Cooperation in innovation

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## 

#Carga de datos  
library(readxl)  
library(dplyr)

##   
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':  
##   
## filter, lag

## The following objects are masked from 'package:base':  
##   
## intersect, setdiff, setequal, union

df <- read\_excel("/Users/unimooc/Dropbox/2021/Directorio R/Research/Cooperation/DATOS 2004-2014.xlsx", sheet = "2004-2014")  
head(df)

## # A tibble: 6 x 41  
## IDENT ACTIVIDAD PERIODO INTEC INTECMAN CIFRA GTINN INTINN TAMANO MDOLOCAL  
## <dbl> <dbl> <chr> <dbl> <chr> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 1 15 2004-2… 2 2.4 7.81e6 14232 0.00182 49 1  
## 2 2 17 2004-2… 2 2.4 3.19e7 291379 0.00913 212 1  
## 3 3 19 2004-2… 2 2.4 4.52e6 177232 0.0392 49 1  
## 4 4 18 2004-2… 2 2.4 1.33e7 172760 0.0130 96 1  
## 5 5 33 2004-2… 2 2.1 2.82e8 320506 0.00114 1129 1  
## 6 6 34 2004-2… 2 2.2 1.42e8 713878 0.00504 319 1  
## # … with 31 more variables: MDONAC <dbl>, MDOUE <dbl>, INNPROD <dbl>,  
## # INNOBIEN <dbl>, INNOSERV <dbl>, INNPROC <dbl>, INNFABRI <dbl>,  
## # INNLOGIS <dbl>, INNAPOYO <dbl>, COOP <dbl>, GIO1 <dbl>, GIO2 <dbl>,  
## # GIO3 <dbl>, GIO4 <dbl>, GIO5 <dbl>, GIO6 <dbl>, GIO7 <dbl>, GIO8 <dbl>,  
## # GIO9 <dbl>, F1 <dbl>, F2 <dbl>, F3 <dbl>, F4 <dbl>, F5 <dbl>, F6 <dbl>,  
## # F7 <dbl>, F8 <dbl>, F9 <dbl>, F10 <dbl>, F11 <dbl>, TIEMPO <dbl>

df <- na.omit(df)  
anyNA(df)

## [1] FALSE

df.gr <- filter(df, TIEMPO <= 2007)  
df.cr <- filter(df, TIEMPO %in% c(2008, 2009, 2010))  
df.re <- filter(df, TIEMPO >= 2011)

## Chi Cuadrado

Creamos un dataframe con las variables COOP y Tiempo.

df.or <- df[,c("COOP","TIEMPO")]

Creamos variables categóricas con la inormación de “TIEMPO” y “COOP”

facTiemp <- factor(df$TIEMPO,  
 levels = c(2004,2005,2006,2007,  
 2008,2009,2010  
 ,2011, 2012, 2013, 2014),  
 labels = c("Growth", "Growth", "Growth", "Growth",   
 "Crisis", "Crisis", "Crisis",   
 "Recovery", "Recovery", "Recovery", "Recovery"))  
df$facTiemp <- facTiemp  
  
facCoop <- factor(df$COOP,  
 levels = c(0, 1),  
 labels = c("NoCoop", "Coop"))  
  
df$facCoop <- facCoop

Creamos variables dicotómicas en función de los distintos momentos del periodo económico

#Etapa de crecimiento  
df$facTiempG <- factor(df$TIEMPO,  
 levels = c(2004,2005,2006,2007,  
 2008,2009,2010  
 ,2011, 2012, 2013, 2014),  
 labels = c("1", "1", "1", "1",   
 "0", "0", "0",   
 "0", "0", "0", "0"))  
  
#Etapa de crisis  
df$facTiempC <- factor(df$TIEMPO,  
 levels = c(2004,2005,2006,2007,  
 2008,2009,2010  
 ,2011, 2012, 2013, 2014),  
 labels = c("0", "0", "0", "0",   
 "1", "1", "1",   
 "0", "0", "0", "0"))  
  
