

Anex: Script

FINAL SCRIPT

```
library(readxl)
library(tidyverse)
library(plm)
library(texreg)
library(knitr)
library(openxlsx)
library(plyr)
library(reshape2)
library(ggplot2)
library(CVXR)
options(scipen = 999)
setwd("~/Dropbox/Project/CMAP project")
comune_code <- read_csv("comune_code.csv")
results <- read_excel("~/Dropbox/analisis municipal/analisis 2017/mesas y resultados.xlsx")
```

FIRST GRAPH

```
c <- matrix(c(6.699011,6.700748,5.697751,7.032523),ncol=2,byrow=TRUE)
rownames(c) <- c("First Round","Second Round")
colnames(c) <- c("2013","2017")
barplot(c,beside = TRUE, main="Turn Out by Election", xlab = "Years", ylab = "Number of Votes
in Millions", col=c("red","blue"))
```

FIRST TABLE

```
results_fr <- data.frame(
  Candidates = c('Carolina Goic(CG)','Jose Antonio Kasta(JK)','Alejandro Guille(AG)','Sebastian
Piñera(SP)','Beatriz Sanchez(BS)','Marco Enriquez Ominami(MEO)','Eduardo
Artes(EA)','Alejandro Navarro(AN)', 'Blank Votes','Annulated Votes','Total' ), Political_Ideology =
c('Centrist','Far-right','Center-Left','Center-Right','Left','Center-Left','Far-Left','Left','',''),
  NVotes = c(sum(results$goic_pv), sum(results$kast_pv),sum(results$guillier_pv),
sum(results$pinera_pv),
sum(results$sanchez_pv),sum(results$meo_pv),sum(results$artes_pv),
sum(results$navarro_pv),sum(results$nulos_pv),sum(results$blanco_pv),0)
)
temp_tvotes <- sum(results_fr$NVotes)
results_fr$NVotes[11] <- temp_tvotes
results_fr$Por. <- as.integer(results_fr$NVotes/temp_tvotes*10000)/100
```

SECOND TABLE

```

results_sr<- data.frame(
  Candidates = c('Alejandro Guille(AG)','Sebastian Piñera(SP)','Blank Votes','Annulated
Votes','Total' ),
  NVotes = c(sum(results$guillier_sv),
sum(results$pinera_sv),sum(results$nulos_sv),sum(results$blancos_sv),0)
)
temp_tvotes <- sum(results_sr$NVotes)
results_sr$NVotes[5] <- temp_tvotes
results_sr$Por. <- as.integer(results_sr$NVotes/temp_tvotes*10000)/100

#### SECOND GRAPH ####

turnout_age2017 <- read_excel("turnout-age2017.xlsx")
turnout_age2017 <- gather(turnout_age2017, event, total, fround:sround)
turnout_age2017$event <- ifelse(turnout_age2017$event == 'fround','First Round','Second
Round')
colnames(turnout_age2017)[2]='Legend'
plot <- ggplot(turnout_age2017, aes(Age, total, fill=Legend))
plot <- plot + geom_bar(stat = "identity", position = 'dodge')
plot + xlab("Age") + ylab("Turn-Out %") + labs(title = "Turn-Out by Age and round of election")+
theme( plot.title = element_text(hjust = 0.5), legend.position="right")

##### Method 1 #####
#results <- join(results,comune_code,type = "inner")
##Political variables
reg_box_level_number_nvotos <- plm(formula = novoto_sv ~ novoto_pv + goic_pv + kast_pv +
pinera_pv + guillier_pv + sanchez_pv + meo_pv+artes_pv +navarro_pv+ nulos_pv + blanco_pv,
data = results, model = "within", index = "comuna")
reg_box_level_number_pinera_sv <- plm(formula = pinera_sv ~ novoto_pv + goic_pv + kast_pv
+ pinera_pv + guillier_pv + sanchez_pv + meo_pv+artes_pv +navarro_pv+ nulos_pv +
blanco_pv, data = results, model = "within", index = "comuna")
reg_box_level_number_guillier_sv <- plm(formula = guillier_sv ~ novoto_pv + goic_pv +
kast_pv + pinera_pv + guillier_pv + sanchez_pv + meo_pv+artes_pv +navarro_pv+ nulos_pv +
blanco_pv, data = results, model = "within", index = "comuna")
##Demographics
results$porc_men <-results$VotantesVarones/results$total
results$av_age <- results$PromEdadGeneral
results$av_age_sq <- results$PromEdadGeneral*results$PromEdadGeneral
reg_box_level_number_nvotos_sv_d <- plm(formula = novoto_sv ~ porc_men + av_age +
av_age_sq , data = results, model = "within", index = "comuna")

