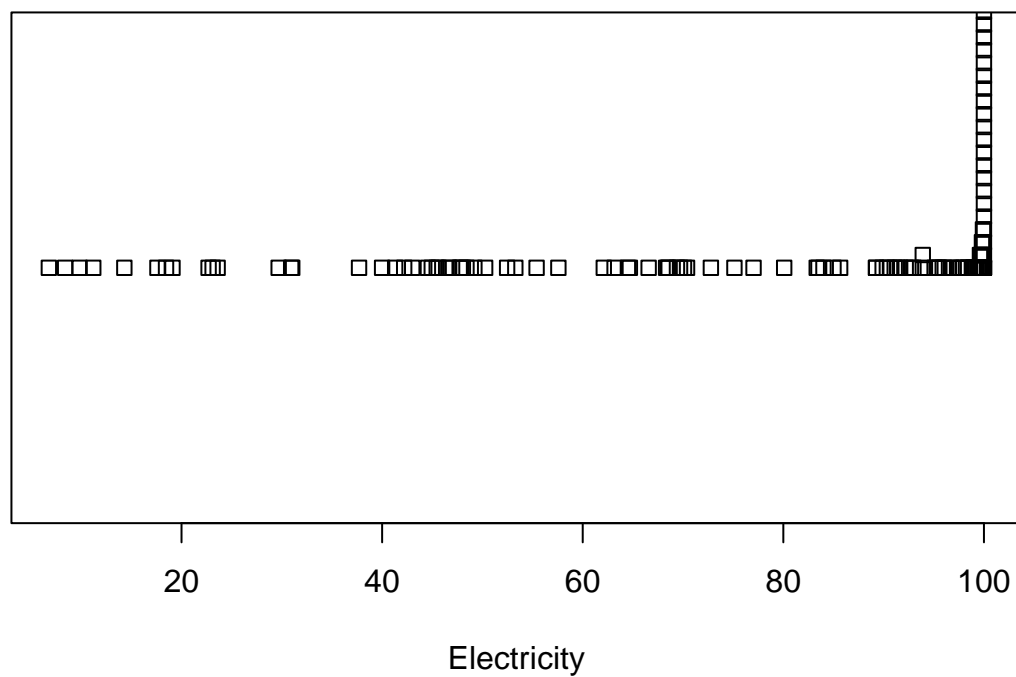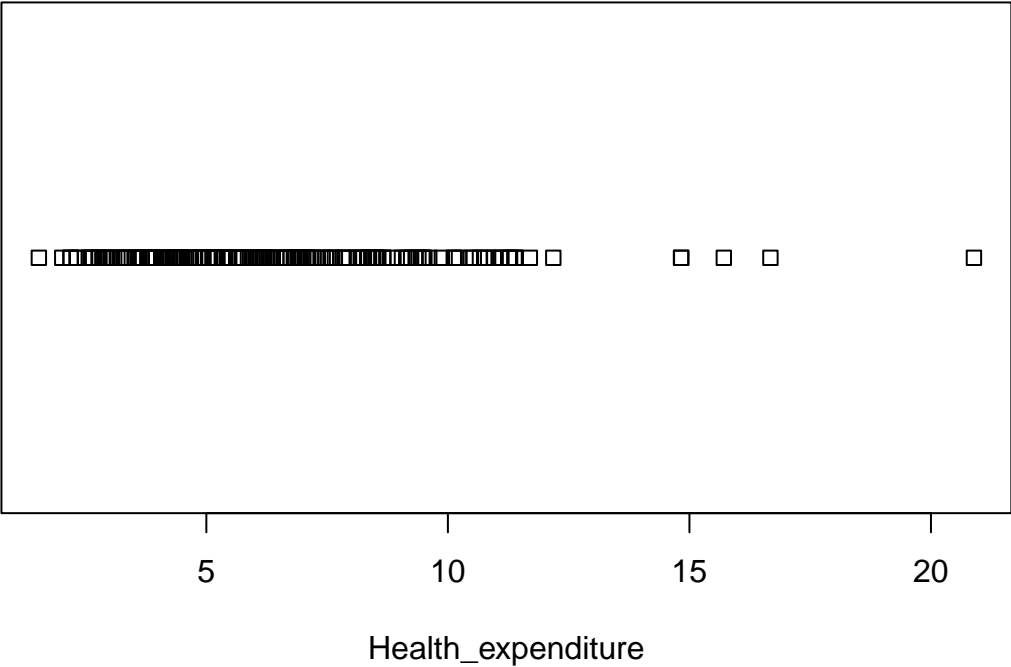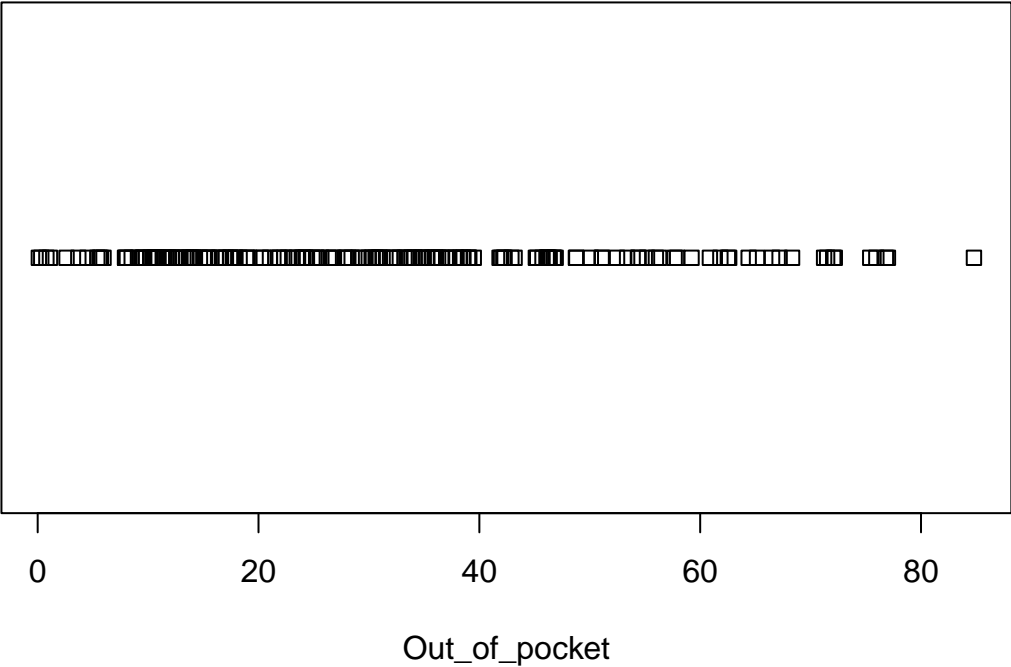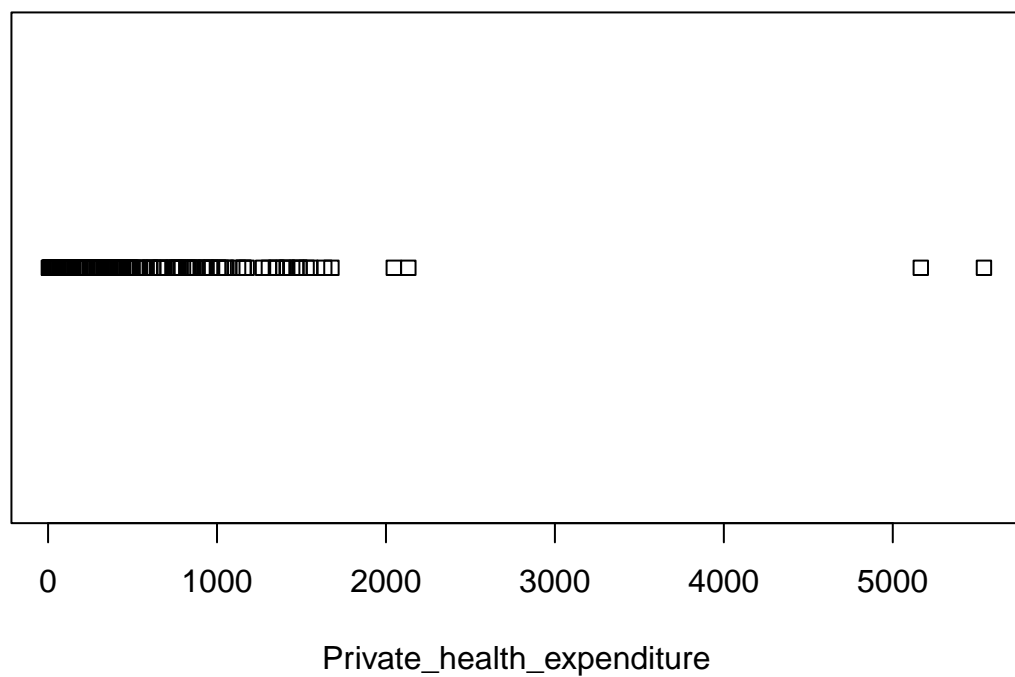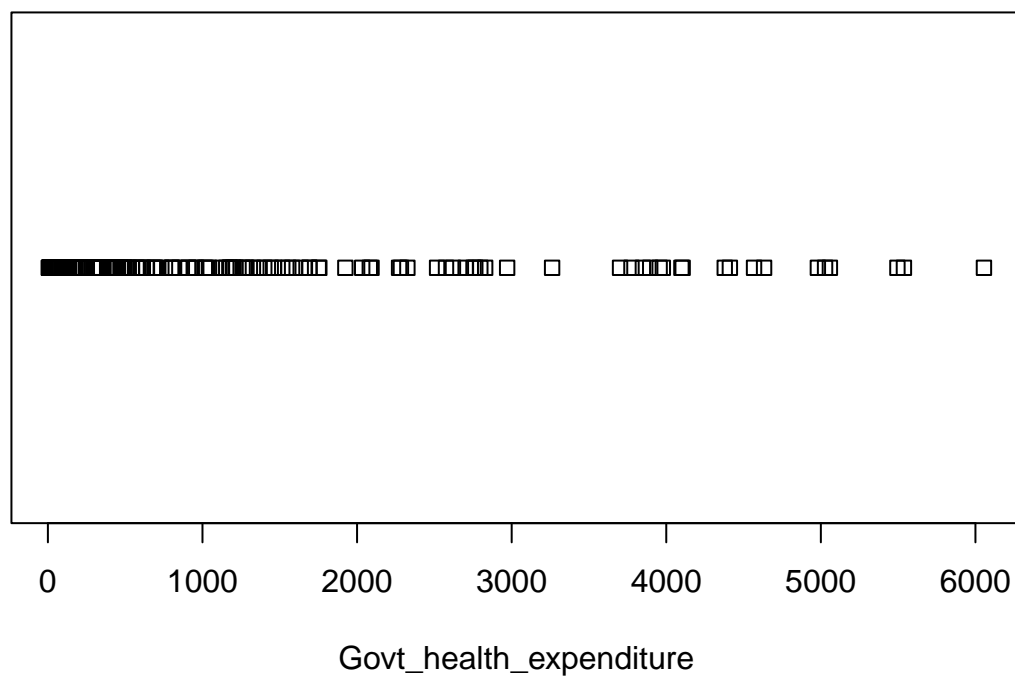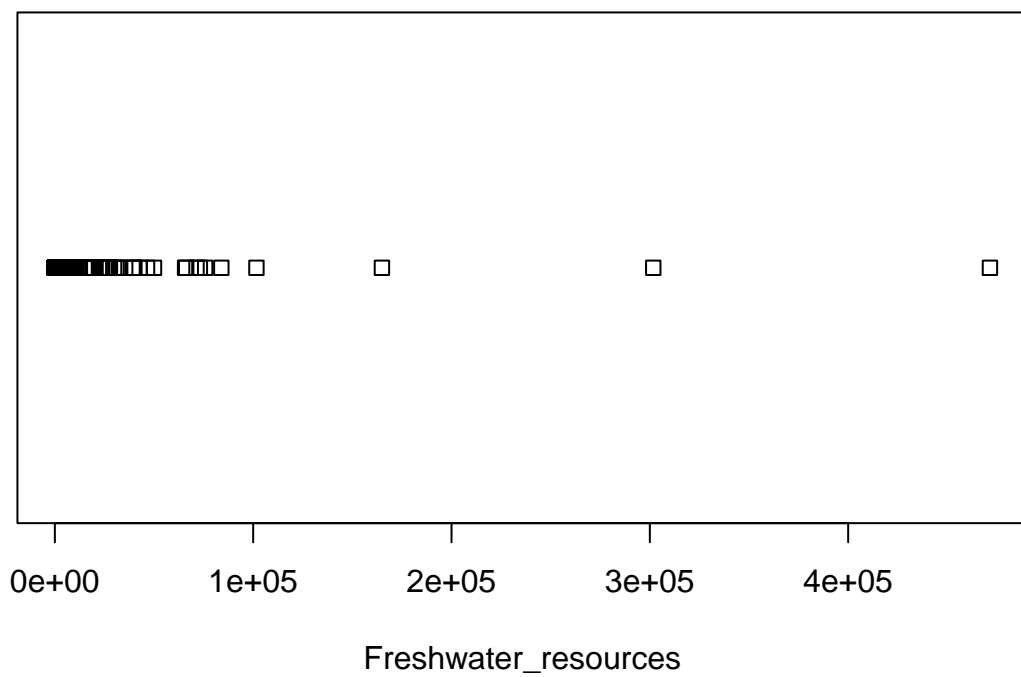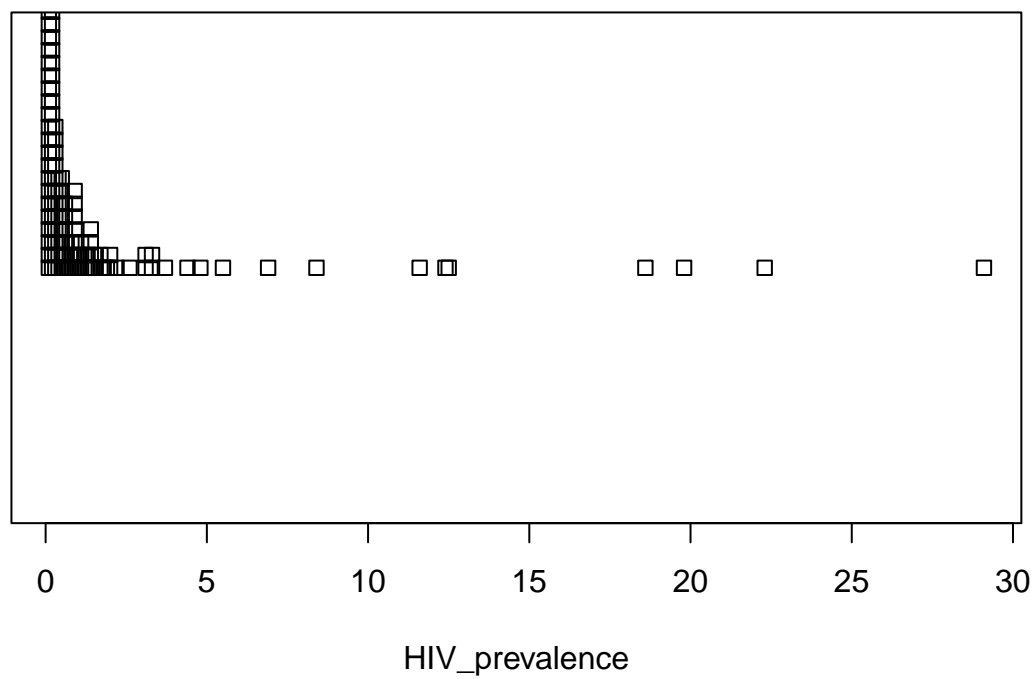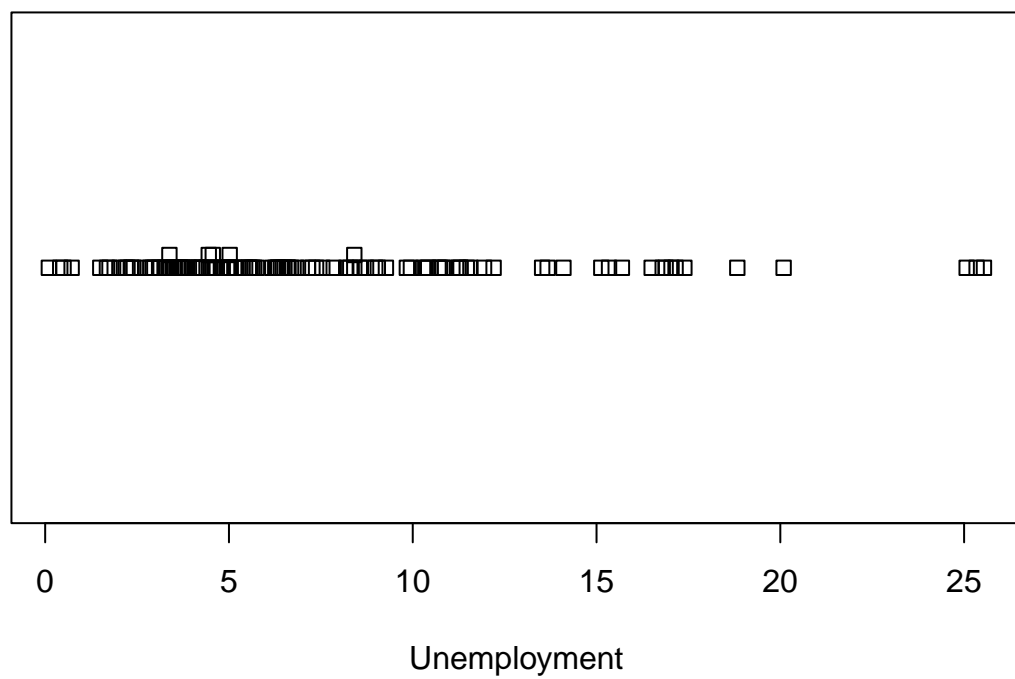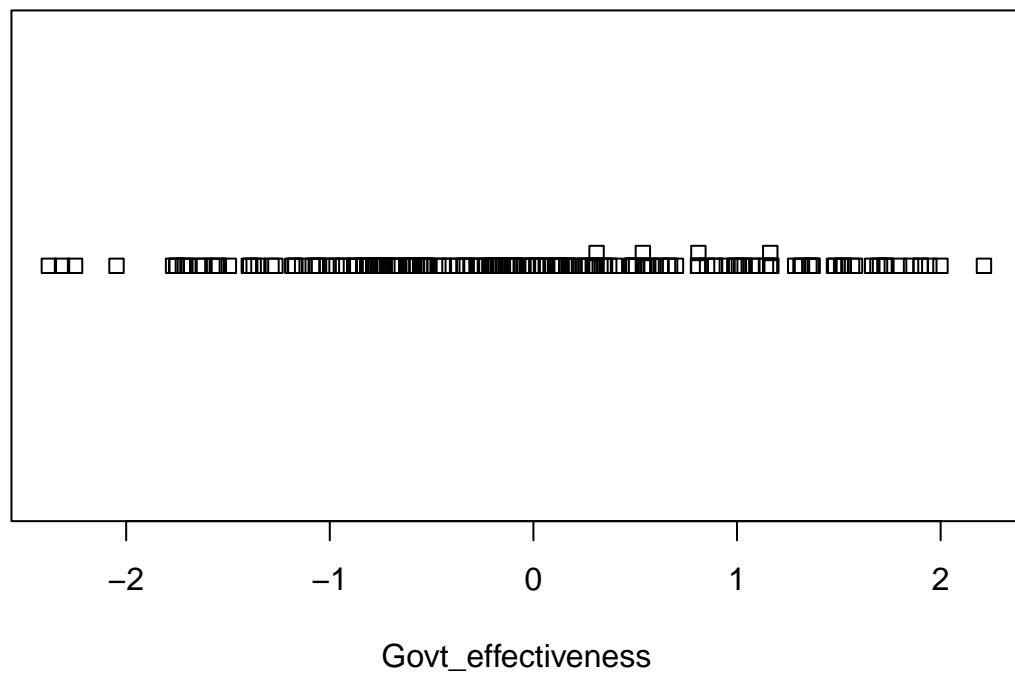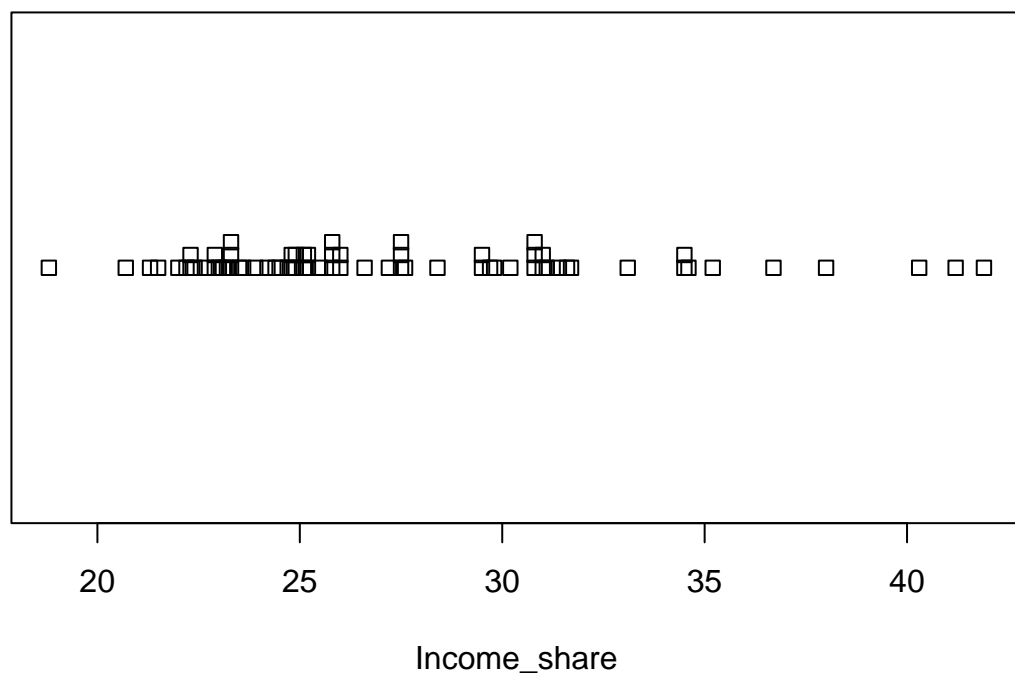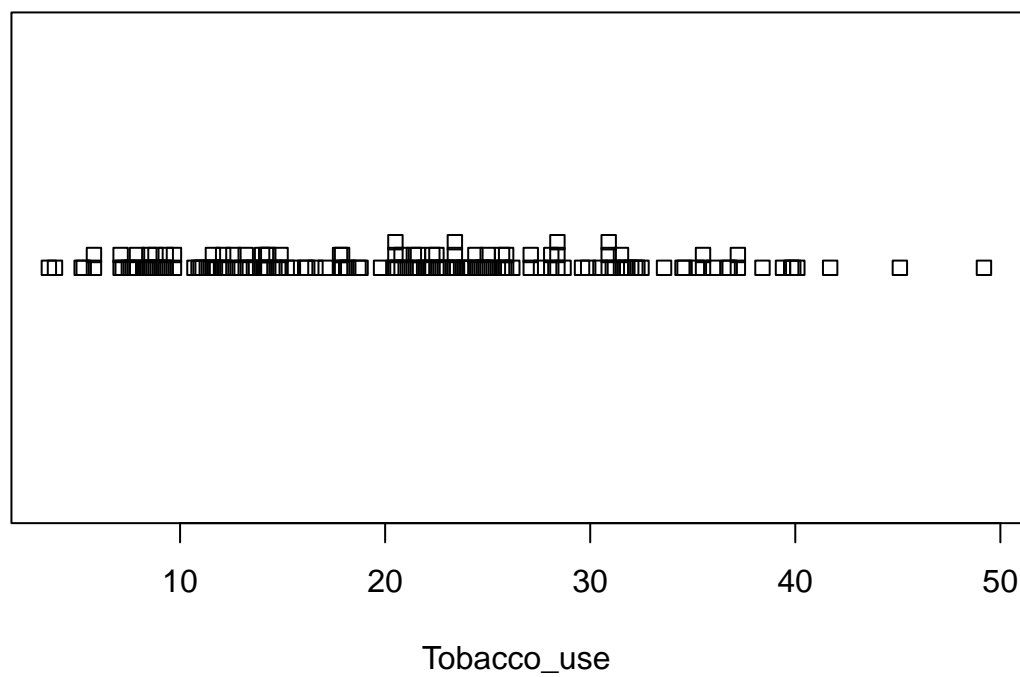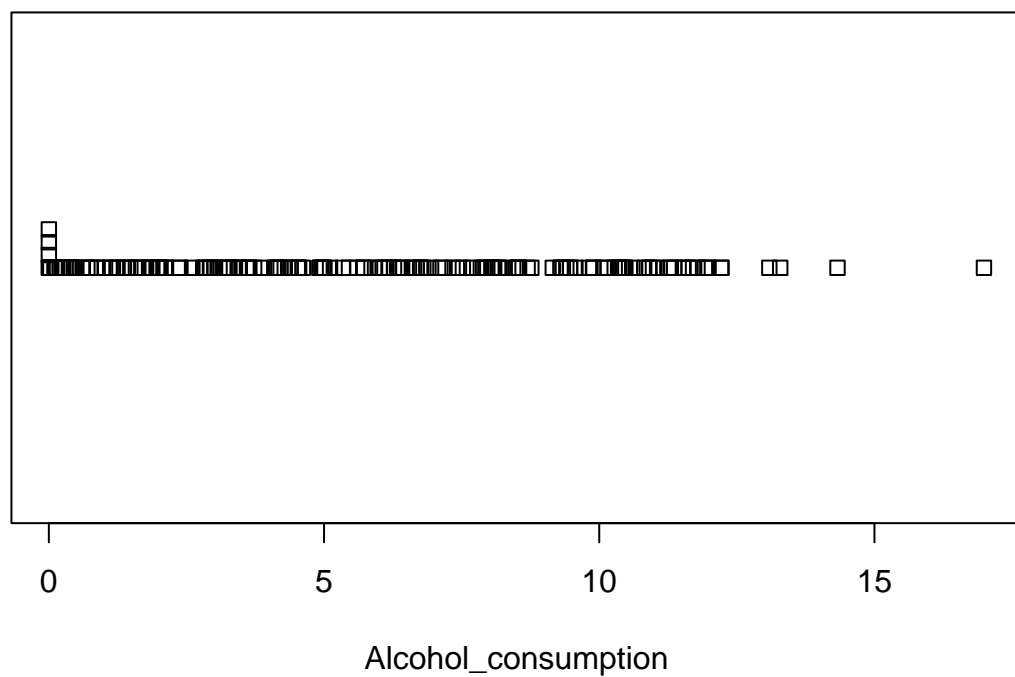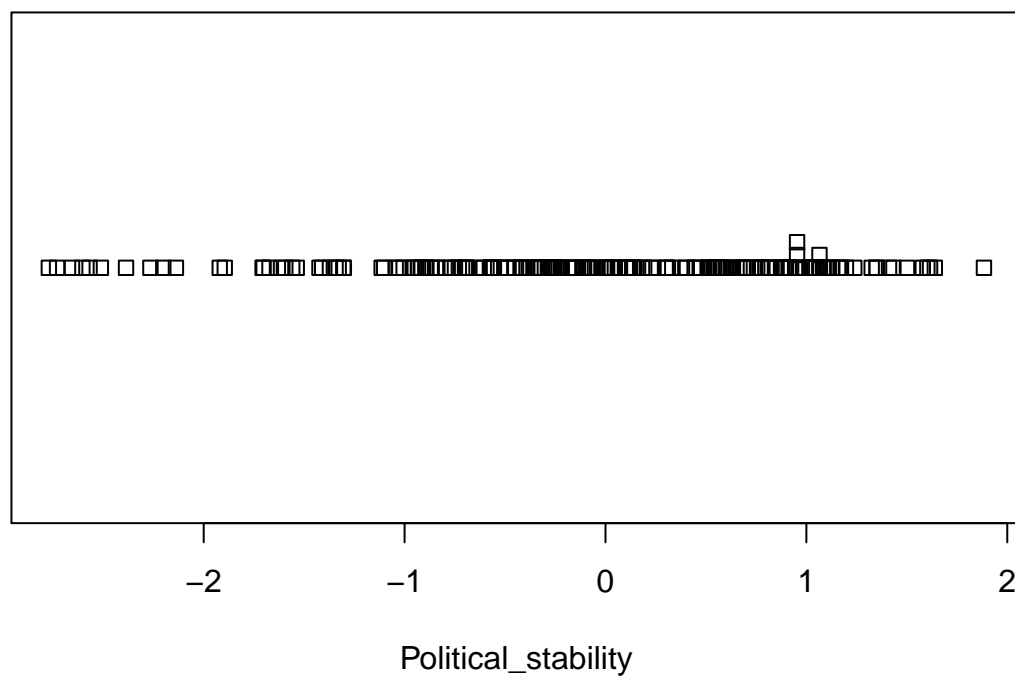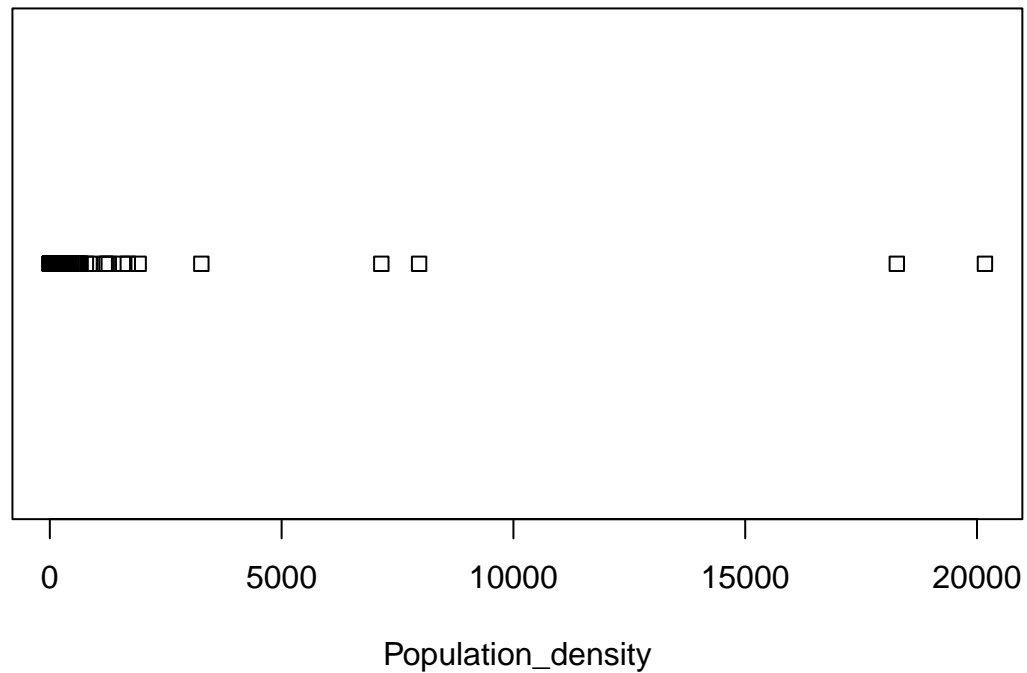
Variance-Covariance Matrix

```r
cov(life_expectancy, use = "pairwise.complete.obs")
```

```
##                          Life_expectancy CO2_emissions Electricity
## Life_expectancy                56.613599     19.656000   143.90904
## CO2_emissions                  19.656000     21.957050    53.47077
## Electricity                   143.909039     53.470768   600.25600
## Health_expenditure              7.036888      1.901462    20.16410
## Out_of_pocket                 -45.276102    -27.520381   -83.98652
## Private_health_expenditure   2998.698602   1402.368831  6592.53067
## Govt_health_expenditure      7099.652598   3461.022535 14659.67137
## Freshwater_resources        27420.830532  -3207.162537 62163.79862
## HIV_prevalence                -12.667762     -2.318291   -32.35660
## Unemployment                   -7.344768     -5.174830   -15.24628
## Govt_effectiveness              5.801790      2.442816    14.96731
## Income_share                  -10.354057     -6.177143   -25.58321
## Tobacco_use                    20.834585      2.787175    95.61148
## Alcohol_consumption            11.493254      3.239246    27.62556
## Political_stability             3.952635      1.505941    11.46460
## Population_density           2567.323142    329.437798  4734.90380
```

```
##                          Health_expenditure Out_of_pocket
## Life_expectancy                   7.0368878 -4.527610e+01
## CO2_emissions                     1.9014623 -2.752038e+01
## Electricity                      20.1640954 -8.398652e+01
## Health_expenditure                9.0758757 -1.700235e+01
## Out_of_pocket                   -17.0023465  3.667401e+02
## Private_health_expenditure      937.5047198 -2.023200e+03
## Govt_health_expenditure        2040.0529666 -1.220182e+04
## Freshwater_resources           6400.0362573 -1.133978e+05
## HIV_prevalence                    0.4001537 -2.014671e+01
## Unemployment                      1.0674188 -4.466286e-01
## Govt_effectiveness                0.9289957 -8.159019e+00
## Income_share                     -1.7383318  1.388092e+01
## Tobacco_use                       7.2202365 -2.657624e+01
## Alcohol_consumption               2.9649858 -1.592692e+01
## Political_stability               0.8223059 -9.718820e+00
## Population_density             -555.9827547 -2.308275e+03
##                          Private_health_expenditure Govt_health_expenditure
## Life_expectancy                          2998.6986               7099.6526
## CO2_emissions                            1402.3688               3461.0225
## Electricity                              6592.5307              14659.6714
## Health_expenditure                        937.5047               2040.0530
## Out_of_pocket                           -2023.2004             -12201.8233
## Private_health_expenditure             467350.7680             606905.1703
## Govt_health_expenditure                606905.1703            1913107.4928
## Freshwater_resources                    80433.4890            8820802.0892
## HIV_prevalence                           -464.1102               -905.2394
## Unemployment                             -500.0547              -1593.9605
## Govt_effectiveness                        416.1200               1020.3935
## Income_share                             -510.8805              -3343.4847
## Tobacco_use                               998.9118               1982.9352
## Alcohol_consumption                      1088.5776               2719.3186
## Political_stability                       223.1083                687.2039
## Population_density                      81818.8445             252013.8840
##                          Freshwater_resources HIV_prevalence  Unemployment
## Life_expectancy                  2.742083e+04  -1.266776e+01 -7.344768e+00
## CO2_emissions                   -3.207163e+03  -2.318291e+00 -5.174830e+00
## Electricity                      6.216380e+04  -3.235660e+01 -1.524628e+01
## Health_expenditure               6.400036e+03   4.001537e-01  1.067419e+00
## Out_of_pocket                   -1.133978e+05  -2.014671e+01 -4.466286e-01
## Private_health_expenditure       8.043349e+04  -4.641102e+02 -5.000547e+02
## Govt_health_expenditure          8.820802e+06  -9.052394e+02 -1.593960e+03
## Freshwater_resources             2.036196e+09  -1.292663e+04 -1.048168e+04
## HIV_prevalence                  -1.292663e+04   1.741906e+01  8.907005e+00
## Unemployment                    -1.048168e+04   8.907005e+00  2.682782e+01
## Govt_effectiveness               4.203043e+03  -4.820353e-01 -1.439840e+00
## Income_share                     1.660246e+04   1.490213e+00  3.039868e+00
## Tobacco_use                     -3.566012e+04  -6.987135e+00  3.968488e+00
## Alcohol_consumption              8.432471e+03   1.294147e+00 -1.816340e+00
## Political_stability              7.230459e+03   3.476909e-02 -1.214624e+00
## Population_density              -2.534178e+06  -1.748864e+02 -1.438084e+03
##                          Govt_effectiveness Income_share   Tobacco_use
## Life_expectancy                   5.8017902   -10.354057     20.834585
## CO2_emissions                     2.4428155    -6.177143      2.787175
```

```
## Electricity                        14.9673140    -25.583207     95.611484
## Health_expenditure                  0.9289957     -1.738332      7.220237
## Out_of_pocket                      -8.1590193     13.880924    -26.576241
## Private_health_expenditure        416.1200285   -510.880549    998.911818
## Govt_health_expenditure          1020.3934947  -3343.484653   1982.935156
## Freshwater_resources             4203.0430596  16602.459395 -35660.123627
## HIV_prevalence                     -0.4820353      1.490213     -6.987135
## Unemployment                       -1.4398405      3.039868      3.968488
## Govt_effectiveness                  0.9865725     -1.921819      1.960994
## Income_share                       -1.9218194     26.068093    -24.833573
## Tobacco_use                         1.9609940    -24.833573     97.527764
## Alcohol_consumption                 2.0353220     -7.687166      7.125095
## Political_stability                 0.7214839     -1.900931      1.833900
## Population_density                301.9096685   -206.206758     30.179168
##                               Alcohol_consumption Political_stability
## Life_expectancy                       11.493254          3.95263462
## CO2_emissions                          3.239246          1.50594139
## Electricity                           27.625558         11.46460215
## Health_expenditure                     2.964986          0.82230593
## Out_of_pocket                        -15.926924         -9.71881976
## Private_health_expenditure          1088.577629        223.10829419
## Govt_health_expenditure             2719.318552        687.20389160
## Freshwater_resources                8432.470830       7230.45946128
## HIV_prevalence                         1.294147          0.03476909
## Unemployment                          -1.816340         -1.21462410
## Govt_effectiveness                     2.035322          0.72148389
## Income_share                          -7.687166         -1.90093069
## Tobacco_use                            7.125095          1.83390009
## Alcohol_consumption                   15.794414          1.73172224
## Political_stability                    1.731722          1.00018271
## Population_density                  -218.842196        345.62908802
##                               Population_density
## Life_expectancy                     2.567323e+03
## CO2_emissions                       3.294378e+02
## Electricity                         4.734904e+03
## Health_expenditure                 -5.559828e+02
## Out_of_pocket                      -2.308275e+03
## Private_health_expenditure          8.181884e+04
## Govt_health_expenditure             2.520139e+05
## Freshwater_resources               -2.534178e+06
## HIV_prevalence                     -1.748864e+02
## Unemployment                       -1.438084e+03
## Govt_effectiveness                  3.019097e+02
## Income_share                       -2.062068e+02
## Tobacco_use                         3.017917e+01
## Alcohol_consumption                -2.188422e+02
## Political_stability                 3.456291e+02
## Population_density                  3.938961e+06
```

Correlation Matrix

```
corr_life_expectancy <- cor(life_expectancy, use = "pairwise.complete.obs")
