Queensland University of Technology
Transport Data Analysis and Modeling Methodologies

Lab Session #10
(Mixed Logit Analysis I: Based on Example 13.1)

Recall from Lab Session #7, you were given 151 observations of a travel survey collected in State College Pennsylvania (See Example 13.1 on page 319 of the text for an estimation of a fixed-parameters logit model of these data). All of the households in the sample are making the morning commute to work. They are all departing from the same origin (a large residential complex in the suburbs) and going to work in the Central Business District. They have the choice of three alternate routes; 1) a four-lane arterial (speed limit = 35mph, 2 lanes each direction), 2) a two-lane rural road (speed limit = 35mph, 1 lane each direction) and 3) a limited access four-lane freeway (speed limit = 55mph, 2 lanes each direction).

As with Lab Session #8, develop a new model with a price variable in all three choice alternatives. The price variable is created as: set price = ((distance/10)/mpg)*1.05.

With this, your task is to experiment with a random parameters logit model using these data. Your write-up should include:

1. The results of your best model specification.
2. A discussion of the findings in searching for a random parameters specification.

Again, for reference, see Example 13.1 on page 319 of the text.

Available distributions:

n = normal
l = lognormal
u = uniform
t = triangular
d = dome
e = Erlang
w = Weibull
p = exponential
c = nonstochastic (constant)

Variables available for your specification are (in file LOGIT-A1.txt):

