Trabajo Práctico N° 6

Ejercicio 1.

Estimar el modelo factorial para la base de datos "eurosec.dta", de acuerdo con el número de factores resultantes del proceso de selección de modelos introducido por Schwarz (1978). Obtener, luego, la matriz ortogonal C_{mxm} verificando que las cargas asociadas a cada factor presenten la máxima varianza posible. Finalmente, estimar el vector de factores correspondiente al ajuste efectuado.

El número de factores resultantes del proceso de selección de modelos introducido por Schwarz (1978) es 5.

```
Test for multivariate normality

    Mardia mSkewness  =   47.01711   chi2(165) =  232.414   Prob>chi2 =  0.0004
    Mardia mKurtosis  =  103.1088     chi2(1) =    0.554    Prob>chi2 =  0.4566
    Henze-Zirkler     =  .9273321     chi2(1) =    0.274    Prob>chi2 =  0.6009
    Doornik-Hansen                   chi2(18) =   38.365    Prob>chi2 =  0.0035
```

Por lo tanto, para los tests Mardia mSkewness y Doornik-Hansen, con un nivel de significancia del 1%, estos datos aportan evidencia suficiente para indicar que no tienen una distribución normal multivariada, mientras que, para los tests Mardia mKurtosis y Henze-Zirkler, con un nivel de significancia del 10%, estos datos no aportan evidencia suficiente para indicar que no tienen una distribución normal multivariada.

```
Factor analysis/correlation                  Number of obs    =        26
    Method: maximum likelihood               Retained factors =         5
    Rotation: (unrotated)                    Number of params =        35
                                             Schwarz's BIC    =   242.486
    Log likelihood = -64.22616               (Akaike's) AIC   =   198.452


Warning: Solution is a Heywood case; that is, invalid or boundary values of
uniqueness.

        --------------------------------------------------------------------
          Factor  |   Eigenvalue   Difference        Proportion   Cumulative
        ----------+---------------------------------------------------------
          Factor1 |     1.52115     -1.77206            0.2023       0.2023
          Factor2 |     3.29322      2.16506            0.4381       0.6404
          Factor3 |     1.12816      0.29455            0.1501       0.7905
          Factor4 |     0.83361      0.09196            0.1109       0.9013
          Factor5 |     0.74164         .               0.0987       1.0000
        --------------------------------------------------------------------
        LR test: independent vs. saturated:  chi2(36) =  287.00 Prob>chi2 = 0.0000
        LR test:   5 factors vs. saturated:  chi2(1)  =   93.05 Prob>chi2 = 0.0000
        (tests formally not valid because a Heywood case was encountered)
```
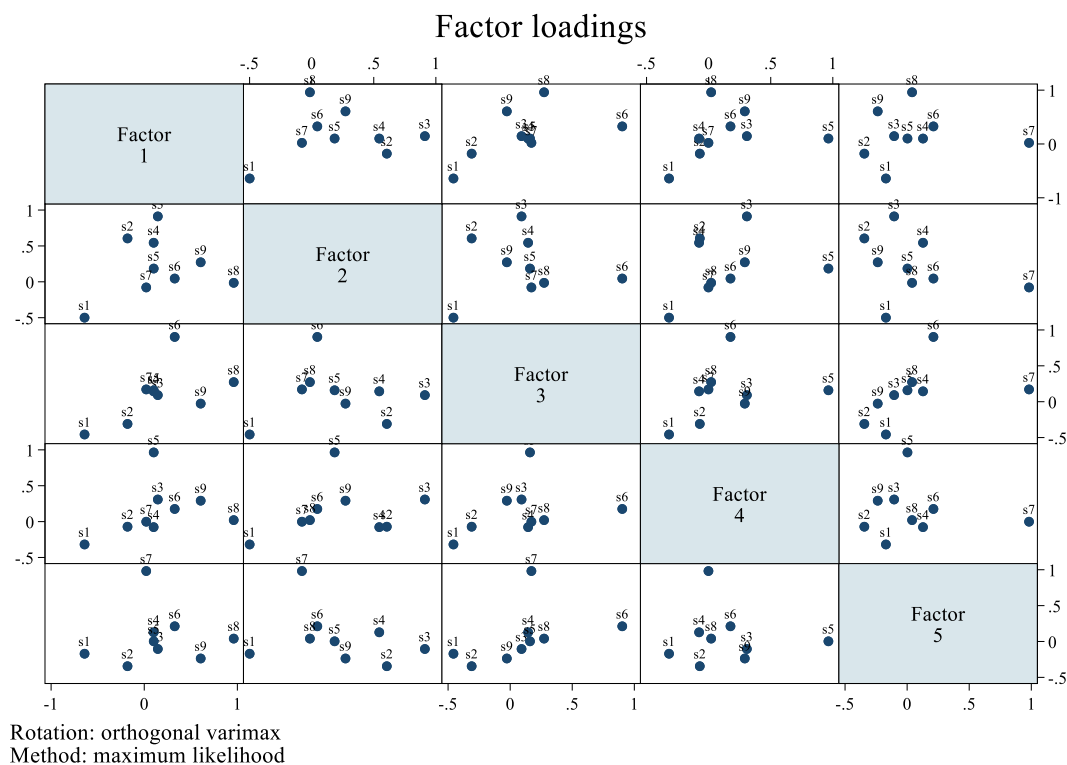
Factor loadings (pattern matrix) and unique variances

```
    ------------------------------------------------------------------------
    Variable |  Factor1   Factor2   Factor3   Factor4   Factor5 | Uniqueness
    ---------+------------------------------------------------------+----------
          s1 |  -0.2659    0.9629    0.0356    0.0267    0.0139 |   0.0000
          s2 |  -0.4405   -0.0559   -0.3140   -0.4046   -0.3988 |   0.3815
          s3 |  -0.1227   -0.6985   -0.5040   -0.3321   -0.3148 |   0.0337
          s4 |   0.1273   -0.3618   -0.1427   -0.4032   -0.1399 |   0.6504
          s5 |   0.0418   -0.5404   -0.6204    0.5668    0.0071 |   0.0000
          s6 |   0.3981   -0.6656    0.0325   -0.0080    0.6304 |   0.0000
          s7 |   0.9989    0.0475    0.0002    0.0006   -0.0008 |   0.0000
          s8 |   0.1438   -0.7632    0.5984    0.1961   -0.0173 |   0.0000
          s9 |  -0.2156   -0.6515    0.0998    0.1911   -0.2569 |   0.4166
    ------------------------------------------------------------------------
```


