Statistical and Econometric Methods for Transportation Data Analysis

Chapter 16 – Random Parameter Models

Example 16.2
Random Parameters Ordered Probit Model

An online survey targeting registered members of a bikesharing company – CycleHop (Tampa, St. Petersburg, Orlando) and members of University of South Florida community was conducted. A total of 675 responses were collected. The goal was to understand how likely a respondent is to rent their personal vehicle and in exchange collect a fee. The respondents were asked the following question: How likely would you be to let someone use your personal vehicle (when you are not using it) while you collect a fee for renting out your vehicle? (x24 in the dataset). The answer choices included extremely unlikely, unlikely, do not know/ cannot say, likely, extremely likely.

To understand the factors determining these opinions, a random parameters ordered probit model is appropriate. Random parameters ordered probit models is an extension of ordered parameter probit model that accounts for unobserved heterogeneity.

Your task is to estimate a random parameter ordered probit model to determine which factors play key roles in the likelihood of renting a personal vehicle to others.

Please provide:

1. The results of your best model specification.
2. A discussion of the logical process that led you to the selection of your final specification (discuss the theory behind the inclusion of your selected variables). Include t-statistics and justify the sign of your variables.

Variables available for your specification are:

x1	Age: 1 if 17 or less, 2 if 18-20, 3 if 21-24, 4 if 25-29, 5 if 30-34, 6 if 35-39, 7 if 40-44, 8 if 45-49, 9 if 50-54, 10 if 55-59, 11 if 60-64, 12 if 65-74, 13 if 75-84, 14 if 85 or more
x2	Income: 1 if $0 - $24,999, 2 if $25,000 - $49,999, 3 if $50,000 - $74,999, 4 if $75,000 - $99,999, 5 if $100,000 - $124,999, 6 if $150,000 - $174,999, 7 if $175,000 - $199,999, 8 if $200,000 and above, 9 if $125,000-149,999
x3	Gender: 1 if male, 2 if female
x4	Ethnicity: 1 if White, 2 if Hispanic/ Latino, 3 if Black or African American, 4 if Native American or American Indian, 5 if Asian/ Pacific Islander, 6 if Other
x5	Licensed driver: 1 if Yes, 2 if No
x6	Number of people in the household (including respondent): 1 if 1, 2 if 2, 3 if 3, 4 if, 5 if 5, 6 if 6, 7 if 7, 8 if more than 7
x7	Number of children under 6 years old in the household: 1 if 0, 2 if 1, 3 if 2, 4 if 3, 5 if 4, 6 if more than 4
x8	Number of children between 6 and 16 years old in the household: 1 if 0, 2 if 1, 3 if 2, 4 if 3, 5 if 4, 6 if more than 4
x9	Number of licensed and operable motor vehicles (owned and leased) in household have (does not include two-wheelers such as motorcycles or bicycles): 1 if 0, 2 if 1, 3 if 2, 4 if 3, 5 if 4, 6 if more than 4
x10	Typical time (in minutes) spent on one-way for the commute/work trips: 2 if Less than 5 minutes, 3 if 5-10 minutes, 4 if 10-20 minutes, 5 if 20-30 minutes, 6 if 30-45 minutes, 7 if 45-60 minutes, 8 if 60-90 minutes, 9 if 90 minutes or more
x11	Typical time (in minutes) spent on one-way to a grocery store: 2 if Less than 5 minutes, 3 if 5-10 minutes, 4 if 10-20 minutes, 5 if 20-30 minutes, 6 if 30-45 minutes, 7 if 45-60 minutes, 8 if 60-90 minutes, 9 if 90 minutes or more
x12	Total daily travel time typically spent traveling (for all travel in a day): 1 if Less than 15 minutes, 2 if 15-30 minutes, 3 if 30-45 minutes, 4 if 45-60 minutes, 5 if 60-90 minutes, 6 if 90-120 minutes, 7 if 120 minutes or more
x13	One-way distance for the commute/work trips: 1 if Not applicable, 2 if Less than 1 mile, 3 if 1-3 miles, 4 if 3-5 miles, 5 if 5-10 miles, 6 if 10-15 miles, 7 if 15-20 miles, 8 if 20-30 miles, 9 if 30-40 miles, 10 if 40 miles or more
x14	Most commonly used mode for commute/work trips: 1 if Not applicable, 2 if Drive alone, 3 if Share a ride (either as a passenger or a driver), 4 if Taxi/cab, 5 if Public transportation, 6 if Bicycle, 7 if Motorcycle/ scooter, 8 if Walk

