

Limited dependent variable estimation in Stata 12 (Spring, 2013): v3

```

. //
. //
. //
. //
. // Binomial probit
. //
. // womenwk from IMEUS
. summarize work age married children education

```

| Variable  | Obs  | Mean   | Std. Dev. | Min | Max |
|-----------|------|--------|-----------|-----|-----|
| work      | 2000 | .6715  | .4697852  | 0   | 1   |
| age       | 2000 | 36.208 | 8.28656   | 20  | 59  |
| married   | 2000 | .6705  | .4701492  | 0   | 1   |
| children  | 2000 | 1.6445 | 1.398963  | 0   | 5   |
| education | 2000 | 13.084 | 3.045912  | 10  | 20  |

```

. probit work age married children education, nolog
Probit regression
Number of obs = 2000
LR chi2(4) = 478.32
Prob > chi2 = 0.0000
Pseudo R2 = 0.1889
Log likelihood = -1027.0616

```

|           | Coef.     | Std. Err. | z      | P> z  | [95% Conf. Interval] |           |
|-----------|-----------|-----------|--------|-------|----------------------|-----------|
| work      |           |           |        |       |                      |           |
| age       | .0347211  | .0042293  | 8.21   | 0.000 | .0264318             | .0430105  |
| married   | .4308575  | .074208   | 5.81   | 0.000 | .2854125             | .5763025  |
| children  | .4473249  | .0287417  | 15.56  | 0.000 | .3909922             | .5036576  |
| education | .0583645  | .0109742  | 5.32   | 0.000 | .0368555             | .0798735  |
| _cons     | -2.467365 | .1925635  | -12.81 | 0.000 | -2.844782            | -2.089948 |

```

. //
. //
. //
. //
. // Marginal effects (AMEs)
. //
. //
. margins, dydx(_all)
Average marginal effects
Model VCE : OIM
Number of obs = 2000
Expression : Pr(work), predict()
dy/dx w.r.t. : age married children education

```

|           | Delta-method |           |       |       |          | [95% Conf. Interval] |  |
|-----------|--------------|-----------|-------|-------|----------|----------------------|--|
|           | dy/dx        | Std. Err. | z     | P> z  |          |                      |  |
| age       | .0100768     | .0011647  | 8.65  | 0.000 | .0077941 | .0123595             |  |
| married   | .1250441     | .0210541  | 5.94  | 0.000 | .0837788 | .1663094             |  |
| children  | .1298233     | .0068418  | 18.98 | 0.000 | .1164137 | .1432329             |  |
| education | .0169386     | .0031183  | 5.43  | 0.000 | .0108269 | .0230504             |  |

```

. // marginal effects for specific values of explanatory variables
. margins, dydx(age married education) over(children)
Average marginal effects
Model VCE : OIM
Number of obs = 2000

```

Expression : Pr(work), predict()  
 dy/dx w.r.t. : age married education  
 over : children

|           |   | Delta-method |           |      |       |                      |
|-----------|---|--------------|-----------|------|-------|----------------------|
|           |   | dy/dx        | Std. Err. | z    | P> z  | [95% Conf. Interval] |
| age       |   |              |           |      |       |                      |
| children  |   |              |           |      |       |                      |
|           | 0 | .0122895     | .0013949  | 8.81 | 0.000 | .0095555 .0150236    |
|           | 1 | .0118794     | .0013592  | 8.74 | 0.000 | .0092154 .0145434    |
|           | 2 | .0103799     | .0011888  | 8.73 | 0.000 | .0080498 .0127099    |
|           | 3 | .0082797     | .0010587  | 7.82 | 0.000 | .0062047 .0103547    |
|           | 4 | .0038001     | .00063    | 6.03 | 0.000 | .0025652 .0050349    |
|           | 5 | .0009481     | .0002622  | 3.62 | 0.000 | .0004342 .001462     |
| married   |   |              |           |      |       |                      |
| children  |   |              |           |      |       |                      |
|           | 0 | .1525019     | .0259523  | 5.88 | 0.000 | .1016363 .2033675    |
|           | 1 | .1474125     | .0245563  | 6.00 | 0.000 | .099283 .1955419     |
|           | 2 | .1288045     | .0223317  | 5.77 | 0.000 | .0850352 .1725737    |
|           | 3 | .1027434     | .0178269  | 5.76 | 0.000 | .0678032 .1376835    |
|           | 4 | .0471552     | .0087329  | 5.40 | 0.000 | .0300391 .0642714    |
|           | 5 | .0117653     | .0029637  | 3.97 | 0.000 | .0059567 .017574     |
| education |   |              |           |      |       |                      |
| children  |   |              |           |      |       |                      |
|           | 0 | .0206581     | .0037314  | 5.54 | 0.000 | .0133447 .0279715    |
|           | 1 | .0199687     | .0036937  | 5.41 | 0.000 | .0127291 .0272083    |
|           | 2 | .017448      | .0032004  | 5.45 | 0.000 | .0111753 .0237207    |
|           | 3 | .0139178     | .0026805  | 5.19 | 0.000 | .008664 .0191715     |
|           | 4 | .0063877     | .0013844  | 4.61 | 0.000 | .0036743 .0091011    |
|           | 5 | .0015937     | .0005207  | 3.06 | 0.002 | .0005732 .0026143    |

```
. marginsplot, ylab(,angle(0)) legend(row(1))
  Variables that uniquely identify margins: children _deriv
. gr export ame1.pdf, replace
(file /Users/cfbaum/Documents/Courses - previous/Courses 2009-2010/EC327 S2010/
> ame1.pdf written in PDF format)
. margins, dydx(education) over(married children)
Average marginal effects      Number of obs =      2000
Model VCE      : OIM
Expression      : Pr(work), predict()
dy/dx w.r.t.    : education
over            : married children
```