Factor loadings
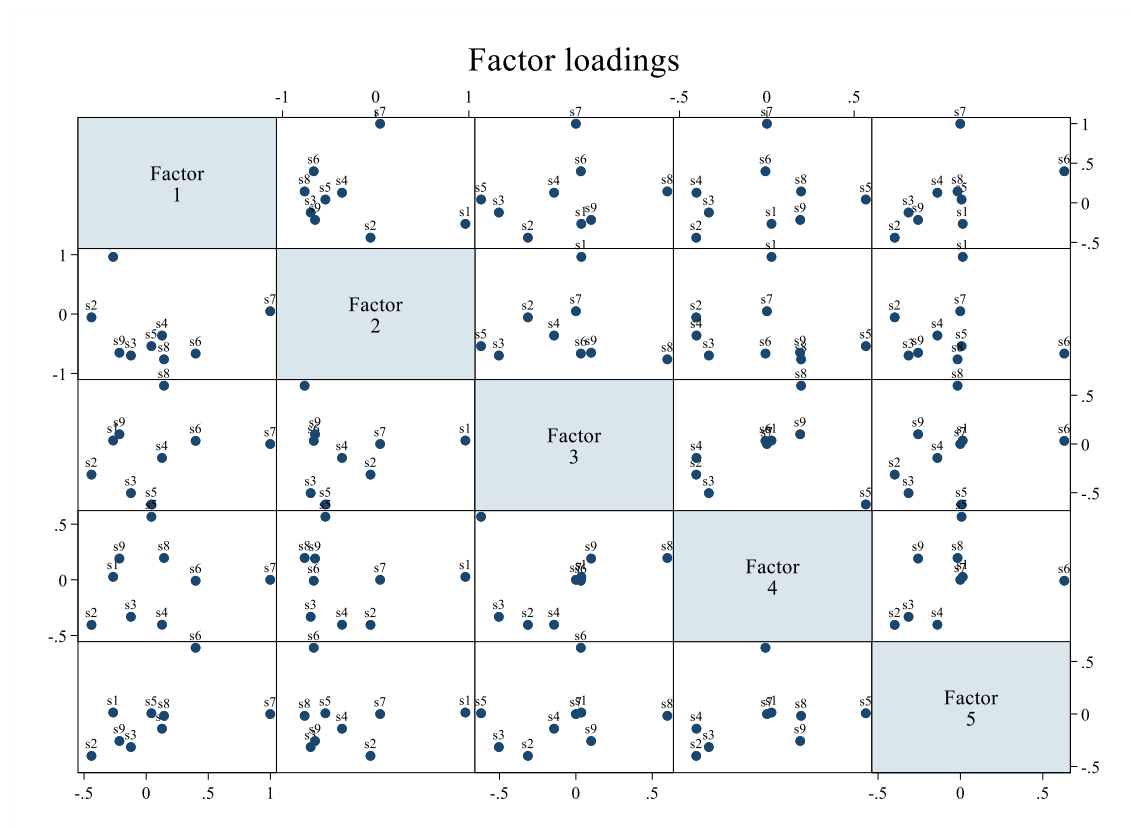
Factor rotation matrix

```
    ----------------------------------------------------------------
            |  Factor1   Factor2   Factor3   Factor4   Factor5
    --------+-------------------------------------------------------
    Factor1 |   0.0531   -0.0549    0.1924    0.0136    0.9783
    Factor2 |  -0.6777   -0.4943   -0.4266   -0.3240    0.0974
    Factor3 |   0.6435   -0.4475   -0.0440   -0.6180   -0.0428
    Factor4 |   0.2368   -0.6263   -0.1982    0.7156   -0.0189
    Factor5 |  -0.2604   -0.4002    0.8601   -0.0304   -0.1770
    ----------------------------------------------------------------
```

Factor loadings

Rotation: orthogonal varimax
Method: maximum likelihood

```
Scoring coefficients (method = regression; based on unrotated factors)

    ------------------------------------------------------------------
    Variable |   Factor1    Factor2    Factor3    Factor4    Factor5
    ---------+--------------------------------------------------------
          s1 |  -0.04594    0.94092    0.69797    1.65016    1.00522
          s2 |  -0.00006    0.00005    0.00001   -0.00004   -0.00004
          s3 |  -0.00041    0.00041    0.00008   -0.00027   -0.00028
          s4 |  -0.00002    0.00002    0.00000   -0.00001   -0.00001
          s5 |   0.00016   -0.01895   -0.43866    1.26563    0.01842
          s6 |   0.00204   -0.02196    0.02186   -0.01714    1.55980
          s7 |   0.98770    0.27076    0.02651    0.21822   -0.33685
          s8 |   0.00205   -0.07422    1.17366    1.21456   -0.12570
          s9 |  -0.00008    0.00008    0.00002   -0.00005   -0.00005
    ------------------------------------------------------------------
```

Ejercicio 2.

Aplicar el contraste empleado en el primer ejercicio a los datos correspondientes al Problem Set anterior. Explicar, brevemente, el resultado obtenido. ¿Cuáles son las conclusiones al respecto?

Ejercicio 1:

El número de factores resultantes del proceso de selección de modelos introducido por Schwarz (1978) es 4.

```
Test for multivariate normality

    Mardia mSkewness =  293.0869   chi2(969) = 8076.406   Prob>chi2 =  0.0000
    Mardia mKurtosis =  589.9546     chi2(1) = 4467.836   Prob>chi2 =  0.0000
    Henze-Zirkler    =   1.28147     chi2(1) =33372.390   Prob>chi2 =  0.0000
    Doornik-Hansen               chi2(34) =10057.382   Prob>chi2 =  0.0000
```

