

CP_IDH

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Índice de Desarrollo Humano

1. Realiza una análisis de componenetes principales de los datos anteriores.

```
#Cargamos los datos
dataset = read.csv2("data_HDI_2019.csv")

#Primero eliminamos las filas con valores faltantes
dataset = na.omit(dataset)

#Eliminamos la primera columna y lo transformo en una matriz
df_mat <- as.matrix(dataset[, -1])

#Aplicamos el análisis de componentes principales
pr.out=prcomp(df_mat, scale=TRUE)
```

2. Interpreta la primera y la segunda componente principal a partir de los vectores de cargas.

```
#Utilizamos el siguiente comando para ver las cargas:
pr.out$rotation
```

##	PC1	PC2	PC3	PC4	PC5
## HDI	-0.25503999	0.11964974	0.029525609	0.033951869	-0.01613554
## LEB	-0.24901546	0.04127739	0.035979924	0.092084384	-0.24739774
## EYEDU	-0.23148962	0.16190407	-0.053255982	0.021102700	-0.07244729
## MYEDU	-0.24599652	0.14853605	0.004783926	0.037423763	0.20098288
## GNIpc	-0.23032353	0.07036771	-0.164813219	-0.005333586	0.05305799
## IHDI	-0.25990122	0.07333476	-0.020101378	0.063605896	0.01567449
## CHI	0.25609773	-0.01278090	0.042923169	-0.116160404	-0.00904747
## IN_LE	0.25253335	-0.08520146	-0.085081432	-0.058605073	0.17238601
## IN_EDU	0.23054681	-0.20142768	0.064034698	-0.101462380	-0.17959866
## IN_INC	0.16573460	0.37988326	0.147619696	-0.149933139	0.03644907
## INC_40_POOR	-0.17142890	-0.41801917	-0.086231626	0.087287251	-0.08635226
## INC_10_RICH	0.18020229	0.40035854	0.080382396	-0.043490999	-0.03286008
## INC_1_RICH	0.15007115	0.32677560	0.115915035	0.301034290	-0.25967228
## GINI	0.17830751	0.41903673	0.083334989	-0.071107924	0.03683423