corr_life_expectancy
```

```
##                          Life_expectancy CO2_emissions Electricity
## Life_expectancy              1.00000000    0.55999776   0.77132283
## CO2_emissions                0.55999776    1.00000000   0.44798419
## Electricity                  0.77132283    0.44798419   1.00000000
## Health_expenditure           0.31923919    0.13514343   0.26203377
## Out_of_pocket               -0.31590957   -0.30728110  -0.17169325
## Private_health_expenditure   0.58056287    0.43553278   0.37753174
## Govt_health_expenditure      0.69738997    0.54482614   0.41566298
## Freshwater_resources         0.08012279   -0.01489428   0.05322852
## HIV_prevalence              -0.39485927   -0.12668544  -0.28164905
## Unemployment                -0.21192883   -0.23554886  -0.20615394
## Govt_effectiveness           0.77980971    0.52486482   0.59899542
## Income_share                -0.37869572   -0.35951654  -0.32397404
## Tobacco_use                  0.28087452    0.05925622   0.38439780
## Alcohol_consumption          0.39149428    0.17379124   0.27762335
## Political_stability          0.53205495    0.32815789   0.45844897
## Population_density           0.21361223    0.11350116   0.09715175
##                          Health_expenditure Out_of_pocket
## Life_expectancy                  0.31923919  -0.315909574
## CO2_emissions                    0.13514343  -0.307281100
## Electricity                      0.26203377  -0.171693247
## Health_expenditure               1.00000000  -0.294703586
## Out_of_pocket                   -0.29470359   1.000000000
## Private_health_expenditure       0.45520572  -0.154539057
## Govt_health_expenditure          0.48854288  -0.459675206
## Freshwater_resources             0.05224326  -0.130707832
## HIV_prevalence                   0.03577408  -0.255857482
## Unemployment                     0.08557317  -0.005638088
## Govt_effectiveness               0.32294387  -0.445579835
## Income_share                    -0.12632900   0.176219118
## Tobacco_use                      0.23675224  -0.141040002
## Alcohol_consumption              0.26096324  -0.211569324
## Political_stability              0.29600878  -0.550363714
## Population_density              -0.12557678  -0.082016388
##                          Private_health_expenditure Govt_health_expenditure
## Life_expectancy                          0.58056287                0.6973900
## CO2_emissions                            0.43553278                0.5448261
## Electricity                              0.37753174                0.4156630
## Health_expenditure                       0.45520572                0.4885429
## Out_of_pocket                           -0.15453906               -0.4596752
## Private_health_expenditure               1.00000000                0.6404790
## Govt_health_expenditure                  0.64047897                1.0000000
## Freshwater_resources                     0.00249387                0.1381351
## HIV_prevalence                          -0.14842832               -0.1627198
## Unemployment                            -0.13822951               -0.2235098
## Govt_effectiveness                       0.63209648                0.7861749
## Income_share                            -0.13705840               -0.3906488
## Tobacco_use                              0.13872210                0.1398185
```

```
## Alcohol_consumption                            0.39928011                  0.5054375
## Political_stability                             0.35392372                  0.5402335
## Population_density                              0.08143745                  0.1243089
##                              Freshwater_resources HIV_prevalence Unemployment
## Life_expectancy                        0.08012279   -0.394859268 -0.211928830
## CO2_emissions                         -0.01489428   -0.126685437 -0.235548860
## Electricity                            0.05322852   -0.281649049 -0.206153935
## Health_expenditure                     0.05224326    0.035774080  0.085573166
## Out_of_pocket                         -0.13070783   -0.255857482 -0.005638088
## Private_health_expenditure             0.00249387   -0.148428320 -0.138229514
## Govt_health_expenditure                0.13813506   -0.162719781 -0.223509794
## Freshwater_resources                   1.00000000   -0.060933622 -0.039744156
## HIV_prevalence                        -0.06093362    1.000000000  0.462438180