Por lo tanto, con un nivel de significancia del 1%, estos datos aportan evidencia suficiente para indicar que no tienen una distribución normal multivariada.

```
Factor analysis/correlation                 Number of obs    =         162
    Method: principal factors               Retained factors =           4
    Rotation: (unrotated)                   Number of params =          62

    --------------------------------------------------------------------------
        Factor  |   Eigenvalue   Difference        Proportion   Cumulative
    ------------+-------------------------------------------------------------
        Factor1 |      6.39667     4.13220            0.5822       0.5822
        Factor2 |      2.26447     1.08372            0.2061       0.7883
        Factor3 |      1.18075     0.47077            0.1075       0.8957
        Factor4 |      0.70998     0.16765            0.0646       0.9604
        Factor5 |      0.54233     0.26020            0.0494       1.0097
        Factor6 |      0.28213     0.09976            0.0257       1.0354
        Factor7 |      0.18238     0.09753            0.0166       1.0520
        Factor8 |      0.08485     0.06604            0.0077       1.0597
        Factor9 |      0.01881     0.01822            0.0017       1.0614
       Factor10 |      0.00059     0.00898            0.0001       1.0615
       Factor11 |     -0.00840     0.01935           -0.0008       1.0607
       Factor12 |     -0.02775     0.03482           -0.0025       1.0582
       Factor13 |     -0.06257     0.03448           -0.0057       1.0525
       Factor14 |     -0.09706     0.02685           -0.0088       1.0437
       Factor15 |     -0.12391     0.03113           -0.0113       1.0324
       Factor16 |     -0.15504     0.04577           -0.0141       1.0183
       Factor17 |     -0.20081          .            -0.0183       1.0000
    --------------------------------------------------------------------------
    LR test: independent vs. saturated: chi2(136) = 2464.59 Prob>chi2 = 0.0000
```
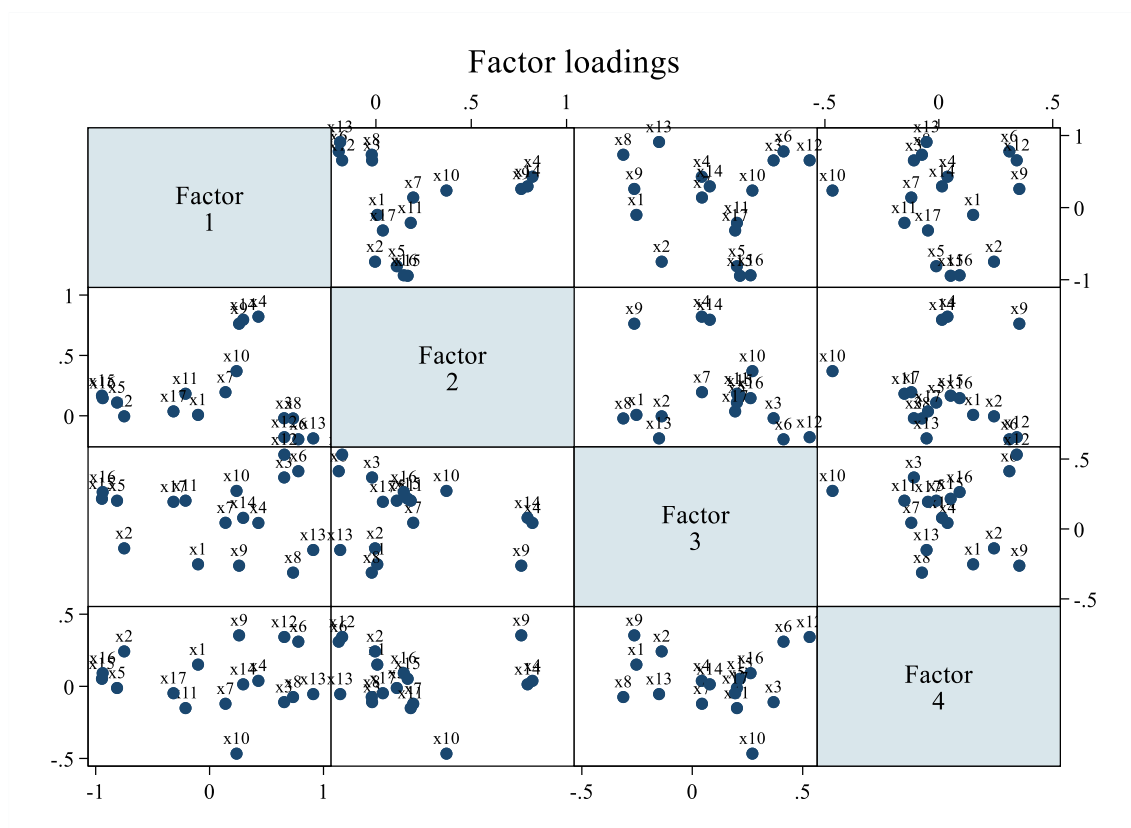
Factor loadings (pattern matrix) and unique variances

```
-------------------------------------------------------------------
    Variable | Factor1   Factor2   Factor3   Factor4 |  Uniqueness
-------------+----------------------------------------+-------------
          x1 | -0.1011    0.0073   -0.2529    0.1506  |    0.9031
          x2 | -0.7498   -0.0044   -0.1385    0.2422  |    0.3599
          x3 |  0.6551   -0.0201    0.3683   -0.1094  |    0.4229
          x4 |  0.4284    0.8210    0.0432    0.0381  |    0.1390
          x5 | -0.8124    0.1095    0.2020   -0.0115  |    0.2871
          x6 |  0.7793   -0.1949    0.4131    0.3098  |    0.0882
          x7 |  0.1398    0.1956    0.0440   -0.1209  |    0.9257
          x8 |  0.7332   -0.0219   -0.3124   -0.0741  |    0.3589
          x9 |  0.2591    0.7625   -0.2627    0.3534  |    0.1575
         x10 |  0.2370    0.3700    0.2722   -0.4667  |    0.5151
         x11 | -0.2111    0.1827    0.2023   -0.1510  |    0.8583
         x12 |  0.6562   -0.1771    0.5314    0.3422  |    0.1386
         x13 |  0.9098   -0.1873   -0.1503   -0.0537  |    0.1118
         x14 |  0.2948    0.7954    0.0793    0.0140  |    0.2740
         x15 | -0.9450    0.1666    0.2159    0.0522  |    0.0299
         x16 | -0.9385    0.1462    0.2639    0.0913  |    0.0199
         x17 | -0.3169    0.0364    0.1941   -0.0477  |    0.8583
-------------------------------------------------------------------
```


Factor loadings

```
Factor rotation matrix
```

```
    ------------------------------------------------------
            |  Factor1    Factor2    Factor3    Factor4
    --------+---------------------------------------------
    Factor1 | -0.8610     0.2428     0.4287     0.1262
    Factor2 |  0.2137     0.9406    -0.1641     0.2064
    Factor3 |  0.4272    -0.0735     0.7547     0.4925
    Factor4 |  0.1745     0.2256     0.4688    -0.8360
    ------------------------------------------------------
```
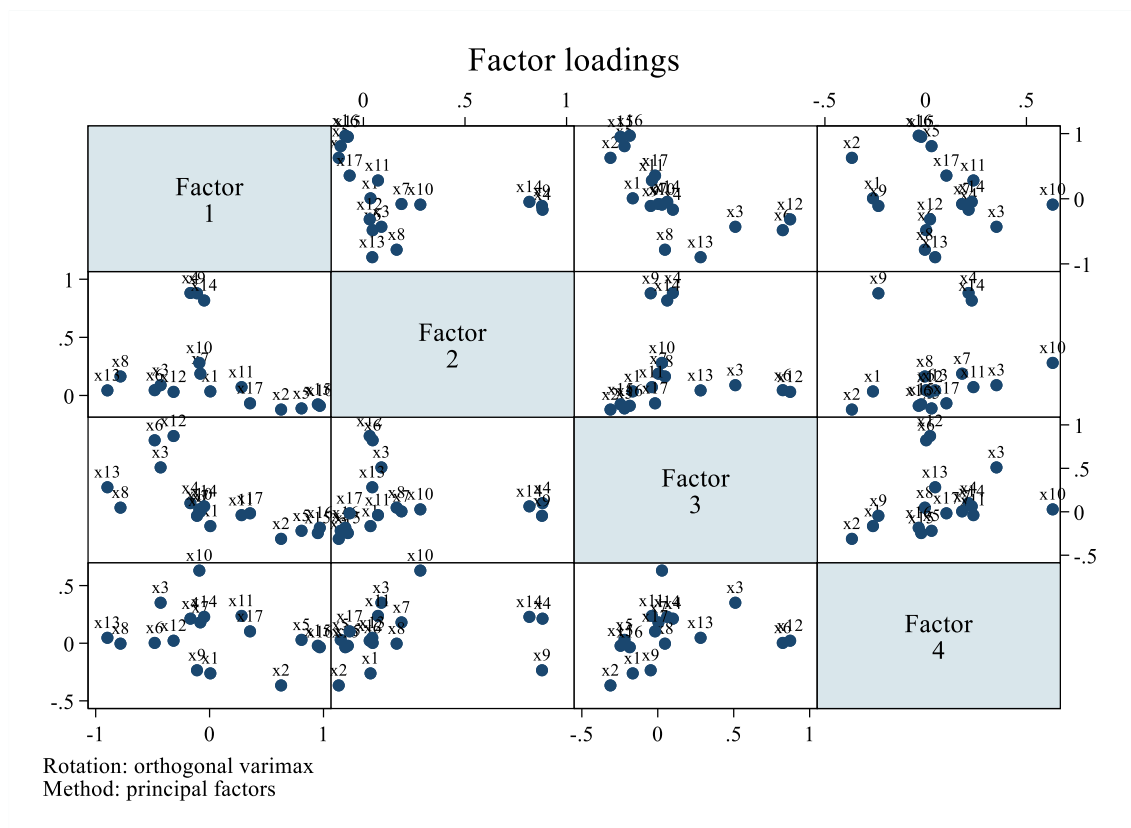
Factor loadings

