Untitled

Brenda Corina Cerezo Silva

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La función del coeficiente:

rhot <- function(a,b,c,d){  
 set.seed(2021)  
 a = ifelse(a==0,0.5,a)  
 b = ifelse(b==0,0.5,b)  
 c = ifelse(c==0,0.5,c)  
 d = ifelse(d==0,0.5,d)  
 N = a+b+c+d  
 h = qnorm(0.5 + ((a+c)-(b+d))/(2\*N))  
 k = qnorm(0.5 + ((a+b)-(c+d))/(2\*N))  
 H = (1/sqrt(2\*pi))\*exp(-0.5\*h^2)  
 K = (1/sqrt(2\*pi))\*exp(-0.5\*k^2)  
 peh <- qnorm(3/4)/(H\*sqrt(N))\*sqrt((b+d)\*(a+c)/(N^2))  
 pek <- qnorm(3/4)/(K\*sqrt(N))\*sqrt((c+d)\*(a+b)/(N^2))  
 eps = (a\*d-b\*c)/(N\*N\*H\*K)  
 coef1 = 1  
 coef2 = h\*k/factorial(2)  
 coef3 = (h^2-1)\*(k^2-1)/factorial(3)  
 coef4 = h\*(h^2-3)\*k\*(k^2-3)/factorial(4)  
 coef5 = (h^4-6\*h^2+3)\*(k^4-6\*k^2+3)/factorial(5)  
 coef6 = h\*(h^4-10\*h^2+15)\*k\*(k^4-10\*k^2+15)/factorial(6)  
 coef7 = (h^6-15\*h^4+45\*h^2-15)\*(k^6-15\*k^4+45\*k^2-15)/factorial(7)  
 coef8 = h\*(h^6-21\*h^4+105\*h^2-105)\*k\*(k^6-21\*k^4+105\*k^2-105)/factorial(8)  
 serie1 <- function(x){  
 return(-1\*eps+coef1\*x+coef2\*x^2+coef3\*x^3+coef4\*x^4+coef5\*x^5+coef6\*x^6+coef7\*x^7+coef8\*x^8)  
 }  
 r1 <- uniroot.all(serie1, c(-1,1))  
 serie2 <- function(x){  
 return(-1\*eps+ x + h\*k/2\*x^2-(h^2+k^2-(h^2)\*(k^2))/6\*x^3 + h\*k\*((h^2)\*(k^2)-3\*(h^2+k^2)+5)/24\*x^4)  
 }  
 tet <- uniroot.all(serie2, c(-1,1))  
 r2 <- sin(tet)  
 per <- function (r){  
 beta1 <- (h-r\*k)/sqrt(1-r^2)  
 beta2 <- (k-r\*h)/sqrt(1-r^2)  
 psi1 <- pnorm(beta1)-0.5  
 psi2 <- pnorm(beta2)-0.5  
 chi0 <- (1/(2\*pi))\*(1/sqrt(1-r^2))\*exp(-0.5\*(1/(1-r^2))\*(h^2+k^2-2\*r\*h\*k))  
 return(qnorm(3/4)/(sqrt(N)\*chi0\*N)\*sqrt(((a+d)\*(c+b))/(4)+psi2^2\*((a+c)\*(b+d))+psi1^2\*((a+b)\*(c+d))+2\*psi1\*psi2\*(a\*d-b\*c)-psi2\*(a\*b-c\*d)-psi1\*(a\*c-b\*d)))  
 }  
 if(length(r1)==1 & length(r2)==1){  
 x <- data.frame(Estimacion = c(r1,r2,h,k),  
 P.E. = c(per(r1),per(r2),peh,pek),  
 l.lim = c(r1-per(r1),r2-per(r2),h-peh,k-pek),  
 u.lim = c(r1+per(r1),r2+per(r2),h+peh,k+pek),  
 row.names = c("Coef. Corr. 1","Coef. Corr. 2","h","k"))  
   
 return(x)  
 }  
 if(length(r1)==1 & length(r2)!=1){  
 x <- data.frame(Estimacion = c(r1,h,k),  
 P.E. = c(per(r1),peh,pek),  
 l.lim = c(r1-per(r1),h-peh,k-pek),  
 u.lim = c(r1+per(r1),h+peh,k+pek),  
 row.names = c("Coef. Corr. 1","h","k"))  
   
 return(list(x, "La serie 2 obtiene los siguientes valores:",r2))  
 }  
 if(length(r1)!=1 & length(r2)==1){  
 x <- data.frame(Estimacion = c(r2,h,k),  
 P.E. = c(per(r2),peh,pek),  
 l.lim = c(r2-per(r2),h-peh,k-pek),  
 u.lim = c(r2+per(r2),h+peh,k+pek),  
 row.names = c("Coef. Corr. 2","h","k"))  
   
 return(list(x, "La serie 1 obtiene los siguientes valores:",r1))  
 }  
 if(length(r1)==0 & length(r2)==0){  
 return("No se pudo calcular.")  
 }  
 else{  
 return(list("La serie 1 obtiene:",r1,"La serie 2 obtiene:",r2))  
 }  
}

