```
      name:  <unnamed>
       log:  D:\Jason\workshop\Categorical data analysis\2019\categorical.log
  log type:  text
 opened on:  30 Sep 2019, 11:23:54

.
.
. ***************************
. * Chi-Square tests
. ***************************
.
.
. webuse lbw, clear
(Hosmer & Lemeshow data)

. des

Contains data from http://www.stata-press.com/data/r15/lbw.dta
  obs:           189                          Hosmer & Lemeshow data
 vars:            11                          15 Jan 2016 05:01
 size:         2,646
-------------------------------------------------------------------------------------------------------------------------------
              storage   display    value
variable name   type    format     label      variable label
-------------------------------------------------------------------------------------------------------------------------------
id              int     %8.0g                 identification code
low             byte    %8.0g                 birthweight<2500g
age             byte    %8.0g                 age of mother
lwt             int     %8.0g                 weight at last menstrual period
race            byte    %8.0g      race       race
smoke           byte    %9.0g      smoke      smoked during pregnancy
ptl             byte    %8.0g                 premature labor history (count)
ht              byte    %8.0g                 has history of hypertension
ui              byte    %8.0g                 presence, uterine irritability
ftv             byte    %8.0g                 number of visits to physician during 1st trimester
bwt             int     %8.0g                 birthweight (grams)
-------------------------------------------------------------------------------------------------------------------------------
Sorted by:

. sum

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
          id |        189    121.0794    63.30363          4        226
         low |        189    .3121693    .4646093          0          1
         age |        189     23.2381    5.298678         14         45
         lwt |        189    129.8201    30.57515         80        250
        race |        189    1.846561    .9183422          1          3
-------------+---------------------------------------------------------
       smoke |        189    .3915344    .4893898          0          1
         ptl |        189    .1957672    .4933419          0          3
          ht |        189    .0634921    .2444936          0          1
          ui |        189    .1481481    .3561903          0          1
         ftv |        189    .7936508    1.059286          0          6
-------------+---------------------------------------------------------
         bwt |        189    2944.286     729.016        709       4990

.
. ****************************************
. * Creating a 2- to 4-way table
. ****************************************
.
. * a 2-way table
.
. table low ui, contents(freq)

----------------------
          | presence,
          |  uterine
          |irritabilit
birthweig |     y
ht<2500g  |    0     1
----------+-----------
        0 |  116    14
        1 |   45    14
----------------------

. tab low ui

           |   presence, uterine
birthweigh |     irritability
   t<2500g |         0          1 |     Total
-----------+----------------------+----------
         0 |       116         14 |       130
         1 |        45         14 |        59
-----------+----------------------+----------
     Total |       161         28 |       189
```

```
.
. * a 3-way table.
.
. table low ui ht, contents(freq)

-------------------------------------
          |      has history of
          |     hypertension and
          |    presence, uterine
          |       irritability
birthweig | ---- 0 ---    ---- 1 ---
ht<2500g  |    0     1       0     1
----------+--------------------------
        0 |  111    14       5
        1 |   38    14       7
-------------------------------------

.
. * alternative commands for a 3-way table
.
. sort ht

. by ht: tab low ui

-------------------------------------------------------------------------------------------------------------------------------------------
-> ht = 0

           |   presence, uterine
birthweigh |     irritability
   t<2500g |         0          1 |     Total
-----------+----------------------+----------
         0 |       111         14 |       125
         1 |        38         14 |        52
-----------+----------------------+----------
     Total |       149         28 |       177

-------------------------------------------------------------------------------------------------------------------------------------------
-> ht = 1

           | presence,
           |  uterine
           | irritabili
birthweigh |     ty
   t<2500g |         0 |     Total
-----------+-----------+----------
         0 |         5 |         5
         1 |         7 |         7
-----------+-----------+----------
     Total |        12 |        12


.
. * a 4-way table.
.
. table low ui ht, by(race)  contents(freq)

-------------------------------------
          |      has history of
          |     hypertension and
          |    presence, uterine
race and  |       irritability
birthweig | ---- 0 ---    ---- 1 ---
ht<2500g  |    0     1       0     1
----------+--------------------------
white     |
        0 |   62     8       3
        1 |   16     5       2
----------+--------------------------
black     |
        0 |   13     1       1
        1 |    7     2       2
----------+--------------------------
other     |
        0 |   36     5       1
        1 |   15     7       3
-------------------------------------

.
. * alterntive commands for a 4-way table
. sort race ht

. by race ht: tab low ui

-------------------------------------------------------------------------------------------------------------------------------------------
-> race = white, ht = 0

           |   presence, uterine
```

```
birthweigh |     irritability
   t<2500g |         0          1 |     Total
-----------+----------------------+----------
         0 |        62          8 |        70
         1 |        16          5 |        21
-----------+----------------------+----------
     Total |        78         13 |        91

-------------------------------------------------------------------------------------------------------------------------------
-> race = white, ht = 1

           | presence,
           |  uterine
           | irritabili
birthweigh |     ty
   t<2500g |         0 |     Total
-----------+-----------+----------
         0 |         3 |         3
         1 |         2 |         2
-----------+-----------+----------
     Total |         5 |         5

-------------------------------------------------------------------------------------------------------------------------------
-> race = black, ht = 0

           |   presence, uterine
birthweigh |     irritability
   t<2500g |         0          1 |     Total
-----------+----------------------+----------
         0 |        13          1 |        14
         1 |         7          2 |         9
-----------+----------------------+----------
     Total |        20          3 |        23

-------------------------------------------------------------------------------------------------------------------------------
-> race = black, ht = 1

           | presence,
           |  uterine
           | irritabili
birthweigh |     ty
   t<2500g |         0 |     Total
-----------+-----------+----------
         0 |         1 |         1
         1 |         2 |         2
-----------+-----------+----------
     Total |         3 |         3

-------------------------------------------------------------------------------------------------------------------------------
-> race = other, ht = 0

           |   presence, uterine
birthweigh |     irritability
   t<2500g |         0          1 |     Total
-----------+----------------------+----------
         0 |        36          5 |        41
         1 |        15          7 |        22
-----------+----------------------+----------
     Total |        51         12 |        63

-------------------------------------------------------------------------------------------------------------------------------
-> race = other, ht = 1

           | presence,
           |  uterine
           | irritabili
birthweigh |     ty
   t<2500g |         0 |     Total
-----------+-----------+----------
         0 |         1 |         1
         1 |         3 |         3
-----------+-----------+----------
     Total |         4 |         4



.
.
. ********************************************************
. *  Test the Chi-Square association for a two-way table
. ********************************************************
.