```

```

reg_box_level_number_piniera_sv_d <- plm(formula = pinera_sv ~ porc_men + av_age +
av_age_sq, data = results, model = "within", index = "comuna")
reg_box_level_number_guillier_sv_d <- plm(formula = guillier_sv ~ porc_men + av_age +
av_age_sq, data = results, model = "within", index = "comuna")
dem_models <-
list(reg_box_level_number_nvotos_sv_d, reg_box_level_number_piniera_sv_d, reg_box_level_n
umber_guillier_sv_d )
##Demographics + Politicals
reg_box_level_number_nvotos_poldem <- plm(formula = novoto_sv ~ novoto_pv + goic_pv +
kast_pv + pinera_pv + guillier_pv + sanchez_pv + meo_pv+artes_pv +navarro_pv+ nulos_pv +
blanco_pv + porc_men + av_age + av_age_sq, data = results, model = "within", index =
"comuna")
reg_box_level_number_pinera_sv_poldem <- plm(formula = pinera_sv ~ novoto_pv + goic_pv
+ kast_pv + pinera_pv + guillier_pv + sanchez_pv + meo_pv+artes_pv +navarro_pv+ nulos_pv +
blanco_pv + porc_men + av_age + av_age_sq, data = results, model = "within", index =
"comuna")
reg_box_level_number_guillier_sv_poldem <- plm(formula = guillier_sv ~ novoto_pv + goic_pv
+ kast_pv + pinera_pv + guillier_pv + sanchez_pv + meo_pv+artes_pv +navarro_pv+ nulos_pv +
blanco_pv+porc_men + av_age + av_age_sq, data = results, model = "within", index =
"comuna")
poldem_models <-
list(reg_box_level_number_nvotos_poldem, reg_box_level_number_pinera_sv_poldem, reg_bo
x_level_number_guillier_sv_poldem )

```

METHOD 2

```

get_model = function(results){
  votos_ant = as.matrix(results[, c(
    "novoto_pv",
    "goic_pv",
    "kast_pv",
    "pinera_pv",
    "guillier_pv",
    "sanchez_pv",
    "meo_pv",
    "artes_pv",
    "navarro_pv"
  )))

  delta_pinera <- Variable(ncol(votos_ant))
  delta_guillier <- Variable(ncol(votos_ant))
  #delta_no_voto_sv <- Variable(ncol(votos_ant))

```

```

obj <- Minimize(sum(square(votos_ant %*% delta_pinera - results$pinera_sv),
square(votos_ant %*% delta_guillier - results$guillier_sv)) )
constr <- list(delta_pinera >= 0,
               delta_guillier >= 0,
               delta_pinera + delta_guillier <= 1
)
prob <- Problem(obj,constr)
result <- solve(prob)
result$value
result$status
result$num_iters

porcentajes = data.frame(origen_voto = colnames(votos_ant),
                          to_pinera = result$getValue(delta_pinera),
                          to_guillier = result$getValue(delta_guillier),
                          he_vote = result$getValue(delta_pinera) + result$getValue(delta_guillier),
                          not_vote = 1 - result$getValue(delta_pinera) - result$getValue(delta_guillier))
#print(porcentajes)
gr_percent = ggplot(melt(porcentajes[,1:3], variable.name = "receptor", value.name =
"percentage")) +
  geom_bar(aes(origen_voto,percentage,group = receptor, fill = receptor),stat = "identity") +
  theme(axis.text.x = element_text(angle = 60,hjust = 1))

totales = data.frame(origen_voto = colnames(votos_ant),porcentajes[,-1] *
colSums(votos_ant))
#print(totales)
gr_votes = ggplot(melt(totales[,1:3], variable.name = "receptor", value.name = "votes")) +
  geom_bar(aes(origen_voto,votes,group = receptor, fill = receptor),stat = "identity") +
  theme(axis.text.x = element_text(angle = 60,hjust = 1))

return(list(porcentajes = porcentajes,
            totales = totales,
            gr_percent = gr_percent,
            gr_votes = gr_votes))
}

gral = get_model(results)
votos_ant = as.matrix(results[, c(
  "novoto_pv",
  "goic_pv",
  "kast_pv",
  "pinera_pv",
  "guillier_pv",

```

```

"sanchez_pv",
"meo_pv",
"artes_pv",
"navarro_pv"
)])

```

```

library(matlib)
xtx <- t(votos_ant) %*% votos_ant
xtx <- inv(xtx)
beta_piniera <- as.matrix(gral$porcentajes[2])
beta_guille <- as.matrix(gral$porcentajes[3])
error_ag = (results$guillier_sv-votos_ant %*% beta_guille)
sigma_sq_guille<- (t(error_ag) %*% error_ag)/(42890-9)
error_sp = (results$pinera_sv-votos_ant %*% beta_piniera)
sigma_sq_piniera<-(t(error_sp) %*% error_sp)/(42890-9)
matrix_var_cov_ag <-sigma_sq_guille[1] * xtx
matrix_var_cov_sp <-sigma_sq_piniera[1] * xtx

```

```

table_beta_ag<- data.frame(
  Variable = c(
    "novoto_pv",
    "goic_pv",
    "kast_pv",
    "pinera_pv",
    "guillier_pv",
    "sanchez_pv",
    "meo_pv",
    "artes_pv",
    "navarro_pv"
  ),
  Coef = c(beta_guille),
  SE = c(diag(matrix_var_cov_ag))
)

```

```

table_beta_ag$SE <- table_beta_ag$SE^(1/2)

```

```

table_beta_sp<- data.frame(
  Variable = c(
    "novoto_pv",
    "goic_pv",
    "kast_pv",

```

```
"pinera_pv",  
"guillier_pv",  
"sanchez_pv",  
"meo_pv",  
"artes_pv",  
"navarro_pv"  
,  
Coef = c(beta_piniera),  
SE = c(diag(matrix_var_cov_sp))  
)  
  
table_beta_sp$SE <- table_beta_sp$SE^(1/2)
```