HW#3

Tyler Cobian

5/15/2019

% Table created by stargazer v.5.2.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
% Date and time: Tue, May 21, 2019 - 21:58:51

```
####Explain what the correlation coefficients mean
```

For every unit increase in level of risk reduction, the respondent is more likely to vote yes by 0.004169 units.

For every unit increase in annual payment for the household, the respondent is less likely to vote yes by 0.005865 units.

For every unit increase in measure of environmental concern, the respondent is more likely to vote yes by 0.083213 units.

Earning an income in the one-percent makes the respondent 0.059366 units more likely to vote yes.

Earning a poor income makes the respondent 0.040298 units more likely to vote yes.

Earning a rich income makes the respondent 0.060219 units more likely to vote yes.

Earning a very rich income makes the respondent 0.277879 units more likely to vote yes.

Each unit increase in age until 30 makes the respondent 0.092936 units more likely to vote yes.

Each unit increase in age until 40 makes the respondent 0.127045 units less likely to vote yes.

Each unit increase in age until 60 makes the respondent 0.107886 units less likely to vote yes.

$$Odds(VotingYes) = 0.1197 + \beta_1(Risk) + \beta_2(BID) + \beta_3 + (NEP) + \beta_4(Income) + \beta_5(Age)$$

Table 1:

	Dependent variable:
	vote
agetofifty	0.010
	(0.063)
agetoforty	−0.020
	(0.062)
agetosixty	−0.016
	(0.060)
agetothirty	0.020
	(0.058)
incomeone_percent	0.009
	(0.060)
incomepoor	0.003
	(0.065)
incomerich	0.007
	(0.068)
incomevery_rich	0.047
	(0.067)
NEP	0.016***
	(0.002)
risk	0.001
	(0.001)
bid	−0.001
	(0.001)
Constant	0.120
	(0.120)
Observations	500
R^2	0.120
Adjusted R^2	0.100
Residual Std. Error	0.429 (df = 488)
F Statistic	6.055*** (df = 11; 488)
Note:	*p<0.1; **p<0.05; ***p<0.01

$Odds(Voting\,Yes) = 0.11970{+}0.02044(Age30){-}0.02012(Age40){+}0.00998(Age50){-}0.01623(Age60){+}0.00274(Poor){+}0.00749$

2. Based on this regression, what can you say about the value of a single prevented whale death? (Hint: Think about how risk reduction for all whales translates into the number of whale deaths avoided) (4% reduction in risk = 1 whale saved)

"'{r}

A 4% reduction in risk = 1 whale saved

to find this out I am changing the risk of the 3 random people looked at in #3 and chaging the risk from 60-64

their responding change in bid should equal their WTP for 1 whale

bid_7(60) # 446.7733 bid_7(64) # 449.5568

wtp_7<- bid_7(64) - bid_7(60) wtp_7 #2.783438

wtp_10<- bid_10(64) - bid_10(60) wtp_10 # 2.783438

wtp_1<- bid_1(64) - bid_1(60) wtp_1 # 2.783438

the overall willingness to pay for a whale in SB is 2.783438, this will be consistant among all people becasue we are using a linear model (lm) not a (glm)