. tab2 low ui, mis chi lrchi2 exac

-> tabulation of low by ui

           |   presence, uterine
birthweigh |     irritability
```

```
   t<2500g |         0          1 |     Total
-----------+----------------------+----------
         0 |       116         14 |       130
         1 |        45         14 |        59
-----------+----------------------+----------
     Total |       161         28 |       189

          Pearson chi2(1) =   5.4008   Pr = 0.020
 likelihood-ratio chi2(1) =   5.0761   Pr = 0.024
           Fisher's exact =                 0.027
   1-sided Fisher's exact =                 0.020

.
.
. ************************************************
. *  Test the Chi-Square association for a three-way table
. ************************************************
.
. * testing the main effect of three variables only
. ipf, fit(low+ui+ht)
Deleting all matrices......

Expansion of the various marginal models
----------------------------------------
marginal model 1 varlist :  low
marginal model 2 varlist :  ui
marginal model 3 varlist :  ht
unique varlist  low ui ht

------------------------------------------------------------------------
N.B.  structural/sampling zeroes may lead to an incorrect df
Residual degrees of freedom = 4

Loglikelihood = 560.3790275675462
Loglikelihood = 560.3790275675462

Goodness of Fit Tests
---------------------
df = 4
Likelihood Ratio Statistic G^2 =  14.3385 p-value = 0.006
Pearson Statistic          X^2 =  14.2036 p-value = 0.007
(Hosmer & Lemeshow data)

.
. *testing the main effects of three variables
. * and one interaction term between low and ui
. ipf, fit (low+ui+ht+ low*ui)
Deleting all matrices......

Expansion of the various marginal models
----------------------------------------
marginal model 1 varlist :  low
marginal model 2 varlist :  ui
marginal model 3 varlist :  ht
marginal model 4 varlist :  low ui
unique varlist  low ui ht

------------------------------------------------------------------------
N.B.  structural/sampling zeroes may lead to an incorrect df
Residual degrees of freedom = 3

Loglikelihood = 562.9170760539813
Loglikelihood = 562.9170760539813

Goodness of Fit Tests
---------------------
df = 3
Likelihood Ratio Statistic G^2 =   9.2624 p-value = 0.026
Pearson Statistic          X^2 =   9.1237 p-value = 0.028
(Hosmer & Lemeshow data)

.
.
.
.
.
. *************************
. * Logistic Regression
. *************************
.
. webuse lbw, clear
(Hosmer & Lemeshow data)

. des

Contains data from http://www.stata-press.com/data/r15/lbw.dta
  obs:           189                          Hosmer & Lemeshow data
 vars:            11                          15 Jan 2016 05:01
```

```
 size:         2,646
-------------------------------------------------------------------------------------------------------------------------------
              storage   display    value
variable name   type    format     label      variable label
-------------------------------------------------------------------------------------------------------------------------------
id              int     %8.0g                 identification code
low             byte    %8.0g                 birthweight<2500g
age             byte    %8.0g                 age of mother
lwt             int     %8.0g                 weight at last menstrual period
race            byte    %8.0g      race       race
smoke           byte    %9.0g      smoke      smoked during pregnancy
ptl             byte    %8.0g                 premature labor history (count)
ht              byte    %8.0g                 has history of hypertension
ui              byte    %8.0g                 presence, uterine irritability
ftv             byte    %8.0g                 number of visits to physician during 1st trimester
bwt             int     %8.0g                 birthweight (grams)
-------------------------------------------------------------------------------------------------------------------------------
Sorted by:

. list in 1/20

     +--------------------------------------------------------------------------+
     |  id   low   age   lwt    race       smoke   ptl   ht   ui   ftv    bwt |
     |--------------------------------------------------------------------------|
  1. |  85     0    19   182   black   nonsmoker     0    0    1     0   2523 |
  2. |  86     0    33   155   other   nonsmoker     0    0    0     3   2551 |
  3. |  87     0    20   105   white      smoker     0    0    0     1   2557 |
  4. |  88     0    21   108   white      smoker     0    0    1     2   2594 |
  5. |  89     0    18   107   white      smoker     0    0    1     0   2600 |
     |--------------------------------------------------------------------------|
  6. |  91     0    21   124   other   nonsmoker     0    0    0     0   2622 |
  7. |  92     0    22   118   white   nonsmoker     0    0    0     1   2637 |
  8. |  93     0    17   103   other   nonsmoker     0    0    0     1   2637 |
  9. |  94     0    29   123   white      smoker     0    0    0     1   2663 |
 10. |  95     0    26   113   white      smoker     0    0    0     0   2665 |
     |--------------------------------------------------------------------------|
 11. |  96     0    19    95   other   nonsmoker     0    0    0     0   2722 |
 12. |  97     0    19   150   other   nonsmoker     0    0    0     1   2733 |
 13. |  98     0    22    95   other   nonsmoker     0    1    0     0   2750 |
 14. |  99     0    30   107   other   nonsmoker     1    0    1     2   2750 |
 15. | 100     0    18   100   white      smoker     0    0    0     0   2769 |
     |--------------------------------------------------------------------------|
 16. | 101     0    18   100   white      smoker     0    0    0     0   2769 |
 17. | 102     0    15    98   black   nonsmoker     0    0    0     0   2778 |
 18. | 103     0    25   118   white      smoker     0    0    0     3   2782 |
 19. | 104     0    20   120   other   nonsmoker     0    0    1     0   2807 |
 20. | 105     0    28   120   white      smoker     0    0    0     1   2821 |
     +--------------------------------------------------------------------------+

.
. * look at the regression coefficients
. logit low age lwt i.race smoke ptl ht ui

Iteration 0:   log likelihood =   -117.336
Iteration 1:   log likelihood = -101.28644
Iteration 2:   log likelihood = -100.72617
Iteration 3:   log likelihood =   -100.724
Iteration 4:   log likelihood =   -100.724

Logistic regression                             Number of obs     =        189
                                                LR chi2(8)        =      33.22
                                                Prob > chi2       =     0.0001
Log likelihood =   -100.724                     Pseudo R2         =     0.1416

------------------------------------------------------------------------------
         low |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0271003   .0364504    -0.74   0.457    -.0985418    .0443412
         lwt |  -.0151508   .0069259    -2.19   0.029    -.0287253   -.0015763
             |
        race |
       black |   1.262647   .5264101     2.40   0.016     .2309024    2.294392
       other |   .8620792   .4391532     1.96   0.050     .0013548    1.722804
             |
       smoke |   .9233448   .4008266     2.30   0.021      .137739    1.708951
         ptl |   .5418366    .346249     1.56   0.118     -.136799    1.220472
          ht |   1.832518   .6916292     2.65   0.008     .4769494    3.188086
          ui |   .7585135   .4593768     1.65   0.099    -.1418484    1.658875
       _cons |   .4612239    1.20459     0.38   0.702    -1.899729    2.822176
------------------------------------------------------------------------------

.
