Problem Set 3 - Stats Spring 22

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Question 1

We are interested in how governments' management of public resources impacts economic prosperity. Our data come from Alvarez, Cheibub, Limongi, and Przeworski (1996) and is labelled gdpChange.csv on GitHub. The dataset covers 135 countries observed between 1950 or the year of independence or the first year for which data on economic growth are available ("entry year"), and 1990 or the last year for which data on economic growth are available ("exit year"). The unit of analysis is a particular country during a particular year, for a total > 3,500 observations.

• Response variable:

– GDPWdiff: Difference in GDP between year t and t−1. Possible categories include:

"positive", "negative", or "no change"

• Explanatory variables:

– REG: 1=Democracy; 0=Non-Democracy

– OIL: 1=if the average ratio of fuel exports to total exports in 1984-86 exceeded 50%; 0= otherwise

Please answer the following questions:

1. Construct and interpret an unordered multinomial logit with GDPWdiff as the output and "no change" as the reference category, including the estimated cutoff points and coefficients.

2. Construct and interpret an ordered multinomial logit with GDPWdiff as the outcome variable, including the estimated cutoff points and coefficients.

Set-up code:

```
# remove objects
rm(list=ls())
# detach all libraries
detachAllPackages <- function() {
  basic.packages <- c("package:stats", "package:graphics", "package:grDevices
", "package:utils", "package:datasets", "package:methods", "package:base")
  package.list <- search()[ifelse(unlist(gregexpr("package:", search()))==1,
TRUE, FALSE)]
  package.list <- setdiff(package.list, basic.packages)
  if (length(package.list)>0)  for (package in package.list) detach(package,
character.only=TRUE)
}
detachAllPackages()

library(nnet)
library("MASS")

setwd(dirname(rstudioapi::getActiveDocumentContext()$path))
```

1. Construct and interpret an unordered multinomial logit with GDPWdiff as the output and ”no change” as the reference category, including the estimated cutoff points and coefficients.

```
data <- read.csv("/Users/Kate/Desktop/Hacker/Stats - HT/Problem Sets - HT/PS3
/gdpChange.csv")

str(data)

## 'data.frame':    3721 obs. of  12 variables:
##  $ X           : int  1 2 3 4 5 6 7 8 9 10 ...
##  $ COUNTRY     : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ CTYNAME     : chr  "Algeria" "Algeria" "Algeria" "Algeria" ...
##  $ YEAR        : int  1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 ..
.
##  $ GDPW        : int  6620 6612 6982 7848 8378 8536 7816 9372 9361 10480 .
..
##  $ OIL         : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ REG         : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ EDT         : chr  "1.45" "1.56" "1.675" "1.805" ...
##  $ GDPWlag     : int  6502 6620 6612 6982 7848 8378 8536 7816 9372 9361 ..
.
##  $ GDPWdiff    : int  118 -8 370 866 530 158 -720 1556 -11 1119 ...
##  $ GDPWdifflag : int  419 118 -8 370 866 530 158 -720 1556 -11 ...
##  $ GDPWdifflag2: int  1071 419 118 -8 370 866 530 158 -720 1556 ...

View(data)
```