Rotation: orthogonal varimax
Method: principal factors

```
Scoring coefficients (method = regression; based on varimax
rotated factors)

        ----------------------------------------------------------
        Variable |  Factor1    Factor2    Factor3    Factor4
        -------------+--------------------------------------------
              x1 | -0.04944    0.00332   -0.04017   -0.08511
              x2 | -0.00437   -0.00721    0.01715   -0.27616
              x3 |  0.00188   -0.01766    0.04609    0.20967
              x4 |  0.09793    0.42155    0.01785    0.47535
              x5 |  0.06308   -0.02252    0.02446    0.11973
              x6 |  0.05583    0.01380    0.65309   -0.28414
              x7 | -0.04678    0.02801   -0.01819   -0.01865
              x8 | -0.03647    0.03766   -0.01896   -0.03532
              x9 |  0.00509    0.41406   -0.00435   -0.76084
             x10 | -0.00494   -0.00205   -0.00685    0.25791
             x11 | -0.00407   -0.00179   -0.01318    0.07225
             x12 |  0.14499    0.00104    0.45527   -0.03547
             x13 | -0.05347   -0.04905    0.02653    0.18764
             x14 |  0.01073    0.21243   -0.00129    0.23819
             x15 |  0.21322    0.11839   -0.25588    0.34191
             x16 |  0.76200    0.02826    0.67590   -0.16553
             x17 |  0.00965   -0.02258    0.05519    0.00355
        ----------------------------------------------------------
```

Ejercicio 2:

El número de factores resultantes del proceso de selección de modelos introducido por Schwarz (1978) es 4.

```
Test for multivariate normality

    Mardia mSkewness =  475.4859   chi2(3276) = 4297.740   Prob>chi2 =  0.0000
    Mardia mKurtosis =  759.9989      chi2(1) =    8.966   Prob>chi2 =  0.0027
    Henze-Zirkler    =  1.000247      chi2(1) =   11.470   Prob>chi2 =  0.0007
    Doornik-Hansen                   chi2(52) =  776.759   Prob>chi2 =  0.0000
```

Por lo tanto, con un nivel de significancia del 1%, estos datos aportan evidencia suficiente para indicar que no tienen una distribución normal multivariada.

```
Factor analysis/correlation                    Number of obs    =        51
   Method: principal factors                   Retained factors =         4
   Rotation: (unrotated)                        Number of params =        98

    --------------------------------------------------------------------
      Factor  |   Eigenvalue   Difference       Proportion   Cumulative
    ----------+---------------------------------------------------------
      Factor1 |    12.08887     9.82667            0.6040       0.6040
      Factor2 |     2.26220     0.68136            0.1130       0.7170
      Factor3 |     1.58085     0.49465            0.0790       0.7960
      Factor4 |     1.08620     0.23100            0.0543       0.8503
      Factor5 |     0.85521     0.03978            0.0427       0.8930
      Factor6 |     0.81542     0.30611            0.0407       0.9337
      Factor7 |     0.50931     0.14179            0.0254       0.9592
      Factor8 |     0.36753     0.05479            0.0184       0.9775
      Factor9 |     0.31273     0.08655            0.0156       0.9932
     Factor10 |     0.22618     0.02765            0.0113       1.0045
     Factor11 |     0.19853     0.08151            0.0099       1.0144
     Factor12 |     0.11702     0.02778            0.0058       1.0202
     Factor13 |     0.08923     0.03101            0.0045       1.0247
     Factor14 |     0.05822     0.01640            0.0029       1.0276
     Factor15 |     0.04182     0.02055            0.0021       1.0297
     Factor16 |     0.02127     0.02397            0.0011       1.0307
     Factor17 |    -0.00270     0.00399           -0.0001       1.0306
     Factor18 |    -0.00669     0.01393           -0.0003       1.0303
     Factor19 |    -0.02063     0.00605           -0.0010       1.0292
     Factor20 |    -0.02667     0.00824           -0.0013       1.0279
     Factor21 |    -0.03492     0.01923           -0.0017       1.0262
     Factor22 |    -0.05414     0.00437           -0.0027       1.0235
     Factor23 |    -0.05852     0.02775           -0.0029       1.0205
     Factor24 |    -0.08627     0.05588           -0.0043       1.0162
     Factor25 |    -0.14215     0.04044           -0.0071       1.0091
     Factor26 |    -0.18259         .             -0.0091       1.0000
    --------------------------------------------------------------------
    LR test: independent vs. saturated: chi2(325) = 1451.04 Prob>chi2 = 0.0000


Factor loadings (pattern matrix) and unique variances

    ---------------------------------------------------------------------
      Variable |  Factor1    Factor2    Factor3    Factor4  |  Uniqueness
    -----------+---------------------------------------------+-----------
         div1  |   0.9243     0.1403     0.0508    -0.0283   |    0.1226
         div2  |   0.9278    -0.0300    -0.0495    -0.1762   |    0.1048
         div3  |   0.4967     0.5590     0.3778     0.2111   |    0.2535
         div4  |   0.6179     0.5234    -0.4220     0.1719   |    0.1366
         div5  |   0.8875     0.2726    -0.1709     0.0932   |    0.1002
         div6  |   0.9735     0.0151    -0.0440     0.0602   |    0.0466
         div7  |  -0.2276     0.3753     0.0376    -0.1729   |    0.7760
         div8  |   0.2853    -0.1056     0.1629     0.4399   |    0.6874
         div9  |   0.3114     0.0928     0.3854    -0.1314   |    0.7286
        div10  |   0.9703    -0.0469    -0.0408    -0.1318   |    0.0373
        div11  |   0.9436    -0.0683    -0.0171    -0.1674   |    0.0767
        div12  |   0.8900     0.1640    -0.0467    -0.2200   |    0.1304
        div13  |   0.2770     0.4537     0.4446    -0.0089   |    0.5197
        div14  |   0.9204     0.0466     0.2044     0.1893   |    0.0731
        div15  |   0.4895    -0.4788     0.0907    -0.1398   |    0.5034
        div16  |   0.1155    -0.3809     0.5300    -0.0282   |    0.5599
        div17  |   0.9286    -0.1886    -0.1047    -0.1031   |    0.0806
        div18  |   0.4423    -0.1346     0.1006     0.6517   |    0.3515
        div19  |   0.9110    -0.1410    -0.1277    -0.0393   |    0.1324
        div20  |   0.6107    -0.2521     0.2895     0.1006   |    0.4696
        div21  |  -0.0193     0.5537     0.4005    -0.1749   |    0.5021
        div22  |  -0.1151     0.4670    -0.2868     0.1314   |    0.6691
        div23  |   0.8660    -0.1777    -0.1542     0.0110   |    0.1945
        div24  |  -0.0563    -0.2340     0.2771     0.0114   |    0.8652
        div25  |   0.9436    -0.0199    -0.0429    -0.1849   |    0.0732
        div26  |  -0.2469     0.2354     0.2200    -0.2191   |    0.7872
    ---------------------------------------------------------------------
```
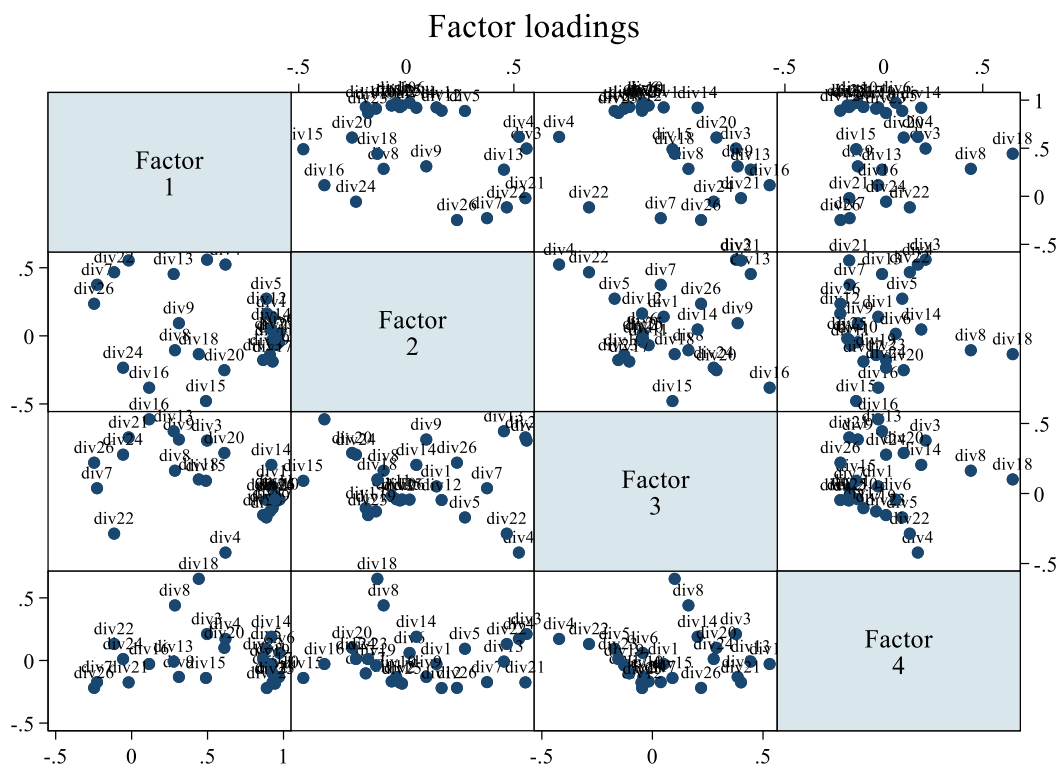
Factor loadings