. * Look at the odds ratio
. logit low age lwt i.race smoke ptl ht ui,or

Iteration 0:   log likelihood =   -117.336
Iteration 1:   log likelihood = -101.28644
Iteration 2:   log likelihood = -100.72617
```

```
Iteration 3:   log likelihood =   -100.724
Iteration 4:   log likelihood =   -100.724

Logistic regression                             Number of obs     =        189
                                                LR chi2(8)        =      33.22
                                                Prob > chi2       =     0.0001
Log likelihood =   -100.724                     Pseudo R2         =     0.1416

------------------------------------------------------------------------------
         low | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .9732636   .0354759    -0.74   0.457     .9061578    1.045339
         lwt |   .9849634   .0068217    -2.19   0.029     .9716834    .9984249
             |
        race |
       black |   3.534767   1.860737     2.40   0.016     1.259736    9.918406
       other |   2.368079   1.039949     1.96   0.050     1.001356    5.600207
             |
       smoke |   2.517698    1.00916     2.30   0.021     1.147676    5.523162
         ptl |   1.719161   .5952579     1.56   0.118     .8721455    3.388787
          ht |   6.249602   4.322408     2.65   0.008     1.611152    24.24199
          ui |     2.1351   .9808153     1.65   0.099     .8677528      5.2534
       _cons |   1.586014   1.910496     0.38   0.702     .1496092     16.8134
------------------------------------------------------------------------------
Note: _cons estimates baseline odds.

.
. * look at the predicted probability
.
. margins i.race, atmeans

Adjusted predictions                            Number of obs     =        189
Model VCE    : OIM

Expression   : Pr(low), predict()
at           : age             =     23.2381 (mean)
               lwt             =    129.8201 (mean)
               1.race          =    .5079365 (mean)
               2.race          =    .1375661 (mean)
               3.race          =    .3544974 (mean)
               smoke           =    .3915344 (mean)
               ptl             =    .1957672 (mean)
               ht              =    .0634921 (mean)
               ui              =    .1481481 (mean)

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        race |
       white |    .191685   .0454474     4.22   0.000     .1026096    .2807603
       black |   .4560013    .107471     4.24   0.000      .245362    .6666405
       other |   .3596187   .0695116     5.17   0.000     .2233784     .495859
------------------------------------------------------------------------------


.
. ************************
. * Ordered Logistic Regression
. ************************
.
.
. use "http://fmwww.bc.edu/repec/bocode/g/gss.dta", clear
(General Social Surveys, 1972-2004 [Cumulative File])

. recode degree 4=3
(degree: 870 changes made)

. label define degree 0 "lt high school" 1 "high school"  ///
> 2 "junior college" 3 "college", modify

. label value degree degre

. save d:\temp\order.dta, replace
file d:\temp\order.dta saved

.
.
.
. use d:\temp\order.dta, clear
(General Social Surveys, 1972-2004 [Cumulative File])

. des

Contains data from d:\temp\order.dta
  obs:        13,421                          General Social Surveys, 1972-2004 [Cumulative File]
 vars:            11                          30 Sep 2019 11:23
 size:       268,420
-------------------------------------------------------------------------------------------------------------------------------
```

```
              storage   display    value
variable name   type    format     label      variable label
------------------------------------------------------------------------------------------------------------------------
sibs            int     %8.0g      SIBS       NUMBER OF BROTHERS AND SISTERS
paeduc          int     %8.0g      PAEDUC     HIGHEST YEAR SCHOOL COMPLETED, FATHER
degree          int     %8.0g      degre      RS HIGHEST DEGREE
coh             float   %9.0g                 (year of birth-1900)/10
paeducXcoh      float   %9.0g                 interaction term paeduc and coh
black           byte    %8.0g
south           byte    %8.0g                 lived in South when 16 yrs old
country         byte    %8.0g                 lived in the countryside when 16 yrs old
town            byte    %8.0g                 lived in a town when 16 yrs old
suburb          byte    %8.0g                 lived in a suburb when 16 yrs old
city            byte    %8.0g                 lived in a city when 16 yrs old
------------------------------------------------------------------------------------------------------------------------
Sorted by:

. list in 1/20

     +-------------------------------------------------------------------------------------------+
     | sibs   paeduc   degree   coh   paeduc~h   black   south   country   town   suburb   city |
     |-------------------------------------------------------------------------------------------|
  1. |    3       10        0   7.5         75       1       0         0      0        0      1 |
  2. |    8       12        1   6.9       82.8       0       0         0      0        0      1 |
  3. |    2       20        3   5.7        114       0       0         0      0        1      0 |
  4. |    1       12        3   4.6       55.2       0       0         0      0        0      1 |
  5. |    1       20        3   4.7         94       0       0         0      0        0      1 |
     |-------------------------------------------------------------------------------------------|
  6. |    1       20        3   5.1        102       0       0         0      0        0      1 |
  7. |    1       12        1   4.3       51.6       0       0         0      0        0      1 |
  8. |    1        .        1   5.1          .       0       0         0      0        0      1 |
  9. |    4        .        1   7.8          .       0       0         0      0        0      1 |
 10. |    1        6        3   4.1       24.6       0       0         0      0        1      0 |
     |-------------------------------------------------------------------------------------------|
 11. |    0       12        1   6.7   80.39999       1       0         0      0        1      0 |
 12. |    3       16        3   4.9       78.4       0       0         0      0        1      0 |
 13. |    2       18        3   5.6      100.8       0       0         0      0        1      0 |
 14. |    1        .        3   4.5          .       0       0         0      0        1      0 |
 15. |    3       13        3   7.1       92.3       1       0         0      0        0      1 |
     |-------------------------------------------------------------------------------------------|
 16. |    3       19        3   5.1       96.9       0       0         0      0        1      0 |
 17. |    4        .        1   5.9          .       1       0         0      0        0      1 |
 18. |    3       16        2   6.3      100.8       1       0         0      0        1      0 |
 19. |    3       12        1   5.9       70.8       0       0         0      0        0      1 |
 20. |    4       13        1   4.9       63.7       0       0         0      0        1      0 |
     +-------------------------------------------------------------------------------------------+


.
. * look at the regression coefficients
. ologit degree south c.coh##c.coh i.black paeduc

Iteration 0:   log likelihood = -10760.575
Iteration 1:   log likelihood = -9652.5572
Iteration 2:   log likelihood = -9607.9033
Iteration 3:   log likelihood = -9607.8172
Iteration 4:   log likelihood = -9607.8172

Ordered logistic regression                     Number of obs     =      9,842
                                                LR chi2(5)        =    2305.52
                                                Prob > chi2       =     0.0000
Log likelihood = -9607.8172                     Pseudo R2         =     0.1071

------------------------------------------------------------------------------
      degree |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       south |  -.2149473   .0453659    -4.74   0.000    -.3038629   -.1260317
         coh |   .9441331    .094664     9.97   0.000      .758595    1.129671
             |
 c.coh#c.coh |  -.0807872    .009825    -8.22   0.000    -.1000439   -.0615305
             |
     1.black |  -.2735195   .0659511    -4.15   0.000    -.4027812   -.1442578
      paeduc |   .2210988   .0060387    36.61   0.000     .2092632    .2329345
-------------+----------------------------------------------------------------
       /cut1 |   2.281408   .2208443                      1.848562    2.714255
       /cut2 |   5.739266   .2300848                      5.288308    6.190224
       /cut3 |   6.144107   .2307705                      5.691805    6.596408
------------------------------------------------------------------------------


.