|                  |     | Delta-method |           |      |       |                   |
|------------------|-----|--------------|-----------|------|-------|-------------------|
|                  |     | dy/dx        | Std. Err. | z    | P> z  | [95% Conf. Interv |
| > al]            |     |              |           |      |       |                   |
| education        |     |              |           |      |       |                   |
| married#children |     |              |           |      |       |                   |
|                  | 0 0 | .0171074     | .0032533  | 5.26 | 0.000 | .0107311 .0234    |

```

> 838
> 467
> 195
> 007
> 902
> 063
> 329
> 345
> 297
> 087
> 558
> 481

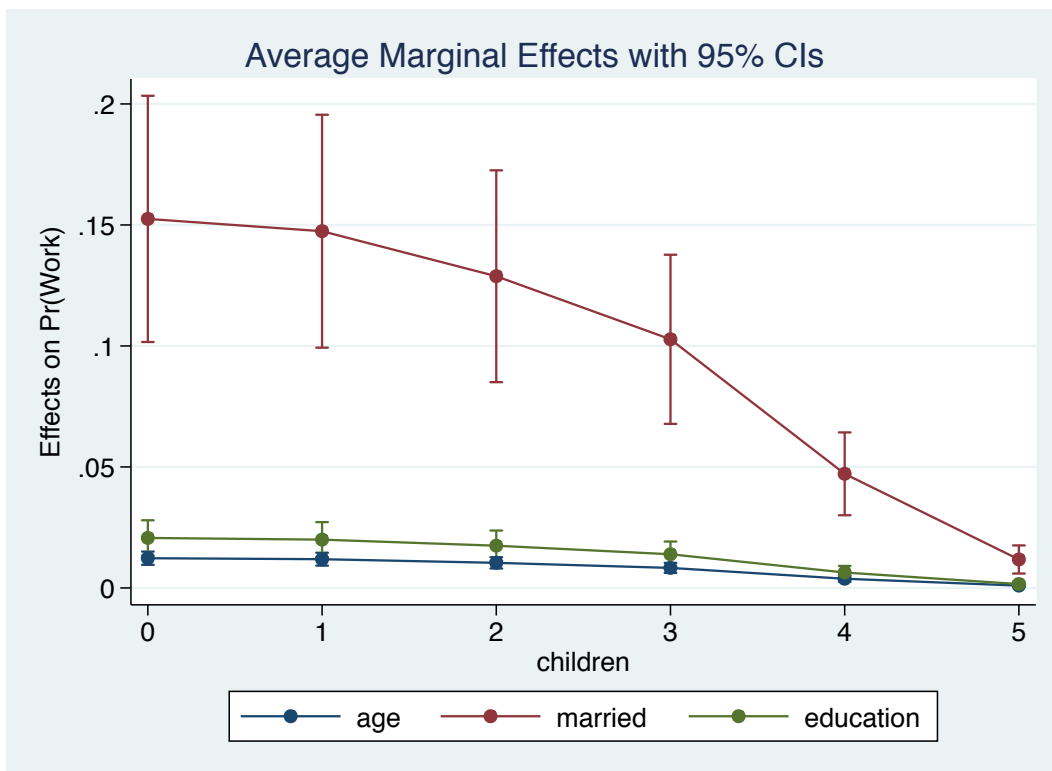
```