Factor rotation matrix

```
---------------------------------------------------------
             | Factor1   Factor2   Factor3   Factor4
-------------+-------------------------------------------
    Factor1  |  0.9783    0.1061   -0.0029    0.1777
    Factor2  | -0.0463    0.7224   -0.6641   -0.1872
    Factor3  | -0.1018    0.6833    0.7041    0.1642
    Factor4  | -0.1742    0.0044   -0.2514    0.9521
---------------------------------------------------------
```
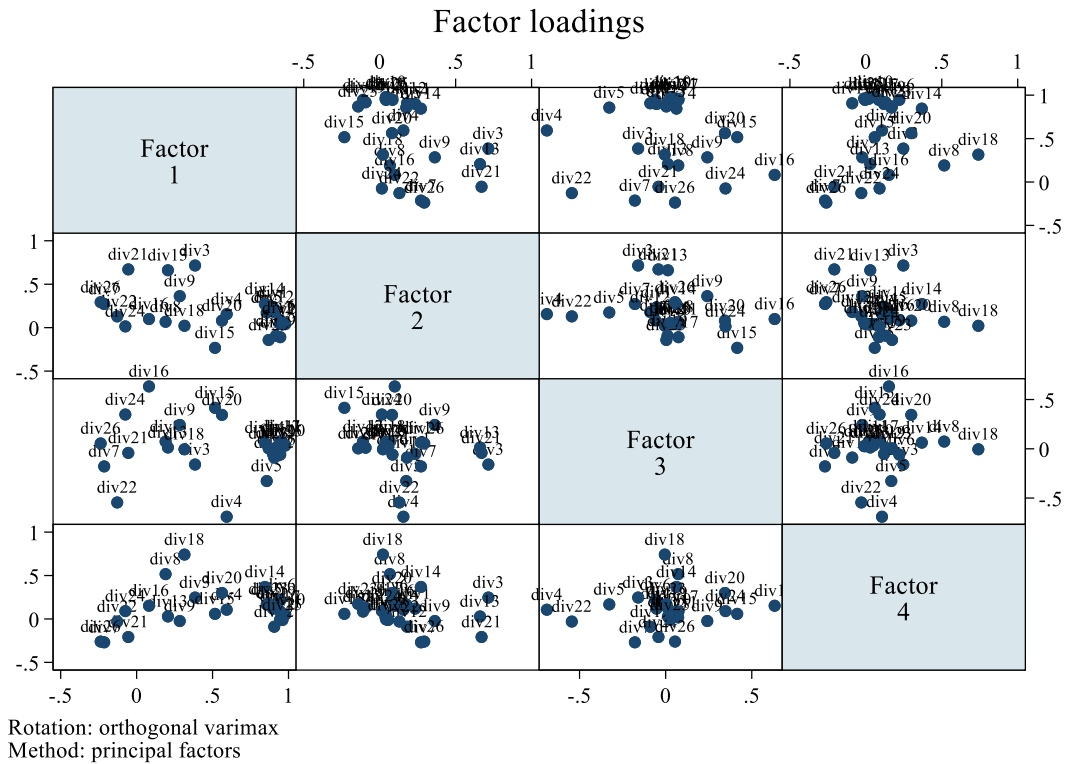
Factor loadings

Rotation: orthogonal varimax
Method: principal factors

Scoring coefficients (method = regression; based on varimax rotated factors)

```
    ----------------------------------------------------------
    Variable |  Factor1    Factor2    Factor3    Factor4
    -------------+--------------------------------------------
        div1 |   0.17885    0.10184   -0.00660   -0.59942
        div2 |   0.11868   -0.03913    0.22780   -0.38276
        div3 |  -0.03201    0.27947   -0.04343   -0.01587
        div4 |  -0.05978   -0.01037   -0.81217    0.21191
        div5 |   0.08776    0.01832   -0.09333    0.20704
        div6 |   0.16440    0.03515    0.07440   -0.00240
        div7 |   0.01046    0.07851   -0.07332   -0.19326
        div8 |  -0.00480   -0.04679   -0.02689    0.05741
        div9 |   0.01119    0.10135    0.08398   -0.10855
       div10 |   0.36607   -0.17317    0.48481   -1.06470
       div11 |   0.09502    0.06248   -0.03609   -0.02651
       div12 |   0.04555    0.17782   -0.09572   -0.29695
       div13 |  -0.00931    0.22529    0.06891    0.05193
       div14 |  -0.18207    0.51022   -0.00610    1.47056
       div15 |   0.01674   -0.01596    0.08531   -0.01058
       div16 |  -0.01491    0.05041    0.12636   -0.05363
       div17 |   0.10932   -0.48002    0.12783   -0.09845
       div18 |  -0.00114   -0.05393    0.07244    0.24379
       div19 |   0.05830   -0.13966   -0.12245    0.04555
       div20 |   0.00136    0.02748    0.12948    0.12901
       div21 |  -0.00321    0.22648    0.07534   -0.12757
       div22 |   0.01474    0.01834   -0.10933   -0.10336
       div23 |  -0.02939   -0.17075   -0.23166    0.35948
       div24 |  -0.01218    0.04318    0.09012    0.06983
       div25 |   0.06780    0.04586   -0.05197    0.27049
       div26 |  -0.00390    0.09017    0.02770   -0.00464
    ----------------------------------------------------------
```

Ejercicio 3.