##	GII	0.25195289	-0.08499712	0.102724641	0.108493839	0.01558324
##	MMR	0.21851291	-0.14944634	-0.174613470	-0.099397180	0.35176428
##	ABR	0.23887198	-0.01455457	-0.154522553	0.072773795	0.16388418
##	SSP_F	-0.10147278	0.11314561	-0.404916778	-0.659232337	-0.44727710
##	P2EDU_F	-0.24160944	0.12944368	0.045812919	0.042501484	0.27216553
##	P2EDU_M	-0.23660436	0.11990409	0.075499071	0.061135954	0.29557376
##	LFP_F	0.05299564	0.19145479	-0.693463602	0.040025074	0.32709844
##	LFP_M	0.12783597	0.07284537	-0.424956348	0.600730266	-0.36027404
##		PC6	PC7	PC8	PC9	PC10
##	HDI	0.001314776	-0.18586900	0.0447559055	-0.081609334	0.003600637
##	LEB	-0.096733993	-0.19115923	0.0162359390	0.078844325	0.281294085
##	EYEDU	-0.063116165	-0.42903337	-0.0162687220	0.108216810	-0.537243430
##	MYEDU	0.095624306	0.13469464	0.0448996247	-0.216074029	-0.114121687
##	GNIpC	0.253935080	-0.49195580	-0.0286928362	-0.463813653	0.328183918
##	IHDI	-0.017059388	-0.10252365	-0.0828071642	-0.089802531	0.010395607
##	CHI	0.140181755	-0.16091977	0.2849553775	0.037007460	-0.005754985
##	IN_LE	0.086171612	-0.04956310	0.0001239761	-0.146813983	-0.147728863
##	IN_EDU	0.070679218	-0.27412775	0.2142638250	0.168697218	-0.092070814
##	IN_INC	0.242060066	-0.03711833	0.5999483008	0.038093480	0.305788487
##	INC_40_POOR	0.283562181	0.06633198	0.0127775802	0.051313797	0.011817568
##	INC_10_RICH	-0.223609075	-0.06036397	-0.2073900393	-0.100668563	-0.108107535
##	INC_1_RICH	0.709338383	0.07441832	-0.3742905275	0.156623972	-0.084533032
##	GINI	-0.257924095	-0.06166375	-0.0991661352	-0.082029412	-0.058794966
##	GII	-0.013738934	0.07277565	-0.0078016191	-0.231257756	-0.139365454
##	MMR	0.236498383	-0.23731506	-0.0012393385	-0.263416613	-0.330071963
##	ABR	-0.041904920	0.13793084	-0.2895192105	-0.301663943	0.373603580
##	SSP_F	0.127207952	0.29959557	-0.0213015549	-0.196684454	-0.126791003
##	P2EDU_F	0.113027978	0.27650979	0.1666421416	-0.069021352	-0.091630915
##	P2EDU_M	0.106881803	0.29424061	0.2151932564	0.001225565	-0.190195818
##	LFP_F	0.010002265	-0.06823898	-0.0459476858	0.524659330	0.128994930
##	LFP_M	-0.153696046	0.11755147	0.3835337531	-0.275842118	-0.141022420
##		PC11	PC12	PC13	PC14	PC15
##	HDI	-0.01980888	-0.115336145	0.094597239	-0.041472078	0.286305453
##	LEB	0.06226341	0.037441860	0.482988195	0.183761705	0.171844902
##	EYEDU	-0.38702683	-0.433202466	-0.003209141	-0.017037951	-0.173645587
##	MYEDU	0.08031687	-0.091624085	-0.116851949	-0.026522328	0.522209263
##	GNIpC	-0.09896566	0.347909934	-0.238257270	-0.107728729	-0.119365134
##	IHDI	0.05978390	-0.084491543	0.042328656	-0.007464195	0.070665374
##	CHI	-0.19429499	0.071599210	-0.001283010	-0.020253342	0.063672000
##	IN_LE	-0.14497362	0.018751327	-0.285951547	-0.188112466	-0.105387102
##	IN_EDU	-0.33008351	0.378124300	0.275992008	0.011613586	0.260869174
##	IN_INC	0.06107868	-0.384355359	-0.074600506	0.150029407	-0.069613470
##	INC_40_POOR	-0.13796494	-0.083408566	-0.250219057	0.616534245	-0.023089576
##	INC_10_RICH	-0.06014310	0.243659595	-0.171527078	0.653107567	-0.017184791
##	INC_1_RICH	0.02720494	0.031469785	0.075321247	-0.097144986	0.005558133
##	GINI	0.04411982	0.149045213	0.047104154	-0.032063142	0.007476523
##	GII	-0.19559678	-0.066891242	-0.104183896	-0.033017397	0.563533428
##	MMR	0.47436024	-0.073035908	0.431525473	0.222952022	-0.043843744
##	ABR	-0.49499290	-0.349363186	0.361688778	0.054068973	-0.091245050
##	SSP_F	-0.04474032	0.002250298	0.079392373	-0.027207043	0.040978906
##	P2EDU_F	-0.21534073	0.133233543	0.077538535	0.141258309	0.088961010
##	P2EDU_M	-0.25564589	0.344625951	0.277383941	-0.038297661	-0.292049756
##	LFP_F	-0.03816448	0.070467586	-0.068364164	0.019511709	0.214878591
##	LFP_M	0.07649713	0.044575846	0.017398606	-0.004966624	-0.092466003

