POL213 TA Session

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```
## Clear Workspace
rm(list = ls())

## Set Working Directory to the File location
## (If using RStudio, can be set automatically)
setwd(dirname(rstudioapi::getActiveDocumentContext()$path))
getwd()
```

```
## [1] "C:/GoogleDrive/Lectures/2019_04to06_UCD/POL213_TA/POL213_TA_resource"
```

```
## Required packages
library(readstata13) # For importing data
library(ggplot2) # Plotting
library(faraway) # for ilogit function
library(pscl) # For pseudo R squared (pR2)
library(DAMisc) # For pre function
library(MASS) # For mvrnorm
```

Annotated (and Slightly Modified) Class Codes

Data Preparation

```
# Import Data
d <- read.table("ca_taxes_soda.txt", header=TRUE, sep="\t")
dim(d) # 9 variables, 795 cases
```

```
## [1] 795   9
```

```
# Some Additional Variables
d$soda_tax <- d$tax_soda
d$soda_tax2 <- as.factor(d$tax_soda) # Ordinal Variable
d$education <- d$educate

# Initiate Data for Analysis
## Keeping Following Variables
keepvars <- c("soda_tax", "soda_tax2", "ideology", "income",
              "education", "cue", "ind", "gop", "gop_cue")
# Subset Variables and Create A New Dataset
ca_soda <- d[,keepvars]
```

Ordinal Logit

```
library(MASS) # For polr function

# Ordinal Logit
ologit.soda <- polr(soda_tax2 ~ ideology + income + education +
                      ind + gop + cue + gop_cue, data = ca_soda, Hess = TRUE)
```

```r
# Summary
(sum.ologit.soda <- summary(ologit.soda))
```

```
## Call:
## polr(formula = soda_tax2 ~ ideology + income + education + ind +
##     gop + cue + gop_cue, data = ca_soda, Hess = TRUE)
##
## Coefficients:
##              Value Std. Error t value
## ideology  -0.54158    0.09181 -5.8988
## income     0.03936    0.02275  1.7298
## education  0.16532    0.05292  3.1239
## ind       -1.01203    0.22919 -4.4157
## gop       -1.48344    0.32327 -4.5888
## cue       -0.16636    0.18307 -0.9087
## gop_cue    0.21577    0.33386  0.6463
##
## Intercepts:
##     Value   Std. Error t value
## 1|2 -1.8272  0.3514    -5.1990
## 2|3 -1.1769  0.3477    -3.3843
## 3|4 -0.1066  0.3458    -0.3084
##
## Residual Deviance: 1774.628
## AIC: 1794.628
```

```r
# Significance Test
table.ologit.soda <- coef(sum.ologit.soda)
p <- pnorm(abs(table.ologit.soda[, "t value"]), lower.tail = FALSE) * 2
(table.ologit.soda2 <- cbind(table.ologit.soda, "p value" = p))
```

```
##                 Value Std. Error    t value      p value
## ideology  -0.54158044 0.09181141 -5.8988358 3.660753e-09
## income     0.03935681 0.02275158  1.7298494 8.365719e-02
## education  0.16532449 0.05292205  3.1239244 1.784563e-03
## ind       -1.01203376 0.22919094 -4.4156796 1.006931e-05
## gop       -1.48344471 0.32327408 -4.5888143 4.457708e-06
## cue       -0.16636483 0.18307142 -0.9087427 3.634859e-01
## gop_cue    0.21577119 0.33386228  0.6462880 5.180929e-01
## 1|2       -1.82716037 0.35144344 -5.1990168 2.003454e-07
## 2|3       -1.17688298 0.34774491 -3.3843285 7.135259e-04
## 3|4       -0.10664648 0.34578198 -0.3084212 7.577619e-01
```

```r
# The Easier Way
library(lmtest)
(cft <- coeftest(ologit.soda))
```

```
##
## z test of coefficients:
##
##            Estimate Std. Error z value  Pr(>|z|)
## ideology  -0.541580   0.091811 -5.8988 3.661e-09 ***
## income     0.039357   0.022752  1.7298 0.0836572 .
## education  0.165324   0.052922  3.1239 0.0017846 **
## ind       -1.012034   0.229191 -4.4157 1.007e-05 ***
```