Estimar un modelo factorial empleando la base "sachs.dta", extracto de Gallup, Sachs & Mellinger (1999).

El número de factores resultantes del proceso de selección de modelos introducido por Schwarz (1978) es 4.

```
Test for multivariate normality

    Mardia mSkewness =    206.39   chi2(455) = 2457.546   Prob>chi2 =  0.0000
    Mardia mKurtosis = 324.3951      chi2(1) =  729.827   Prob>chi2 =  0.0000
    Henze-Zirkler    = 1.644722      chi2(1) = 7583.382   Prob>chi2 =  0.0000
    Doornik-Hansen                  chi2(26) = 4006.593   Prob>chi2 =  0.0000
```

Por lo tanto, con un nivel de significancia del 1%, estos datos aportan evidencia suficiente para indicar que no tienen una distribución normal multivariada.

```
Factor analysis/correlation                      Number of obs    =        68
    Method: principal factors                    Retained factors =         4
    Rotation: (unrotated)                        Number of params =        46

    --------------------------------------------------------------------------
        Factor  |   Eigenvalue   Difference        Proportion   Cumulative
    ------------+-------------------------------------------------------------
        Factor1 |      5.01467      3.08644            0.5908       0.5908
        Factor2 |      1.92823      1.22268            0.2272       0.8179
        Factor3 |      0.70555      0.07401            0.0831       0.9010
        Factor4 |      0.63155      0.26287            0.0744       0.9754
        Factor5 |      0.36868      0.15252            0.0434       1.0189
        Factor6 |      0.21615      0.14000            0.0255       1.0443
        Factor7 |      0.07616      0.03014            0.0090       1.0533
        Factor8 |      0.04602      0.07192            0.0054       1.0587
        Factor9 |     -0.02591      0.04197           -0.0031       1.0557
        Factor10|     -0.06788      0.01447           -0.0080       1.0477
        Factor11|     -0.08235      0.02814           -0.0097       1.0380
        Factor12|     -0.11049      0.10135           -0.0130       1.0250
        Factor13|     -0.21184            .           -0.0250       1.0000
    --------------------------------------------------------------------------
    LR test: independent vs. saturated:  chi2(78) =  691.68 Prob>chi2 = 0.0000

Factor loadings (pattern matrix) and unique variances

    ----------------------------------------------------------------------
        Variable |  Factor1    Factor2    Factor3    Factor4 |  Uniqueness
    ------------+---------------------------------------------+-------------
           gdp95 |   0.7523    -0.5526    -0.0681    -0.0504  |    0.1215
        lnd100km |   0.7707     0.5388    -0.1264     0.1049  |    0.0887
        pop100km |   0.7778     0.4087    -0.3223     0.2253  |    0.0733
        lnd100cr |   0.8274     0.4465     0.2349    -0.0555  |    0.0578
        pop100cr |   0.9009     0.2158     0.1215     0.0874  |    0.1194
         dens95c |   0.2788     0.0802    -0.0046     0.1286  |    0.8993
         dens95i |   0.1725     0.1317     0.5512     0.0223  |    0.6486
         airdist |  -0.5996     0.3105    -0.1676     0.3128  |    0.4182
       ciffob95  |  -0.5771     0.2979    -0.1212    -0.0757  |    0.5578
        landarea |  -0.0529    -0.5398    -0.0316     0.4942  |    0.4606
        open6590 |   0.6776    -0.4727    -0.0257    -0.2014  |    0.2761
        urbpop95 |   0.6959    -0.4157    -0.1754     0.0692  |    0.3073
           pop95 |  -0.0849    -0.1516     0.3634     0.3825  |    0.6915
    ----------------------------------------------------------------------
```
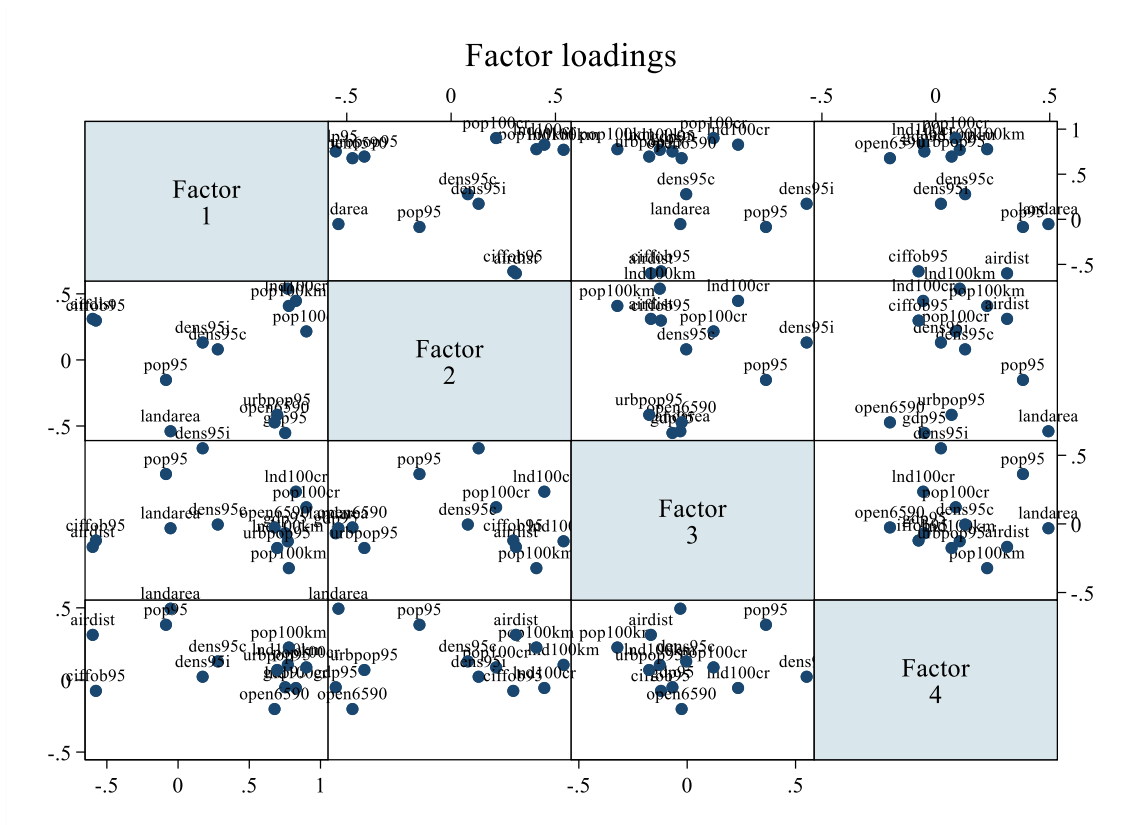
Factor loadings