3. Pick three arbitrary respondents. For each of those respondents, estimate their WTP for a VSR program offering 60% risk reduction.

```
# not sure whos model to use but for now I will use my regression

###################
# For this portion put age, NEP, Income, risk (60), and age into the equation
# next set the equation = nd solve for the bid vlaue
# once yo have the bid value put all of the inputs into the regression eqaution and solve for vote

# if they are "middle income" put nothing in for income becasue this is the refrence value and is what
##################
```

```
# risk = 0.6

# look at person "#7" and plug their info into the regression equation
# bid = ?
# NEP = 50
# income = middle
```

```r
# age = 30
# income = middle (so set = 0)

# 1 =  0.1196977 + 0.0204401*1 + 0.0158639*50 + 0.0007445*60 - 0.0010699*x

bid_7<- function(x){(0.1196977 + 0.0204401*1 + 0.0158639*50 + 0.0007445*x - 0.5)/0.0010699}
bid_7(60)
```

```
## [1] 446.7733
```

```r
# bid = 446.7733
#########################################################
#Look at person #10
# bid = ?
# NEP = 32
# Income = poor
# age = 30
# risk = 60

# 1 = 0.1196977 + 0.0204401*1 + 0.0027386*1 + 0.0158639*32 + 0.0007445*60 - 0.0010699*x

# 1 + 0.0010699*x = 0.1196977 + 0.0204401*1 + 0.0027386*1 + 0.0158639*32 + 0.0007445*60

# x = (0.1196977 + 0.0204401*1 + 0.0027386*1 + 0.0158639*32 + 0.0007445*x - 1)/0.0010699

bid_10<- function(x){ (0.1196977 + 0.0204401*1 + 0.0027386*1 + 0.0158639*32 + 0.0007445*x - 0.5)/0.0010

bid_10(60)
```

```
## [1] 182.4387
```

```r
# bid = 182.4387
#############################################################

# person 1
# bid = ?
# NEP = 15
# Income = very_rich
# age = 30
# risk = 60

# 1 = 0.1196977 + 0.0204401*1 + 0.0467922*1 + 0.0158639*15 + 0.0007445*60 - 0.0010699*x

# 1 - 0.0010699*x = 0.1196977 + 0.0204401*1 + 0.0467922*1 + 0.0158639*15 + 0.0007445*60

# x = (0.1196977 + 0.0204401*1 + 0.0467922*1 + 0.0158639*15 + 0.0007445*60 -1)/0.0010699

bid_1<- function(x){(0.1196977 + 0.0204401*1 + 0.0467922*1 + 0.0158639*15 + 0.0007445*x -0.5)/0.0010699

bid_1(60)
```

```
## [1] -28.45266
```

```r
# bid = -28.45266
```

Based on this regression, what can you say about the value of a single prevented whale death? (Hint: Think about how risk reduction for all whales translates into the number of whale deathsavoided) (4% reduction in risk = 1 whale saved)

```r
# A 4% reduction in risk = 1 whale saved
# to find this out I am changing the risk of the 3 random people looked at in #3 and chaging the risk f
# their responding change in bid should equal their WTP for 1 whale


bid_7(60) # 446.7733
```

```
## [1] 446.7733
```

```r
bid_7(64) # 449.5568
```

```
## [1] 449.5568
```

```r
wtp_7<- bid_7(64) - bid_7(60)
wtp_7 #2.783438
```

```
## [1] 2.783438
```

```r
wtp_10<- bid_10(64) - bid_10(60)
wtp_10 # 2.783438
```

```
## [1] 2.783438
```

```r
wtp_1<- bid_1(64) - bid_1(60)
wtp_1 # 2.783438
```

```
## [1] 2.783438
```

```r
# the overall willingness to pay for a whale in SB is 2.783438, this will be consistant among all peopl
```