#Etapa de recuperación  
df$facTiempR <- factor(df$TIEMPO,  
 levels = c(2004,2005,2006,2007,  
 2008,2009,2010  
 ,2011, 2012, 2013, 2014),  
 labels = c("0", "0", "0", "0",   
 "0", "0", "0",   
 "1", "1", "1", "1"))

### Chi cuadrado - Pearson para la primera hipótesis

H1: Companies change their perspective on cooperation to develop innovation according to the economic cycle.

tablaCoop <-table(df$facCoop, df$facTiemp)  
chisq.test(tablaCoop,correct=FALSE)

##   
## Pearson's Chi-squared test  
##   
## data: tablaCoop  
## X-squared = 620.47, df = 2, p-value < 2.2e-16

tablaCoopG <-table(df$facCoop, df$facTiempG)  
chisq.test(tablaCoopG, correct=FALSE)

##   
## Pearson's Chi-squared test  
##   
## data: tablaCoopG  
## X-squared = 339.69, df = 1, p-value < 2.2e-16

tablaCoopC <-table(df$facCoop, df$facTiempC)  
chisq.test(tablaCoopC, correct=FALSE)

##   
## Pearson's Chi-squared test  
##   
## data: tablaCoopC  
## X-squared = 13.291, df = 1, p-value = 0.0002667

tablaCoopR <-table(df$facCoop, df$facTiempR)  
chisq.test(tablaCoopR, correct=FALSE)

##   
## Pearson's Chi-squared test  
##   
## data: tablaCoopR  
## X-squared = 577.95, df = 1, p-value < 2.2e-16

Cálculo de medias

mean(df$COOP)

## [1] 0.1508814

mean(df.gr$COOP)

## [1] 0.1242933

mean(df.cr$COOP)

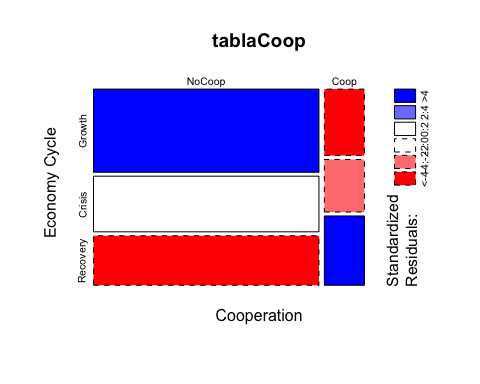
## [1] 0.143812

mean(df.re$COOP)

## [1] 0.199162

Representación gráfica

mosaicplot(tablaCoop, ylab="Economy Cycle", xlab = "Cooperation",  
 shade = T)



### Chi cuadrado - Pearson para la segunda hipótesis

H2: Companies change their views on the competitive need for innovation depending on the economic cycle.

DOI\_1 <-table(df$GIO1, df$facTiemp)  
 chisq.test(DOI\_1,correct=FALSE)

##   
## Pearson's Chi-squared test  
##   
## data: DOI\_1  
## X-squared = 723.59, df = 6, p-value < 2.2e-16

DOI\_2 <-table(df$GIO2, df$facTiemp)  
 chisq.test(DOI\_2,correct=FALSE)

##   
## Pearson's Chi-squared test  
##   
## data: DOI\_2  
## X-squared = 1281.2, df = 6, p-value < 2.2e-16

DOI\_3 <-table(df$GIO3, df$facTiemp)  
 chisq.test(DOI\_3,correct=FALSE)

##   
## Pearson's Chi-squared test  
##   
## data: DOI\_3  
## X-squared = 905.93, df = 6, p-value < 2.2e-16

DOI\_4 <-table(df$GIO4, df$facTiemp)  
 chisq.test(DOI\_4,correct=FALSE)

##   
## Pearson's Chi-squared test  
##   
## data: DOI\_4  
## X-squared = 645.66, df = 6, p-value < 2.2e-16

DOI\_5 <-table(df$GIO5, df$facTiemp)  
 chisq.test(DOI\_5,correct=FALSE)

##   
## Pearson's Chi-squared test  
##   
## data: DOI\_5  
## X-squared = 371.83, df = 6, p-value < 2.2e-16

DOI\_6 <-table(df$GIO6, df$facTiemp)  
 chisq.test(DOI\_6,correct=FALSE)