## Unemployment                          -0.03974416    0.462438180  1.000000000
## Govt_effectiveness                     0.09333064   -0.118009647 -0.313294450
## Income_share                           0.20451138    0.212703450  0.178164324
## Tobacco_use                           -0.07827645   -0.160712654  0.098762188
## Alcohol_consumption                    0.04701274    0.078517395 -0.096025078
## Political_stability                    0.16475643    0.008648074 -0.277681395
## Population_density                    -0.08858449   -0.060200051 -0.144207934
##                              Govt_effectiveness Income_share  Tobacco_use
## Life_expectancy                      0.77980971   -0.3786957  0.280874521
## CO2_emissions                        0.52486482   -0.3595165  0.059256221
## Electricity                          0.59899542   -0.3239740  0.384397796
## Health_expenditure                   0.32294387   -0.1263290  0.236752240
## Out_of_pocket                       -0.44557983    0.1762191 -0.141040002
## Private_health_expenditure           0.63209648   -0.1370584  0.138722104
## Govt_health_expenditure              0.78617492   -0.3906488  0.139818547
## Freshwater_resources                 0.09333064    0.2045114 -0.078276453
## HIV_prevalence                      -0.11800965    0.2127034 -0.160712654
## Unemployment                        -0.31329445    0.1781643  0.098762188
## Govt_effectiveness                   1.00000000   -0.4566493  0.205702881
## Income_share                        -0.45664929    1.0000000 -0.560267739
## Tobacco_use                          0.20570288   -0.5602677  1.000000000
## Alcohol_consumption                  0.52522762   -0.3827800  0.177376911
## Political_stability                  0.72903475   -0.5241907  0.204038304
## Population_density                   0.18902761   -0.1470346  0.004574052
##                              Alcohol_consumption Political_stability
## Life_expectancy                       0.39149428         0.532054954
## CO2_emissions                         0.17379124         0.328157892
## Electricity                           0.27762335         0.458448965
## Health_expenditure                    0.26096324         0.296008776
## Out_of_pocket                        -0.21156932        -0.550363714
## Private_health_expenditure            0.39928011         0.353923721
## Govt_health_expenditure               0.50543750         0.540233461
## Freshwater_resources                  0.04701274         0.164756432
## HIV_prevalence                        0.07851740         0.008648074
## Unemployment                         -0.09602508        -0.277681395
## Govt_effectiveness                    0.52522762         0.729034749
## Income_share                         -0.38277996        -0.524190675
## Tobacco_use                           0.17737691         0.204038304
## Alcohol_consumption                   1.00000000         0.453387855
## Political_stability                   0.45338786         1.000000000
## Population_density                   -0.08799626         0.169802564
```

```
##                              Population_density
## Life_expectancy                     0.213612229
## CO2_emissions                       0.113501161
## Electricity                         0.097151748
## Health_expenditure                 -0.125576783
## Out_of_pocket                      -0.082016388
## Private_health_expenditure          0.081437450
## Govt_health_expenditure             0.124308889
## Freshwater_resources               -0.088584492
## HIV_prevalence                     -0.060200051
## Unemployment                       -0.144207934
## Govt_effectiveness                  0.189027613
## Income_share                       -0.147034574
## Tobacco_use                         0.004574052
## Alcohol_consumption                -0.087996260
## Political_stability                 0.169802564
## Population_density                  1.000000000
```
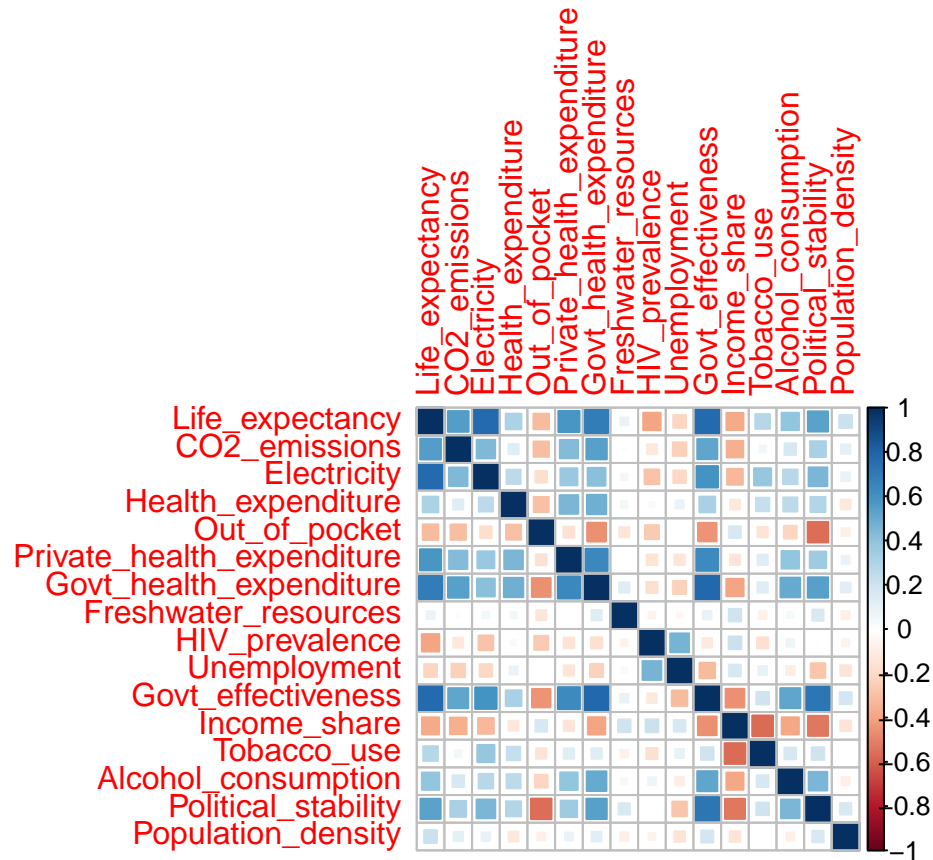
Scatterplot Matrix

```r
pairs(life_expectancy, pch = 16, lower.panel = NULL)
```
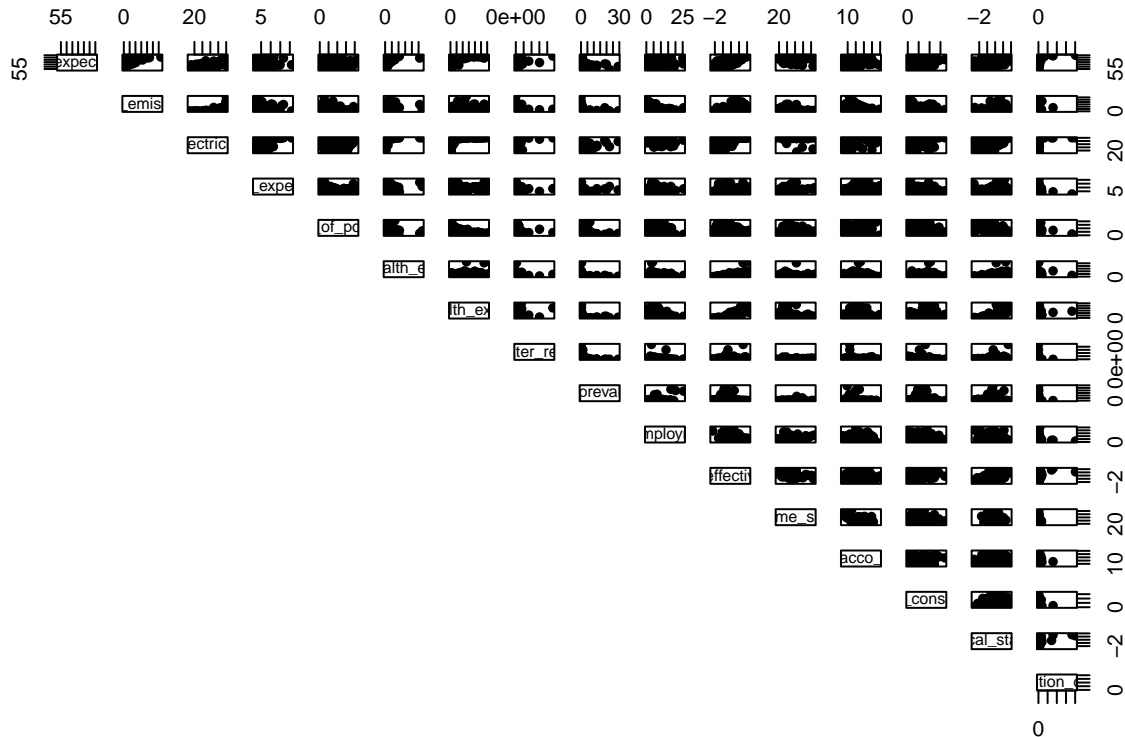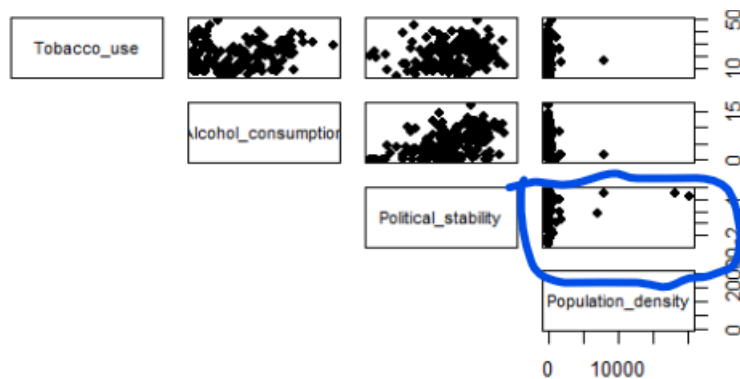
Correlation Plot

```
corrplot(corr_life_expectancy, method = "square")
```


Likely Outliers

The following is the concept we followed when identifying outliers.

1. Find a pair of dimensions that appear to have outliers on the **Scatterplot Matrix.**

Here it appears that Population Density and Political Stability have a few outliers.