4. Now repeat this process and estimate the mean WTP for a VSR program offering 60% risk reduction among Santa Barbara County households.

```r
# take the average amonst all of the values, average NEP, average income = medium, have to see the mode

# create a equation for bid using these values and find the bid value for a 60% reduction

# make a table of the averages

# make income and age number so that their modes show up in the summary table
data_new<- mutate(data, "income_num" = case_when(income == "poor" ~ 0,
                                   income == "middle" ~ 1,
                                   income == "rich" ~ 2,
                                   income == "very_rich" ~ 3,
                                   income == "one_percent" ~ 4),
                  "age_num" = case_when(age == "tothirty" ~ 30,
                                   age == "toforty" ~ 40,
```

```r
                                                    age == "tofifty" ~ 50,
                                                    age == "tosixty" ~ 6))
data_new
```

```
## # A tibble: 500 x 8
##     risk   bid  vote   NEP income      age      income_num age_num
##    <int> <int> <int> <int> <chr>       <chr>         <dbl>   <dbl>
##  1    20    80     0    15 very_rich   tothirty          3      30
##  2    40   100     1    37 middle      tothirty          1      30
##  3    80    40     1    32 one_percent tothirty          4      30
##  4    20    40     0    32 middle      tothirty          1      30
##  5    80    80     1    40 middle      toforty           1      40
##  6    80    80     1    29 poor        tothirty          0      30
##  7    60    20     1    50 middle      tothirty          1      30
##  8    60    40     1    46 poor        toforty           0      40
##  9    20    40     0    27 very_rich   toforty           3      40
## 10    60    40     1    32 poor        tothirty          0      30
## # ... with 490 more rows
```

```r
#names(data_new)<- c("risk", "bid", "vote", "nep", "income", "age", "income_num", "age_num")


data_table_sum <- data_new %>%
  summarise(
    mean_nep = mean(NEP),
    mode_age = mode(age_num),
    mode_income = mode(income_num)
  )

data_table_sum
```

```
## # A tibble: 1 x 3
##   mean_nep mode_age mode_income
##      <dbl> <chr>    <chr>
## 1     38.4 numeric  numeric
```

```r
# mean NEP = 38.366
# most common age = 30
# average income = medium

# plug in these values and find the WTP for a 60% reduction

# vote = 0.1196977 + 0.0204401(age_30) -0.0201190(age_40) + 0.0099816(age_50)  -0.0162261(age_60) + 0.0

# 0.5 + 0.0010699(bid) = 0.1196977 + 0.0204401(age_30) -0.0201190(age_40) + 0.0099816(age_50)  -0.01622

# (bid) = (0.1196977 + 0.0204401(age_30) -0.0201190(age_40) + 0.0099816(age_50)  -0.0162261(age_60) + 0

bid_mean<- function(x){(0.1196977 + 0.0204401*1 + 0.0158639*38.366 + 0.0007445*x - 0.5)/0.0010699}

bid_mean(60)
```

```
## [1] 274.2707
```

```r
# avergae WTP = 274.2707
```

5. If there are 150,000 households in Santa Barbara County, estimate the total benefit of a VSR program to these households

```r
# a 60% reduction would lead to 15 whales saved
# Before we solved that each person values each whale worth 2.783438
# multiply the wtp per whale by the population

total_benefit<- 2.783438*15*150000
total_benefit # total benefit to sb for a 60% reduction is 6262736
```

```
## [1] 6262736
```

6. Based only on these benefits, do the benefits of the VSR program outweigh the costs?

```r
# take the wtp and multiply is by the number of people
# then compare it to the total benefit solved for in problem 5

total_cost<- 150000*274.2707
total_cost
```

```
## [1] 41140605
```

```r
total_cost - total_benefit # the benefits outweigh the costs where costs - benefits = 34877870
```

```
## [1] 34877870
```

7. Suppose the price of a carbon credit is $Z per ton, at what price Z* will the shipping industry decide to adopt the VSR for purely self-interested reasons? (Note: if ships voluntarily reduce speed, then the $7 million cost (noted above) of implementing the VSR would be avoided)

```r
# at a 60% reduction will cost the ship $1000 but also result in 20 fewer tonn of CO2 per trip
# 20 tonn = 1000 in costs

cost_per_tonn<- 1000/20
cost_per_tonn # 50 dollars per tonn reduced
```

```
## [1] 50
```

```r
# If the price of the carbon credit Z were anything above $50 then the shipping company will adopt the
```

8. Now suppose the carbon credit price is exactly Z*, so all ships voluntarily reduce speed toachieve the 60% risk reduction. Approximately how many whales would be saved by this? What would be the social value of allowing ships to enter the carbon trading market?

```r
# the number of whales saved a year with a 60% reduction would ential 15 whales saved

# to find the social value of the carbon program in the chanel I think you would take the vlaue we got

# 15 whales would be saved from a 60% reduction

total_benefit # 6262736 total social benefit from the program
```

```
## [1] 6262736
```