##   
## Pearson's Chi-squared test  
##   
## data: DOI\_6  
## X-squared = 1607.7, df = 6, p-value < 2.2e-16

DOI\_7 <-table(df$GIO7, df$facTiemp)  
 chisq.test(DOI\_7,correct=FALSE)

##   
## Pearson's Chi-squared test  
##   
## data: DOI\_7  
## X-squared = 7763.1, df = 6, p-value < 2.2e-16

DOI\_8 <-table(df$GIO8, df$facTiemp)  
 chisq.test(DOI\_8,correct=FALSE)

##   
## Pearson's Chi-squared test  
##   
## data: DOI\_8  
## X-squared = 748.2, df = 6, p-value < 2.2e-16

DOI\_9 <-table(df$GIO9, df$facTiemp)  
 chisq.test(DOI\_9,correct=FALSE)

##   
## Pearson's Chi-squared test  
##   
## data: DOI\_9  
## X-squared = 201.83, df = 6, p-value < 2.2e-16

#Replicar para facTiempG, facTiempC, facTiempR

Cálculo de medias

mean(df$GIO1)

## [1] 2.090599

mean(df$GIO2)

## [1] 2.287346

mean(df$GIO3)

## [1] 1.968636

mean(df.gr$GIO1)

## [1] 2.160374

mean(df.cr$GIO1)

## [1] 2.108191

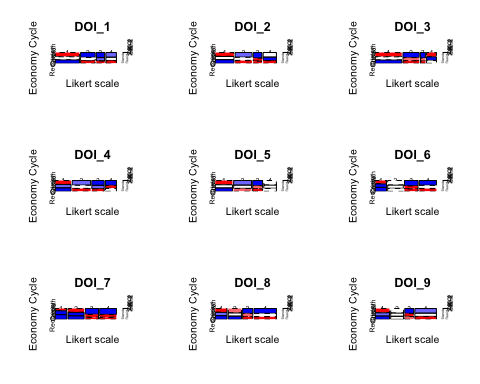
mean(df.re$GIO1)

## [1] 1.964908

#Replicar para todos los casos restantes

Representación gráfica

par(mfrow = c(3,3))  
 mosaicplot(DOI\_1, ylab="Economy Cycle", xlab = "Likert scale",  
 shade = T)  
   
 mosaicplot(DOI\_2, ylab="Economy Cycle", xlab = "Likert scale",  
 shade = T)  
   
 mosaicplot(DOI\_3, ylab="Economy Cycle", xlab = "Likert scale",  
 shade = T)   
  
 mosaicplot(DOI\_4, ylab="Economy Cycle", xlab = "Likert scale",  
 shade = T)  
   
 mosaicplot(DOI\_5, ylab="Economy Cycle", xlab = "Likert scale",  
 shade = T)  
   
 mosaicplot(DOI\_6, ylab="Economy Cycle", xlab = "Likert scale",  
 shade = T)  
   
 mosaicplot(DOI\_7, ylab="Economy Cycle", xlab = "Likert scale",  
 shade = T)  
   
 mosaicplot(DOI\_8, ylab="Economy Cycle", xlab = "Likert scale",  
 shade = T)  
   
 mosaicplot(DOI\_9, ylab="Economy Cycle", xlab = "Likert scale",  
 shade = T)



### Chi cuadrado - Pearson para la tercera hipótesis

H3: Companies change their views on the problems and barriers to entry for developing innovation according to the economic cycle.

Mismo proceso que anterior.

## U de Mann-Whitney

### Mann-Whitney para la cuarta hipótesis

H4: The firms’ perspective on the competitive importance of innovation and the possible problems for the development of innovation conditions their response on whether or not to cooperate with technology centres.

library(survival)  
library(coin)

P-valores de ManW

wilcox.test(GIO1~COOP,data=df, Paired = TRUE, exact = FALSE)

##   
## Wilcoxon rank sum test with continuity correction  
##   
## data: GIO1 by COOP  
## W = 522146456, p-value < 2.2e-16  
## alternative hypothesis: true location shift is not equal to 0

wilcox.test(GIO2~COOP,data=df, Paired = TRUE, exact = FALSE)