. * Look at the odds ratio
. ologit degree south c.coh##c.coh i.black paeduc, or

Iteration 0:   log likelihood = -10760.575
Iteration 1:   log likelihood = -9652.5572
Iteration 2:   log likelihood = -9607.9033
Iteration 3:   log likelihood = -9607.8172
Iteration 4:   log likelihood = -9607.8172
```

```
Ordered logistic regression                     Number of obs     =      9,842
                                                LR chi2(5)        =    2305.52
                                                Prob > chi2       =     0.0000
Log likelihood = -9607.8172                     Pseudo R2         =     0.1071

------------------------------------------------------------------------------
      degree | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       south |    .806584   .0365914    -4.74   0.000      .737962    .8815869
         coh |   2.570584   .2433419     9.97   0.000     2.135274    3.094639
             |
 c.coh#c.coh |     .92239   .0090625    -8.22   0.000     .9047977    .9403242
             |
     1.black |   .7606975   .0501688    -4.15   0.000     .6684583    .8656646
      paeduc |   1.247447    .007533    36.61   0.000     1.232769    1.262299
-------------+----------------------------------------------------------------
       /cut1 |   2.281408   .2208443                      1.848562    2.714255
       /cut2 |   5.739266   .2300848                      5.288308    6.190224
       /cut3 |   6.144107   .2307705                      5.691805    6.596408
------------------------------------------------------------------------------
Note: Estimates are transformed only in the first equation.

.
. * look at the predicted probability
. margins i.black, atmeans

Adjusted predictions                            Number of obs     =      9,842
Model VCE    : OIM

1._predict   : Pr(degree==0), predict(pr outcome(0))
2._predict   : Pr(degree==1), predict(pr outcome(1))
3._predict   : Pr(degree==2), predict(pr outcome(2))
4._predict   : Pr(degree==3), predict(pr outcome(3))
at           : south           =    .3250356 (mean)
               coh             =    4.894605 (mean)
               0.black         =    .8766511 (mean)
               1.black         =    .1233489 (mean)
               paeduc          =      10.804 (mean)

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_predict#black |
          1 0  |   .0616178   .0025327    24.33   0.000     .0566538    .0665819
          1 1  |   .0794615   .0051826    15.33   0.000     .0693037    .0896193
          2 0  |   .6142074   .0061163   100.42   0.000     .6022196    .6261952
          2 1  |   .6532006   .0092061    70.95   0.000      .635157    .6712442
          3 0  |   .0817612   .0030376    26.92   0.000     .0758076    .0877148
          3 1  |   .0715785   .0035063    20.41   0.000     .0647062    .0784507
          4 0  |   .2424136   .0056522    42.89   0.000     .2313354    .2534917
          4 1  |   .1957594   .0103568    18.90   0.000     .1754605    .2160583
------------------------------------------------------------------------------

.
.
.
. ************************************
. * Sequential logistic Regression
. ************************************
.
.
.
.    use d:\temp\order.dta, clear
(General Social Surveys, 1972-2004 [Cumulative File])

.     des

Contains data from d:\temp\order.dta
  obs:        13,421                          General Social Surveys, 1972-2004 [Cumulative File]
 vars:            11                          30 Sep 2019 11:23
 size:       268,420
-------------------------------------------------------------------------------------------------------------------------------
              storage   display    value
variable name   type    format     label      variable label
-------------------------------------------------------------------------------------------------------------------------------
sibs            int     %8.0g      SIBS       NUMBER OF BROTHERS AND SISTERS
paeduc          int     %8.0g      PAEDUC     HIGHEST YEAR SCHOOL COMPLETED, FATHER
degree          int     %8.0g      degre      RS HIGHEST DEGREE
coh             float   %9.0g                 (year of birth-1900)/10
paeducXcoh      float   %9.0g                 interaction term paeduc and coh
black           byte    %8.0g
south           byte    %8.0g                 lived in South when 16 yrs old
country         byte    %8.0g                 lived in the countryside when 16 yrs old
town            byte    %8.0g                 lived in a town when 16 yrs old
suburb          byte    %8.0g                 lived in a suburb when 16 yrs old
city            byte    %8.0g                 lived in a city when 16 yrs old
-------------------------------------------------------------------------------------------------------------------------------
```

Sorted by:

```
.     list in 1/20
```

	sibs	paeduc	degree	coh	paeduc~h	black	south	country	town	suburb	city
1.	3	10	0	7.5	75	1	0	0	0	0	1
2.	8	12	1	6.9	82.8	0	0	0	0	0	1
3.	2	20	3	5.7	114	0	0	0	0	1	0
4.	1	12	3	4.6	55.2	0	0	0	0	0	1
5.	1	20	3	4.7	94	0	0	0	0	0	1
6.	1	20	3	5.1	102	0	0	0	0	0	1
7.	1	12	1	4.3	51.6	0	0	0	0	0	1
8.	1	.	1	5.1	.	0	0	0	0	0	1
9.	4	.	1	7.8	.	0	0	0	0	0	1
10.	1	6	3	4.1	24.6	0	0	0	0	1	0
11.	0	12	1	6.7	80.39999	1	0	0	0	1	0
12.	3	16	3	4.9	78.4	0	0	0	0	1	0
13.	2	18	3	5.6	100.8	0	0	0	0	1	0
14.	1	.	3	4.5	.	0	0	0	0	1	0
15.	3	13	3	7.1	92.3	1	0	0	0	0	1
16.	3	19	3	5.1	96.9	0	0	0	0	1	0
17.	4	.	1	5.9	.	1	0	0	0	0	1
18.	3	16	2	6.3	100.8	1	0	0	0	1	0
19.	3	12	1	5.9	70.8	0	0	0	0	0	1
20.	4	13	1	4.9	63.7	0	0	0	0	1	0

```
.     seqlogit degree south c.coh##c.coh if black == 0 ,     ///
>     tree(0 : 1 2 3 , 1 : 2 3 , 2 : 3 )                     ///
>     ofinterest(paeduc)  over(c.coh##c.coh)                 ///
>     levels(0=9, 1=12, 2=14, 3=16)

Transition tree:

Transition 1: 0 : 1 2 3
Transition 2: 1 : 2 3
Transition 3: 2 : 3

Computing starting values for:

Transition 1
Transition 2
Transition 3

Iteration 0:   log likelihood = -8210.5689
Iteration 1:   log likelihood = -8210.5689

                                              Number of obs     =      8,628
                                              LR chi2(18)       =    2184.02
Log likelihood = -8210.5689                   Prob > chi2       =     0.0000

------------------------------------------------------------------------------
             degree |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
--------------------+---------------------------------------------------------
_1_2_3v0            |
              south |  -.7348171   .0831112    -8.84   0.000    -.8977121   -.5719222
                coh |   .4909053    .374101     1.31   0.189    -.2423191     1.22413
                    |
        c.coh#c.coh |  -.0289612   .0440321    -0.66   0.511    -.1152627    .0573402
                    |
             paeduc |   .0685306   .0844396     0.81   0.417    -.0969679    .2340291
