ECONhw5

Nick Gembs

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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

data <- read.csv("C:/Users/Nick/Downloads/pntsprd.csv")  
  
#2.1  
  
data$sprdcvr

## [1] 1 1 1 0 0 1 0 1 0 1 1 1 1 0 0 0 0 1 0 0 1 0 0 1 1 0 1 1 1 1 1 1 1 0 0 0 1  
## [38] 1 0 1 0 1 0 0 1 0 1 1 0 1 1 0 1 0 1 1 0 1 1 1 1 0 0 1 1 1 1 1 1 1 1 1 1 0  
## [75] 0 1 0 1 1 1 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 1 1 1 1 1 0 1 0 1 1  
## [112] 0 0 0 0 0 0 0 1 0 0 1 1 0 0 0 0 0 1 1 0 1 1 1 1 0 1 1 1 1 0 1 0 1 0 1 0 1  
## [149] 1 0 0 0 0 0 0 1 0 1 1 1 1 1 0 1 0 0 0 1 0 0 0 1 1 1 1 0 0 1 0 0 0 0 1 0 1  
## [186] 0 0 1 0 1 1 0 0 1 0 1 0 1 1 0 1 0 1 0 0 0 1 1 1 0 0 1 1 1 1 1 0 0 1 0 1 0  
## [223] 0 1 0 1 0 1 0 1 0 0 1 0 0 0 0 1 1 1 1 1 0 0 0 0 1 0 1 0 0 1 1 1 1 1 1 0 0  
## [260] 1 1 0 0 1 0 0 1 0 1 1 0 0 1 1 1 1 0 1 1 1 0 1 1 0 0 1 0 1 0 1 1 0 1 1 1 0  
## [297] 1 1 0 1 0 0 1 1 0 1 1 0 0 0 1 0 0 0 1 0 1 1 1 1 0 1 0 0 1 0 1 0 0 1 0 1 0  
## [334] 1 0 1 1 1 0 0 1 1 0 1 1 1 0 0 1 1 1 1 1 0 1 1 0 1 1 0 1 0 1 0 0 1 0 1 1 1  
## [371] 1 0 0 1 1 0 0 1 1 1 1 0 0 1 1 1 1 1 1 1 0 1 1 0 1 0 1 0 1 0 1 0 1 0 1 1 1  
## [408] 1 1 0 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 0 1 1 0 0 1 1 1 0 0 1 0 0 1  
## [445] 0 0 1 1 0 1 0 0 0 1 0 1 1 1 1 1 0 0 0 0 0 1 1 0 0 0 0 1 1 0 1 1 0 0 0 1 0  
## [482] 0 0 0 1 1 1 0 0 0 0 1 0 1 0 0 0 1 1 0 1 0 0 1 1 0 1 0 1 0 1 0 1 0 1 1 1 1  
## [519] 0 1 0 0 0 1 1 0 1 0 0 1 1 1 1 1 0 1 1 0 1 1 1 0 1 0 0 0 1 0 0 1 1 0 0

t.test(data$sprdcvr,mu = .5, paired = F, conf.level=.9)

##   
## One Sample t-test  
##   
## data: data$sprdcvr  
## t = 0.7226, df = 552, p-value = 0.4702  
## alternative hypothesis: true mean is not equal to 0.5  
## 90 percent confidence interval:  
## 0.4803236 0.5504178  
## sample estimates:  
## mean of x   
## 0.5153707

# Fail to reject the null hyothesis as the p-value if greater than .05.

#2.2  
  
gamesonneutralcourt = sum(data$neutral)  
gamesonneutralcourt

## [1] 35

#2.3  
  
lm.fit <- lm(data$sprdcvr ~ data$favhome + data$neutral + data$fav25 + data$und25)  
summary(lm.fit)

##   
## Call:  
## lm(formula = data$sprdcvr ~ data$favhome + data$neutral + data$fav25 +   
## data$und25)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.6072 -0.5242 0.3928 0.4758 0.5339   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 0.48957 0.04476 10.938 <2e-16 \*\*\*  
## data$favhome 0.03459 0.04972 0.696 0.487   
## data$neutral 0.11762 0.09466 1.242 0.215   
## data$fav25 -0.02347 0.05019 -0.468 0.640   
## data$und25 0.01787 0.09188 0.195 0.846   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5012 on 548 degrees of freedom  
## Multiple R-squared: 0.0034, Adjusted R-squared: -0.003874   
## F-statistic: 0.4674 on 4 and 548 DF, p-value: 0.7597