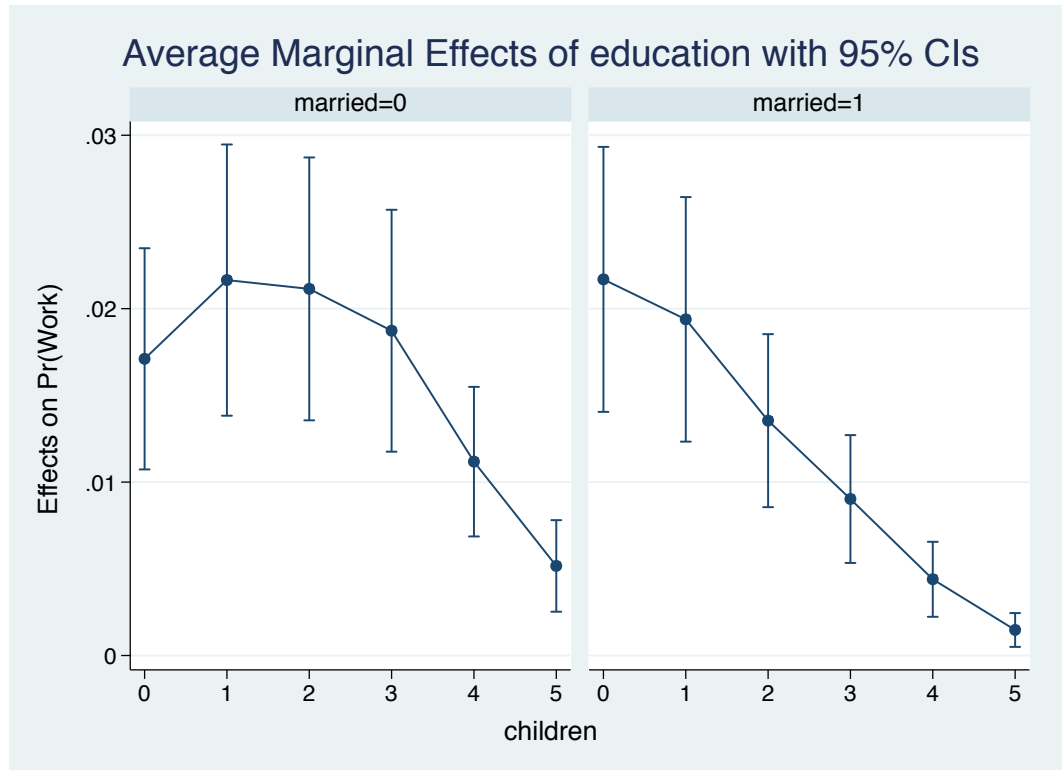
|   |   |  |          |          |      |       |          |       |
|---|---|--|----------|----------|------|-------|----------|-------|
| 0 | 1 |  | .0216477 | .0039896 | 5.43 | 0.000 | .0138283 | .029  |
| 0 | 2 |  | .0211407 | .0038668 | 5.47 | 0.000 | .0135619 | .0287 |
| 0 | 3 |  | .0187269 | .0035581 | 5.26 | 0.000 | .0117532 | .0257 |
| 0 | 4 |  | .0111781 | .0022001 | 5.08 | 0.000 | .0068866 | .0154 |
| 0 | 5 |  | .0051655 | .0013474 | 3.83 | 0.000 | .0025246 | .0078 |
| 1 | 0 |  | .0216887 | .0038982 | 5.56 | 0.000 | .0140483 | .029  |
| 1 | 1 |  | .0193831 | .0035977 | 5.39 | 0.000 | .0123317 | .0264 |
| 1 | 2 |  | .0135423 | .0025446 | 5.32 | 0.000 | .0085549 | .0185 |
| 1 | 3 |  | .0090232 | .0018804 | 4.80 | 0.000 | .0053378 | .0127 |
| 1 | 4 |  | .0043949 | .0011037 | 3.98 | 0.000 | .0022318 | .006  |
| 1 | 5 |  | .0014727 | .0004977 | 2.96 | 0.003 | .0004973 | .0024 |

```

. marginsplot, by(married) ylab(,angle(0))
Variables that uniquely identify margins: married children

```





```

. //
. //          Binomial logit
. //
. logit work age married children education, nolog
Logistic regression          Number of obs   =       2000
                             LR chi2(4)     =       476.62
                             Prob > chi2    =       0.0000
                             Pseudo R2     =       0.1882
Log likelihood = -1027.9144