```
## gop       -1.483445   0.323274 -4.5888 4.458e-06 ***
## cue       -0.166365   0.183071 -0.9087 0.3634859
## gop_cue    0.215771   0.333862  0.6463 0.5180929
## 1|2       -1.827160   0.351443 -5.1990 2.003e-07 ***
## 2|3       -1.176883   0.347745 -3.3843 0.0007135 ***
## 3|4       -0.106646   0.345782 -0.3084 0.7577619
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Confidence Interval
(ci <- confint(ologit.soda))
```

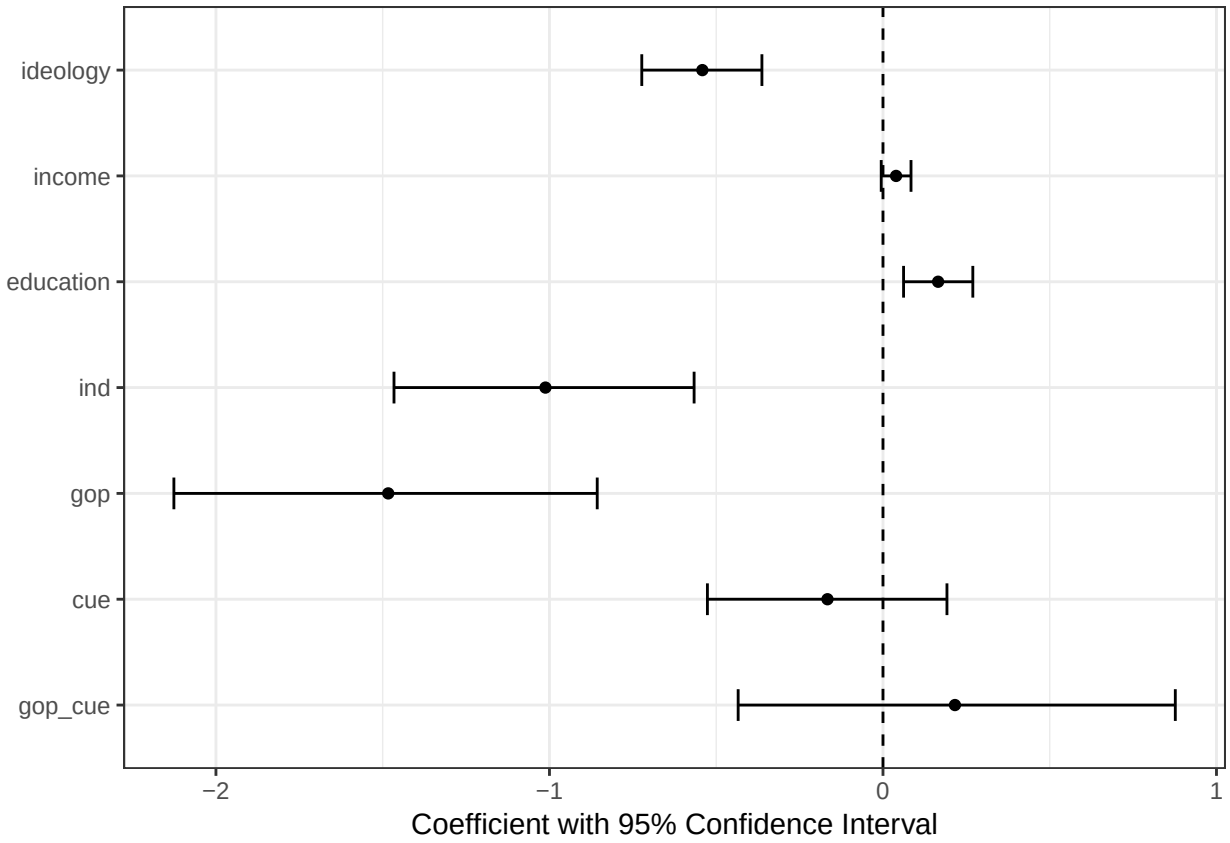
```
## Waiting for profiling to be done...
```