# Load libraries  
library("lmtest")

## Loading required package: zoo

##   
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':  
##   
## as.Date, as.Date.numeric

library("sandwich")  
  
# Robust t test  
hetero.fit <- coeftest(lm.fit, vcov = vcovHC(lm.fit, type = "HC0"))  
hetero.fit

##   
## t test of coefficients:  
##   
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 0.489567 0.044648 10.9651 <2e-16 \*\*\*  
## data$favhome 0.034591 0.049597 0.6974 0.4858   
## data$neutral 0.117618 0.092701 1.2688 0.2051   
## data$fav25 -0.023467 0.050154 -0.4679 0.6400   
## data$und25 0.017873 0.089655 0.1994 0.8421   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

summary(hetero.fit)

## Estimate Std. Error t value Pr(>|t|)   
## Min. :-0.02347 Min. :0.04465 Min. :-0.4679 Min. :0.0000   
## 1st Qu.: 0.01787 1st Qu.:0.04960 1st Qu.: 0.1993 1st Qu.:0.2051   
## Median : 0.03459 Median :0.05015 Median : 0.6974 Median :0.4858   
## Mean : 0.12724 Mean :0.06535 Mean : 2.5325 Mean :0.4346   
## 3rd Qu.: 0.11762 3rd Qu.:0.08966 3rd Qu.: 1.2688 3rd Qu.:0.6400   
## Max. : 0.48957 Max. :0.09270 Max. :10.9651 Max. :0.8421

# Standard errors do not significantly change for any estimators when assuming heteroskedasticity robust model. heteroskedasticity robust model is more significant (lower p-values).

#2.4  
  
# If all of the estimators equal zero (B1 = B2 = B3 = B4 = 0), the OLS fit will just be a horizontal line across the data with a y value at the mean of the regressand (sprdcvr). Since sprdcvr is binary and all estimators equal zero, variance of error will not be dependent on any regressor, suggesting homoskedascticity.

#2.5  
  
# None of the statistics in any of the tests performed on the model above have shown any significance of relationship between the regressors and if the game will cover the spread. This suggests that the market of sports betting is efficient and that one cannot use available data to get advantage in calling sports bets.