2. Find the Mahalanobis Distances for every row between those dimensions.

```r
# dimension 1
dim1 <- "Private_health_expenditure"  # CHANGE THIS
# dimension 2
dim2 <- "Income_share" # CHANGE THIS
# pair of dimensions
pair_dims <- c(dim1, dim2)

# all rows between the pairs of dimensions
rows_pair_dims <- life_expectancy[,pair_dims]
# centroid
centroid <- c(mean(life_expectancy[,dim1], na.rm = TRUE),
              mean(life_expectancy[,dim2], na.rm = TRUE))
# covariance matrix between dimensions
cov_pair_dims <- cov(life_expectancy[,pair_dims], use = "pairwise.complete.obs")

# mahalanobis distance for each row between these dimensions
m_dims <- mahalanobis(x = rows_pair_dims,
                      center = centroid,
                      cov = cov_pair_dims)
```

3. Compare the Mahalanobis Distances for every row to the critical value to find the outliers.

```r
# our constant critical value
critical_value <- qchisq(p = 1 - 0.001, df = 2)

# find which Mahalanobis distances for every row to the critical value
outlierIndicies <- which(m_dims>critical_value)
m_dims[outlierIndicies]
```

```
## United States
##      49.25951
```

4. Find the correlation matrices for our pair of dimensions with and without each outlier to see if it is significant.

```r
for (outlier in outlierIndicies) {
   cor_with <- cor(life_expectancy[,pair_dims],
                   use = "pairwise.complete.obs")
   cor_without <- cor(life_expectancy[-outlier, pair_dims],
                      use = "pairwise.complete.obs")
   print(rownames(life_expectancy)[outlier])
   print(cor_with)
   print(cor_without)
   cat('\n')
   cat('\n')
}
```

```
## [1] "United States"
##                              Private_health_expenditure Income_share
```

```
## Private_health_expenditure                               1.0000000   -0.1370584
## Income_share                                             -0.1370584    1.0000000
##                               Private_health_expenditure Income_share
## Private_health_expenditure                      1.0000000   -0.2949124
## Income_share                                   -0.2949124    1.0000000
```

Find All Outliers

The following takes the idea above and does it for all pairs of dimension (however a bit redundantly).

```r
outlier_matrix <- matrix(nrow = 0, ncol = 4)
colnames(outlier_matrix) <- c("Country", "dim1", "dim2", "MD")
```

```r
for (i in col_names) {
  other_col_names <- col_names[col_names != i]
  for (j in other_col_names) {
    # dimension 1
    dim1 <- i
    # dimension 2
    dim2 <- j
    # pair of dimensions
    pair_dims <- c(dim1, dim2)

    # all rows between the pairs of dimensions
    rows_pair_dims <- life_expectancy[,pair_dims]
    # centroid
    centroid <- c(mean(life_expectancy[,dim1], na.rm = TRUE),
                  mean(life_expectancy[,dim2], na.rm = TRUE))
    # covariance matrix between dimensions
    cov_pair_dims <- cov(life_expectancy[,pair_dims], use = "pairwise.complete.obs")

    # mahalanobis distance for each row between these dimensions
    m_dims <- mahalanobis(x = rows_pair_dims,
                          center = centroid,
                          cov = cov_pair_dims)
    # our constant critical value
    critical_value <- qchisq(p = 1 - 0.001, df = 2)

    # find which Mahalanobis distances for every row to the critical value
    outlierIndicies <- which(m_dims>critical_value)
    m_dims[outlierIndicies]

    for (outlier in outlierIndicies) {
      country <- rownames(life_expectancy)[outlier]
      m_dist <- m_dims[outlier]
      outlier_matrix <- rbind(outlier_matrix, c(country, dim1, dim2, m_dist))
      cor_with <- cor(life_expectancy[,pair_dims],
                  use = "pairwise.complete.obs")
      cor_without <- cor(life_expectancy[-outlier, pair_dims],
                  use = "pairwise.complete.obs")
      change <- abs(cor_with[2,1]-cor_without[2,1])
```

```
    if (change > 0.3) {
      cat(sprintf("%s is an influetial outlier for the dimensions %s and %s as the correlation changes
      cat('\n')
      cat('\n')
    }
  }
 }
}
```

We have many outliers in the following matrix, but several that are redundant. We attempted to avoid this but are unsure how to achieve this. However it is of note that none of these outliers were actually found to be influential based on the code we wrote.

`outlier_matrix`

```
##         Country              dim1
##   [1,] "Bahrain"            "Life_expectancy"
##   [2,] "Kuwait"             "Life_expectancy"
##   [3,] "Qatar"              "Life_expectancy"
##   [4,] "Tuvalu"             "Life_expectancy"
##   [5,] "Switzerland"        "Life_expectancy"
##   [6,] "United States"      "Life_expectancy"
##   [7,] "Norway"             "Life_expectancy"
##   [8,] "United States"      "Life_expectancy"
##   [9,] "Guyana"             "Life_expectancy"
##  [10,] "Iceland"            "Life_expectancy"
##  [11,] "Botswana"           "Life_expectancy"
##  [12,] "Eswatini"           "Life_expectancy"
##  [13,] "Lesotho"            "Life_expectancy"
##  [14,] "South Africa"       "Life_expectancy"
##  [15,] "Kosovo"             "Life_expectancy"
##  [16,] "Macao SAR, China"   "Life_expectancy"
##  [17,] "Singapore"          "Life_expectancy"
##  [18,] "Bahrain"            "CO2_emissions"
##  [19,] "Kuwait"             "CO2_emissions"
##  [20,] "Qatar"              "CO2_emissions"
##  [21,] "Bahrain"            "CO2_emissions"
##  [22,] "Kuwait"             "CO2_emissions"
##  [23,] "Qatar"              "CO2_emissions"
##  [24,] "Bahrain"            "CO2_emissions"
##  [25,] "Kuwait"             "CO2_emissions"
##  [26,] "Qatar"              "CO2_emissions"
##  [27,] "Tuvalu"             "CO2_emissions"
##  [28,] "United States"      "CO2_emissions"
##  [29,] "Bahrain"            "CO2_emissions"
##  [30,] "Qatar"              "CO2_emissions"
##  [31,] "Bahrain"            "CO2_emissions"
##  [32,] "Kuwait"             "CO2_emissions"
##  [33,] "Qatar"              "CO2_emissions"
##  [34,] "Switzerland"        "CO2_emissions"
##  [35,] "United States"      "CO2_emissions"
##  [36,] "Bahrain"            "CO2_emissions"
##  [37,] "Kuwait"             "CO2_emissions"
```

```
## [38,] "Norway"               "CO2_emissions"
## [39,] "Qatar"                "CO2_emissions"
## [40,] "United Arab Emirates" "CO2_emissions"
## [41,] "Bahrain"              "CO2_emissions"
## [42,] "Guyana"               "CO2_emissions"
## [43,] "Iceland"              "CO2_emissions"
## [44,] "Qatar"                "CO2_emissions"
## [45,] "Bahrain"              "CO2_emissions"
## [46,] "Botswana"             "CO2_emissions"
## [47,] "Eswatini"             "CO2_emissions"
## [48,] "Lesotho"              "CO2_emissions"
## [49,] "Qatar"                "CO2_emissions"
## [50,] "South Africa"         "CO2_emissions"
## [51,] "Qatar"                "CO2_emissions"
## [52,] "South Africa"         "CO2_emissions"
## [53,] "Bahrain"              "CO2_emissions"
## [54,] "Kuwait"               "CO2_emissions"
## [55,] "Qatar"                "CO2_emissions"
## [56,] "Bahrain"              "CO2_emissions"
## [57,] "Qatar"                "CO2_emissions"
## [58,] "Bahrain"              "CO2_emissions"
## [59,] "Kuwait"               "CO2_emissions"
## [60,] "Qatar"                "CO2_emissions"
## [61,] "Bahrain"              "CO2_emissions"
## [62,] "Kuwait"               "CO2_emissions"
## [63,] "Qatar"                "CO2_emissions"
## [64,] "Bahrain"              "CO2_emissions"
## [65,] "Qatar"                "CO2_emissions"
## [66,] "Singapore"            "CO2_emissions"
## [67,] "Bahrain"              "Electricity"
## [68,] "Kuwait"               "Electricity"
## [69,] "Qatar"                "Electricity"
## [70,] "Tuvalu"               "Electricity"
## [71,] "Switzerland"          "Electricity"
## [72,] "United States"        "Electricity"
## [73,] "Norway"               "Electricity"
## [74,] "Guyana"               "Electricity"
## [75,] "Iceland"              "Electricity"
## [76,] "Botswana"             "Electricity"
## [77,] "Eswatini"             "Electricity"
## [78,] "Lesotho"              "Electricity"
## [79,] "South Africa"         "Electricity"
## [80,] "Papua New Guinea"     "Electricity"
## [81,] "Macao SAR, China"     "Electricity"
## [82,] "Monaco"               "Electricity"
## [83,] "Singapore"            "Electricity"
## [84,] "Tuvalu"               "Health_expenditure"
## [85,] "Bahrain"              "Health_expenditure"
## [86,] "Kuwait"               "Health_expenditure"
## [87,] "Qatar"                "Health_expenditure"
## [88,] "Tuvalu"               "Health_expenditure"
## [89,] "United States"        "Health_expenditure"
## [90,] "Tuvalu"               "Health_expenditure"
## [91,] "Afghanistan"          "Health_expenditure"
```

```
##  [92,] "Armenia"           "Health_expenditure"
##  [93,] "Tuvalu"            "Health_expenditure"
##  [94,] "Switzerland"       "Health_expenditure"
##  [95,] "Tuvalu"            "Health_expenditure"
##  [96,] "United States"     "Health_expenditure"
##  [97,] "Luxembourg"        "Health_expenditure"
##  [98,] "Tuvalu"            "Health_expenditure"
##  [99,] "United States"     "Health_expenditure"
## [100,] "Guyana"            "Health_expenditure"
## [101,] "Iceland"           "Health_expenditure"
## [102,] "Botswana"          "Health_expenditure"
## [103,] "Eswatini"          "Health_expenditure"
## [104,] "Lesotho"           "Health_expenditure"
## [105,] "South Africa"      "Health_expenditure"
## [106,] "Marshall Islands"  "Health_expenditure"
## [107,] "Tuvalu"            "Health_expenditure"
## [108,] "Tuvalu"            "Health_expenditure"
## [109,] "Tuvalu"            "Health_expenditure"
## [110,] "Afghanistan"       "Health_expenditure"
## [111,] "Tuvalu"            "Health_expenditure"
## [112,] "Monaco"            "Health_expenditure"
## [113,] "Singapore"         "Health_expenditure"
## [114,] "Tuvalu"            "Health_expenditure"
## [115,] "Bahrain"           "Out_of_pocket"
## [116,] "Qatar"             "Out_of_pocket"
## [117,] "Afghanistan"       "Out_of_pocket"
## [118,] "Armenia"           "Out_of_pocket"
## [119,] "Tuvalu"            "Out_of_pocket"
## [120,] "Switzerland"       "Out_of_pocket"
## [121,] "United States"     "Out_of_pocket"
## [122,] "Norway"            "Out_of_pocket"
## [123,] "Guyana"            "Out_of_pocket"
## [124,] "Iceland"           "Out_of_pocket"
## [125,] "Botswana"          "Out_of_pocket"
## [126,] "Eswatini"          "Out_of_pocket"
## [127,] "Lesotho"           "Out_of_pocket"
## [128,] "South Africa"      "Out_of_pocket"
## [129,] "South Africa"      "Out_of_pocket"
## [130,] "Monaco"            "Out_of_pocket"
## [131,] "Singapore"         "Out_of_pocket"
## [132,] "Switzerland"       "Private_health_expenditure"
## [133,] "United States"     "Private_health_expenditure"
## [134,] "Bahrain"           "Private_health_expenditure"
## [135,] "Kuwait"            "Private_health_expenditure"
## [136,] "Qatar"             "Private_health_expenditure"
## [137,] "Switzerland"       "Private_health_expenditure"
## [138,] "United States"     "Private_health_expenditure"
## [139,] "Switzerland"       "Private_health_expenditure"
## [140,] "United States"     "Private_health_expenditure"
## [141,] "Switzerland"       "Private_health_expenditure"
## [142,] "Tuvalu"            "Private_health_expenditure"
## [143,] "United States"     "Private_health_expenditure"
## [144,] "Switzerland"       "Private_health_expenditure"
## [145,] "United States"     "Private_health_expenditure"
```

```
