Juan Menduiña

Trabajo Práctico N° 5

Ejercicio 1.

El archivo "ind.dta" contiene información sobre 17 indicadores económicos:

Variable	Indicador
X1	Agricultural land (% of land area)
X2	Agriculture, value added (% of GDP)
X3	CO2 emissions (metric tons per capita)
X4	Exports of goods and services (% of GDP)
X5	Fertility rate, total (births per woman)
X6	Fixed line and mobile phone subscribers (per 1000 people)
X7	GDP growth (annual)
X8	Immunization, measles (% of children ages 12-23 months)
X9	Imports of goods and services (% of GDP)
X10	Industry, value added (% of GDP)
X11	Inflation, GDP deflator (annual %)
X12	Internet users (per 1000 people)
X13	Life expectancy at birth, total (years)
X14	Merchandise trade (% of GDP)
X15	Mortality rate, infant (per 1000 live births)
X16	Mortality rate, under 5 (per 1000)
X17	Population growth (annual %)

(a) *Realizar un test de normalidad multivariada.*

```
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.

```
Test for multivariate normality

    Mardia mSkewness =  101.7785   chi2(969) = 1820.830   Prob>chi2 =  0.0000
    Mardia mKurtosis =  364.9691     chi2(1) =   70.893   Prob>chi2 =  0.0000
    Henze-Zirkler    =  1.014665     chi2(1) =  122.887   Prob>chi2 =  0.0000
    Doornik-Hansen                  chi2(34) =  313.331   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.

(b) *Determinar el número de factores a extraer.*

```
Factor analysis/correlation                       Number of obs    =        162
    Method: principal factors                     Retained factors =         10
    Rotation: (unrotated)                         Number of params =        125
```

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	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10	Uniqueness
x1	-0.1011	0.0073	-0.2529	0.1506	-0.0530	0.0688	0.3052	0.0205	-0.0004	0.0005	0.8020
x2	-0.7498	-0.0044	-0.1385	0.2422	-0.0394	0.0634	-0.1638	0.1517	-0.0301	-0.0050	0.3036
x3	0.6551	-0.0201	0.3683	-0.1094	0.0635	-0.0960	0.0737	0.1535	-0.0156	-0.0033	0.3804
x4	0.4284	0.8210	0.0432	0.0381	-0.0608	-0.0534	0.0000	0.0313	-0.0574	-0.0006	0.1282
x5	-0.8124	0.1095	0.2020	-0.0115	0.0598	-0.1511	-0.0400	-0.0163	0.0618	0.0011	0.2550
x6	0.7793	-0.1949	0.4131	0.3098	-0.0566	0.0920	0.0597	-0.0461	-0.0030	0.0022	0.0708
x7	0.1398	0.1956	0.0440	-0.1209	0.4829	0.2649	-0.0576	0.0165	-0.0076	-0.0020	0.6186
x8	0.7332	-0.0219	-0.3124	-0.0741	0.0689	-0.0115	0.0677	0.1534	0.0705	0.0014	0.3209
x9	0.2591	0.7625	-0.2627	0.3534	-0.0507	-0.1093	-0.0099	-0.0036	0.0022	0.0032	0.1429
x10	0.2370	0.3700	0.2722	-0.4667	-0.1433	0.0304	0.0685	-0.0054	-0.0204	0.0002	0.4885
x11	-0.2111	0.1827	0.2023	-0.1510	-0.4183	0.0839	-0.0950	0.0575	0.0347	0.0019	0.6627
x12	0.6562	-0.1771	0.5314	0.3422	0.0060	0.0053	-0.0412	0.0197	0.0210	-0.0020	0.1360
x13	0.9098	-0.1873	-0.1503	-0.0537	0.0298	-0.0103	-0.1288	0.0122	-0.0150	0.0172	0.0935
x14	0.2948	0.7954	0.0793	0.0140	0.1124	0.0803	-0.0346	-0.0541	0.0555	-0.0022	0.2477
x15	-0.9450	0.1666	0.2159	0.0522	0.0733	0.1018	0.0686	0.0488	-0.0015	0.0144	0.0069
x16	-0.9385	0.1462	0.2639	0.0913	0.0316	0.0786	0.0749	0.0364	-0.0049	0.0028	0.0057
x17	-0.3169	0.0364	0.1941	-0.0477	0.2597	-0.3415	0.0159	0.0117	-0.0104	0.0021	0.6737

Por lo tanto, el número de factores a extraer es 6.