#2.6  
  
lm.fit$fitted.values

## 1 2 3 4 5 6 7 8   
## 0.4660991 0.5241576 0.5241576 0.5241576 0.4895665 0.5837171 0.5241576 0.5006902   
## 9 10 11 12 13 14 15 16   
## 0.4895665 0.4895665 0.5241576 0.5241576 0.4660991 0.5241576 0.4895665 0.5006902   
## 17 18 19 20 21 22 23 24   
## 0.5241576 0.5241576 0.4895665 0.5241576 0.5241576 0.4895665 0.5241576 0.5006902   
## 25 26 27 28 29 30 31 32   
## 0.6071845 0.4895665 0.5241576 0.5241576 0.5006902 0.5241576 0.5006902 0.5837171   
## 33 34 35 36 37 38 39 40   
## 0.6071845 0.5241576 0.5241576 0.6071845 0.5241576 0.6071845 0.5241576 0.6071845   
## 41 42 43 44 45 46 47 48   
## 0.5241576 0.6071845 0.4895665 0.6071845 0.6071845 0.5241576 0.5837171 0.5241576   
## 49 50 51 52 53 54 55 56   
## 0.5006902 0.5241576 0.5241576 0.5006902 0.4660991 0.5241576 0.5241576 0.5241576   
## 57 58 59 60 61 62 63 64   
## 0.4895665 0.5241576 0.5006902 0.6071845 0.6071845 0.4895665 0.5241576 0.5241576   
## 65 66 67 68 69 70 71 72   
## 0.6015899 0.5241576 0.5241576 0.5241576 0.5241576 0.5241576 0.6071845 0.4895665   
## 73 74 75 76 77 78 79 80   
## 0.4660991 0.5241576 0.4895665 0.4895665 0.5241576 0.4895665 0.5241576 0.4895665   
## 81 82 83 84 85 86 87 88   
## 0.4895665 0.5185630 0.4660991 0.5241576 0.5006902 0.5006902 0.5241576 0.5241576   
## 89 90 91 92 93 94 95 96   
## 0.5006902 0.6071845 0.5241576 0.6071845 0.5241576 0.5241576 0.6071845 0.5241576   
## 97 98 99 100 101 102 103 104   
## 0.6071845 0.5006902 0.5241576 0.5241576 0.5241576 0.5241576 0.6015899 0.5420304   
## 105 106 107 108 109 110 111 112   
## 0.4660991 0.5241576 0.5241576 0.5006902 0.5241576 0.5241576 0.5241576 0.4660991   
## 113 114 115 116 117 118 119 120   
## 0.5241576 0.4660991 0.5241576 0.5241576 0.5837171 0.5241576 0.5185630 0.5241576   
## 121 122 123 124 125 126 127 128   
## 0.5241576 0.5241576 0.5241576 0.5241576 0.5241576 0.5241576 0.5006902 0.5241576   
## 129 130 131 132 133 134 135 136   
## 0.4895665 0.5241576 0.5241576 0.4895665 0.5241576 0.5241576 0.5241576 0.5241576   
## 137 138 139 140 141 142 143 144   
## 0.5241576 0.5241576 0.5241576 0.4895665 0.4895665 0.6071845 0.6071845 0.5241576   
## 145 146 147 148 149 150 151 152   
## 0.5241576 0.6071845 0.4895665 0.5241576 0.5420304 0.5241576 0.4660991 0.5241576   
## 153 154 155 156 157 158 159 160   
## 0.5837171 0.5241576 0.5006902 0.5837171 0.5006902 0.4895665 0.4895665 0.5241576   
## 161 162 163 164 165 166 167 168   
## 0.5006902 0.4660991 0.5420304 0.4660991 0.4660991 0.4660991 0.4895665 0.5006902   
## 169 170 171 172 173 174 175 176   
## 0.5241576 0.4895665 0.5241576 0.5241576 0.5006902 0.5241576 0.4660991 0.4895665   
## 177 178 179 180 181 182 183 184   
## 0.5241576 0.5241576 0.4895665 0.4895665 0.5241576 0.5241576 0.5241576 0.4895665   
## 185 186 187 188 189 190 191 192   
## 0.5241576 0.5241576 0.5241576 0.4895665 0.5241576 0.5241576 0.5241576 0.5006902   
## 193 194 195 196 197 198 199 200   
## 0.5241576 0.5241576 0.5241576 0.4895665 0.5006902 0.5241576 0.5241576 0.5006902   
## 201 202 203 204 205 206 207 208   
## 0.5241576 0.5006902 0.4895665 0.5241576 0.5241576 0.4895665 0.5241576 0.5241576   
## 209 210 211 212 213 214 215 216   
## 0.5241576 0.5185630 0.5006902 0.5241576 0.5241576 0.5241576 0.5241576 0.4895665   
## 217 218 219 220 221 222 223 224   
## 0.5241576 0.5241576 0.5241576 0.4895665 0.5241576 0.5241576 0.5241576 0.5241576   
## 225 226 227 228 229 230 231 232   
## 0.5241576 0.5241576 0.4839719 0.5241576 0.5006902 0.4895665 0.5006902 0.5241576   
## 233 234 235 236 237 238 239 240   
## 0.4895665 0.4895665 0.5006902 0.4895665 0.4895665 0.5006902 0.4660991 0.5241576   
## 241 242 243 244 245 246 247 248   
## 0.5006902 0.5006902 0.5241576 0.5241576 0.4895665 0.5241576 0.5241576 0.5837171   
## 249 250 251 252 253 254 255 256   
## 0.4895665 0.5241576 0.5241576 0.5006902 0.5420304 0.5241576 0.5006902 0.5006902   
## 257 258 259 260 261 262 263 264   
## 0.6071845 0.5241576 0.5837171 0.6071845 0.4895665 0.4895665 0.5241576 0.4895665   
## 265 266 267 268 269 270 271 272   
## 0.5241576 0.4895665 0.5241576 0.4895665 0.5241576 0.4895665 0.5241576 0.5241576   
## 273 274 275 276 277 278 279 280   
## 0.5241576 0.5241576 0.5241576 0.5241576 0.5006902 0.5241576 0.5006902 