                    |
      c.paeduc#c.coh |   .0718055   .0404933     1.77   0.076    -.0075599    .1511709
                    |
c.paeduc#c.coh#c.coh |  -.0072088   .0045803    -1.57   0.116    -.0161861    .0017684
                    |
              _cons |  -1.203447   .7443751    -1.62   0.106    -2.662396     .255501
--------------------+---------------------------------------------------------
_2_3v1              |
              south |    .004525   .0573868     0.08   0.937    -.1079511     .117001
                coh |   .3082506   .4567014     0.67   0.500    -.5868677    1.203369
                    |
        c.coh#c.coh |  -.0356673   .0487353    -0.73   0.464    -.1311868    .0598522
                    |
             paeduc |   .1393199   .0865966     1.61   0.108    -.0304064    .3090462
                    |
      c.paeduc#c.coh |   .0169894   .0371299     0.46   0.647    -.0557839    .0897627
                    |
c.paeduc#c.coh#c.coh |  -.0004602   .0038771    -0.12   0.906    -.0080591    .0071387
                    |
              _cons |  -3.633174    1.03597    -3.51   0.000    -5.663637    -1.60271
--------------------+---------------------------------------------------------
_3v2                |
```

```
              south |   .1002435   .1092198     0.92   0.359    -.1138233    .3143103
                coh |   .9567647   .9130258     1.05   0.295     -.832733    2.746262
                    |
        c.coh#c.coh |  -.1680158   .0945841    -1.78   0.076    -.3533973    .0173657
                    |
             paeduc |   .3321725   .1885094     1.76   0.078    -.0372991    .7016441
                    |
      c.paeduc#c.coh |  -.1180361   .0767987    -1.54   0.124    -.2685588    .0324867
                    |
c.paeduc#c.coh#c.coh |    .015099   .0077237     1.95   0.051    -.0000392    .0302372
                    |
               _cons |  -.7467388   2.158269    -0.35   0.729    -4.976867     3.48339
------------------------------------------------------------------------------

.
.
.     seqlogitdecomp, overat(coh 1.5,       ///
>                            coh 2.5,       ///
>                            coh 3.5,       ///
>                            coh 4.5,       ///
>                            coh 5.5,       ///
>                            coh 6.5)       ///
>         at(south 0 paeduc 12)             ///
>         yline(0) xline(0)                 ///
>         subtitle("1915" "1925" "1935"     ///
>                  "1945" "1955" "1965")    ///
>         eqlabel(`""less than high school" "versus" "high school or more""' ///
>                 `""high school" "versus" "any college""'                   ///
>                 `""junior college" "versus" "college""' )

At:

    variable |   value
-------------+---------
       south |       0
      paeduc |      12

Over:

    variable |   col 1    col 2    col 3    col 4    col 5    col 6
-------------+------------------------------------------------------
         coh |     1.5      2.5      3.5      4.5      5.5      6.5

.
.
. **********************
. * Multi-nomial Logistic Regression
. **********************
.
. use http://www.stata-press.com/data/r13/choice, clear

. keep if choice == 1
(590 observations deleted)

. des

Contains data from http://www.stata-press.com/data/r13/choice.dta
  obs:           295
 vars:             7                          3 Mar 2013 07:14
 size:         8,260
-------------------------------------------------------------------------------------------------------------------------------
              storage   display    value
variable name   type    format     label      variable label
-------------------------------------------------------------------------------------------------------------------------------
id              float   %9.0g
sex             float   %9.0g      sex
income          float   %9.0g
car             float   %9.0g      nation
size            float   %9.0g
choice          float   %9.0g
dealer          float   %9.0g
-------------------------------------------------------------------------------------------------------------------------------
Sorted by: id
     Note: Dataset has changed since last saved.

. list in 1/30

     +-----------------------------------------------------------+
     | id      sex   income        car   size   choice   dealer |
     |-----------------------------------------------------------|
  1. |  1     male     46.7     Europe      2        1        5 |
  2. |  2     male     26.1   American      3        1       17 |
  3. |  3     male     32.7   American      4        1       12 |
  4. |  4   female     49.2      Japan      2        1        7 |
  5. |  5     male     24.3   American      4        1       10 |
     |-----------------------------------------------------------|
  6. |  6   female       39   American      4        1       13 |
  7. |  7     male       33   American      2        1       24 |
```

```
  8. |  8     male     20.3   American      4        1        9 |
  9. |  9     male       38      Japan      3        1       10 |
 10. | 10   female     60.4   American      3        1       18 |
     |-----------------------------------------------------------|
 11. | 11     male       69   American      3        1       23 |
 12. | 12     male     27.7      Japan      1        1        9 |
 13. | 13     male       41      Japan      2        1       10 |
 14. | 14     male     65.6      Japan      4        1        4 |
 15. | 15     male     24.8   American      3        1       21 |
     |-----------------------------------------------------------|
 16. | 16     male     21.6   American      2        1       19 |
 17. | 17   female     43.3   American      1        1       23 |
 18. | 18   female     44.4      Japan      1        1       10 |
 19. | 19     male     45.3   American      4        1       17 |
 20. | 20     male     48.8   American      3        1       20 |
     |-----------------------------------------------------------|
 21. | 21     male     44.7     Europe      4        1        2 |
 22. | 22     male     57.5   American      1        1       24 |
 23. | 23     male       42   American      2        1       20 |
 24. | 24     male     40.5   American      1        1       23 |
 25. | 25     male     44.4   American      1        1       24 |
     |-----------------------------------------------------------|
 26. | 26   female     50.3   American      2        1       21 |
 27. | 27   female     41.1   American      4        1       13 |
 28. | 28     male       49      Japan      3        1       10 |
 29. | 29   female       43   American      3        1       21 |
 30. | 30     male     43.8     Europe      4        1        3 |
     +-----------------------------------------------------------+

.
.
.
.