(c) *Realizar el análisis exploratorio de acuerdo con el modelo factorial.*

```
Factor analysis/correlation                      Number of obs    =        162
    Method: principal factors                    Retained factors =          6
    Rotation: (unrotated)                        Number of params =         87
```

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	Factor5	Factor6	Uniqueness
x1	-0.1011	0.0073	-0.2529	0.1506	-0.0530	0.0688	0.8956
x2	-0.7498	-0.0044	-0.1385	0.2422	-0.0394	0.0634	0.3544
x3	0.6551	-0.0201	0.3683	-0.1094	0.0635	-0.0960	0.4097
x4	0.4284	0.8210	0.0432	0.0381	-0.0608	-0.0534	0.1325
x5	-0.8124	0.1095	0.2020	-0.0115	0.0598	-0.1511	0.2607
x6	0.7793	-0.1949	0.4131	0.3098	-0.0566	0.0920	0.0765
x7	0.1398	0.1956	0.0440	-0.1209	0.4829	0.2649	0.6223
x8	0.7332	-0.0219	-0.3124	-0.0741	0.0689	-0.0115	0.3540
x9	0.2591	0.7625	-0.2627	0.3534	-0.0507	-0.1093	0.1430
x10	0.2370	0.3700	0.2722	-0.4667	-0.1433	0.0304	0.4937
x11	-0.2111	0.1827	0.2023	-0.1510	-0.4183	0.0839	0.6763
x12	0.6562	-0.1771	0.5314	0.3422	0.0060	0.0053	0.1385
x13	0.9098	-0.1873	-0.1503	-0.0537	0.0298	-0.0103	0.1108
x14	0.2948	0.7954	0.0793	0.0140	0.1124	0.0803	0.2549
x15	-0.9450	0.1666	0.2159	0.0522	0.0733	0.1018	0.0142
x16	-0.9385	0.1462	0.2639	0.0913	0.0316	0.0786	0.0127
x17	-0.3169	0.0364	0.1941	-0.0477	0.2597	-0.3415	0.6742

(d) *Reportar las comunalidades.*

```
commonality[17,1]
     commonality
 x1    .10443817
 x2     .6456483
 x3    .59033742
 x4    .86754007
 x5    .73931917
 x6    .92349359
 x7    .37773843
 x8    .64597902
 x9    .85698196
x10    .50634663
x11    .32371151
x12     .8614879
x13    .88924266
x14      .745089
x15    .98584624
x16    .98729607
x17    .32582455
```

Ejercicio 2.

El archivo "ipc2dig.dta" contiene datos sobre variaciones mensuales de precios desagregados en componentes de la canasta básica de alimentos para el período comprendido entre marzo de 2022 y marzo de 2006.

Variable	Descripción
div1	Alimentos para consumir en el hogar

Variable	Descripción
div2	Bebidas e infusiones para consumir en el hogar
div3	Alimentos y bebidas consumidos fuera del hogar
div4	Ropa
div5	Calzado
div6	Accesorios y servicios para la indumentaria
div7	Alquiler de la vivienda
div8	Servicios básicos y combustibles para la vivienda
div9	Reparaciones y gastos comunes de la vivienda
div10	Equipamiento del hogar
div11	Mantenimiento del hogar
div12	Productos medicinales y accesorios terapéuticos
div13	Servicios para la salud
div14	Transporte
div15	Comunicaciones
div16	Turismo
div17	Equipos, conexiones y servicios de audio, televisión y computación
div18	Diarios, revistas y libros
div19	Jueguetes y artículos para deporte
div20	Flores, planes y atención de animales domésticos
div21	Otros servicios de esparcimiento
div22	Servicios educativos
div23	Textos y útiles escolares
div24	Cigarrillos y accesorios
div25	Artículos y servicios para el cuidado personal
div26	Servicios diversos