GDPWdiff is a count variable, not categories. This needs to be changed.

```
attach(data)
cat = c();
for (i in 1: length(GDPWdiff)){
  if (GDPWdiff [i] == 0){cat[i]=0} # no change = 0
  if(GDPWdiff[i]>0){cat[i]=1} # positive = 1
  if(GDPWdiff[i]<0){cat[i]=2} # negative = 2
}

data$cat = as.factor(cat)
as.factor(cat) #changed to factor 3 categories
```

```
##    [1] 1 2 1 1 1 1 2 1 2 1 1 1 1 1 1 2 2 1 1 1 1 2 2 2 1 2 1 1 1 2 1 1 1 1
2 2 2
##   [38] 2 1 1 1 2 2 2 2 1 2 1 1 2 2 2 1 0 1 1 1 2 1 1 1 2 2 2 2 2 1 1 1 1 1
1 2 1
##   [75] 2 1 1 1 1 1 2 1 1 1 2 1 2 2 1 2 2 1 1 1 2 1 1 2 1 1 1 1 2 1 2 1 1 2
2 1 1
##  [112] 1 1 1 0 2 1 1 1 2 2 1 2 1 2 1 1 1 2 1 2 1 1 2 0 1 1 2 1 2 1 2 1 1 1
1 1 2
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2 2 1
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1 1 1
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1 1 1
##  [260] 1 1 2 1 2 1 1 1 1 1 1 2 2 2 2 2 1 2 0 2 1 2 2 1 1 1 1 1 1 1 1 1 1 1
1 1 2
##  [297] 1 1 1 1 1 1 2 2 1 1 1 1 1 1 1 1 1 1 2 2 1 1 1 2 2 1 2 2 1 1 1 1 1 1
1 1 1
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2 2 2
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1 2 1
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2 1 2
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1 1 1
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1 1 2
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1 1 2
##  [556] 1 1 1 2 1 1 2 1 1 1 2 2 1 2 2 2 2 2 2 2 1 1 2 1 1 1 2 2 2 2 2 1 2 1
2 2 2
##  [593] 2 2 1 2 2 2 0 1 1 2 1 2 1 2 2 1 1 1 2 1 1 1 2 2 2 1 1 2 2 1 1 2 2 1
2 1 2
##  [630] 2 1 1 1 2 1 1 1 1 1 1 2 2 1 2 1 1 2 2 2 2 2 2 1 1 2 2 1 1 1 2 1 0 1 2
1 2 2
##  [667] 2 2 1 1 1 2 2 2 2 2 2 2 1 1 2 1 1 1 1 1 1 2 2 2 2 1 1 1 1 1 1 2 1 1
```

```
1 1 1
##  [704] 1 2 2 1 1 1 1 1 2 1 1 1 1 1 1 1 1 2 1 2 2 1 1 2 1 1 2 2 1 2 1 2 2 2
2 1 2
##  [741] 1 1 2 2 1 1 2 1 2 1 1 2 2 1 2 2 1 1 1 1 2 1 2 2 2 1 2 1 2 1 1 1 2 2
2 1 1
##  [778] 1 2 1 1 1 1 1 1 2 1 1 2 2 2 1 2 2 2 2 2 2 1 1 1 1 1 2 2 2 1 1 1 1 1
1 1 1
##  [815] 2 1 2 1 1 0 2 2 1 1 1 1 2 1 2 1 2 2 2 1 1 1 2 2 1 2 1 1 1 2 1 2 2 2
2 2 1
##  [852] 1 2 1 2 1 1 1 1 1 1 1 1 2 2 1 1 1 2 2 1 1 2 2 2 2 1 2 2 2 1 2 2 2 2
1 1 2
##  [889] 2 2 1 1 2 2 1 2 1 2 2 1 2 1 2 1 2 1 1 2 1 2 1 2 2 2 1 1 1 1 1 1 2 1
1 1 1
##  [926] 1 1 1 1 1 1 1 1 2 1 1 2 2 2 1 1 1 1 2 2 1 2 2 2 1 2 2 1 1 1 1 2 2 1 1
1 1 2
##  [963] 2 1 2 2 1 2 2 1 2 2 1 2 1 1 1 2 1 2 2 1 2 1 1 1 1 1 1 1 1 1 1 1 2
1 1 1
## [1000] 2 2 1 2 2 2 1 2 1 1 1 1 0 1 1 1 1 1 1 1 2 1 1 1 0 1 1 1 2 1 2 2 2 1
1 1 2
## [1037] 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 2 1 2 1 1 1 1 2 2
1 2 1
## [1074] 2 2 2 2 2 0 2 2 2 1 1 1 2 2 2 2 1 1 2 2 2 1 1 2 1 1 1 2 2 1 1 2 2 2
2 2 2
## [1111] 1 2 2 1 2 1 1 0 2 1 1 2 1 1 1 2 1 1 2 2 2 2 1 1 2 2 2 2 2 2 2 2 2 2
1 1 1
## [1148] 1 1 1 2 2 2 1 1 1 1 1 1 2 1 2 2 2 1 2 2 1 2 1 1 2 2 1 1 1 1 2 2 1 2
1 1 1
## [1185] 2 2 2 2 1 2 1 1 1 1 2 2 1 1 1 1 2 2 1 1 2 2 1 1 2 1 1 1 1 1 1 1 1 1
1 1 1