. * obtain regression coefficients
. mlogit car i.sex income

Iteration 0:   log likelihood =  -259.1712
Iteration 1:   log likelihood = -252.81165
Iteration 2:   log likelihood = -252.72014
Iteration 3:   log likelihood = -252.72012

Multinomial logistic regression                 Number of obs     =        295
                                                LR chi2(4)        =      12.90
                                                Prob > chi2       =     0.0118
Log likelihood = -252.72012                     Pseudo R2         =     0.0249

------------------------------------------------------------------------------
         car |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
American     |  (base outcome)
-------------+----------------------------------------------------------------
Japan        |
         sex |
        male |  -.4694798   .3114939    -1.51   0.132    -1.079997    .1410371
      income |   .0276854   .0123666     2.24   0.025     .0034472    .0519236
       _cons |  -1.962651   .6216803    -3.16   0.002    -3.181122   -.7441801
-------------+----------------------------------------------------------------
Europe       |
         sex |
        male |   .5388443   .4525278     1.19   0.234     -.348094    1.425783
      income |    .027367    .013787     1.98   0.047      .000345    .0543889
       _cons |   -3.18003   .7546837    -4.21   0.000    -4.659182   -1.700877
------------------------------------------------------------------------------

.
. * obtain relative-risk ratios,
. mlogit car i.sex income, rrr

Iteration 0:   log likelihood =  -259.1712
Iteration 1:   log likelihood = -252.81165
Iteration 2:   log likelihood = -252.72014
Iteration 3:   log likelihood = -252.72012

Multinomial logistic regression                 Number of obs     =        295
                                                LR chi2(4)        =      12.90
                                                Prob > chi2       =     0.0118
Log likelihood = -252.72012                     Pseudo R2         =     0.0249

------------------------------------------------------------------------------
         car |        RRR   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
American     |  (base outcome)
-------------+----------------------------------------------------------------
Japan        |
         sex |
        male |   .6253275   .1947857    -1.51   0.132     .3395966    1.151467
      income |   1.028072   .0127138     2.24   0.025     1.003453    1.053295
       _cons |   .1404855   .0873371    -3.16   0.002      .041539    .4751237
```

```
-------------+----------------------------------------------------------------
Europe       |
         sex |
        male |   1.714025   .7756439     1.19   0.234     .7060325    4.161113
      income |   1.027745   .0141695     1.98   0.047     1.000345    1.055895
       _cons |   .0415844   .0313831    -4.21   0.000     .0094742    .1825234
------------------------------------------------------------------------------
Note: _cons estimates baseline relative risk for each outcome.

.
. * obtain predicted probability
. margins sex, atmeans

Adjusted predictions                            Number of obs     =        295
Model VCE    : OIM

1._predict   : Pr(car==American), predict(pr outcome(1))
2._predict   : Pr(car==Japan), predict(pr outcome(2))
3._predict   : Pr(car==Europe), predict(pr outcome(3))
at           : 0.sex           =    .2677966 (mean)
               1.sex           =    .7322034 (mean)
               income          =    42.09661 (mean)

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_predict#sex |
   1#female  |   .6320332   .0546148    11.57   0.000     .5249901    .7390763
     1#male  |   .6634214   .0327628    20.25   0.000     .5992075    .7276354
   2#female  |     .28479   .0508943     5.60   0.000     .1850391     .384541
     2#male  |   .1869313   .0269823     6.93   0.000      .134047    .2398155
   3#female  |   .0831768   .0305147     2.73   0.006      .023369    .1429846
     3#male  |   .1496473   .0246759     6.06   0.000     .1012835    .1980111
------------------------------------------------------------------------------

. margins, over(sex) dydx(income)

Average marginal effects                        Number of obs     =        295
Model VCE    : OIM

dy/dx w.r.t. : income
over         : sex
1._predict   : Pr(car==American), predict(pr outcome(1))
2._predict   : Pr(car==Japan), predict(pr outcome(2))
3._predict   : Pr(car==Europe), predict(pr outcome(3))

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
income       |
_predict#sex |
   1#female  |  -.0065398   .0025349    -2.58   0.010    -.0115082   -.0015714
     1#male  |  -.0059245   .0020821    -2.85   0.004    -.0100053   -.0018436
   2#female  |   .0050847   .0025689     1.98   0.048     .0000497    .0101198
     2#male  |   .0033167   .0017398     1.91   0.057    -.0000933    .0067266
   3#female  |    .001455   .0011789     1.23   0.217    -.0008556    .0037656
     3#male  |   .0026078   .0016367     1.59   0.111       -.0006    .0058156
------------------------------------------------------------------------------


.
. ***********************************
. * Conditional Logistic Regression
. ***********************************
.
. use http://www.stata-press.com/data/r13/union, clear
(NLS Women 14-24 in 1968)

. des

Contains data from http://www.stata-press.com/data/r13/union.dta
  obs:        26,200                          NLS Women 14-24 in 1968
 vars:             8                          4 May 2013 13:54
 size:       235,800
-------------------------------------------------------------------------------------------------------------------------------
              storage   display    value
variable name   type    format     label      variable label
-------------------------------------------------------------------------------------------------------------------------------
idcode          int     %8.0g                 NLS ID
year            byte    %8.0g                 interview year
age             byte    %8.0g                 age in current year
grade           byte    %8.0g                 current grade completed
not_smsa        byte    %8.0g                 1 if not SMSA
south           byte    %8.0g                 1 if south
union           byte    %8.0g                 1 if union
black           byte    %8.0g                 race black
```

```
Sorted by: idcode  year

. sort idcode

. list in 1/20, sepby(idcode)

     +-------------------------------------------------------------------+
     | idcode   year   age   grade   not_smsa   south   union   black |
     |-------------------------------------------------------------------|
  1. |      1     72    20      12          0       0       1       1 |
  2. |      1     77    25      12          0       0       0       1 |
  3. |      1     80    28      12          0       0       1       1 |
  4. |      1     83    31      12          0       0       1       1 |
  5. |      1     85    33      12          0       0       1       1 |
  6. |      1     87    35      12          0       0       1       1 |
  7. |      1     88    37      12          0       0       1       1 |
     |-------------------------------------------------------------------|
  8. |      2     71    19      12          0       0       0       1 |
  9. |      2     77    25      12          0       0       1       1 |
 10. |      2     78    26      12          0       0       1       1 |
 11. |      2     80    28      12          0       0       1       1 |
 12. |      2     82    30      12          0       0       1       1 |
 13. |      2     83    31      12          0       0       1       1 |
 14. |      2     85    33      12          0       0       1       1 |
 15. |      2     87    35      12          0       0       1       1 |
 16. |      2     88    37      12          0       0       1       1 |
     |-------------------------------------------------------------------|
 17. |      3     70    24      12          0       0       1       1 |
 18. |      3     71    25      12          0       0       0       1 |
 19. |      3     72    26      12          0       0       0       1 |
 20. |      3     73    27      12          0       0       0       1 |
     +-------------------------------------------------------------------+

.
.
. clogit union age grade not_smsa south black, group(idcode)
note: multiple positive outcomes within groups encountered.
note: 2,744 groups (14,165 obs) dropped because of all positive or
      all negative outcomes.
note: black omitted because of no within-group variance.