## [146,] "Luxembourg"            "Private_health_expenditure"
## [147,] "Norway"                "Private_health_expenditure"
## [148,] "Switzerland"           "Private_health_expenditure"
## [149,] "United States"         "Private_health_expenditure"
## [150,] "Guyana"                "Private_health_expenditure"
## [151,] "Iceland"               "Private_health_expenditure"
## [152,] "Switzerland"           "Private_health_expenditure"
## [153,] "United States"         "Private_health_expenditure"
## [154,] "Botswana"              "Private_health_expenditure"
## [155,] "Eswatini"              "Private_health_expenditure"
## [156,] "Lesotho"               "Private_health_expenditure"
## [157,] "South Africa"          "Private_health_expenditure"
## [158,] "Switzerland"           "Private_health_expenditure"
## [159,] "United States"         "Private_health_expenditure"
## [160,] "Switzerland"           "Private_health_expenditure"
## [161,] "United States"         "Private_health_expenditure"
## [162,] "Switzerland"           "Private_health_expenditure"
## [163,] "United States"         "Private_health_expenditure"
## [164,] "United States"         "Private_health_expenditure"
## [165,] "Switzerland"           "Private_health_expenditure"
## [166,] "United States"         "Private_health_expenditure"
## [167,] "Switzerland"           "Private_health_expenditure"
## [168,] "United States"         "Private_health_expenditure"
## [169,] "Switzerland"           "Private_health_expenditure"
## [170,] "United States"         "Private_health_expenditure"
## [171,] "Monaco"                "Private_health_expenditure"
## [172,] "Singapore"             "Private_health_expenditure"
## [173,] "Switzerland"           "Private_health_expenditure"
## [174,] "United States"         "Private_health_expenditure"
## [175,] "Norway"                "Govt_health_expenditure"
## [176,] "United States"         "Govt_health_expenditure"
## [177,] "Bahrain"               "Govt_health_expenditure"
## [178,] "Kuwait"                "Govt_health_expenditure"
## [179,] "Norway"                "Govt_health_expenditure"
## [180,] "Qatar"                 "Govt_health_expenditure"
## [181,] "United Arab Emirates"  "Govt_health_expenditure"
## [182,] "Norway"                "Govt_health_expenditure"
## [183,] "Luxembourg"            "Govt_health_expenditure"
## [184,] "Tuvalu"                "Govt_health_expenditure"
## [185,] "United States"         "Govt_health_expenditure"
## [186,] "Norway"                "Govt_health_expenditure"
## [187,] "Luxembourg"            "Govt_health_expenditure"
## [188,] "Norway"                "Govt_health_expenditure"
## [189,] "Switzerland"           "Govt_health_expenditure"
## [190,] "United States"         "Govt_health_expenditure"
## [191,] "Guyana"                "Govt_health_expenditure"
## [192,] "Iceland"               "Govt_health_expenditure"
## [193,] "Botswana"              "Govt_health_expenditure"
## [194,] "Eswatini"              "Govt_health_expenditure"
## [195,] "Lesotho"               "Govt_health_expenditure"
## [196,] "South Africa"          "Govt_health_expenditure"
## [197,] "Norway"                "Govt_health_expenditure"
## [198,] "Norway"                "Govt_health_expenditure"
## [199,] "United States"         "Govt_health_expenditure"
```

```
## [200,]  "Norway"          "Govt_health_expenditure"
## [201,]  "Norway"          "Govt_health_expenditure"
## [202,]  "Monaco"          "Govt_health_expenditure"
## [203,]  "Singapore"       "Govt_health_expenditure"
## [204,]  "Guyana"          "Freshwater_resources"
## [205,]  "Iceland"         "Freshwater_resources"
## [206,]  "Bahrain"         "Freshwater_resources"
## [207,]  "Guyana"          "Freshwater_resources"
## [208,]  "Iceland"         "Freshwater_resources"
## [209,]  "Qatar"           "Freshwater_resources"
## [210,]  "Guyana"          "Freshwater_resources"
## [211,]  "Iceland"         "Freshwater_resources"
## [212,]  "Guyana"          "Freshwater_resources"
## [213,]  "Iceland"         "Freshwater_resources"
## [214,]  "Guyana"          "Freshwater_resources"
## [215,]  "Iceland"         "Freshwater_resources"
## [216,]  "Guyana"          "Freshwater_resources"
## [217,]  "Iceland"         "Freshwater_resources"
## [218,]  "Switzerland"     "Freshwater_resources"
## [219,]  "United States"   "Freshwater_resources"
## [220,]  "Guyana"          "Freshwater_resources"
## [221,]  "Iceland"         "Freshwater_resources"
## [222,]  "Botswana"        "Freshwater_resources"
## [223,]  "Eswatini"        "Freshwater_resources"
## [224,]  "Guyana"          "Freshwater_resources"
## [225,]  "Iceland"         "Freshwater_resources"
## [226,]  "Lesotho"         "Freshwater_resources"
## [227,]  "South Africa"    "Freshwater_resources"
## [228,]  "Guyana"          "Freshwater_resources"
## [229,]  "Iceland"         "Freshwater_resources"
## [230,]  "Guyana"          "Freshwater_resources"
## [231,]  "Iceland"         "Freshwater_resources"
## [232,]  "Guyana"          "Freshwater_resources"
## [233,]  "Iceland"         "Freshwater_resources"
## [234,]  "Guyana"          "Freshwater_resources"
## [235,]  "Iceland"         "Freshwater_resources"
## [236,]  "Guyana"          "Freshwater_resources"
## [237,]  "Iceland"         "Freshwater_resources"
## [238,]  "Guyana"          "Freshwater_resources"
## [239,]  "Iceland"         "Freshwater_resources"
## [240,]  "Singapore"       "Freshwater_resources"
## [241,]  "Botswana"        "HIV_prevalence"
## [242,]  "Eswatini"        "HIV_prevalence"
## [243,]  "Lesotho"         "HIV_prevalence"
## [244,]  "South Africa"    "HIV_prevalence"
## [245,]  "Bahrain"         "HIV_prevalence"
## [246,]  "Botswana"        "HIV_prevalence"
## [247,]  "Eswatini"        "HIV_prevalence"
## [248,]  "Lesotho"         "HIV_prevalence"
## [249,]  "Qatar"           "HIV_prevalence"
## [250,]  "South Africa"    "HIV_prevalence"
## [251,]  "Botswana"        "HIV_prevalence"
## [252,]  "Eswatini"        "HIV_prevalence"
## [253,]  "Lesotho"         "HIV_prevalence"
```

```
## [254,] "South Africa"      "HIV_prevalence"
## [255,] "Botswana"          "HIV_prevalence"
## [256,] "Eswatini"          "HIV_prevalence"
## [257,] "Lesotho"           "HIV_prevalence"
## [258,] "South Africa"      "HIV_prevalence"
## [259,] "Botswana"          "HIV_prevalence"
## [260,] "Eswatini"          "HIV_prevalence"
## [261,] "Lesotho"           "HIV_prevalence"
## [262,] "South Africa"      "HIV_prevalence"
## [263,] "Botswana"          "HIV_prevalence"
## [264,] "Eswatini"          "HIV_prevalence"
## [265,] "Lesotho"           "HIV_prevalence"
## [266,] "South Africa"      "HIV_prevalence"
## [267,] "Switzerland"       "HIV_prevalence"
## [268,] "United States"     "HIV_prevalence"
## [269,] "Botswana"          "HIV_prevalence"
## [270,] "Eswatini"          "HIV_prevalence"
## [271,] "Lesotho"           "HIV_prevalence"
## [272,] "South Africa"      "HIV_prevalence"
## [273,] "Botswana"          "HIV_prevalence"
## [274,] "Eswatini"          "HIV_prevalence"
## [275,] "Guyana"            "HIV_prevalence"
## [276,] "Iceland"           "HIV_prevalence"
## [277,] "Lesotho"           "HIV_prevalence"
## [278,] "South Africa"      "HIV_prevalence"
## [279,] "Botswana"          "HIV_prevalence"
## [280,] "Lesotho"           "HIV_prevalence"
## [281,] "South Africa"      "HIV_prevalence"
## [282,] "Botswana"          "HIV_prevalence"
## [283,] "Eswatini"          "HIV_prevalence"
## [284,] "Lesotho"           "HIV_prevalence"
## [285,] "South Africa"      "HIV_prevalence"
## [286,] "Botswana"          "HIV_prevalence"
## [287,] "Eswatini"          "HIV_prevalence"
## [288,] "Lesotho"           "HIV_prevalence"
## [289,] "South Africa"      "HIV_prevalence"
## [290,] "Botswana"          "HIV_prevalence"
## [291,] "Eswatini"          "HIV_prevalence"
## [292,] "Lesotho"           "HIV_prevalence"
## [293,] "South Africa"      "HIV_prevalence"
## [294,] "Botswana"          "HIV_prevalence"
## [295,] "Eswatini"          "HIV_prevalence"
## [296,] "Lesotho"           "HIV_prevalence"
## [297,] "South Africa"      "HIV_prevalence"
## [298,] "Botswana"          "HIV_prevalence"
## [299,] "Eswatini"          "HIV_prevalence"
## [300,] "Lesotho"           "HIV_prevalence"
## [301,] "Singapore"         "HIV_prevalence"
## [302,] "South Africa"      "HIV_prevalence"
## [303,] "Kosovo"            "Unemployment"
## [304,] "Qatar"             "Unemployment"
## [305,] "South Africa"      "Unemployment"
## [306,] "South Africa"      "Unemployment"
## [307,] "Switzerland"       "Unemployment"
```

```
## [308,] "United States"     "Unemployment"
## [309,] "Guyana"            "Unemployment"
## [310,] "Iceland"           "Unemployment"
## [311,] "Botswana"          "Unemployment"
## [312,] "Lesotho"           "Unemployment"
## [313,] "South Africa"      "Unemployment"
## [314,] "South Africa"      "Unemployment"
## [315,] "Macao SAR, China"  "Unemployment"
## [316,] "Singapore"         "Unemployment"
## [317,] "Bahrain"           "Govt_effectiveness"
## [318,] "Kuwait"            "Govt_effectiveness"
## [319,] "Qatar"             "Govt_effectiveness"
## [320,] "Marshall Islands"  "Govt_effectiveness"
## [321,] "Tuvalu"            "Govt_effectiveness"
## [322,] "Switzerland"       "Govt_effectiveness"
## [323,] "United States"     "Govt_effectiveness"
## [324,] "Norway"            "Govt_effectiveness"
## [325,] "Guyana"            "Govt_effectiveness"
## [326,] "Iceland"           "Govt_effectiveness"
## [327,] "Botswana"          "Govt_effectiveness"
## [328,] "Eswatini"          "Govt_effectiveness"
## [329,] "Lesotho"           "Govt_effectiveness"
## [330,] "South Africa"      "Govt_effectiveness"
## [331,] "South Africa"      "Govt_effectiveness"
## [332,] "Macao SAR, China"  "Govt_effectiveness"
## [333,] "Singapore"         "Govt_effectiveness"
## [334,] "United States"     "Income_share"
## [335,] "Norway"            "Income_share"
## [336,] "United States"     "Income_share"
## [337,] "Bahrain"           "Tobacco_use"
## [338,] "Qatar"             "Tobacco_use"
## [339,] "Papua New Guinea"  "Tobacco_use"
## [340,] "Tuvalu"            "Tobacco_use"
## [341,] "Switzerland"       "Tobacco_use"
## [342,] "United States"     "Tobacco_use"
## [343,] "Norway"            "Tobacco_use"
## [344,] "Guyana"            "Tobacco_use"
## [345,] "Iceland"           "Tobacco_use"
## [346,] "Botswana"          "Tobacco_use"
## [347,] "Eswatini"          "Tobacco_use"
## [348,] "Lesotho"           "Tobacco_use"
## [349,] "South Africa"      "Tobacco_use"
## [350,] "Singapore"         "Tobacco_use"
## [351,] "Bahrain"           "Alcohol_consumption"
## [352,] "Kuwait"            "Alcohol_consumption"
## [353,] "Qatar"             "Alcohol_consumption"
## [354,] "Tuvalu"            "Alcohol_consumption"
## [355,] "Switzerland"       "Alcohol_consumption"
## [356,] "United States"     "Alcohol_consumption"
## [357,] "Norway"            "Alcohol_consumption"
## [358,] "Guyana"            "Alcohol_consumption"
## [359,] "Iceland"           "Alcohol_consumption"
## [360,] "Botswana"          "Alcohol_consumption"
## [361,] "Eswatini"          "Alcohol_consumption"
```

```
## [362,] "Lesotho"              "Alcohol_consumption"
## [363,] "South Africa"         "Alcohol_consumption"
## [364,] "Singapore"            "Alcohol_consumption"
## [365,] "Bahrain"              "Political_stability"
## [366,] "Kuwait"               "Political_stability"
## [367,] "Qatar"                "Political_stability"
## [368,] "Afghanistan"          "Political_stability"
## [369,] "Tuvalu"               "Political_stability"
## [370,] "Switzerland"          "Political_stability"
## [371,] "United States"        "Political_stability"
## [372,] "Guyana"               "Political_stability"
## [373,] "Iceland"              "Political_stability"
## [374,] "Botswana"             "Political_stability"
## [375,] "Eswatini"             "Political_stability"
## [376,] "Lesotho"              "Political_stability"
## [377,] "South Africa"         "Political_stability"
## [378,] "Macao SAR, China"     "Political_stability"
## [379,] "Monaco"               "Political_stability"
## [380,] "Singapore"            "Political_stability"
## [381,] "Macao SAR, China"     "Population_density"
## [382,] "Singapore"            "Population_density"
## [383,] "Bahrain"              "Population_density"
## [384,] "Qatar"                "Population_density"
## [385,] "Singapore"            "Population_density"
## [386,] "Macao SAR, China"     "Population_density"
## [387,] "Monaco"               "Population_density"
## [388,] "Singapore"            "Population_density"
## [389,] "Monaco"               "Population_density"
## [390,] "Singapore"            "Population_density"
## [391,] "Tuvalu"               "Population_density"
## [392,] "Monaco"               "Population_density"
## [393,] "Singapore"            "Population_density"
## [394,] "Monaco"               "Population_density"
## [395,] "Singapore"            "Population_density"
## [396,] "Switzerland"          "Population_density"
## [397,] "United States"        "Population_density"
## [398,] "Monaco"               "Population_density"
## [399,] "Singapore"            "Population_density"
## [400,] "Guyana"               "Population_density"
## [401,] "Iceland"              "Population_density"
## [402,] "Singapore"            "Population_density"
## [403,] "Botswana"             "Population_density"
## [404,] "Eswatini"             "Population_density"
## [405,] "Lesotho"              "Population_density"
## [406,] "Singapore"            "Population_density"
## [407,] "South Africa"         "Population_density"
## [408,] "Macao SAR, China"     "Population_density"
## [409,] "Singapore"            "Population_density"
## [410,] "Macao SAR, China"     "Population_density"
## [411,] "Singapore"            "Population_density"
## [412,] "Singapore"            "Population_density"
## [413,] "Singapore"            "Population_density"
## [414,] "Macao SAR, China"     "Population_density"
## [415,] "Monaco"               "Population_density"
```