##	PC16	PC17	PC18	PC19	PC20
## HDI	-0.235458696	0.19029563	0.076901072	-0.646022841	0.503184690
## LEB	0.118395630	-0.41576688	0.455627774	0.192608027	0.015192432
## EYEDU	0.120040895	-0.04504490	-0.048782249	0.189511286	0.014886900
## MYEDU	-0.487492406	-0.15148544	-0.132171178	0.454038817	-0.008983880
## GNIpc	0.188581617	-0.00759662	-0.138859266	0.105225056	0.047303132
## IHDI	-0.122149595	0.07923912	0.034799708	-0.380486235	-0.839004617
## CHI	-0.172902409	-0.01634901	0.152433754	-0.013085465	-0.092155208
## IN_LE	-0.237174939	-0.25891048	0.673211420	-0.094177928	-0.014543314
## IN_EDU	-0.220028829	0.21918112	-0.170533108	0.072823599	-0.118051313
## IN_INC	0.068049887	-0.06345228	-0.077859984	-0.034551310	-0.061499261
## INC_40_POOR	-0.074673463	-0.08646149	-0.034303493	-0.070471951	0.061262041
## INC_10_RICH	-0.106006963	-0.03710591	0.013046803	-0.071220623	-0.024456692
## INC_1_RICH	-0.012817889	0.01912704	0.035553848	-0.005756178	0.004956131
## GINI	-0.003206716	0.02409856	-0.013772283	0.037667415	0.067089245
## GII	0.566530615	-0.28922300	-0.106883439	-0.191910768	-0.056270119
## MMR	0.071270458	0.03047231	-0.019498450	-0.008749618	0.023586083
## ABR	-0.169351481	0.07171972	-0.082873994	0.040252506	0.005662305
## SSP_F	0.051632777	-0.03553164	0.014003195	-0.046886318	-0.009671904
## P2EDU_F	0.318291539	0.56897317	0.407297388	0.165097370	-0.021114701
## P2EDU_M	-0.042875374	-0.45464854	-0.214514025	-0.222430901	0.022060654
## LFP_F	0.081208192	-0.06283617	-0.031258253	-0.055483535	-0.004962233
## LFP_M	-0.068525604	0.07124379	0.000821133	0.009186521	0.001127706
##	PC21	PC22			
## HDI	2.578202e-02	-4.721017e-03			
## LEB	-1.183666e-02	1.309111e-03			
## EYEDU	1.212907e-02	-9.009314e-04			
## MYEDU	1.965545e-02	-7.324245e-04			
## GNIpc	1.302696e-02	2.628088e-04			
## IHDI	-8.843507e-02	7.909898e-03			
## CHI	-1.056151e-02	-8.253289e-01			
## IN_LE	-2.184173e-02	3.156403e-01			
## IN_EDU	-1.225678e-02	3.942353e-01			
## IN_INC	2.550921e-03	2.523347e-01			
## INC_40_POOR	-4.397950e-01	-1.037189e-03			
## INC_10_RICH	3.763245e-01	1.411144e-03			
## INC_1_RICH	-3.958203e-03	-1.499442e-04			
## GINI	-8.091589e-01	-2.763347e-03			
## GII	1.436346e-03	2.085213e-03			
## MMR	1.865641e-03	-1.513703e-03			
## ABR	5.307287e-03	-1.125922e-03			
## SSP_F	5.386357e-05	2.056087e-05			
## P2EDU_F	-9.475786e-03	-5.295045e-04			
## P2EDU_M	2.903770e-03	7.231387e-04			
## LFP_F	-6.662263e-04	1.164847e-03			
## LFP_M	-1.839601e-04	-5.053232e-04			

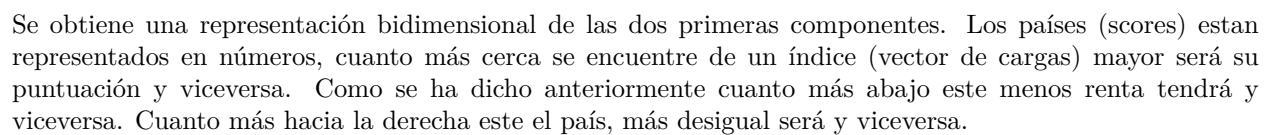
La primera componente principal:

Tiene asociaciones positivas con HDI, LEB, EYEDU, MYEDU, GNIpc, IHDI, P2EDU_M. Y asociaciones negativas con CHI, IN_LE, IN_EDU, GII, ABR. Este componente recoge principalmente la desigualdad.

El segundo componente principal:

Tiene asociaciones positivas con INC_40_POOR y negativas con IN_INC, INC_10_RICH, INC_1_RICH, GINI. Así que este componente recoge mayoritariamente información sobre la renta.