## [1222] 1 2 1 1 1 1 2 1 2 1 1 1 1 1 1 1 2 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1
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1 1 1
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1 1 1
## [1370] 1 1 1 1 2 1 1 1 1 1 2 2 2 2 2 2 1 1 1 2 2 1 1 2 1 1 2 1 0 2 1 2 1 1
1 1 1
## [1407] 2 2 2 2 1 2 2 2 2 2 1 1 1 2 1 2 2 1 1 1 1 1 1 1 2 1 1 1 1 2 1 1 1 1
1 2 2
## [1444] 2 2 1 2 2 1 1 1 2 1 1 1 1 1 1 1 1 2 1 2 2 2 2 2 2 2 2 2 2 2 2 1 1 1
2 1 1
## [1481] 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 1 1 1 1 2 2 1 1 2 2 1 1
1 1 1
## [1518] 2 1 2 2 1 1 1 1 1 1 1 1 2 1 1 2 2 1 1 2 1 1 2 2 1 1 2 1 2 2 2 2 2 2
2 1 1
## [1555] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 1 1 1 1 1 2 2 1 1 2 2 2
1 2 1
## [1592] 1 2 1 2 1 1 1 1 1 1 1 1 1 1 1 2 2 2 1 2 2 2 2 2 2 1 1 2 2 1 1 2 1 1
```

```
1 1 1
## [1629] 1 1 1 2 1 1 1 2 2 1 1 1 1 2 1 2 1 1 1 1 1 1 1 2 1 1 2 1 1 2 1 1 2 2
1 1 2
## [1666] 1 1 1 1 1 1 1 1 2 2 1 2 1 1 2 2 1 1 2 1 1 2 2 2 1 1 2 2 1 2 1 1 1 1
1 1 1
## [1703] 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 2 2 2 2 2 2 1 2 2 1 1 2 1 1 1 1 1 1 2
2 2 1
## [1740] 1 1 1 1 1 1 1 1 1 1 1 2 1 1 2 2 2 1 1 1 1 2 1 2 2 1 2 1 1 2 1 1 1 1
1 1 1
## [1777] 1 1 1 1 1 2 2 2 2 2 1 1 1 1 1 2 2 1 1 1 1 1 1 2 1 1 2 2 2 1 1 1 1 2
1 2 1
## [1814] 2 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 2 2
1 1 1
## [1851] 1 1 1 2 1 1 1 1 1 1 1 1 1 1 2 2 2 2 1 2 2 1 2 2 1 1 2 2 1 2 1 1 2 2
2 1 1
## [1888] 2 2 2 1 1 2 1 2 2 1 1 2 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 1 1
## [1925] 2 2 1 2 2 1 2 1 1 1 1 1 2 2 2 1 1 1 1 1 1 1 2 1 1 1 2 1 1 1 2 2 2
2 1 1
## [1962] 2 2 2 2 1 1 2 2 2 1 2 2 1 2 2 2 1 2 2 1 2 1 1 2 1 2 2 1 2 2 2 1 2 1
2 2 1
## [1999] 1 2 2 1 1 1 1 1 1 1 1 1 2 2 2 1 1 1 2 2 2 1 1 1 1 2 1 2 1 1 1 1 1 2
1 1 1
## [2036] 1 2 2 2 2 2 1 1 2 2 2 2 2 2 2 2 1 1 1 2 1 1 2 1 2 1 1 1 2 1 2 1 1 1
2 1 1
## [2073] 1 1 1 1 2 2 1 1 1 2 1 2 1 2 1 1 1 1 2 2 1 1 1 2 1 1 1 2 1 1 1 1 1 1
1 2 1
## [2110] 1 1 2 2 1 1 1 1 1 2 1 2 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1
1 1 1
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2 1 2
## [2184] 2 2 2 2 1 1 2 1 2 2 2 2 1 2 1 2 1 1 1 2 1 1 1 2 1 2 2 1 2 1 1 1 1 1
2 1 2
## [2221] 2 2 1 2 2 2 2 1 1 1 1 1 1 1 1 2 2 1 1 1 1 1 1 1 2 2 1 1 1 1 2 1
2 1 1
## [2258] 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1
1 1 1
## [2295] 1 1 1 1 1 1 1 1 2 1 1 1 1 1 2 1 2 1 1 2 2 1 1 1 1 1 1 1 1 2 2 2 1 2 2
2 2 1
## [2332] 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 2
1 1 1
## [2369] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 2 2 2 1 1 1 1 1 2 2
1 2 1
## [2406] 2 1 1 2 1 1 2 1 2 2 1 1 1 2 1 2 2 1 1 1 1 1 1 1 1 1 1 1 2 2 2 1 1 2
1 2 2
## [2443] 1 1 1 1 2 1 2 1 1 1 1 2 1 1 1 1 1 1 1 2 1 2 2 1 1 1 1 1 1 1 1 1 1 2
1 2 2
## [2480] 1 1 2 1 1 1 1 1 2 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1
1 1 1