```
## [416,] "Singapore"                  "Population_density"
##          dim2                         MD
##   [1,] "CO2_emissions"               "16.8231922360675"
##   [2,] "CO2_emissions"               "15.1182143005169"
##   [3,] "CO2_emissions"               "42.4676468840029"
##   [4,] "Health_expenditure"         "30.4699758206622"
##   [5,] "Private_health_expenditure" "66.3134292549167"
##   [6,] "Private_health_expenditure" "61.8618088206492"
##   [7,] "Govt_health_expenditure"    "15.5965254639934"
##   [8,] "Govt_health_expenditure"    "14.1567313504708"
##   [9,] "Freshwater_resources"       "41.5123273050624"
##  [10,] "Freshwater_resources"       "102.779994104612"
##  [11,] "HIV_prevalence"             "19.5001007132259"
##  [12,] "HIV_prevalence"             "44.3127463011574"
##  [13,] "HIV_prevalence"             "24.6706853142231"
##  [14,] "HIV_prevalence"             "17.0501339898414"
##  [15,] "Unemployment"               "13.9628192761266"
##  [16,] "Population_density"         "98.8345710338524"
##  [17,] "Population_density"         "14.9747891658854"
##  [18,] "Life_expectancy"            "16.8231922360675"
##  [19,] "Life_expectancy"            "15.1182143005169"
##  [20,] "Life_expectancy"            "42.467646884003"
##  [21,] "Electricity"                "16.6503006624704"
##  [22,] "Electricity"                "14.8912945481484"
##  [23,] "Electricity"                "41.3807104161089"
##  [24,] "Health_expenditure"         "16.6281876933866"
##  [25,] "Health_expenditure"         "14.0295833720652"
##  [26,] "Health_expenditure"         "38.4775594123"
##  [27,] "Health_expenditure"         "24.6280825156571"
##  [28,] "Health_expenditure"         "14.7279430615298"
##  [29,] "Out_of_pocket"              "16.115753954895"
##  [30,] "Out_of_pocket"              "35.78898833561"
##  [31,] "Private_health_expenditure" "16.434809126189"
##  [32,] "Private_health_expenditure" "17.6317762526812"
##  [33,] "Private_health_expenditure" "41.4463825157564"
##  [34,] "Private_health_expenditure" "66.5253757134203"
##  [35,] "Private_health_expenditure" "47.0569256956058"
##  [36,] "Govt_health_expenditure"    "19.9779341673009"
##  [37,] "Govt_health_expenditure"    "14.6947763979928"
##  [38,] "Govt_health_expenditure"    "15.5345958092032"
##  [39,] "Govt_health_expenditure"    "41.1273779303174"
##  [40,] "Govt_health_expenditure"    "14.3632995853497"
##  [41,] "Freshwater_resources"       "14.8109158887825"
##  [42,] "Freshwater_resources"       "40.4664427022144"
##  [43,] "Freshwater_resources"       "102.548341074487"
##  [44,] "Freshwater_resources"       "35.2626419441593"
##  [45,] "HIV_prevalence"             "14.745023032369"
##  [46,] "HIV_prevalence"             "18.8831987255665"
##  [47,] "HIV_prevalence"             "43.12627583616"
##  [48,] "HIV_prevalence"             "24.3743067264175"
##  [49,] "HIV_prevalence"             "35.3119544116243"
##  [50,] "HIV_prevalence"             "17.9923552381178"
##  [51,] "Unemployment"               "35.2241022875264"
##  [52,] "Unemployment"               "14.8231788223695"
```

```
## [53,]  "Govt_effectiveness"         "18.6532015703147"
## [54,]  "Govt_effectiveness"         "18.0408794985305"
## [55,]  "Govt_effectiveness"         "42.9911785464882"
## [56,]  "Tobacco_use"                "15.3637323562188"
## [57,]  "Tobacco_use"                "36.7475258082696"
## [58,]  "Alcohol_consumption"        "17.4845745403339"
## [59,]  "Alcohol_consumption"        "17.3622672481721"
## [60,]  "Alcohol_consumption"        "39.7782670326656"
## [61,]  "Political_stability"        "18.4598192720145"
## [62,]  "Political_stability"        "14.249429469499"
## [63,]  "Political_stability"        "36.7396938581622"
## [64,]  "Population_density"         "15.1078623776723"
## [65,]  "Population_density"         "35.3036875822335"
## [66,]  "Population_density"         "14.8423207333135"
## [67,]  "CO2_emissions"              "16.6503006624704"
## [68,]  "CO2_emissions"              "14.8912945481484"
## [69,]  "CO2_emissions"              "41.3807104161089"
## [70,]  "Health_expenditure"         "23.412449366406"
## [71,]  "Private_health_expenditure" "60.5986041218626"
## [72,]  "Private_health_expenditure" "51.7162607486612"
## [73,]  "Govt_health_expenditure"    "14.398497980599"
## [74,]  "Freshwater_resources"       "40.4836989328481"
## [75,]  "Freshwater_resources"       "102.483893404884"
## [76,]  "HIV_prevalence"             "19.3861403047708"
## [77,]  "HIV_prevalence"             "46.3420393928365"
## [78,]  "HIV_prevalence"             "24.3906466650499"
## [79,]  "HIV_prevalence"             "18.0963845737912"
## [80,]  "Tobacco_use"                "16.852256644384"
## [81,]  "Population_density"         "98.986558064029"
## [82,]  "Population_density"         "80.7889767073865"
## [83,]  "Population_density"         "14.409468898346"
## [84,]  "Life_expectancy"            "30.4699758206622"
## [85,]  "CO2_emissions"              "16.6281876933866"
## [86,]  "CO2_emissions"              "14.0295833720652"
## [87,]  "CO2_emissions"              "38.4775594123"
## [88,]  "CO2_emissions"              "24.6280825156571"
## [89,]  "CO2_emissions"              "14.7279430615298"
## [90,]  "Electricity"                "23.412449366406"
## [91,]  "Out_of_pocket"              "18.8508674558783"
## [92,]  "Out_of_pocket"              "14.389285297377"
## [93,]  "Out_of_pocket"              "22.8464807797514"
## [94,]  "Private_health_expenditure" "58.0830442283182"
## [95,]  "Private_health_expenditure" "33.2407817836726"
## [96,]  "Private_health_expenditure" "46.5105573098939"
## [97,]  "Govt_health_expenditure"    "15.5606974069481"
## [98,]  "Govt_health_expenditure"    "30.8474823911369"
## [99,]  "Govt_health_expenditure"    "14.6409969498657"
## [100,] "Freshwater_resources"       "41.1427179702146"
## [101,] "Freshwater_resources"       "102.521742893106"
## [102,] "HIV_prevalence"             "18.8851903025696"
## [103,] "HIV_prevalence"             "43.1277054919132"
## [104,] "HIV_prevalence"             "26.5322977901876"
## [105,] "HIV_prevalence"             "16.6043249205488"
## [106,] "Govt_effectiveness"         "13.888096565946"
```

```
## [107,] "Govt_effectiveness"          "27.5517077955717"
## [108,] "Tobacco_use"                 "22.9633556507671"
## [109,] "Alcohol_consumption"         "28.1000425045056"
## [110,] "Political_stability"         "19.9483161582756"
## [111,] "Political_stability"         "22.8072777851576"
## [112,] "Population_density"          "81.3621524962153"
## [113,] "Population_density"          "14.4879706483509"
## [114,] "Population_density"          "22.9673416733301"
## [115,] "CO2_emissions"               "16.1157539548949"
## [116,] "CO2_emissions"               "35.78898833561"
## [117,] "Health_expenditure"          "18.8508674558783"
## [118,] "Health_expenditure"          "14.389285297377"
## [119,] "Health_expenditure"          "22.8464807797514"
## [120,] "Private_health_expenditure"  "54.8731366991019"
## [121,] "Private_health_expenditure"  "46.4152811010376"
## [122,] "Govt_health_expenditure"     "13.9132545368126"
## [123,] "Freshwater_resources"        "41.5393977883603"
## [124,] "Freshwater_resources"        "102.752539726423"
## [125,] "HIV_prevalence"              "18.9099006602107"
## [126,] "HIV_prevalence"              "43.4717634315822"
## [127,] "HIV_prevalence"              "24.5013503153522"
## [128,] "HIV_prevalence"              "16.5038276370703"
## [129,] "Unemployment"                "14.1165881252001"
## [130,] "Population_density"          "81.1398131811239"
## [131,] "Population_density"          "14.3786631266305"
## [132,] "Life_expectancy"             "66.3134292549167"
## [133,] "Life_expectancy"             "61.8618088206492"
## [134,] "CO2_emissions"               "16.434809126189"
## [135,] "CO2_emissions"               "17.6317762526812"
## [136,] "CO2_emissions"               "41.4463825157564"
## [137,] "CO2_emissions"               "66.5253757134203"
## [138,] "CO2_emissions"               "47.0569256956058"
## [139,] "Electricity"                 "60.5986041218626"
## [140,] "Electricity"                 "51.7162607486612"
## [141,] "Health_expenditure"          "58.0830442283182"
## [142,] "Health_expenditure"          "33.2407817836726"
## [143,] "Health_expenditure"          "46.5105573098939"
## [144,] "Out_of_pocket"               "54.8731366991019"
## [145,] "Out_of_pocket"               "46.4152811010376"
## [146,] "Govt_health_expenditure"     "15.0709511352671"
## [147,] "Govt_health_expenditure"     "17.4895903895872"
## [148,] "Govt_health_expenditure"     "75.9575885821978"
## [149,] "Govt_health_expenditure"     "48.6647259911004"
## [150,] "Freshwater_resources"        "40.6220870101618"
## [151,] "Freshwater_resources"        "102.712237396694"
## [152,] "Freshwater_resources"        "54.2219572242922"
## [153,] "Freshwater_resources"        "46.438277074192"
## [154,] "HIV_prevalence"              "18.8696561169658"
## [155,] "HIV_prevalence"              "43.396052906031"
## [156,] "HIV_prevalence"              "24.3852284291672"
## [157,] "HIV_prevalence"              "16.794820224185"
## [158,] "HIV_prevalence"              "54.8867213964474"
## [159,] "HIV_prevalence"              "47.0683489742375"
## [160,] "Unemployment"                "54.3962639666178"
```

```
## [161,] "Unemployment"               "46.4841872155102"
## [162,] "Govt_effectiveness"          "64.316350259634"
## [163,] "Govt_effectiveness"          "57.642627299628"
## [164,] "Income_share"                "49.2595052854235"
## [165,] "Tobacco_use"                 "54.5118787349572"
## [166,] "Tobacco_use"                 "46.9672608504426"
## [167,] "Alcohol_consumption"         "57.5842710814374"
## [168,] "Alcohol_consumption"         "49.793207059264"
## [169,] "Political_stability"         "55.3801195037627"
## [170,] "Political_stability"         "51.1352137137548"
## [171,] "Population_density"          "81.0245440386298"
## [172,] "Population_density"          "18.9974180647348"
## [173,] "Population_density"          "54.4760484106828"
## [174,] "Population_density"          "46.7952445023255"
## [175,] "Life_expectancy"             "15.5965254639934"
## [176,] "Life_expectancy"             "14.1567313504708"
## [177,] "CO2_emissions"               "19.9779341673008"
## [178,] "CO2_emissions"               "14.6947763979928"
## [179,] "CO2_emissions"               "15.5345958092032"
## [180,] "CO2_emissions"               "41.1273779303174"
## [181,] "CO2_emissions"               "14.3632995853497"
## [182,] "Electricity"                 "14.398497980599"
## [183,] "Health_expenditure"          "15.5606974069481"
## [184,] "Health_expenditure"          "30.8474823911369"
## [185,] "Health_expenditure"          "14.6409969498657"
## [186,] "Out_of_pocket"               "13.9132545368126"
## [187,] "Private_health_expenditure" "15.0709511352671"
## [188,] "Private_health_expenditure" "17.4895903895872"
## [189,] "Private_health_expenditure" "75.9575885821978"
## [190,] "Private_health_expenditure" "48.6647259911004"
## [191,] "Freshwater_resources"        "42.3703132941412"
## [192,] "Freshwater_resources"        "103.116635506265"
## [193,] "HIV_prevalence"              "19.0039500371744"
## [194,] "HIV_prevalence"              "43.3656119344405"
## [195,] "HIV_prevalence"              "24.3841267941476"
## [196,] "HIV_prevalence"              "16.556434446226"
## [197,] "Govt_effectiveness"          "14.5573380438022"
## [198,] "Income_share"                "13.870184004427"
## [199,] "Income_share"                "16.6063736027887"
## [200,] "Tobacco_use"                 "13.969731857047"
## [201,] "Alcohol_consumption"         "15.918955473594"
## [202,] "Population_density"          "80.8662482169383"
## [203,] "Population_density"          "14.6786652910447"
## [204,] "Life_expectancy"             "41.5123273050624"
## [205,] "Life_expectancy"             "102.779994104612"
## [206,] "CO2_emissions"               "14.8109158887825"
## [207,] "CO2_emissions"               "40.4664427022144"
## [208,] "CO2_emissions"               "102.548341074487"
## [209,] "CO2_emissions"               "35.2626419441593"
## [210,] "Electricity"                 "40.4836989328481"
## [211,] "Electricity"                 "102.483893404884"
## [212,] "Health_expenditure"          "41.1427179702146"
## [213,] "Health_expenditure"          "102.521742893106"
## [214,] "Out_of_pocket"               "41.5393977883603"
```