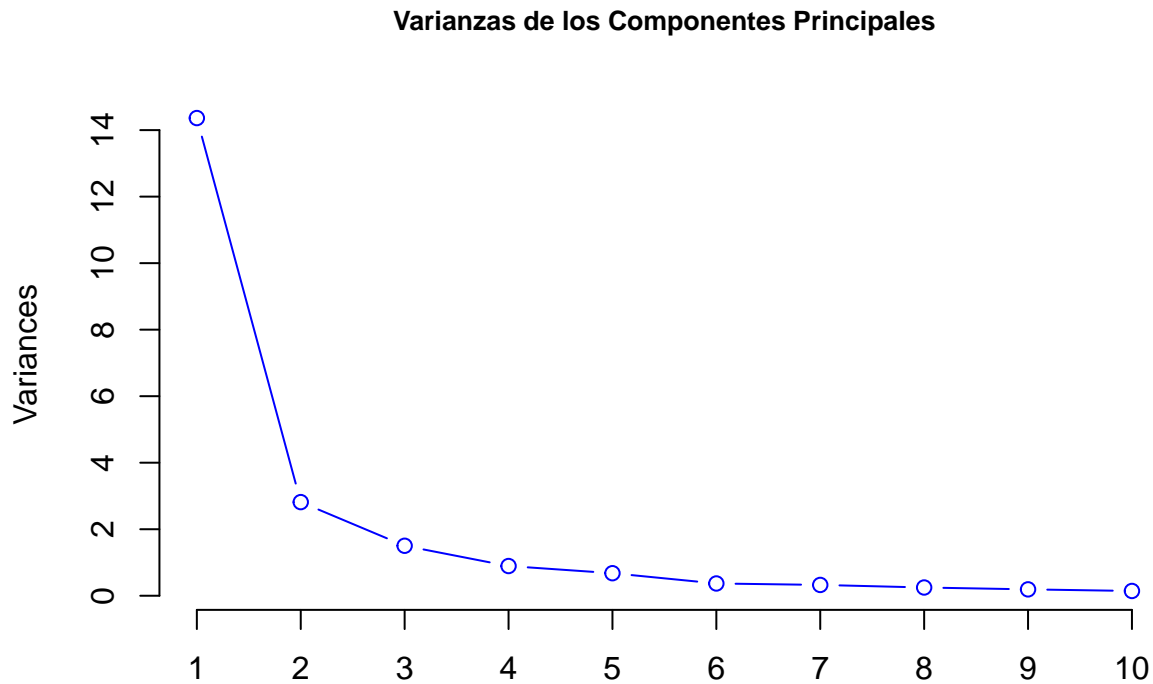
```
biplot(pr.out, scale=0)
```



```
#Desviaciones típicas de las componentes:
pr.out$sdev
```

4

```
#Gráfico para observar la regla del codo
screepplot(pr.out, type = "l", main = "Varianzas de los Componentes Principales",
           col = "blue", cex.main = 0.8)
```



Escogería 3 componentes ya que la desviación del 4 componente es menor de 1. Aunque según la regla del codo podríamos escoger 2.

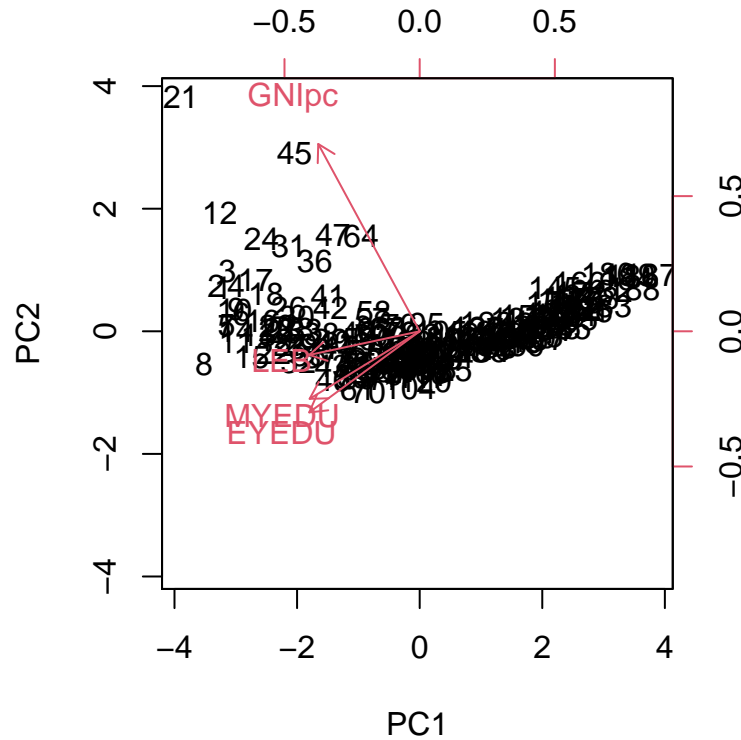
5. Calcula las componentes principales de las variables LEB, EYEDU, MYEDU y GNIpc. Estudia sus vectores de carga y comenta dichos resultados en función de cómo pondera el IDH los diferentes indicadores. ¿Con cuantas componentes principales te quedarías?

```
dataset2 = read.csv2("data_HDI_2019.csv")
df_mat2 <- as.matrix(dataset2[, -1])
new_mat <- df_mat2[, 2:5]
pr.out.2 = prcomp(new_mat, scale = TRUE)
pr.out.2$rotation
```

```
##           PC1           PC2           PC3           PC4
## LEB    -0.5102770 -0.1092925  0.79381958  0.31228678
## EYEDU  -0.5107632 -0.3749363 -0.07710668 -0.76980405
## MYEDU  -0.5087707 -0.3121884 -0.58572160  0.54828911
## GNIpc  -0.4689250  0.8660348 -0.14434419 -0.09621713
```