x15	One-way distance for the grocery store trips: 2 if Less than 1 mile, 3 if 1-3 miles, 4 if 3-5 miles, 5 if 5-10 miles, 6 if 10-15 miles, 7 if 15-20 miles, 8 if 20-30 miles, 9 if 30-40 miles, 10 if 40 miles or more
x16	Most commonly used mode for grocery store trips: 2 if Drive alone, 3 if Share a ride (either as a passenger or a driver), 4 if Taxi/cab, 5 if Public transportation, 6 if Bicycle, 7 if Motorcycle/ scooter, 8 if Walk
x17	The average time spent on parking a vehicle for the most regular trip? NOTE: Average time=find a parking spot + park + walk from parking spot to desired location): 2 if Less than 5 minutes, 3 if 5-10 minutes, 4 if 10-15 minutes, 5 if 15-20 minutes, 6 if 20-30 minutes, 7 if 30 minutes or more
x18	Number of minutes out of the time mentioned in the previous question is spent solely on finding a parking space: 1 if Less than 3 minutes, 2 if 3-5 minutes, 3 if 5-10 minutes, 4 if 10-15 minutes, 5 if 15 minutes more
x19	Involved in a traffic crash: 1 if Yes, 2 if No
x20	Whose fault was the primary cause for your most severe crash: 1 if I, as the driver, 2 if The driver of the other vehicle, 3 if The driver of the other vehicle that I was in, as a passenger, 4 if Pedestrian or bicyclist on the road, 5 if No one
x21	What was the most severe level of damage to the vehicle during the most severe crash? 1 if Vehicle was completely damaged without a possibility of repair, 2 if Vehicle could not be driven after the crash, could be repaired, 3 if Vehicle could be driven from the crash scene, sent for minor repairs later, 4 if No damage to vehicle was done
x22	What was the most severe level of injury to those involved in their most severe crash (including those not in their vehicle)? 1 if Fatality/ death, 2 if Major, incapacitating injuries (e.g. loss of limb), 3 if Major injury, but not incapacitating, 4 if Minor injuries like bruises or abrasions, 5 if No injury
x23	Bikesharing registration: 1 if Yes, 2 if No
x24	How likely would you be to let someone use your personal vehicle (when you are not using it) while you collect a fee for renting out your vehicle? 1 if Extremely unlikely, 2 if Unlikely, 3 if Do not know/ Cannot say, 4 if Likely, 5 if Extremely likely
x25	Frequency of using ride-sourcing services such as Uber/Lyft: 1if have never used them, 2 if Less than once a month, 3 if A few times a month 4 if 1-2 times a week, 5 if A few times a week

```
read;nvar=25;nobs=675;file=C:\Users\Natalia\Desktop\assignment_data_p2p.txt$

create;if(x24=1)xx24=0$
create;if(x24=2)xx24=1$
create;if(x24=3)xx24=2$
create;if(x24=4)xx24=3$
create;if(x24=5)xx24=4$
create;if(x1<6)millen=1$
create;if(x3=1)male=1$
create;if(x2>7)highinc=1$
create;if(x17>4)highpt$
create;if(x23=1)bikesh=1$

ordered;lhs=xx24;rhs=one,millen,highinc,bikesh,onemv
;rpm; fcn=highinc(n);halton$
```

To check your estimations, you may use 1,000 Halton draws:

```
ordered;lhs=xx24;rhs=one,millen,highinc,bikesh,onemv
;rpm; fcn=highinc(n);halton; pts=1000; marginal$
```

<u>NOTE: After running the full code, if you get an error, try running a fixed parameter ordred probit model first, then run the random parameter code.</u>

```
-------------------------------------------------------------------------------
Random Coefficients  OrdProbs Model
Dependent variable                 XX24
Log likelihood function       -887.11413
Estimation based on N =     675, K =   9
Inf.Cr.AIC  =   1792.2 AIC/N =    2.655
Sample is  1 pds and     675 individuals
Simulation  based on   100 Halton draws
Ordered probability model
Ordered probit (normal) model
LHS variable = values 0,1,..., 4
--------+----------------------------------------------------------------------
        |                    Standard              Prob.      95% Confidence
   XX24 | Coefficient        Error       z     |z|>Z*         Interval
--------+----------------------------------------------------------------------
        |Nonrandom parameters.......................................
Constant|     .07168         .09003      .80   .4260     -.10479     .24814
 MILLEN |     .12688         .09001     1.41   .1586     -.04953     .30330
 BIKESH |     .12148         .08666     1.40   .1609     -.04836     .29132
  ONEMV |     .07001         .09233      .76   .4483     -.11095     .25097
        |Means for random parameters................................
 HIGHINC|    -.46248***      .14596    -3.17   .0015     -.74856    -.17640
        |Scale parameters for dists. of random parameters...........
 HIGHINC|     .78891***      .14609     5.40   .0000      .50258    1.07523
        |Threshold parameters for probabilities.....................
  Mu(01)|     .86515***      .05195    16.65   .0000      .76332     .96697
  Mu(02)|    1.24676***      .06316    19.74   .0000     1.12296    1.37056
  Mu(03)|    2.01571***      .09768    20.64   .0000     1.82426    2.20715
--------+----------------------------------------------------------------------
***, **, * ==>  Significance at 1%, 5%, 10% level.
Model was estimated on Jun 18, 2019 at 08:25:10 AM
-------------------------------------------------------------------------------
```