0.6015899   
## 281 282 283 284 285 286 287 288   
## 0.5837171 0.5006902 0.4895665 0.4660991 0.4895665 0.5241576 0.5241576 0.5241576   
## 289 290 291 292 293 294 295 296   
## 0.4839719 0.5241576 0.5241576 0.5006902 0.5420304 0.4895665 0.5241576 0.5241576   
## 297 298 299 300 301 302 303 304   
## 0.5185630 0.5006902 0.4895665 0.5006902 0.4895665 0.4660991 0.5241576 0.5006902   
## 305 306 307 308 309 310 311 312   
## 0.4660991 0.4660991 0.5241576 0.5006902 0.5241576 0.5241576 0.5241576 0.5241576   
## 313 314 315 316 317 318 319 320   
## 0.5185630 0.5006902 0.5420304 0.5241576 0.5006902 0.5006902 0.5241576 0.5006902   
## 321 322 323 324 325 326 327 328   
## 0.4895665 0.5185630 0.5185630 0.5006902 0.5185630 0.4895665 0.5241576 0.5241576   
## 329 330 331 332 333 334 335 336   
## 0.4660991 0.4895665 0.5006902 0.5241576 0.5241576 0.4660991 0.5241576 0.5006902   
## 337 338 339 340 341 342 343 344   
## 0.4660991 0.5241576 0.4895665 0.5241576 0.4895665 0.5420304 0.4839719 0.4895665   
## 345 346 347 348 349 350 351 352   
## 0.5241576 0.5420304 0.5006902 0.5006902 0.5006902 0.4895665 0.4895665 0.5241576   
## 353 354 355 356 357 358 359 360   
## 0.5241576 0.5420304 0.4660991 0.5241576 0.5241576 0.5006902 0.5006902 0.5006902   
## 361 362 363 364 365 366 367 368   
## 0.5241576 0.5241576 0.4895665 0.4660991 0.4839719 0.5241576 0.5420304 0.5241576   
## 369 370 371 372 373 374 375 376   
## 0.5241576 0.4660991 0.5006902 0.4895665 0.5241576 0.4895665 0.4660991 0.5241576   
## 377 378 379 380 381 382 383 384   
## 0.5241576 0.5241576 0.5241576 0.4660991 0.4895665 0.5241576 0.5241576 0.5241576   
## 385 386 387 388 389 390 391 392   
## 0.5241576 0.5241576 0.5006902 0.5241576 0.5241576 0.5241576 0.4895665 0.4895665   
## 393 394 395 396 397 398 399 400   
## 0.5241576 0.5185630 0.5241576 0.5185630 0.5006902 0.5006902 0.5241576 0.4895665   
## 401 402 403 404 405 406 407 408   
## 0.5006902 0.5241576 0.5241576 0.4895665 0.5241576 0.5241576 0.5241576 0.5185630   
## 409 410 411 412 413 414 415 416   
## 0.5241576 0.5241576 0.5241576 0.5241576 0.4895665 0.4895665 0.5241576 0.5006902   
## 417 418 419 420 421 422 423 424   
## 0.5006902 0.5241576 0.5241576 0.5241576 0.4895665 0.5241576 0.4895665 0.5241576   
## 425 426 427 428 429 430 431 432   
## 0.4660991 0.4895665 0.5006902 0.5241576 0.5241576 0.5241576 0.4895665 0.4660991   
## 433 434 435 436 437 438 439 440   
## 0.5241576 0.5241576 0.5241576 0.5006902 0.5006902 0.5241576 0.5241576 0.5241576   
## 441 442 443 444 445 446 447 448   
## 0.5241576 0.5241576 0.5241576 0.5241576 0.5006902 0.5241576 0.4895665 0.5241576   
## 449 450 451 452 453 454 455 456   
## 0.5241576 0.5241576 0.4895665 0.5420304 0.5241576 0.5241576 0.4895665 0.5185630   
## 457 458 459 460 461 462 463 464   
## 0.4660991 0.5241576 0.5241576 0.5241576 0.5241576 0.5241576 0.4895665 0.5241576   
## 465 466 467 468 469 470 471 472   
## 0.5006902 0.4660991 0.4660991 0.4660991 0.5241576 0.5241576 0.4660991 0.4895665   
## 473 474 475 476 477 478 479 480   
## 0.5185630 0.6071845 0.4895665 0.5241576 0.4895665 0.5241576 0.4895665 0.5241576   
## 481 482 483 484 485 486 487 488   
## 0.5241576 0.5241576 0.5241576 0.5241576 0.4895665 0.5241576 0.5241576 0.5241576   
## 489 490 491 492 493 494 495 496   
## 0.5241576 0.5241576 0.5006902 0.5241576 0.5241576 0.5241576 0.4895665 0.4895665   
## 497 498 499 500 501 502 503 504   
## 0.5241576 0.5241576 0.4895665 0.4660991 0.4895665 0.4895665 0.4660991 0.5241576   
## 505 506 507 508 509 510 511 512   
## 0.4895665 0.5241576 0.4895665 0.5241576 0.5185630 0.4895665 0.5241576 0.5241576   
## 513 514 515 516 517 518 519 520   
## 0.5241576 0.5241576 0.4895665 0.5241576 0.4895665 0.5241576 0.5006902 0.5241576   
## 521 522 523 524 525 526 527 528   
## 0.5241576 0.5241576 0.5185630 0.5241576 0.5006902 0.6071845 0.5241576 0.5241576   
## 529 530 531 532 533 534 535 536   
## 0.5837171 0.4660991 0.5241576 0.4660991 0.5241576 0.5241576 0.5241576 0.4895665   
## 537 538 539 540 541 542 543 544   
## 0.5241576 0.5006902 0.4895665 0.4895665 0.4660991 0.5185630 0.5241576 0.5241576   
## 545 546 547 548 549 550 551 552   
## 0.5241576 0.5241576 0.5006902 0.5241576 0.4660991 0.5241576 0.5241576 0.4660991   
## 553   
## 0.4660991