La primera componente recoge muy bien que la ONU da el mismo peso a estos indicadores La segunda recoge principalmente el PIB per cápita.

```
biplot(pr.out.2, scale=0)
```

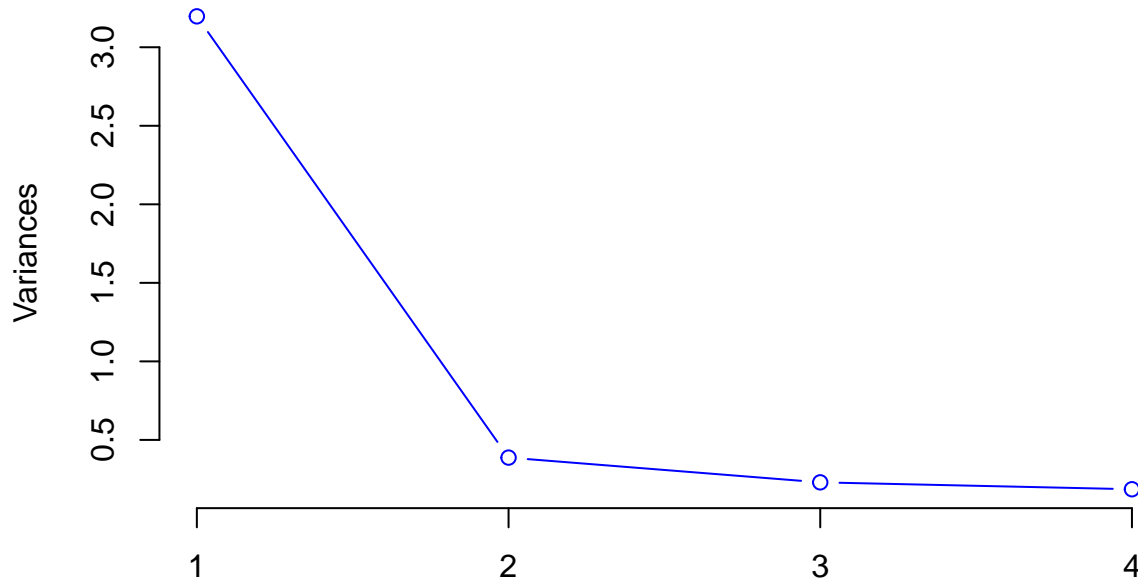


```
#Obtenemos las desviaciones típicas
pr.out.2$sdev
```

```
## [1] 1.7879597 0.6224001 0.4794378 0.4312281
```

```
#Gráfico para observar la regla del codo
screeplot(pr.out.2, type = "l", main = "Varianzas de los Componentes Principales",
          col = "blue", cex.main = 0.8)
```

Varianzas de los Componentes Principales



Con el criterio de la desviación típica, nos quedaríamos con una sola componente, ya que la primera componente es la única que está por encima de 1. En cambio con la regla del codo, cogeríamos 2 componentes principales.