## [2517] 1 1 1 1 1 1 1 1 1 2 1 2 2 2 2 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1
```

```
1 2 1
## [2554] 1 1 1 1 2 1 2 1 1 1 1 2 1 2 2 1 1 1 2 1 1 0 2 1 1 2 1 1 1 1 1 2 1 1
1 1 1
## [2591] 2 2 1 1 1 2 2 1 1 1 1 1 1 2 1 1 1 1 1 2 1 1 2 2 2 1 2 1 1 2 1 1 1 1
1 1 1
## [2628] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1
1 1 1
## [2665] 1 1 1 1 1 1 1 1 1 1 2 1 1 2 1 1 1 1 1 1 1 2 1 1 2 1 1 1 1 1 1 1 1 1
1 2 1
## [2702] 1 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1
2 1 1
## [2739] 2 2 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 2
1 1 1
## [2776] 2 1 2 1 2 1 1 1 1 1 1 1 1 1 1 2 2 2 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1
2 1 1
## [2813] 1 1 1 1 1 1 1 2 1 2 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 2 2 1 1 2 1 2
2 1 1
## [2850] 1 1 1 2 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 1 1 1
1 1 1
## [2887] 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1
2 1 2
## [2924] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 2 2 1 1 1 1 1
2 2 1
## [2961] 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1
## [2998] 1 1 1 1 1 1 2 1 1 1 1 1 1 2 1 2 1 1 1 2 1 1 1 1 1 1 1 1 2 1 1 1 2 1 1
1 1 2
## [3035] 1 2 1 1 1 2 1 1 1 2 1 1 1 1 1 2 2 2 1 1 1 1 1 2 1 1 1 1 1 1 1 2 1 1
1 1 2
## [3072] 2 2 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1
2 1 1
## [3109] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 2 2 2 1 1
1 1 1
## [3146] 1 1 2 1 1 1 1 1 1 1 1 2 2 1 2 2 1 1 1 1 1 1 1 2 1 2 1 1 1 2 1 1 1 1
1 1 1
## [3183] 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1
1 1 1
## [3220] 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 2 2 2 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1
## [3257] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 2 2 1 1 1 1 1 1 2 2 2 2
1 1 1
## [3294] 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 2 1 1 1 1
2 2 1
## [3331] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 1 1 1 1 1 1 1 2 1 1 1
1 1 2
## [3368] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 2 2 1 2 1 1 2 1 1 1 1 1 1 1 1 1
1 1 1
## [3405] 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 2 2 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1
1 2 1
## [3442] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 1 2 1 1 1 2 2 1 1 1 1 1 1 1 2 1 2
```

```
1 1 2
## [3479] 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 1 1 1 1 1 2 2 1 1 1 1
1 2 1
## [3516] 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 1 1 1 1 2 2 1 1 1 1 1 1 1 2 1 1 1
1 1 1
## [3553] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 2 1 1 2 2 1
1 1 2
## [3590] 2 2 2 2 2 1 2 2 1 2 1 1 2 1 1 1 1 2 1 1 1 2 1 1 1 1 1 1 1 2 1 1 2
1 2 1
## [3627] 1 2 1 1 1 2 1 1 1 2 1 1 2 1 1 2 1 2 1 2 2 1 2 1 2 1 1 1 1 1 2 1 2 1
1 1 1
## [3664] 1 1 1 1 2 2 1 1 1 1 1 1 2 1 2 2 1 2 1 2 1 1 2 1 2 2 1 2 1 1 2 2 2 2
2 1 2
## [3701] 1 1 2 2 1 2 1 2 1 1 2 2 1 1 1 1 1 1 1 2 2
## Levels: 0 1 2
```