```

| work      | Coef.     | Std. Err. | z      | P> z  | [95% Conf. Interval] |
|-----------|-----------|-----------|--------|-------|----------------------|
| age       | .0579303  | .007221   | 8.02   | 0.000 | .0437773 .0720833    |
| married   | .7417775  | .1264705  | 5.87   | 0.000 | .4938998 .9896552    |
| children  | .7644882  | .0515289  | 14.84  | 0.000 | .6634935 .865483     |
| education | .0982513  | .0186522  | 5.27   | 0.000 | .0616936 .134809     |
| _cons     | -4.159247 | .3320401  | -12.53 | 0.000 | -4.810034 -3.508461  |

```

. margins, dydx(_all)
Average marginal effects          Number of obs   =       2000
Model VCE      : OIM
Expression    : Pr(work), predict()
dy/dx w.r.t.  : age married children education

```

|           | Delta-method |           |        |       |                      |
|-----------|--------------|-----------|--------|-------|----------------------|
|           | dy/dx        | Std. Err. | z      | P> z  | [95% Conf. Interval] |
| age       | .0579303     | .007221   | 8.02   | 0.000 | .0437773 .0720833    |
| married   | .7417775     | .1264705  | 5.87   | 0.000 | .4938998 .9896552    |
| children  | .7644882     | .0515289  | 14.84  | 0.000 | .6634935 .865483     |
| education | .0982513     | .0186522  | 5.27   | 0.000 | .0616936 .134809     |
| _cons     | -4.159247    | .3320401  | -12.53 | 0.000 | -4.810034 -3.508461  |

| age       | .0099674 | .0011682 | 8.53  | 0.000 | .0076778 | .0122569 |
|-----------|----------|----------|-------|-------|----------|----------|
| married   | .127629  | .021152  | 6.03  | 0.000 | .0861717 | .1690862 |
| children  | .1315365 | .007073  | 18.60 | 0.000 | .1176736 | .1453994 |
| education | .0169049 | .0031243 | 5.41  | 0.000 | .0107814 | .0230285 |

```
. //
. //
. //           Ordered logit
. //
. // panel84extract from IMEUS
. // dia: change in Inc/Asset ratio, 1982-1983
. summarize rating83c ia83 dia
```

| Variable  | Obs | Mean     | Std. Dev. | Min       | Max      |
|-----------|-----|----------|-----------|-----------|----------|
| rating83c | 98  | 3.479592 | 1.17736   | 2         | 5        |
| ia83      | 98  | 10.11473 | 7.441946  | -13.08016 | 30.74564 |
| dia       | 98  | .7075242 | 4.711211  | -10.79014 | 20.05367 |

```
. tabulate rating83c
```

| Bond<br>rating,<br>1983 | Freq. | Percent | Cum.   |
|-------------------------|-------|---------|--------|
| BA_B_C                  | 26    | 26.53   | 26.53  |
| BAA                     | 28    | 28.57   | 55.10  |
| AA_A                    | 15    | 15.31   | 70.41  |
| AAA                     | 29    | 29.59   | 100.00 |
| Total                   | 98    | 100.00  |        |

```
. ologit rating83c ia83 dia, nolog
Ordered logistic regression           Number of obs =          98
LR chi2(2) =          11.54
Prob > chi2 =          0.0031
Pseudo R2 =          0.0434
Log likelihood = -127.27146
```

| rating83c | Coef.     | Std. Err. | z     | P> z  | [95% Conf. Interval] |
|-----------|-----------|-----------|-------|-------|----------------------|
| ia83      | .0939166  | .0296196  | 3.17  | 0.002 | .0358633 .1519699    |
| dia       | -.0866925 | .0449789  | -1.93 | 0.054 | -.1748496 .0014646   |
| /cut1     | -.1853053 | .3571432  |       |       | -.8852932 .5146826   |
| /cut2     | 1.185726  | .3882099  |       |       | .4248488 1.946604    |
| /cut3     | 1.908412  | .4164896  |       |       | 1.092108 2.724717    |

```
. predict spBA_B_C spBAA spAA_A spAAA
(option pr assumed; predicted probabilities)
. summarize spAAA,mean
. list sp* rating83c if spAAA==r(max)
```