```
##                  2.5 %      97.5 %
## ideology  -0.723167501 -0.36297115
## income    -0.005205857  0.08404382
## education  0.061798217  0.26938091
## ind       -1.466085468 -0.56629794
## gop       -2.126046993 -0.85674237
## cue       -0.526354952  0.19188442
## gop_cue   -0.434162661  0.87654044
```

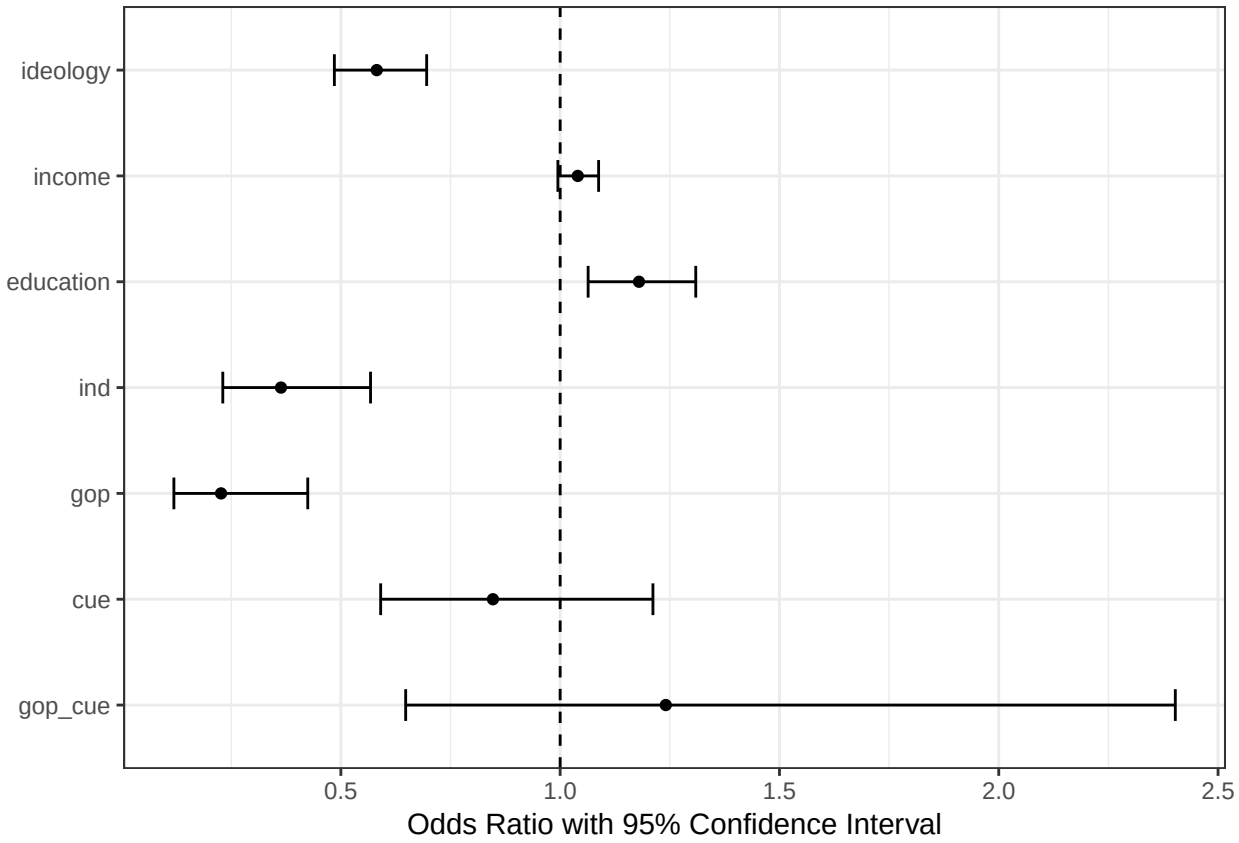
```
# Plot
## Data Frame with Coefficient Values
cdt <- as.data.frame(cbind(cft[,1],ci))
```