Iteration 0:   log likelihood = -4521.3385
Iteration 1:   log likelihood = -4516.1404
Iteration 2:   log likelihood = -4516.1385
Iteration 3:   log likelihood = -4516.1385

Conditional (fixed-effects) logistic regression

                                                Number of obs     =     12,035
                                                LR chi2(4)        =      68.09
                                                Prob > chi2       =     0.0000
Log likelihood = -4516.1385                     Pseudo R2         =     0.0075

------------------------------------------------------------------------------
       union |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0170301    .004146     4.11   0.000     .0089042    .0251561
       grade |   .0853572   .0418781     2.04   0.042     .0032777    .1674368
    not_smsa |   .0083678   .1127963     0.07   0.941    -.2127088    .2294445
       south |   -.748023   .1251752    -5.98   0.000    -.9933619   -.5026842
       black |          0  (omitted)
------------------------------------------------------------------------------

.
.
.
. ***************************
. * Nested Logistic Regression
. ***************************
.
. webuse restaurant

.
. des

Contains data from http://www.stata-press.com/data/r15/restaurant.dta
  obs:         2,100
 vars:             8                          2 Dec 2016 15:07
 size:        33,600
-------------------------------------------------------------------------------
              storage   display    value
variable name   type    format     label      variable label
-------------------------------------------------------------------------------
family_id       int     %9.0g                 family ID
restaurant      byte    %12.0g     names      choices of restaurants
income          int     %9.0g                 household income
cost            float   %9.0g                 average meal cost per person
```

```
kids            byte    %9.0g                 number of kids in the household
rating          byte    %9.0g                 ratings in local restaurant guide
distance        float   %9.0g                 distance between home and restaurant
chosen          byte    %9.0g                 0 no 1 yes
------------------------------------------------------------------------------------------------------------------------
Sorted by: family_id

.
. tab1 restaurant, mis

-> tabulation of restaurant

  choices of |
 restaurants |      Freq.     Percent        Cum.
-------------+-----------------------------------
   Freebirds |        300       14.29       14.29
  MamasPizza |        300       14.29       28.57
  CafeEccell |        300       14.29       42.86
 LosNortenos |        300       14.29       57.14
  WingsNmore |        300       14.29       71.43
Christophers |        300       14.29       85.71
     MadCows |        300       14.29      100.00
-------------+-----------------------------------
       Total |      2,100      100.00

.
. sort family_id restaurant

.
. list in 1/30, sepby(family_id)

     +-------------------------------------------------------------------------------+
     | family~d     restaurant   income       cost   kids   rating   distance   chosen |
     |-------------------------------------------------------------------------------|
  1. |        1      Freebirds       39   5.444695      1        0   1.245553        1 |
  2. |        1     MamasPizza       39    6.19446      1        1    2.82493        0 |
  3. |        1     CafeEccell       39   8.182085      1        2    4.21293        0 |
  4. |        1    LosNortenos       39   9.861741      1        3   4.167634        0 |
  5. |        1     WingsNmore       39   9.667909      1        2   6.330531        0 |
  6. |        1   Christophers       39   25.95777      1        4   10.19829        0 |
  7. |        1        MadCows       39   28.99846      1        5   5.601388        0 |
     |-------------------------------------------------------------------------------|
  8. |        2      Freebirds       58    5.26874      3        0   4.162657        0 |
  9. |        2     MamasPizza       58   5.728618      3        1   2.865081        0 |
 10. |        2     CafeEccell       58   7.054855      3        2   5.337799        0 |
 11. |        2    LosNortenos       58   10.78514      3        3   4.282864        1 |
 12. |        2     WingsNmore       58   8.313948      3        2   8.133914        0 |
 13. |        2   Christophers       58    21.2801      3        4   8.664631        0 |
 14. |        2        MadCows       58   25.87567      3        5   9.119597        0 |
     |-------------------------------------------------------------------------------|
 15. |        3      Freebirds       30   4.616315      3        0   2.112586        1 |
 16. |        3     MamasPizza       30   5.992166      3        1   2.215329        0 |
 17. |        3     CafeEccell       30   7.980528      3        2   6.978715        0 |
 18. |        3    LosNortenos       30    10.0605      3        3   5.117877        0 |
 19. |        3     WingsNmore       30    8.76644      3        2   5.312941        0 |
 20. |        3   Christophers       30   23.64499      3        4   9.551273        0 |
 21. |        3        MadCows       30   24.72128      3        5   5.539806        0 |
     |-------------------------------------------------------------------------------|
 22. |        4      Freebirds       24   4.974085      5        0   2.401803        0 |
 23. |        4     MamasPizza       24   6.244085      5        1   2.059263        0 |
 24. |        4     CafeEccell       24   8.451072      5        2   4.944536        0 |
 25. |        4    LosNortenos       24   10.14855      5        3   4.783116        1 |
 26. |        4     WingsNmore       24   9.105867      5        2   5.897751        0 |
 27. |        4   Christophers       24   22.22009      5        4   7.547688        0 |
 28. |        4        MadCows       24   26.61075      5        5    7.36597        0 |
     |-------------------------------------------------------------------------------|
 29. |        5      Freebirds       35   4.681487      0        0   2.669857        1 |
 30. |        5     MamasPizza       35   6.325174      0        1   4.312208        0 |
     +-------------------------------------------------------------------------------+

.
. nlogitgen type = restaurant(fast: Freebirds | MamasPizza, family:  CafeEccell | LosNortenos | WingsNmore, fancy: Chris
new variable type is generated with 3 groups
label list lb_type
lb_type:
           1 fast
           2 family
           3 fancy

.
. nlogittree restaurant type, choice(chosen) case(family_id)

tree structure specified for the nested logit model

 type    N      restaurant    N   k
----------------------------------
 fast   600 --- Freebirds    300  12
            +- MamasPizza    300  15
```

```
 family 900 --- CafeEccell   300  78
             |- LosNortenos  300  75
             +- WingsNmore   300  69
 fancy  600 --- Christophers 300  27
             +- MadCows      300  24
------------------------------------
                     total  2100 300

k = number of times alternative is chosen
N = number of observations at each level

Note: At least one case has only one alternative; nlogit will drop these cases.

.