#2.7  
  
library(foreign)  
  
logit <- glm(data$sprdcvr ~ data$favhome + data$neutral + data$fav25 + data$und25, family=binomial(link="logit"))   
logit

##   
## Call: glm(formula = data$sprdcvr ~ data$favhome + data$neutral + data$fav25 +   
## data$und25, family = binomial(link = "logit"))  
##   
## Coefficients:  
## (Intercept) data$favhome data$neutral data$fav25 data$und25   
## -0.04169 0.13845 0.47618 -0.09424 0.07177   
##   
## Degrees of Freedom: 552 Total (i.e. Null); 548 Residual  
## Null Deviance: 766.1   
## Residual Deviance: 764.2 AIC: 774.2

summary(logit)

##   
## Call:  
## glm(formula = data$sprdcvr ~ data$favhome + data$neutral + data$fav25 +   
## data$und25, family = binomial(link = "logit"))  
##   
## Deviance Residuals:   
## Min 1Q Median 3Q Max   
## -1.3666 -1.2188 0.9993 1.1366 1.2356   
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)  
## (Intercept) -0.04169 0.17873 -0.233 0.816  
## data$favhome 0.13845 0.19855 0.697 0.486  
## data$neutral 0.47618 0.38413 1.240 0.215  
## data$fav25 -0.09424 0.20070 -0.470 0.639  
## data$und25 0.07177 0.36783 0.195 0.845  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 766.10 on 552 degrees of freedom  
## Residual deviance: 764.21 on 548 degrees of freedom  
## AIC: 774.21  
##   
## Number of Fisher Scoring iterations: 3

probit <- glm(data$sprdcvr ~ data$favhome + data$neutral + data$fav25 + data$und25, family=binomial(link="probit"))   
probit

##   
## Call: glm(formula = data$sprdcvr ~ data$favhome + data$neutral + data$fav25 +   
## data$und25, family = binomial(link = "probit"))  
##   
## Coefficients:  
## (Intercept) data$favhome data$neutral data$fav25 data$und25   
## -0.02606 0.08665 0.29798 -0.05916 0.04591   
##   
## Degrees of Freedom: 552 Total (i.e. Null); 548 Residual  
## Null Deviance: 766.1   
## Residual Deviance: 764.2 AIC: 774.2

summary(probit)

##   
## Call:  
## glm(formula = data$sprdcvr ~ data$favhome + data$neutral + data$fav25 +   
## data$und25, family = binomial(link = "probit"))  
##   
## Deviance Residuals:   
## Min 1Q Median 3Q Max   
## -1.367 -1.219 0.999 1.137 1.236   
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)  
## (Intercept) -0.02606 0.11197 -0.233 0.816  
## data$favhome 0.08665 0.12439 0.697 0.486  
## data$neutral 0.29798 0.23901 1.247 0.213  
## data$fav25 -0.05916 0.12566 -0.471 0.638  
## data$und25 0.04591 0.23020 0.199 0.842  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 766.10 on 552 degrees of freedom  
## Residual deviance: 764.21 on 548 degrees of freedom  
## AIC: 774.21  
##   
## Number of Fisher Scoring iterations: 3

# Probit and logit models still return similar results without statisticsal significance.