```
## Warning in cbind(cft[, 1], ci): number of rows of result is not a multiple
## of vector length (arg 1)
```

```
colnames(cdt) <- c("cf","lci","uci")
## Variable Names
cdt$vn <- factor(row.names(cdt),
                 levels=rev(row.names(cdt)))
## Draw Plot
ggplot(cdt, aes(x=vn,y=cf,ymin=lci,ymax=uci)) +
  geom_point() + geom_errorbar(width=0.3) +
  geom_hline(aes(yintercept=0), linetype=2) +
  xlab(NULL) +
  ylab("Coefficient with 95% Confidence Interval") +
  coord_flip() + # Flip Plot
  theme_bw()
```



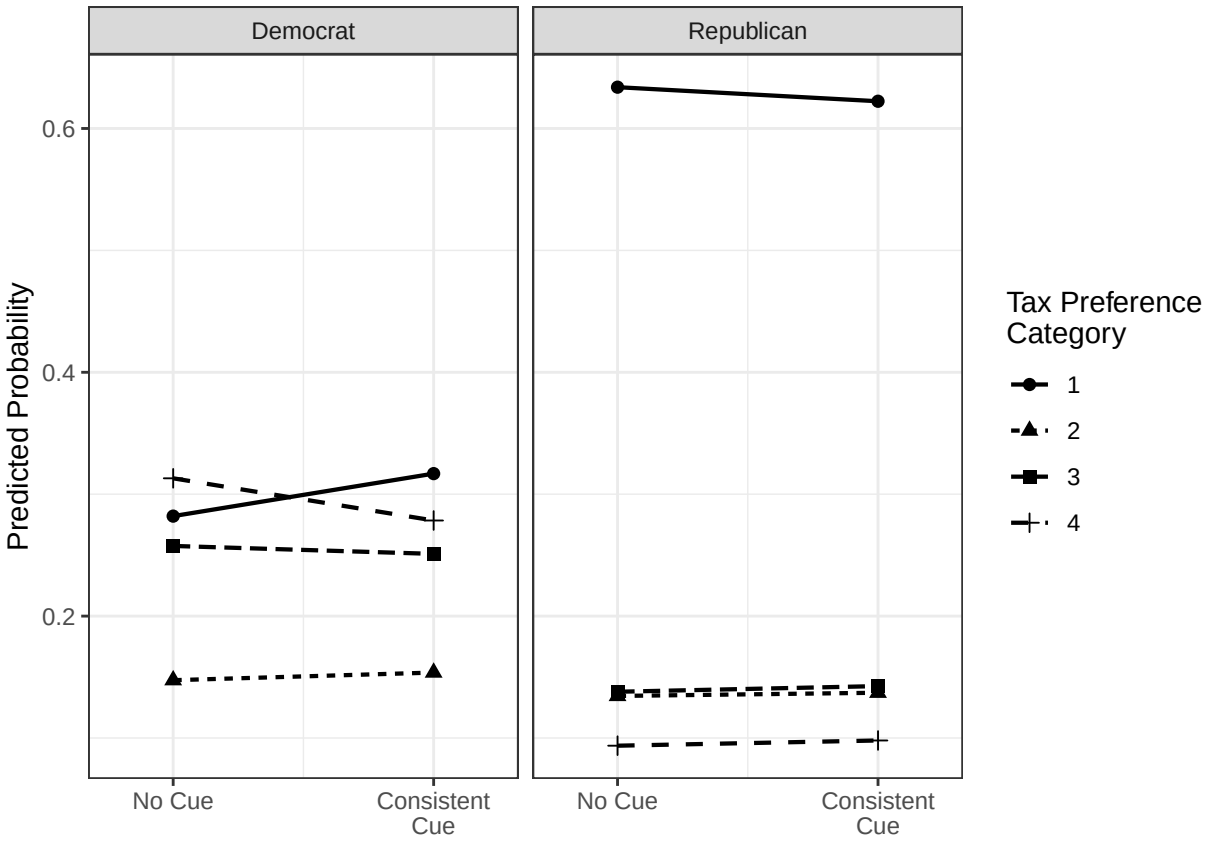