. nlogit chosen cost distance rating || type: income kids, base(family) || restaurant:, noconst case(family_id)

tree structure specified for the nested logit model

 type    N      restaurant    N   k
------------------------------------
 fast   600 --- Freebirds    300  12
             +- MamasPizza   300  15
 family 900 --- CafeEccell   300  78
             |- LosNortenos  300  75
             +- WingsNmore   300  69
 fancy  600 --- Christophers 300  27
             +- MadCows      300  24
------------------------------------
                     total  2100 300

k = number of times alternative is chosen
N = number of observations at each level

Iteration 0:   log likelihood = -541.93581
Iteration 1:   log likelihood = -517.95909  (backed up)
Iteration 2:   log likelihood = -511.99261  (backed up)
Iteration 3:   log likelihood =  -506.5559  (backed up)
Iteration 4:   log likelihood = -501.33127  (backed up)
Iteration 5:   log likelihood = -492.93121  (backed up)
Iteration 6:   log likelihood = -491.75884
Iteration 7:   log likelihood = -490.81911
Iteration 8:   log likelihood = -489.56195
Iteration 9:   log likelihood = -488.58891
Iteration 10:  log likelihood = -485.68122
Iteration 11:  log likelihood = -485.59216
Iteration 12:  log likelihood = -485.56202
Iteration 13:  log likelihood = -485.51992
Iteration 14:  log likelihood = -485.48062
Iteration 15:  log likelihood = -485.47384
Iteration 16:  log likelihood = -485.47333
Iteration 17:  log likelihood = -485.47331

RUM-consistent nested logit regression         Number of obs      =      2,100
Case variable: family_id                       Number of cases    =        300

Alternative variable: restaurant               Alts per case: min =          7
                                                              avg =        7.0
                                                              max =          7

                                                  Wald chi2(7)    =      46.71
Log likelihood = -485.47331                       Prob > chi2     =     0.0000

------------------------------------------------------------------------------
      chosen |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
restaurant   |
        cost |  -.1843847   .0933975    -1.97   0.048    -.3674404   -.0013289
    distance |  -.3797474   .1003828    -3.78   0.000    -.5764941   -.1830007
      rating |    .463694   .3264935     1.42   0.156    -.1762215     1.10361
-------------+----------------------------------------------------------------
type equations
-------------+----------------------------------------------------------------
fast         |
      income |  -.0266038   .0117306    -2.27   0.023    -.0495952   -.0036123
        kids |  -.0872584   .1385026    -0.63   0.529    -.3587184    .1842016
-------------+----------------------------------------------------------------
family       |
      income |          0  (base)
        kids |          0  (base)
-------------+----------------------------------------------------------------
fancy        |
      income |   .0461827   .0090936     5.08   0.000     .0283595    .0640059
        kids |  -.3959413   .1220356    -3.24   0.001    -.6351267   -.1567559
-------------+----------------------------------------------------------------
dissimilarity parameters
-------------+----------------------------------------------------------------
type         |
   /fast_tau |   1.712878    1.48685                     -1.201295    4.627051
```

```
 /family_tau |   2.505113   .9646351                      .614463    4.395763
  /fancy_tau |   4.099844   2.810123                    -1.407896    9.607583
------------------------------------------------------------------------------
LR test for IIA (tau=1): chi2(3) = 6.87                  Prob > chi2 = 0.0762

.
.
.
. ****************************************
. * Alternative-Specific Conditional Logit
. ****************************************
. use http://www.stata-press.com/data/r13/choice, clear

.
. sort id car

. list in 1/30, sepby(id)

     +-------------------------------------------------------------+
     | id      sex   income        car   size   choice   dealer |
     |-------------------------------------------------------------|
  1. |  1     male     46.7   American      2        0       18 |
  2. |  1     male     46.7      Japan      2        0        8 |
  3. |  1     male     46.7     Europe      2        1        5 |
     |-------------------------------------------------------------|
  4. |  2     male     26.1   American      3        1       17 |
  5. |  2     male     26.1      Japan      3        0        6 |
  6. |  2     male     26.1     Europe      3        0        2 |
     |-------------------------------------------------------------|
  7. |  3     male     32.7   American      4        1       12 |
  8. |  3     male     32.7      Japan      4        0        6 |
  9. |  3     male     32.7     Europe      4        0        2 |
     |-------------------------------------------------------------|
 10. |  4   female     49.2   American      2        0       18 |
 11. |  4   female     49.2      Japan      2        1        7 |
 12. |  4   female     49.2     Europe      2        0        4 |
     |-------------------------------------------------------------|
 13. |  5     male     24.3   American      4        1       10 |
 14. |  5     male     24.3      Japan      4        0        7 |
 15. |  5     male     24.3     Europe      4        0        3 |
     |-------------------------------------------------------------|
 16. |  6   female       39   American      4        1       13 |
 17. |  6   female       39      Japan      4        0        4 |
 18. |  6   female       39     Europe      4        0        1 |
     |-------------------------------------------------------------|
 19. |  7     male       33   American      2        1       24 |
 20. |  7     male       33      Japan      2        0        7 |
 21. |  7     male       33     Europe      2        0        4 |
     |-------------------------------------------------------------|
 22. |  8     male     20.3   American      4        1        9 |
 23. |  8     male     20.3      Japan      4        0        3 |
 24. |  8     male     20.3     Europe      4        0        3 |
     |-------------------------------------------------------------|
 25. |  9     male       38   American      3        0       14 |
 26. |  9     male       38      Japan      3        1       10 |
 27. |  9     male       38     Europe      3        0        2 |
     |-------------------------------------------------------------|
 28. | 10   female     60.4   American      3        1       18 |
 29. | 10   female     60.4      Japan      3        0        5 |
 30. | 10   female     60.4     Europe      3        0        4 |
     +-------------------------------------------------------------+

. asclogit choice dealer, case(id) alternatives(car) casevars(sex income)

Iteration 0:   log likelihood = -273.55685
Iteration 1:   log likelihood = -252.75109
Iteration 2:   log likelihood = -250.78555
Iteration 3:   log likelihood =  -250.7794
Iteration 4:   log likelihood =  -250.7794

Alternative-specific conditional logit         Number of obs      =        885
Case variable: id                              Number of cases    =        295

Alternative variable: car                      Alts per case: min =          3
                                                              avg =        3.0
                                                              max =          3

                                                  Wald chi2(5)    =      15.86
Log likelihood =  -250.7794                       Prob > chi2     =     0.0072

------------------------------------------------------------------------------
      choice |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
car          |
      dealer |   .0680938   .0344465     1.98   0.048       .00058    .1356076
-------------+----------------------------------------------------------------
American     |  (base alternative)
-------------+----------------------------------------------------------------
```

```
Japan        |
         sex |  -.5346039   .3141564    -1.70   0.089    -1.150339    .0811314
      income |   .0325318    .012824     2.54   0.011     .0073973    .0576663
       _cons |  -1.352189   .6911829    -1.96   0.050    -2.706882    .0025049
-------------+----------------------------------------------------------------
Europe       |
         sex |   .5704109   .4540247     1.26   0.209    -.3194612    1.460283
      income |    .032042   .0138676     2.31   0.021      .004862    .0592219
       _cons |  -2.355249   .8526681    -2.76   0.006    -4.026448   -.6840501
------------------------------------------------------------------------------

.
.
. log close
      name:  <unnamed>
       log:  D:\Jason\workshop\Categorical data analysis\2019\categorical.log
  log type:  text
 closed on:  30 Sep 2019, 11:24:04
-------------------------------------------------------------------------------------------------------------------------------
```