##   
## Wilcoxon rank sum test with continuity correction  
##   
## data: GIO2 by COOP  
## W = 522807048, p-value < 2.2e-16  
## alternative hypothesis: true location shift is not equal to 0

wilcox.test(GIO3~COOP,data=df, Paired = TRUE, exact = FALSE)

##   
## Wilcoxon rank sum test with continuity correction  
##   
## data: GIO3 by COOP  
## W = 513178808, p-value < 2.2e-16  
## alternative hypothesis: true location shift is not equal to 0

#Replicar para todas las posiblidades

Valores Z de ManW

df$COOP <- as.factor(df$COOP)  
df.gr$COOP <- as.factor(df.gr$COOP)  
df.cr$COOP <- as.factor(df.cr$COOP)  
df.re$COOP <- as.factor(df.re$COOP)  
  
wilcox\_test(df$GIO1 ~ df$COOP)

##   
## Asymptotic Wilcoxon-Mann-Whitney Test  
##   
## data: df$GIO1 by df$COOP (0, 1)  
## Z = 38.661, p-value < 2.2e-16  
## alternative hypothesis: true mu is not equal to 0

wilcox\_test(df$GIO2 ~ df$COOP)

##   
## Asymptotic Wilcoxon-Mann-Whitney Test  
##   
## data: df$GIO2 by df$COOP (0, 1)  
## Z = 38.439, p-value < 2.2e-16  
## alternative hypothesis: true mu is not equal to 0

wilcox\_test(df$GIO2 ~ df$COOP)

##   
## Asymptotic Wilcoxon-Mann-Whitney Test  
##   
## data: df$GIO2 by df$COOP (0, 1)  
## Z = 38.439, p-value < 2.2e-16  
## alternative hypothesis: true mu is not equal to 0

#La función wilcox\_test necesita que se le indique una variable como factor.  
#Repetir para todas las posibilidades

Cálculo de medias (para las que cooperan y para las que no)

df.0 <- filter(df, COOP == "0")  
df.1 <- filter(df, COOP == "1")  
  
mean(df.0$GIO1)

## [1] 2.155942

mean(df.1$GIO1)

## [1] 1.722867

df.gr.0 <- filter(df.gr, COOP == "0")  
df.gr.1 <- filter(df.gr, COOP == "1")  
  
mean(df.gr.0$GIO1)

## [1] 2.204159

mean(df.gr.1$GIO1)

## [1] 1.851886

#Replicar para todos los valores necesarios

Representación gráfica

par(mfrow = c(3,3))  
  
DOI\_1 <-table(df$GIO1, df$COOP)  
mosaicplot(DOI\_1, ylab="Cooperation", xlab = "Likert scale",  
 shade = T)  
  
DOI\_2 <-table(df$GIO2, df$COOP)  
mosaicplot(DOI\_2, ylab="Cooperation", xlab = "Likert scale",  
 shade = T)  
  
DOI\_3 <-table(df$GIO3, df$COOP)  
mosaicplot(DOI\_3, ylab="Cooperation", xlab = "Likert scale",  
 shade = T)  
  
DOI\_4 <-table(df$GIO1, df$COOP)  
mosaicplot(DOI\_1, ylab="Cooperation", xlab = "Likert scale",  
 shade = T)  
  
DOI\_5 <-table(df$GIO2, df$COOP)  
mosaicplot(DOI\_2, ylab="Cooperation", xlab = "Likert scale",  
 shade = T)  
  
DOI\_6 <-table(df$GIO3, df$COOP)  
mosaicplot(DOI\_3, ylab="Cooperation", xlab = "Likert scale",  
 shade = T)  
  
DOI\_7 <-table(df$GIO1, df$COOP)  
mosaicplot(DOI\_1, ylab="Cooperation", xlab = "Likert scale",  
 shade = T)  
  
DOI\_8 <-table(df$GIO2, df$COOP)  
mosaicplot(DOI\_2, ylab="Cooperation", xlab = "Likert scale",  
 shade = T)  
  
DOI\_9 <-table(df$GIO3, df$COOP)  
mosaicplot(DOI\_3, ylab="Cooperation", xlab = "Likert scale",  
 shade = T)

