__Understanding Consumer Behavior through Discrete Choice Models__

Homework Assignment No. 1
Binary Choice Models – Application to electric vehicle adoption

Date distributed: April 1, 2019

Due date: Wednesday April 17, 2019, 11:59PM

The file Data_HW_001.dat defines the data to be used for this assignment. The data set comprises 2,775 observations. Each record represents a household. This data contains information about the decision to adopt electric vehicles technology in the state of California, United States of America. Random households were selected and a private company offered them an electric vehicle along with the computation of the expected yearly expenses of using the vehicle (electricity bill, maintenance, fee, etc.). Some of the households decided to get the vehicle (adopt the technology), some others do not. The definitions of the variables in the data set are attached to the end of document.

1. Examine Characteristics of Data Set

   Your first task is to become familiar with characteristics of your data set. Please use frequency tables, descriptive statistics, and cross tabulations for this purpose. Report only the most interesting findings of this exploration. You may include printed tables with handwritten comments but do not turn in large amounts of output. Focus your comments only on those items you think are most important or interesting. As part of this effort, you should examine the effect of potential explanatory variables on the decision to adopt the technology, and determine the current sample shares of the two options ("to adopt" and "to not adopt").

2. Estimate Base Market Share Model

   Estimate base market share model (*i.e.* the model with 'alternative specific constants only'). Note that you can only estimate one of the constants (among the "to adopt" alternative specific constant and the "to not adopt" alternative specific constant). Estimate the discrete choice model with the "to adopt" specific constant. What does the sign on the constant indicate? How is the estimated constant related to the market shares computed in question 1?

3. Estimate Binary Choice Model with Explanatory Variables

   a) Estimate a model with the "to adopt" alternative specific constant (this should be included in all estimations), the following socio-demographic variables specific to the "to adopt" alternative: SPOOL, GRAD, PTRANSP, NEIGHB, PSENIORS, NCHILD, and the level-of- service variable: COST. Interpret your estimation results (are the signs on the estimated coefficients what you expected?).

   b) Drop the variables which are not statistically significant in the above estimation ($|t| < 1.00$). Compare this restricted model with the model in part (a) using a likelihood ratio test.

   c) Use the specification in part (b), except that two interaction terms between income and cost have been added: COST*Medium_income and COST*High_income where Medium_Income is a dummy variable that takes the value of 1 if Income=2, 0 otherwise, and High_Income is a dummy variable that takes the value of 1 if Income=3, 0 otherwise. Report the results of a likelihood ratio test on the addition of these parameters.

4. Searching for Your Final Specification

   a) Now you are free to add to your specification any variable you want. Look for the best specification (in terms of goodness of fit measures) that you can explain intuitively. Discuss briefly the intuition behind the value (sign) of each of the coefficients.

      Note: You are free to transform the explanatory variables. For example, number of children can be transformed to "presence of children" (presence of children takes the value of 1 if NCHILD>0, 0 otherwise). Use your imagination. The sky is the limit.

   b) Compute the marginal utility of cost for your final preferred specification. Do these values seem reasonable?

5. Aggregate Effect on Adoption shares Due to Level-of-Service Changes

   Consider a proposal to reduce the cost of electric vehicles in a 25%. Use your estimated binary logit model to determine the impact of such an incentive market policy on electric vehicle adoption.

Description of file "Data_HW_001.dat"

HHID	Household (hh) identification number
CHOSEN	1: electric vehicle is adopted, 2: otherwise
INCOME	Household available income in dollars per year. 1: Less than US$50,000, 2: Between US$50,000 and US$100,000, 3: More than US$100,000
HHSIZE	Household size (number of people in the household)
NUMVEH	Number of vehicles (cars) in the household
WOMEN	Number of women in the household
MEN	Number of men in the household
NWORK	Number of workers in the household
NCHILD	Number of children (16 years or younger) in the household
NYCHILD	Number of very young children (5 years or younger) in the household
ETHN	Ethnicity. 1: white, 2: african-american, 3: asian, 4: hispanic
DIST	Distance (in miles) from the household location to the nearest shopping center
NBIKES	Number of bikes in the household
PTRANSP	1: at least one hh member uses public transportation, 0: otherwise
SOLARPAN	1: household has solar panels, 0: otherwise
WALKBIKE	1: at least one hh member walks or bikes to work, 0: otherwise
TELECO	1: at least one hh member telecommutes (work from home), 0: otherwise
PSENIORS	1: at least one hh member is senior (65 years or older); 0: otherwise
GRAD	Number of hh members with a bachelor's degree or higher
POPDENSE	Population density (people per sq mile) at the residence's zip code
NEIGHB	1: Neighbors have electric vehicle, 0: otherwise
SMARTPH	Number of hh members who own a smartphone
SPOOL	1: household has a swimming pool, 0: otherwise
CABLE	1: household has cable tv, 0: otherwise
COST	yearly cost of electric vehicle in US$10,000