ESM 204 Assignment 3

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1. Linear Probability Model

Create a linear probility model that predicts a respondent's probability of voting "yes" on the ballot based on their age, income, NEP score, the program's risk reduction, and cost of the program to that respondent.

Regression Model:

$Probability(Voting\ Yes) = 0.1197 + 0.0204(Age\ to\ 30) - 0.0201(Age\ to\ 40) + 0.01(Age\ to\ 50) - 0.0162(Age\ to\ 60) + 0.0088(Income\ One\ Percent) + 0.0027(Income\ Poor) + 0.0075(Income\ Rich) + 0.0468(Income\ Very\ Rich) + 0.0159(NEP) - 0.0011(Bid) + 7 \times 10^{-4}(Risk\ Reduction)$

Coefficient Interpretation:
Age: Reference Level Over 65
- to 30:
- to 40:
- to 50:
- to 60:

Income: Reference Level Middle
- One Percent:
- Poor:
- Rich:
- Very Rich:

NEP:
Bid:
Risk:

2. Value of Prevented Whale Deaths

Reducing the risk of whale strikes by 20% saves five whales every year. Based on this, the vessel speed reduction by 4% saves a single whale every year. To find the value of each individual whale saved find the willingess to pay for vessel speed reduction programs of 0% and compare to the willingness to pay for vessel speed reduction of 4%.

Risk Reduction 0%
Assume the probability of voting yes is the average of the votes ($p = 0.714$), assume an age to 30, income rich, and the average NEP (38.366), solve for the willingness to pay for the program using:

$0.714 = 0.1197 + 0.0204(Age\ to\ 30) + 0.0075(Income\ Rich) + 0.0159(NEP) - 0.0011(Bid) + 7 \times 10^{-4}(0)$

$Willingness\ to\ Pay = 39.5002$

Risk Reduction 4%
Again, assume the probability of voting yes is the average of the votes ($p = 0.714$), assume an age to 30, income rich, and the average NEP (38.366), solve for the willingness to pay for the program using:

$0.714 = 0.1197 + 0.0204(Age\ to\ 30) + 0.0075(Income\ Rich) + 0.0159(NEP) - 0.0011(Bid) + 7 \times 10^{-4}(4)$

$Willingness\ to\ Pay = 42.2836$

The value of a single whale is the difference between the willingness to pay for a vessel speed reduction program at 4% and at 0%.

$Individual\ Whale\ Value = 2.7834$

3. Estimated Willingness to Pay for a Vessel Speed Reduction Program

a. Choose three participants at random

Using a random number generator select three participants:
- 38 NEP:32 Income:Rich Age:to30
- 44 NEP:51 Income:Poor Age:to40
- 102 NEP:51 Income:Middle Age:to60

b. Predict willingness to pay for 60% VSR program

Assume the probability of voting yes the average of all the yes votes ($p = 0.714$), calculate the willingness to pay using the following equations:

Individual 38:
$0.714 = 0.1197 + 0.0204(Age\ to\ 30) + 0.0075(Income\ Rich) + 0.0159(NEP) - 0.0011(Bid) + 7 \times 10^{-4}(60)$

Individual 44:
$0.714 = 0.1197 - 0.0201(Age\ to\ 40) + 0.0027(Income\ Poor) + 0.0159(NEP) - 0.0011(Bid) + 7 \times 10^{-4}(60)$

Individual 122:
$0.714 = 0.1197 - 0.0162(Age\ to\ 60) + 0.0159(NEP) - 0.0011(Bid) + 7 \times 10^{-4}(60)$

Individual 38:
$Willingness\ to\ Pay = 13.1408$

Individual 44:
$Willingness\ to\ Pay = 263.8417$

Individual 122:
$Willingness\ to\ Pay = 257.6434$

4. Santa Barbara Estimated Willingness to Pay for VSR Program

Again assume the probability of voting yes the average of voting yes ($p = 0.714$). Use the average income bracket (middle), the average age bracket (to 50), and average NEP (38.366) to calculate willingness to pay using:

$0.714 = 0.1197 + 0.01(Age\ to\ 50) + 0.0159(NEP) - 0.0011(Bid) + 7 \times 10^{-4}(60)$

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# Use the average NEP, middle income, and middle age bracket (to 50) to find the average bid

bid_sb <- (int + age_50 + (nep*nep_avg) + (risk*60) - avg_vote)/bid
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$Average\ Santa\ Barbara\ Willingness\ to\ Pay = `round(abs(rbid_sb), digits = 4)`$