Factor rotation matrix

	Factor1	Factor2	Factor3	Factor4
Factor1	0.7546	0.6493	−0.0111	0.0937
Factor2	0.6116	−0.7223	−0.3200	0.0422
Factor3	−0.0970	−0.0306	0.0147	0.9947
Factor4	0.2170	−0.2359	0.9472	−0.0001
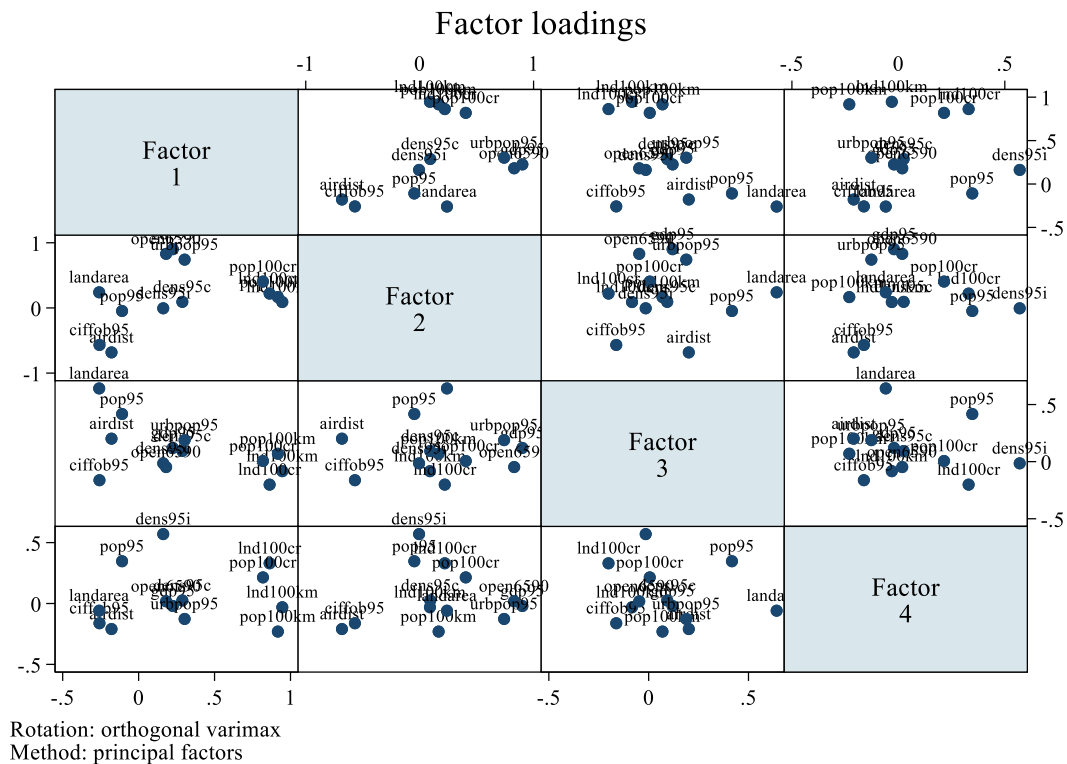
Factor loadings

Rotation: orthogonal varimax
Method: principal factors

```
Scoring coefficients (method = regression; based on varimax
rotated factors)
```

Variable	Factor1	Factor2	Factor3	Factor4
gdp95	-0.06881	0.51213	0.18654	-0.28673
lnd100km	0.32177	-0.07360	0.37913	0.28969
pop100km	0.40629	-0.21274	-0.04651	-1.16543
lnd100cr	0.28593	-0.25421	-0.90320	0.31861
pop100cr	0.11440	0.32092	0.64413	0.70563
dens95c	0.02714	-0.04003	0.05469	0.02433
dens95i	0.00876	-0.04354	0.10595	0.18612
airdist	0.06427	-0.12876	0.27673	-0.01836
ciffob95	0.01223	-0.05945	-0.07444	-0.11893
landarea	0.01604	-0.06632	0.38983	0.04208
open6590	-0.09585	0.25316	-0.27843	0.17955
urbpop95	0.00689	0.15520	0.12482	-0.18473
pop95	0.00550	-0.00865	0.25192	0.22795

Ejercicio 4.

En base a los datos empleados por la Fundación Heritage para construir el Freedom Index 2010, contenidos en la base "heritage.dta", ajustar un modelo factorial y comentar, brevemente, los resultados obtenidos.

El número de factores resultantes del proceso de selección de modelos introducido por Schwarz (1978) es 3.

```
Test for multivariate normality

    Mardia mSkewness =   56.1748   chi2(364) = 1717.712   Prob>chi2 =  0.0000
    Mardia mKurtosis = 226.8436     chi2(1) =  463.736   Prob>chi2 =  0.0000
    Henze-Zirkler    =  1.070629    chi2(1) =  160.551   Prob>chi2 =  0.0000
    Doornik-Hansen               chi2(24) =  365.055   Prob>chi2 =  0.0000
```