I then did same to OIL and REG because even though they are binary they might not be as factors, better safe than sorry.

```
data$OIL = as.factor(data$OIL)
data$REG = as.factor(data$REG)
```

I don't need to determine reference category for cat when I run logit is 0 "no change" as it will automatically set 0 to the reference category.

```
multinom_model1 <- multinom(cat ~ OIL + REG, data = data)

## # weights:  12 (6 variable)
## initial  value 4087.936326
## iter  10 value 2340.076844
## final  value 2339.385155
## converged

summary(multinom_model1)

## Call:
## multinom(formula = cat ~ OIL + REG, data = data)
##
## Coefficients:
##   (Intercept)     OIL1     REG1
## 1    4.533759 4.576321 1.769007
## 2    3.805370 4.783968 1.379282
##
## Std. Errors:
##   (Intercept)     OIL1      REG1
## 1   0.2692006 6.885097 0.7670366
## 2   0.2706832 6.885366 0.7686958
##
## Residual Deviance: 4678.77
## AIC: 4690.77
```

I need to exponentiate these results to interpret them.

```
exp(coef(multinom_model1)[,c(1:3)])
```

```
##   (Intercept)      OIL1     REG1
## 1    93.10789  97.15632 5.865024
## 2    44.94186 119.57794 3.972047
```

Interpretation:

```
In a given country, there is an increase in the baseline odds that the GDP di
fference would increase by 4.58 times when the average ratio of fuel exports
to total exports in 1984-86 exceeded 50%

In a given country, there is an increase in the baseline odds that the GDP di
fference would decrease by 4.78 times when the average ratio of fuel exports
to total exports in 1984-86 exceeded 50%.

In a given country, there is an increase in the baseline odds that the GDP di
fference would increase by 1.77 times when the country is a democracy.

In a given country, there is an increase in the baseline odds that the GDP di
fference would decrease by 1.38 times when the country is a democracy.
```

2. Construct and interpret an ordered multinomial logit with GDPWdiff as the outcome variable, including the estimated cutoff points and coefficients.

```
m <- MASS::polr(cat ~ OIL + REG, data = data)
summary(m)
```

```
##
## Re-fitting to get Hessian

## Call:
## MASS::polr(formula = cat ~ OIL + REG, data = data)
##
## Coefficients:
##        Value Std. Error t value
## OIL1  0.2306    0.11510   2.003
## REG1 -0.3566    0.07485  -4.764
##
## Intercepts:
##     Value    Std. Error t value
## 0|1  -5.5846   0.2534   -22.0378
## 1|2   0.7491   0.0479    15.6475
##
## Residual Deviance: 4692.109
## AIC: 4700.109
```

Exponentiate

```
exp(cbind(OR=coef(m), confint(m)))

## Waiting for profiling to be done...

##
## Re-fitting to get Hessian

##             OR     2.5 %    97.5 %
## OIL1 1.2593051 1.0029960 1.5754005
## REG1 0.7000737 0.6042257 0.8102918

For countries whose average ratio of fuel exports to total exports in 1984-86
exceeded 50%, the odds of their GDP changing year on year is 1.26X higher tha
n countries whose average ratio of fuel exports to total exports in 1984-86 w
as less than 50%, holding constant all other variables.

Countries which are democracies have odds of their GDP changing which are .7X
higher than countries that are not democracies, holding constant all other va
riables.
```

Question 2

Consider the data set MexicoMuniData.csv, which includes municipal-level information from Mexico. The outcome of interest is the number of times the winning PAN presidential candidate in 2006 (PAN.visits.06) visited a district leading up to the 2009 federal elections, which is a count. Our main predictor of interest is whether the district was highly contested, or whether it was not (the PAN or their opponents have electoral security) in the previ- ous federal elections during 2000 (competitive.district), which is binary (1=close/swing district, 0="safe seat"). We also include marginality.06 (a measure of poverty) and PAN.governor.06 (a dummy for whether the state has a PAN-affiliated governor) as ad- ditional control variables.

```
mexico <- read.csv("/Users/Kate/Desktop/Hacker/Stats - HT/Problem Sets - HT/P
S3/MexicoMuniData.csv")
mexico$competitive.district = as.factor(mexico$competitive.district) # make s
ure they're factors
mexico$PAN.governor.06 = as.factor(mexico$PAN.governor.06)
```