Variable Number	Explanation
x1	Route chosen, rows: 1 - arterial, 2 - rural road, 3 - freeway
x2	Arterial row indicator; 1 for arterial row, 0 for others
x3	Rural row indicator; 1 for rural row, 0 for others
x4	Freeway row indicator; 1 for freeway row, 0 for others
x5	Traffic flow rate
x6	Number of traffic signals
x7	Distance in tenths of miles
x8	Seat belts: 1 - if wear, 0 - if not
x9	Number of passengers in car
x10	Driver age in years: 1 - 18 to 23, 2 - 24 to 29, 3 - 30 to 39, 4 - 40 to 49, 5 - 50 and above
x11	Gender: 1 - male, 0 - female
x12	Marital status: 1 - single, 0 - married
x13	Number of children
x14	Annual income: 1 - less than 20000, 2 - 20000 to 29999, 3 - 30000 to 39999, 4 - 40000 to 49999, 5 - more than 50000
x15	Model year of car (e.g. 86 = 1986)
x16	Origin of car: 1 - domestic, 0 - foreign
x17	Fuel efficiency in miles per gallon

```
--> read;nvar=17;nobs=453;file=D:\old_drive_d\new_laptop\CE697N-disk\LOGIT-A1...
--> create;cage=86-x15$
--> create;price=(x7/10)/x17*1.05$
--> create;if(x10>3)old=1$
--> rplogit;lhs=x1;choices=arterial,rural,freeway;model:
    u(arterial)=pricea*price/
    u(rural)=rural*one+pricer*price+cager*cage+olda*old/
    u(freeway)=freeway*one+pricef*price+cagef*cage
    ;fcn=olda(n),pricea(n);pts=200;halton$

+---------------------------------------------+
| Discrete choice and multinomial logit models|
+---------------------------------------------+
Normal exit from iterations. Exit status=0.
+---------------------------------------------+
| Start values obtained using MNL model       |
| Maximum Likelihood Estimates                |
| Model estimated: Oct 09, 2013 at 01:12:25PM.|
| Dependent variable                Choice    |
| Weighting variable                  None    |
| Number of observations               151    |
| Iterations completed                  19    |
| Log likelihood function        -93.36348    |
| Number of parameters                   8    |
| Info. Criterion: AIC =           1.34256    |
|   Finite Sample: AIC =           1.34928    |
| Info. Criterion: BIC =           1.50242    |
| Info. Criterion:HQIC =           1.40750    |
| R2=1-LogL/LogL*  Log-L fncn  R-sqrd  RsqAdj |
| Constants only    -124.2267  .24844  .22270 |
| Chi-squared[ 6]          =     61.72638     |
| Prob [ chi squared > value ] =    .00000    |
| Response data are given as ind. choice.     |
| Number of obs.=   151, skipped   0 bad obs. |
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| Notes No coefficients=> P(i,j)=1/J(i).      |
|       Constants only => P(i,j) uses ASCs    |
|         only. N(j)/N if fixed choice set.   |
|         N(j) = total sample frequency for j |
|         N    = total sample frequency.      |
|       These 2 models are simple MNL models. |
|       R-sqrd = 1 - LogL(model)/logL(other)  |
|       RsqAdj=1-[nJ/(nJ-nparm)]*(1-R-sqrd)   |
|         nJ   = sum over i, choice set sizes |
+---------------------------------------------+
+--------+--------------+----------------+--------+--------+
|Variable| Coefficient  | Standard Error |b/St.Er.|P[|Z|>z]|
+--------+--------------+----------------+--------+--------+
 OLDA    |      .04448785       .58295617      .076   .9392
 PRICEA  |    -27.6571556      5.99385421    -4.614   .0000
 RURAL   |     1.89729274       .96471957     1.967   .0492
 PRICER  |    -35.9286692      5.94298185    -6.046   .0000
 CAGER   |      .20412871       .07980156     2.558   .0105
 FREEWAY |    -2.48430113      1.39064056    -1.786   .0740
 PRICEF  |    -21.1150878      5.83757645    -3.617   .0003
 CAGEF   |      .24877766       .09774359     2.545   .0109
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Normal exit from iterations. Exit status=0.
+---------------------------------------------+
| Random Parameters Logit Model               |
| Maximum Likelihood Estimates                |
| Model estimated: Oct 09, 2013 at 01:12:33PM.|
| Dependent variable                 X1       |
| Weighting variable               None       |
| Number of observations            151       |
| Iterations completed               26       |
| Log likelihood function       -92.55105     |
| Number of parameters               10       |
| Info. Criterion: AIC =          1.35829     |
|   Finite Sample: AIC =          1.36870     |
| Info. Criterion: BIC =          1.55811     |
| Info. Criterion:HQIC =          1.43947     |
| Restricted log likelihood     -165.8905     |
| McFadden Pseudo R-squared      .4420954     |
| Chi squared                    146.6788     |
| Degrees of freedom                 10       |
| Prob[ChiSqd > value] =         .0000000     |
| R2=1-LogL/LogL*  Log-L fncn  R-sqrd  RsqAdj |
| No coefficients   -165.8905  .44210  .42299 |
| Constants only    -124.2267  .25498  .22947 |
| At start values    -93.3635  .00870 -.02525 |
| Response data are given as ind. choice.     |
+---------------------------------------------+
+---------------------------------------------+
| Notes No coefficients=> P(i,j)=1/J(i).      |
|       Constants only => P(i,j) uses ASCs    |
|         only. N(j)/N if fixed choice set.   |
|         N(j) = total sample frequency for j |
|         N    = total sample frequency.      |
|       These 2 models are simple MNL models. |
|       R-sqrd = 1 - LogL(model)/logL(other)  |
|       RsqAdj=1-[nJ/(nJ-nparm)]*(1-R-sqrd)   |
|         nJ   = sum over i, choice set sizes |
+---------------------------------------------+

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| Random Parameters Logit Model               |
| Replications for simulated probs. = 200     |
| Halton sequences used for simulations       |
| Number of obs.=   151, skipped   0 bad obs. |
+---------------------------------------------+
+--------+--------------+----------------+--------+--------+
|Variable| Coefficient  | Standard Error |b/St.Er.|P[|Z|>z]|
+--------+--------------+----------------+--------+--------+
---------+Random parameters in utility functions
 OLDA    |      .60859982      1.35026837      .451   .6522
 PRICEA  |    -38.2869508      12.9071062    -2.966   .0030
---------+Nonrandom parameters in utility functions
 RURAL   |     1.88945007      1.38046749     1.369   .1711
 PRICER  |    -46.3293183      11.6230518    -3.986   .0001
 CAGER   |      .28079135       .13107773     2.142   .0322
 FREEWAY |    -2.77785442      1.88824857    -1.471   .1413
 PRICEF  |    -28.6579781      10.3335246    -2.773   .0055
 CAGEF   |      .32557435       .15330278     2.124   .0337
---------+Derived standard deviations of parameter distributions
 NsOLDA  |     2.57230263      2.31217021     1.113   .2659
 NsPRICEA|     6.35725032      4.32955776     1.468   .1420
```