Por lo tanto, con un nivel de significancia del 1%, estos datos aportan evidencia suficiente para indicar que no tienen una distribución normal multivariada.

```
Factor analysis/correlation                    Number of obs   =        180
    Method: principal factors                  Retained factors =          3
    Rotation: (unrotated)                      Number of params =         33

    --------------------------------------------------------------------------
        Factor  |   Eigenvalue   Difference        Proportion   Cumulative
    ------------+-------------------------------------------------------------
        Factor1 |     5.41921      4.23969            0.7939       0.7939
        Factor2 |     1.17951      0.63156            0.1728       0.9667
        Factor3 |     0.54795      0.32643            0.0803       1.0470
        Factor4 |     0.22152      0.09794            0.0325       1.0795
        Factor5 |     0.12358      0.08258            0.0181       1.0976
        Factor6 |     0.04100      0.09542            0.0060       1.1036
        Factor7 |    -0.05441      0.00706           -0.0080       1.0956
        Factor8 |    -0.06147      0.03881           -0.0090       1.0866
        Factor9 |    -0.10028      0.00635           -0.0147       1.0719
        Factor10 |   -0.10662      0.04573           -0.0156       1.0563
        Factor11 |   -0.15235      0.07947           -0.0223       1.0340
        Factor12 |   -0.23183            .           -0.0340       1.0000
    --------------------------------------------------------------------------
    LR test: independent vs. saturated:  chi2(66) = 1370.91 Prob>chi2 = 0.0000
```
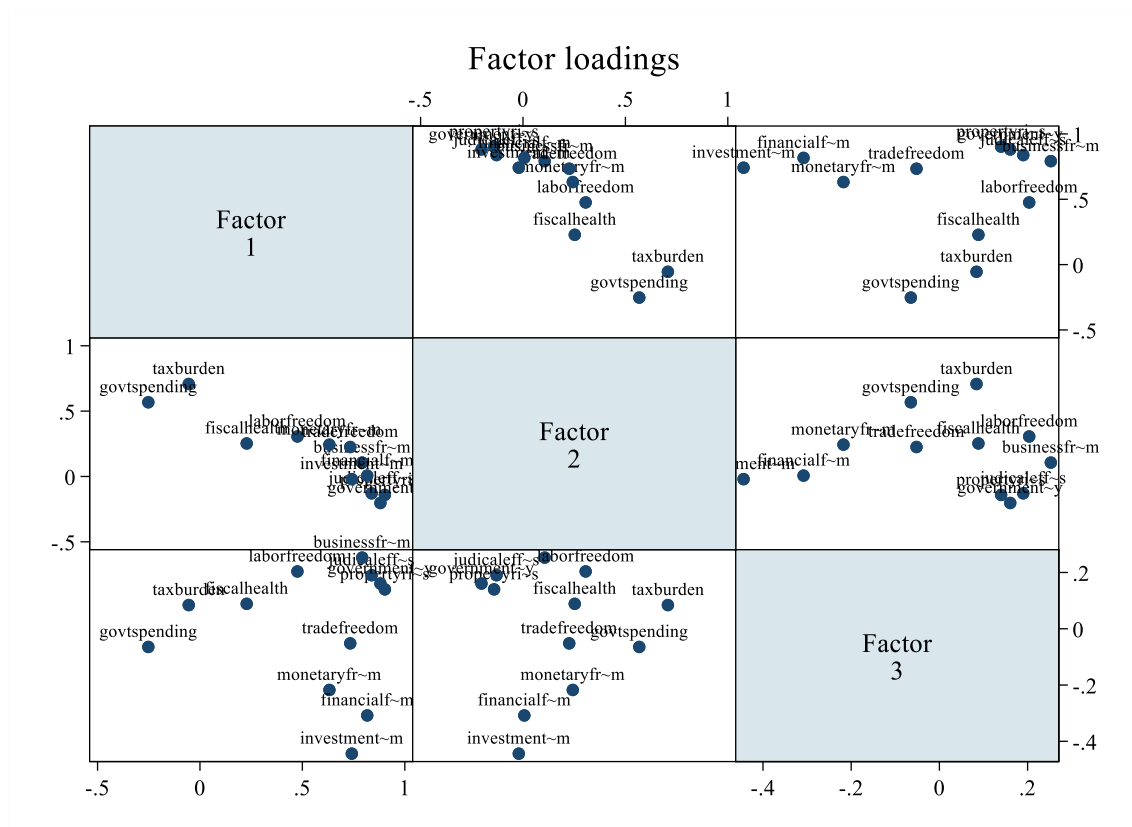
```
Factor loadings (pattern matrix) and unique variances
```

```
    -------------------------------------------------------------
      Variable |   Factor1    Factor2    Factor3 |   Uniqueness
    -------------+------------------------------------+-------------
    propertyri~s |    0.9027    -0.1412     0.1399 |      0.1456
    judicaleff~s |    0.8381    -0.1291     0.1902 |      0.2448
    government~y |    0.8810    -0.2028     0.1606 |      0.1570
       taxburden |   -0.0549     0.7075     0.0842 |      0.4894
    govtspending |   -0.2522     0.5675    -0.0647 |      0.6101
    fiscalhealth |    0.2281     0.2526     0.0886 |      0.8763
    businessfr~m |    0.7919     0.1061     0.2527 |      0.2978
    laborfreedom |    0.4757     0.3060     0.2036 |      0.6386
    monetaryfr~m |    0.6318     0.2432    -0.2175 |      0.4944
    tradefreedom |    0.7337     0.2255    -0.0519 |      0.4082
    investment~m |    0.7414    -0.0206    -0.4439 |      0.2529
    financialf~m |    0.8166     0.0064    -0.3080 |      0.2383
    -------------------------------------------------------------
```


Factor loadings

```
Factor rotation matrix
```

```
    --------------------------------------------------
              |   Factor1    Factor2    Factor3
    -------------+------------------------------------
       Factor1 |    0.8502     0.5255     0.0333
       Factor2 |   -0.1095     0.1147     0.9874
       Factor3 |    0.5150    -0.8431     0.1550
    --------------------------------------------------
```
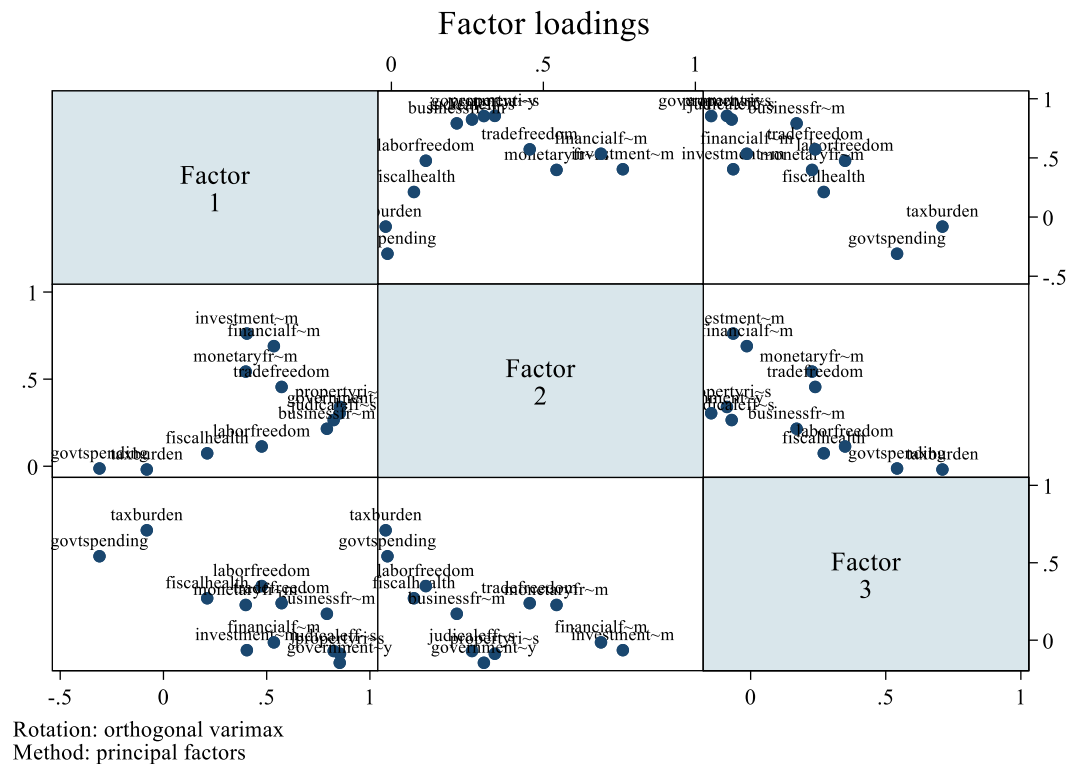
Factor loadings

Rotation: orthogonal varimax
Method: principal factors

Scoring coefficients (method = regression; based on varimax rotated factors)

```
------------------------------------------------
    Variable |   Factor1    Factor2    Factor3
-------------+----------------------------------
propertyri~s |   0.36310   -0.12448   -0.10484
judicaleff~s |   0.21451   -0.11300   -0.01531
government~y |   0.34141   -0.13879   -0.20422
    taxburden |   0.01266   -0.01098    0.38810
 govtspending |  -0.03155    0.01738    0.27961
  fiscalhealth |  -0.00061    0.01366    0.12259
   businessfr~m |   0.21898   -0.15093    0.20870
    laborfreedom |   0.07333   -0.05357    0.16750
   monetaryfr~m |  -0.01848    0.17040    0.13541
    tradefreedom |   0.05514    0.10121    0.18267
  investment~m |  -0.17474    0.54042   -0.10334
   financialf~m |  -0.13248    0.46943   -0.02438
------------------------------------------------
```