La función de la tablita de frecuencias simuladas:

frecuencias <- function(N,sigma1,sigma2,rhot,h,k){  
 z <- function(x,y){  
 N/(2\*pi\*sigma1\*sigma2\*sqrt(1-rhot^2))\*exp(-0.5\*(1/(1-rhot^2))\*((x/sigma1)^2+(y/sigma2)^2-2\*rhot\*x\*y/(sigma1\*sigma2)))  
 }  
 aux1 <- pbivnorm::pbivnorm(x=c(h/s1), y=c(k/s2), rho=p)  
 a <- N\*aux1  
 aux2 <- pbivnorm::pbivnorm(x=c(Inf), y=c(k/s2), rho=p)  
 b <- N\*(aux2-aux1)  
 aux3 <- pbivnorm::pbivnorm(x=c(h/s1), y=c(Inf), rho=p)  
 c <- N\*(aux3-aux1)  
 d <- N\*(1-aux2-aux3+aux1)  
 return(c(round(a),round(b),round(c),round(d)))  
}

Aplicando mi función a las ilustraciones de Pearson:

library(psych)  
library(pbivnorm)  
library(rootSolve)  
  
#Ilustración 1 de Pearson  
rhot(631,125,147,147) #mi función

## Estimacion P.E. l.lim u.lim  
## Coef. Corr. 1 0.5419234 0.02858312 0.5133402 0.5705065  
## Coef. Corr. 2 0.5411731 0.02860379 0.5125693 0.5697769  
## h 0.6462843 0.02816790 0.6181164 0.6744522  
## k 0.5828415 0.02776398 0.5550775 0.6106055

(tetrachoric(matrix(c(631,125,147,147),2,2))) #función de la librería psych

## Call: tetrachoric(x = matrix(c(631, 125, 147, 147), 2, 2))  
## tetrachoric correlation   
## [1] 0.54  
##   
## with tau of   
## [1] 0.65 0.58

#Ilustración 3 de Pearson  
rhot(1766,842,842,722)

## Estimacion P.E. l.lim u.lim  
## Coef. Corr. 1 0.2221271 0.01636714 0.2057600 0.2384943  
## Coef. Corr. 2 0.2221256 0.01636715 0.2057585 0.2384928  
## h 0.3189554 0.01333251 0.3056229 0.3322879  
## k 0.3189554 0.01333251 0.3056229 0.3322879

(tetrachoric(matrix(c(1766,842,842,722),2,2))) #función de la librería psych

## Call: tetrachoric(x = matrix(c(1766, 842, 842, 722), 2, 2))  
## tetrachoric correlation   
## [1] 0.22  
##   
## with tau of   
## [1] 0.32 0.32

#Ilustración 6 de Pearson  
rhot(1562,42,383,94)

## Estimacion P.E. l.lim u.lim  
## Coef. Corr. 1 0.5956617 0.02721521 0.5684465 0.6228769  
## Coef. Corr. 2 0.5968316 0.02719090 0.5696407 0.6240225  
## h 1.5113222 0.02869930 1.4826229 1.5400215  
## k 0.7414289 0.02050633 0.7209225 0.7619352

(tetrachoric(matrix(c(1562,42,383,94),2,2))) #función de la librería psych

## Call: tetrachoric(x = matrix(c(1562, 42, 383, 94), 2, 2))  
## tetrachoric correlation   
## [1] 0.6  
##   
## with tau of   
## [1] 1.51 0.74

Ejemplo simulados

#Ejemplo 1  
N <- 1000  
s1 <- 5  
s2 <- 5  
p <- 0.4  
h <- 4  
k <- 1  
ns <- frecuencias(N,s1,s2,p,h,k)  
ns

## [1] 504 75 284 136

sum(ns)

## [1] 999

rhot(ns[1],ns[2],ns[3],ns[4]) #Mi función

## Estimacion P.E. l.lim u.lim  
## Coef. Corr. 1 0.4008761 0.03349095 0.3673851 0.4343670  
## Coef. Corr. 2 0.4005529 0.03349532 0.3670576 0.4340482  
## h 0.8022257 0.03012104 0.7721046 0.8323467  
## k 0.2008181 0.02694251 0.1738755 0.2277606

(tetrachoric(matrix(c(ns[1],ns[2],ns[3],ns[4]),2,2))) #Función de la librería psych

## Call: tetrachoric(x = matrix(c(ns[1], ns[2], ns[3], ns[4]), 2, 2))  
## tetrachoric correlation   
## [1] 0.4  
##   
## with tau of   
## [1] 0.8 0.2

#Ejemplo 4, NO se rechaza que p=0 porque N es pequeña  
N <- 1000  
s1 <- 5  
s2 <- 5  
p <- 0.05  
h <- 4  
k <- 1  
ns <- frecuencias(N,s1,s2,p,h,k)  
ns