```
# Odds Ratio
## Conversion
cdt$or <- exp(cdt$cf)
cdt$orlci <- exp(cdt$lci)
cdt$oruci <- exp(cdt$uci)
## Draw Plot
ggplot(cdt, aes(x=vn,y=or,ymin=orlci,ymax=oruci)) +
  geom_point() + geom_errorbar(width=0.3) +
  geom_hline(aes(yintercept=1), linetype=2) +
  xlab(NULL) +
  ylab("Odds Ratio with 95% Confidence Interval") +
  coord_flip() + # Flip Plot
  theme_bw()
```



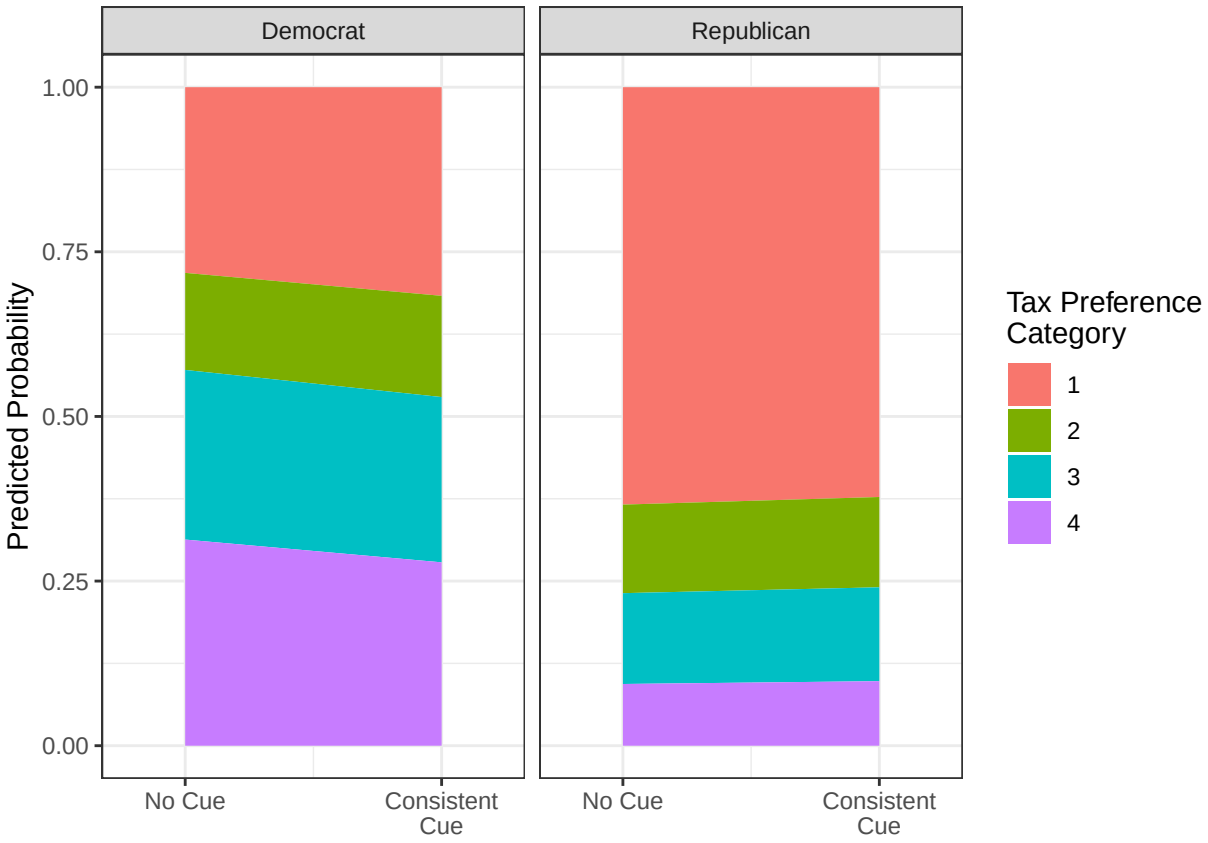
Predicted Probabilities