(a) Run a Poisson regression because the outcome is a count variable. Is there evidence that PAN presidential candidates visit swing districts more? Provide a test statistic and p-value.

```
poisson <- glm(PAN.visits.06 ~ competitive.district + marginality.06 + PAN.go
vernor.06, family = poisson (link = "log"), data=mexico)
summary(poisson)
```

```
##
## Call:
## glm(formula = PAN.visits.06 ~ competitive.district + marginality.06 +
##     PAN.governor.06, family = poisson(link = "log"), data = mexico)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.2309  -0.3748  -0.1804  -0.0804  15.2669
##
## Coefficients:
##                       Estimate Std. Error z value Pr(>|z|)
## (Intercept)           -3.81023    0.22209 -17.156   <2e-16 ***
## competitive.district1 -0.08135    0.17069  -0.477   0.6336
## marginality.06        -2.08014    0.11734 -17.728   <2e-16 ***
## PAN.governor.061      -0.31158    0.16673  -1.869   0.0617 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 1473.87  on 2406  degrees of freedom
## Residual deviance:  991.25  on 2403  degrees of freedom
## AIC: 1299.2
##
## Number of Fisher Scoring iterations: 7
```

Coefficients:

```
exp(poisson$coefficients)

##           (Intercept) competitive.district1        marginality.06
##            0.02214298            0.92186932            0.12491227
##      PAN.governor.061
##            0.73228985

competetive.district: Test Statistic = -0.477, P-Value = 0.6336
marginality.06: Test Statistic = -17.728, P-Value <2e-16
PAN.governor.061: Test Statistic = -1.869, P-Value= 0.0617
```

Interpret

```
Yes, there is evidence that PAN presidential candidates visit swing districts
more.
There is an increase in the baseline odds that PAN presidential candidates wi
ll visit if the district is a swing district by 0.92 times, holding other var
iables constant.
```

(b) Interpret the marginality.06 and PAN.governor.06 coefficients.

```
# marginality.06
# There is an increase in the baseline odds that PAN presidential candidates
will visit a district,
# for every increase of the poverty measure, by 0.12 times, holding all other
variables constant.

# PAN.governor.06
# There is an increase in the baseline odds that the PAN presidential candida
tes will visit a
# district, if the state has a PAN-affiliated governor, by 0.73 times, holdin
g all other variables constant.
```

(c) Provide the estimated mean number of visits from the winning PAN presidential candidate for a hypothetical district that was competitive (competitive.district=1), had an average poverty level (marginality.06 = 0), and a PAN governor (PAN.governor.06=1).

```
summary(poisson)

##
## Call:
## glm(formula = PAN.visits.06 ~ competitive.district + marginality.06 +
##     PAN.governor.06, family = poisson(link = "log"), data = mexico)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.2309  -0.3748  -0.1804  -0.0804  15.2669
##
## Coefficients:
##                       Estimate Std. Error z value Pr(>|z|)
## (Intercept)           -3.81023    0.22209 -17.156   <2e-16 ***
## competitive.district1 -0.08135    0.17069  -0.477   0.6336
## marginality.06        -2.08014    0.11734 -17.728   <2e-16 ***
## PAN.governor.061      -0.31158    0.16673  -1.869   0.0617 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 1473.87  on 2406  degrees of freedom
## Residual deviance:  991.25  on 2403  degrees of freedom
## AIC: 1299.2
##
## Number of Fisher Scoring iterations: 7

# competitive.district*1 + marginality.06*0 + PAN.governor.06*1
-0.08135 + (-2.08014*0) + -0.31158 # -0.39293
```

```
## [1] -0.39293
```

```
exp(-0.39293) # = 0.675076
```

```
## [1] 0.675076
```

```
Estimated mean number of 0.68 visits from the winning PAN presidential candid
ate to district when competitive = 1, poverty = 0, PAN.governor = 1
```