## [1] 462 117 326 95

sum(ns)

## [1] 1000

rhot(ns[1],ns[2],ns[3],ns[4]) #Mi función

## Estimacion P.E. l.lim u.lim  
## Coef. Corr. 1 0.05049398 0.03785009 0.01264389 0.08834406  
## Coef. Corr. 2 0.05049649 0.03785007 0.01264642 0.08834656  
## h 0.79950094 0.03008134 0.76941960 0.82958229  
## k 0.19933590 0.02692613 0.17240977 0.22626203

(tetrachoric(matrix(c(ns[1],ns[2],ns[3],ns[4]),2,2))) #Función de la librería psych

## Call: tetrachoric(x = matrix(c(ns[1], ns[2], ns[3], ns[4]), 2, 2))  
## tetrachoric correlation   
## [1] 0.051  
##   
## with tau of   
## [1] 0.8 0.2

#Ejemplo 7 ejemplo loco  
N <- 1000  
s1 <- 1  
s2 <- 1  
p <- -0.89  
h <- 15 #vs 3  
k <- 0.3  
ns <- frecuencias(N,s1,s2,p,h,k)  
ns

## [1] 618 0 382 0

sum(ns)

## [1] 1000

rhot(ns[1],ns[2],ns[3],ns[4]) #Mi función

## [[1]]  
## Estimacion P.E. l.lim u.lim  
## Coef. Corr. 1 0.08906063 0.2500356 -0.160975 0.3390962  
## h 3.09052914 0.2002018 2.890327 3.2907309  
## k 0.29992316 0.0271602 0.272763 0.3270834  
##   
## [[2]]  
## [1] "La serie 2 obtiene los siguientes valores:"  
##   
## [[3]]  
## [1] 0.08907405 0.68770911

(tetrachoric(matrix(c(ns[1],ns[2],ns[3],ns[4]),2,2))) #Función de la librería psych

## For i = 1 j = 1 A cell entry of 0 was replaced with correct = 0.5. Check your data!

## Call: tetrachoric(x = matrix(c(ns[1], ns[2], ns[3], ns[4]), 2, 2))  
## tetrachoric correlation   
## [1] 0.089  
##   
## with tau of   
## [1] 3.1 0.3

#Ejemplo 8 ejemplo loco  
N <- 1000  
s1 <- 1  
s2 <- 1  
p <- -0.89  
h <- 3 #vs15  
k <- 0.3  
ns <- frecuencias(N,s1,s2,p,h,k)  
ns

## [1] 617 1 382 0

sum(ns)

## [1] 1000

rhot(ns[1],ns[2],ns[3],ns[4]) #Mi función

## [[1]]  
## Estimacion P.E. l.lim u.lim  
## Coef. Corr. 1 -0.04037005 0.2181101 -0.2584802 0.1777401  
## h 2.96789158 0.1691545 2.7987371 3.1370461  
## k 0.29942251 0.0271655 0.2722570 0.3265880  
##   
## [[2]]  
## [1] "La serie 2 obtiene los siguientes valores:"  
##   
## [[3]]  
## [1] -0.80036495 -0.04035908 0.74608258

(tetrachoric(matrix(c(ns[1],ns[2],ns[3],ns[4]),2,2))) #Función de la librería psych

## For i = 1 j = 1 A cell entry of 0 was replaced with correct = 0.5. Check your data!

## Call: tetrachoric(x = matrix(c(ns[1], ns[2], ns[3], ns[4]), 2, 2))  
## tetrachoric correlation   
## [1] -0.04  
##   
## with tau of   
## [1] 3.0 0.3

#Ejemplo 9 ejemplo loco  
N <- 1000  
s1 <- 1  
s2 <- 1  
p <- -0.89  
h <- 0.1 #vs15  
k <- 0.3  
ns <- frecuencias(N,s1,s2,p,h,k)  
ns

## [1] 178 439 361 21

sum(ns)

## [1] 999

rhot(ns[1],ns[2],ns[3],ns[4]) #Mi función

## [[1]]  
## Estimacion P.E. l.lim u.lim  
## Coef. Corr. 1 -0.89360564 0.01172868 -0.90533432 -0.8818770  
## h 0.09927375 0.02679356 0.07248019 0.1260673  
## k 0.29922973 0.02718531 0.27204442 0.3264150  
##   
## [[2]]  
## [1] "La serie 2 obtiene los siguientes valores:"  
##   
## [[3]]  
## numeric(0)

(tetrachoric(matrix(c(ns[1],ns[2],ns[3],ns[4]),2,2))) #Función de la librería psych

## Call: tetrachoric(x = matrix(c(ns[1], ns[2], ns[3], ns[4]), 2, 2))  
## tetrachoric correlation   
## [1] -0.89  
##   
## with tau of   
## [1] 0.099 0.299