```
## [215,]  "Out_of_pocket"              "102.752539726423"
## [216,]  "Private_health_expenditure" "40.6220870101618"
## [217,]  "Private_health_expenditure" "102.712237396694"
## [218,]  "Private_health_expenditure" "54.2219572242922"
## [219,]  "Private_health_expenditure" "46.438277074192"
## [220,]  "Govt_health_expenditure"    "42.3703132941412"
## [221,]  "Govt_health_expenditure"    "103.116635506265"
## [222,]  "HIV_prevalence"             "18.8149687562634"
## [223,]  "HIV_prevalence"             "43.1420289346936"
## [224,]  "HIV_prevalence"             "40.6000677503883"
## [225,]  "HIV_prevalence"             "102.58189268368"
## [226,]  "HIV_prevalence"             "24.3745526749561"
## [227,]  "HIV_prevalence"             "16.4041992572987"
## [228,]  "Unemployment"               "42.6764866114284"
## [229,]  "Unemployment"               "102.561609390865"
## [230,]  "Govt_effectiveness"         "41.355395031324"
## [231,]  "Govt_effectiveness"         "102.855709921312"
## [232,]  "Tobacco_use"                "40.5634554663065"
## [233,]  "Tobacco_use"                "102.483985823581"
## [234,]  "Alcohol_consumption"        "40.5654539527955"
## [235,]  "Alcohol_consumption"        "102.521600324371"
## [236,]  "Political_stability"        "42.0211038617454"
## [237,]  "Political_stability"        "102.486624851165"
## [238,]  "Population_density"         "40.4674391482236"
## [239,]  "Population_density"         "102.488163498034"
## [240,]  "Population_density"         "14.4172528940462"
## [241,]  "Life_expectancy"            "19.5001007132259"
## [242,]  "Life_expectancy"            "44.3127463011574"
## [243,]  "Life_expectancy"            "24.6706853142231"
## [244,]  "Life_expectancy"            "17.0501339898414"
## [245,]  "CO2_emissions"              "14.745023032369"
## [246,]  "CO2_emissions"              "18.8831987255665"
## [247,]  "CO2_emissions"              "43.12627583616"
## [248,]  "CO2_emissions"              "24.3743067264175"
## [249,]  "CO2_emissions"              "35.3119544116243"
## [250,]  "CO2_emissions"              "17.9923552381178"
## [251,]  "Electricity"                "19.3861403047708"
## [252,]  "Electricity"                "46.3420393928365"
## [253,]  "Electricity"                "24.3906466650499"
## [254,]  "Electricity"                "18.0963845737912"
## [255,]  "Health_expenditure"         "18.8851903025695"
## [256,]  "Health_expenditure"         "43.1277054919132"
## [257,]  "Health_expenditure"         "26.5322977901876"
## [258,]  "Health_expenditure"         "16.6043249205488"
## [259,]  "Out_of_pocket"              "18.9099006602107"
## [260,]  "Out_of_pocket"              "43.4717634315822"
## [261,]  "Out_of_pocket"              "24.5013503153522"
## [262,]  "Out_of_pocket"              "16.5038276370703"
## [263,]  "Private_health_expenditure" "18.8696561169658"
## [264,]  "Private_health_expenditure" "43.396052906031"
## [265,]  "Private_health_expenditure" "24.3852284291672"
## [266,]  "Private_health_expenditure" "16.794820224185"
## [267,]  "Private_health_expenditure" "54.8867213964474"
## [268,]  "Private_health_expenditure" "47.0683489742375"
```

```
## [269,] "Govt_health_expenditure"     "19.0039500371744"
## [270,] "Govt_health_expenditure"     "43.3656119344405"
## [271,] "Govt_health_expenditure"     "24.3841267941476"
## [272,] "Govt_health_expenditure"     "16.556434446226"
## [273,] "Freshwater_resources"        "18.8149687562634"
## [274,] "Freshwater_resources"        "43.1420289346936"
## [275,] "Freshwater_resources"        "40.6000677503883"
## [276,] "Freshwater_resources"        "102.58189268368"
## [277,] "Freshwater_resources"        "24.3745526749561"
## [278,] "Freshwater_resources"        "16.4041992572987"
## [279,] "Unemployment"                "19.3740095915378"
## [280,] "Unemployment"                "24.4115452587398"
## [281,] "Unemployment"                "20.5344416663668"
## [282,] "Govt_effectiveness"          "19.7143432385925"
## [283,] "Govt_effectiveness"          "43.1485361465141"
## [284,] "Govt_effectiveness"          "24.4451902882209"
## [285,] "Govt_effectiveness"          "16.8575207780275"
## [286,] "Tobacco_use"                 "19.2416851769556"
## [287,] "Tobacco_use"                 "43.1128626264284"
## [288,] "Tobacco_use"                 "25.8804866105951"
## [289,] "Tobacco_use"                 "16.8461216651951"
## [290,] "Alcohol_consumption"         "18.9409677923547"
## [291,] "Alcohol_consumption"         "43.1375217772741"
## [292,] "Alcohol_consumption"         "24.7376068650139"
## [293,] "Alcohol_consumption"         "16.6838967226326"
## [294,] "Political_stability"         "20.0457939409118"
## [295,] "Political_stability"         "43.1978923239625"
## [296,] "Political_stability"         "24.5534155600574"
## [297,] "Political_stability"         "16.4744772268341"
## [298,] "Population_density"          "18.8315792443214"
## [299,] "Population_density"          "43.1135669916203"
## [300,] "Population_density"          "24.376877339318"
## [301,] "Population_density"          "14.4483518032586"
## [302,] "Population_density"          "16.4161024383866"
## [303,] "Life_expectancy"             "13.9628192761266"
## [304,] "CO2_emissions"               "35.2241022875264"
## [305,] "CO2_emissions"               "14.8231788223695"
## [306,] "Out_of_pocket"               "14.1165881252001"
## [307,] "Private_health_expenditure" "54.3962639666178"
## [308,] "Private_health_expenditure" "46.4841872155102"
## [309,] "Freshwater_resources"        "42.6764866114284"
## [310,] "Freshwater_resources"        "102.561609390865"
## [311,] "HIV_prevalence"              "19.3740095915378"
## [312,] "HIV_prevalence"              "24.4115452587398"
## [313,] "HIV_prevalence"              "20.5344416663668"
## [314,] "Govt_effectiveness"          "13.9160208570013"
## [315,] "Population_density"          "98.9259481871459"
## [316,] "Population_density"          "14.4514924614679"
## [317,] "CO2_emissions"               "18.6532015703147"
## [318,] "CO2_emissions"               "18.0408794985305"
## [319,] "CO2_emissions"               "42.9911785464882"
## [320,] "Health_expenditure"          "13.888096565946"
## [321,] "Health_expenditure"          "27.5517077955717"
## [322,] "Private_health_expenditure" "64.316350259634"
```

```
## [323,]  "Private_health_expenditure" "57.642627299628"
## [324,]  "Govt_health_expenditure"     "14.5573380438022"
## [325,]  "Freshwater_resources"        "41.355395031324"
## [326,]  "Freshwater_resources"        "102.855709921312"
## [327,]  "HIV_prevalence"              "19.7143432385925"
## [328,]  "HIV_prevalence"              "43.1485361465141"
## [329,]  "HIV_prevalence"              "24.4451902882209"
## [330,]  "HIV_prevalence"              "16.8575207780275"
## [331,]  "Unemployment"                "13.9160208570013"
## [332,]  "Population_density"          "98.9252007911286"
## [333,]  "Population_density"          "17.2677197735715"
## [334,]  "Private_health_expenditure" "49.2595052854235"
## [335,]  "Govt_health_expenditure"     "13.870184004427"
## [336,]  "Govt_health_expenditure"     "16.6063736027887"
## [337,]  "CO2_emissions"               "15.3637323562188"
## [338,]  "CO2_emissions"               "36.7475258082696"
## [339,]  "Electricity"                 "16.852256644384"
## [340,]  "Health_expenditure"          "22.9633556507671"
## [341,]  "Private_health_expenditure" "54.5118787349572"
## [342,]  "Private_health_expenditure" "46.9672608504426"
## [343,]  "Govt_health_expenditure"     "13.969731857047"
## [344,]  "Freshwater_resources"        "40.5634554663065"
## [345,]  "Freshwater_resources"        "102.483985823581"
## [346,]  "HIV_prevalence"              "19.2416851769556"
## [347,]  "HIV_prevalence"              "43.1128626264284"
## [348,]  "HIV_prevalence"              "25.8804866105951"
## [349,]  "HIV_prevalence"              "16.8461216651951"
## [350,]  "Population_density"          "14.5483036049484"
## [351,]  "CO2_emissions"               "17.4845745403339"
## [352,]  "CO2_emissions"               "17.3622672481721"
## [353,]  "CO2_emissions"               "39.7782670326656"
## [354,]  "Health_expenditure"          "28.1000425045056"
## [355,]  "Private_health_expenditure" "57.5842710814374"
## [356,]  "Private_health_expenditure" "49.793207059264"
## [357,]  "Govt_health_expenditure"     "15.918955473594"
## [358,]  "Freshwater_resources"        "40.5654539527955"
## [359,]  "Freshwater_resources"        "102.521600324371"
## [360,]  "HIV_prevalence"              "18.9409677923547"
## [361,]  "HIV_prevalence"              "43.1375217772741"
## [362,]  "HIV_prevalence"              "24.7376068650139"
## [363,]  "HIV_prevalence"              "16.6838967226326"
## [364,]  "Population_density"          "14.9878066018872"
## [365,]  "CO2_emissions"               "18.4598192720145"
## [366,]  "CO2_emissions"               "14.249429469499"
## [367,]  "CO2_emissions"               "36.7396938581622"
## [368,]  "Health_expenditure"          "19.9483161582756"
## [369,]  "Health_expenditure"          "22.8072777851576"
## [370,]  "Private_health_expenditure" "55.3801195037627"
## [371,]  "Private_health_expenditure" "51.1352137137548"
## [372,]  "Freshwater_resources"        "42.0211038617454"
## [373,]  "Freshwater_resources"        "102.486624851164"
## [374,]  "HIV_prevalence"              "20.0457939409118"
## [375,]  "HIV_prevalence"              "43.1978923239625"
## [376,]  "HIV_prevalence"              "24.5534155600574"
```

```
## [377,] "HIV_prevalence"             "16.4744772268341"
## [378,] "Population_density"          "99.0389430517696"
## [379,] "Population_density"          "80.6946601237373"
## [380,] "Population_density"          "15.1605253028365"
## [381,] "Life_expectancy"             "98.8345710338524"
## [382,] "Life_expectancy"             "14.9747891658854"
## [383,] "CO2_emissions"               "15.1078623776723"
## [384,] "CO2_emissions"               "35.3036875822335"
## [385,] "CO2_emissions"               "14.8423207333135"
## [386,] "Electricity"                 "98.986558064029"
## [387,] "Electricity"                 "80.7889767073865"
## [388,] "Electricity"                 "14.409468898346"
## [389,] "Health_expenditure"          "81.3621524962153"
## [390,] "Health_expenditure"          "14.4879706483509"
## [391,] "Health_expenditure"          "22.9673416733302"
## [392,] "Out_of_pocket"               "81.1398131811239"
## [393,] "Out_of_pocket"               "14.3786631266305"
## [394,] "Private_health_expenditure" "81.0245440386298"
## [395,] "Private_health_expenditure" "18.9974180647348"
## [396,] "Private_health_expenditure" "54.4760484106828"
## [397,] "Private_health_expenditure" "46.7952445023255"
## [398,] "Govt_health_expenditure"     "80.8662482169383"
## [399,] "Govt_health_expenditure"     "14.6786652910447"
## [400,] "Freshwater_resources"        "40.4674391482236"
## [401,] "Freshwater_resources"        "102.488163498034"
## [402,] "Freshwater_resources"        "14.4172528940462"
## [403,] "HIV_prevalence"             "18.8315792443214"
## [404,] "HIV_prevalence"             "43.1135669916203"
## [405,] "HIV_prevalence"             "24.376877339318"
## [406,] "HIV_prevalence"             "14.4483518032586"
## [407,] "HIV_prevalence"             "16.4161024383866"
## [408,] "Unemployment"                "98.9259481871459"
## [409,] "Unemployment"                "14.4514924614679"
## [410,] "Govt_effectiveness"          "98.9252007911286"
## [411,] "Govt_effectiveness"          "17.2677197735715"
## [412,] "Tobacco_use"                 "14.5483036049484"
## [413,] "Alcohol_consumption"         "14.9878066018873"
## [414,] "Political_stability"         "99.0389430517696"
## [415,] "Political_stability"         "80.6946601237373"
## [416,] "Political_stability"         "15.1605253028365"
```