(a) *Realizar un análisis factorial y determinar el número de factores a considerar en el mismo.*

```
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

Por lo tanto, el número de factores a considerar en el análisis factorial es 4.

(b) *Estimar los factores.*

```
Scoring coefficients (method = regression)
```

Variable	Factor1	Factor2	Factor3	Factor4
div1	0.07925	0.18186	-0.05170	-0.59974
div2	0.04326	-0.11339	0.05872	-0.44253
div3	-0.00436	0.23518	0.16104	0.00260
div4	-0.01953	0.49494	-0.53807	0.41634
div5	0.12488	0.03240	-0.02813	0.20538
div6	0.16392	-0.03118	0.05927	-0.04948
div7	-0.01557	0.14109	-0.03078	-0.16704
div8	0.00063	-0.02647	-0.04099	0.06205
div9	0.00216	0.03724	0.10942	-0.12597
div10	0.14911	-0.26471	0.01094	-1.20009
div11	0.09499	0.06966	0.00325	-0.03244
div12	0.01092	0.24549	0.00071	-0.26581
div13	0.02381	0.10769	0.21193	0.03472
div14	0.13740	0.10581	0.60434	1.43553
div15	0.01255	-0.06698	0.04572	-0.03451
div16	-0.01914	-0.03677	0.11613	-0.08001
div17	0.03816	-0.41828	-0.26528	-0.14701
div18	0.03628	-0.13264	0.05431	0.21385
div19	0.05068	-0.03080	-0.18010	0.06339
div20	0.02680	-0.09034	0.13100	0.09015
div21	-0.00201	0.13760	0.18718	-0.13885
div22	-0.00168	0.10451	-0.08293	-0.07340
div23	0.01771	-0.03543	-0.21777	0.40487
div24	0.00482	-0.04115	0.10567	0.04613
div25	0.11943	0.01387	0.03226	0.25898
div26	0.00484	0.04779	0.08075	-0.01031

(c) *Analizar los residuos del modelo, con arreglo a los supuestos considerados.*

```
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) =  601.620   Prob>chi2 =  0.0000
```

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

```
Test that covariance matrix is diagonal

 Adjusted LR chi2(325) =    944.31
           Prob > chi2 =    0.0000
```

Por lo tanto, con un nivel de significancia del 1%, estos datos aportan evidencia suficiente para indicar que la matriz de varianzas y covarianzas de los residuos no es diagonal.

(d) *Obtener las principales medidas estadísticas que permitan inferir acerca de la bondad del ajuste del modelo estimado.*

Coeficiente de correlación al cuadrado entre cada variable observable y los factores:

```
rho2_1 = .98497393
rho2_2 = .98902324
rho2_3 = .93575745
rho2_4 = .98133713
rho2_5 = .9899648
rho2_6 = .99782874
rho2_7 = .39777721
rho2_8 = .52745178
rho2_9 = .46913039
rho2_10 = .99861103
rho2_11 = .99412209
rho2_12 = .98300747
rho2_13 = .72994253
rho2_14 = .9946607
rho2_15 = .74662227
rho2_16 = .68655422
rho2_17 = .99350546
rho2_18 = .87645452
rho2_19 = .98246967
rho2_20 = .77948868
rho2_21 = .74787243
rho2_22 = .5522995
rho2_23 = .96217425
rho2_24 = .25149728
rho2_25 = .99464147
rho2_26 = .38029008
```

Coeficiente de determinación= 0,12818739.