```
## Profiles
prof_baseD <- c(3, # ideology
                6, # income
                3, # education
                0, # ind (not)
                0, # gop (not) * means democrat
                0, # cue
                0) # gop_cue
names(prof_baseD) <- all.vars(ologit.soda$terms)[-1]
prof_cueD <- prof_baseR <- prof_cueR <- prof_baseD
prof_cueD[6] <- 1 # Receiving (dem) cues
prof_baseR[5] <- 1 # GOP member
prof_cueR[c(5,6,7)] <- 1 # Receiving R cues and GOP Member

## Function for Prediction
predologit <- function(model,profile) {

  # Parameters
  cf <- coef(model) # Coefficients
  z <- summary(model)$zeta # Thresholds

  xb <- sum(profile * cf) # Individual Estiamtes
```

```r
  # Temporal Probabilities
  prtmp <- c(0,sapply(z, function(zi) 1 / (1 + exp(xb - zi))),1)

  # Predicted Probabilities
  pr <- rep(NA, length(z)+1)
  for (i in seq(1,length(z)+1,1)) pr[i] <- prtmp[i+1] - prtmp[i]

  # Names
  names(pr) <- paste0("Pr.",seq(1,length(pr),1))

  return(pr)

}

# Make Prediction
pred_baseD <- predologit(ologit.soda,prof_baseD)
pred_cueD <- predologit(ologit.soda,prof_cueD)
pred_baseR <- predologit(ologit.soda,prof_baseR)
pred_cueR <- predologit(ologit.soda,prof_cueR)

# Plot Prediction
preddt <- rbind(cbind(pred_baseD,rbind(prof_baseD,prof_baseD,prof_baseD,prof_baseD)),
                cbind(pred_cueD,rbind(prof_cueD,prof_cueD,prof_cueD,prof_cueD)),
                cbind(pred_baseR,rbind(prof_baseR,prof_baseR,prof_baseR,prof_baseR)),
                cbind(pred_cueR,rbind(prof_cueR,prof_cueR,prof_cueR,prof_cueR)))
preddt <- as.data.frame(preddt)
colnames(preddt)[1] <- "pr"
preddt$cats <- as.factor(rep(seq(1,4,1),4))
## Label Party Membership
preddt$gop <- ifelse(preddt$gop==1,"Republican","Democrat")

# One By One
ggplot(preddt, aes(x=cue, y=pr)) +
  geom_line(aes(linetype=cats), size=0.75) +
  geom_point(aes(shape=cats), size=2) +
  facet_grid(.~gop) +
  scale_x_continuous(limits=c(-0.25,1.25),
                     breaks=c(0,1),
                     labels=c("No Cue","Consistent\nCue")) +
  scale_shape_discrete(name="Tax Preference \nCategory") +
  scale_linetype_discrete(name="Tax Preference \nCategory") +
  ylab("Predicted Probability") + xlab(NULL) +
  theme_bw()
```




```
# Cummulative
ggplot(preddt, aes(x=cue, y=pr)) +
  geom_area(aes(fill=cats)) +
  facet_grid(.~gop) +
  scale_x_continuous(limits=c(-0.25,1.25),
                     breaks=c(0,1),
                     labels=c("No Cue","Consistent\nCue")) +
  scale_fill_discrete(name="Tax Preference \nCategory") +
  ylab("Predicted Probability") + xlab(NULL) +
  theme_bw()
```


Democrat
Republican
Predicted Probability
1.00
0.75
0.50
0.25
0.00
No Cue
Consistent Cue
No Cue
Consistent Cue
Tax Preference Category
1
2
3
4