|     | spBA_B_C | spBAA    | spAA_A   | spAAA    | rati-83c |
|-----|----------|----------|----------|----------|----------|
| 31. | .0388714 | .0985567 | .1096733 | .7528986 | AAA      |

```
. summarize spBA_B_C, mean
. list sp* rating83c if spBA_B_C=r(max)
```

|     | spBA_B_C | spBAA    | spAA_A   | spAAA    | rati-83c |
|-----|----------|----------|----------|----------|----------|
| 67. | .7158453 | .1926148 | .0449056 | .0466343 | AAA      |

```
. //
. // Poisson regression
. //
. use mus17data, clear
. summarize docvis private medicaid age age2 educyr actlim totchr, sep(0)
```

| Variable | Obs  | Mean     | Std. Dev. | Min  | Max  |
|----------|------|----------|-----------|------|------|
| docvis   | 3677 | 6.822682 | 7.394937  | 0    | 144  |
| private  | 3677 | .4966005 | .5000564  | 0    | 1    |
| medicaid | 3677 | .166712  | .3727692  | 0    | 1    |
| age      | 3677 | 74.24476 | 6.376638  | 65   | 90   |
| age2     | 3677 | 5552.936 | 958.9996  | 4225 | 8100 |
| educyr   | 3677 | 11.18031 | 3.827676  | 0    | 17   |
| actlim   | 3677 | .333152  | .4714045  | 0    | 1    |
| totchr   | 3677 | 1.843351 | 1.350026  | 0    | 8    |

```
. tab docvis
```

| # doctor visits | Freq. | Percent | Cum.  |
|-----------------|-------|---------|-------|
| 0               | 401   | 10.91   | 10.91 |
| 1               | 314   | 8.54    | 19.45 |
| 2               | 358   | 9.74    | 29.18 |
| 3               | 334   | 9.08    | 38.26 |
| 4               | 339   | 9.22    | 47.48 |
| 5               | 266   | 7.23    | 54.72 |
| 6               | 231   | 6.28    | 61.00 |
| 7               | 202   | 5.49    | 66.49 |
| 8               | 179   | 4.87    | 71.36 |
| 9               | 154   | 4.19    | 75.55 |
| 10              | 108   | 2.94    | 78.49 |
| 11              | 127   | 3.45    | 81.94 |
| 12              | 89    | 2.42    | 84.36 |
| 13              | 85    | 2.31    | 86.67 |
| 14              | 81    | 2.20    | 88.88 |
| 15              | 70    | 1.90    | 90.78 |
| 16              | 51    | 1.39    | 92.17 |
| 17              | 43    | 1.17    | 93.34 |
| 18              | 33    | 0.90    | 94.23 |
| 19              | 27    | 0.73    | 94.97 |
| 20              | 26    | 0.71    | 95.68 |
| 21              | 19    | 0.52    | 96.19 |
| 22              | 21    | 0.57    | 96.76 |
| 23              | 17    | 0.46    | 97.23 |
| 24              | 15    | 0.41    | 97.63 |
| 25              | 6     | 0.16    | 97.80 |
| 26              | 5     | 0.14    | 97.93 |

|     |    |      |        |
|-----|----|------|--------|
| 27  | 11 | 0.30 | 98.23  |
| 28  | 4  | 0.11 | 98.34  |
| 29  | 6  | 0.16 | 98.50  |
| 30  | 8  | 0.22 | 98.72  |
| 31  | 2  | 0.05 | 98.78  |
| 32  | 6  | 0.16 | 98.94  |
| 33  | 3  | 0.08 | 99.02  |
| 34  | 3  | 0.08 | 99.10  |
| 35  | 5  | 0.14 | 99.24  |
| 36  | 1  | 0.03 | 99.27  |
| 37  | 2  | 0.05 | 99.32  |
| 38  | 2  | 0.05 | 99.37  |
| 39  | 2  | 0.05 | 99.43  |
| 40  | 4  | 0.11 | 99.54  |
| 41  | 2  | 0.05 | 99.59  |
| 42  | 1  | 0.03 | 99.62  |
| 43  | 2  | 0.05 | 99.67  |
| 44  | 2  | 0.05 | 99.73  |
| 47  | 2  | 0.05 | 99.78  |
| 48  | 2  | 0.05 | 99.84  |
| 50  | 1  | 0.03 | 99.86  |
| 54  | 1  | 0.03 | 99.89  |
| 59  | 1  | 0.03 | 99.92  |
| 73  | 1  | 0.03 | 99.95  |
| 106 | 1  | 0.03 | 99.97  |
| 144 | 1  | 0.03 | 100.00 |

|       |       |        |
|-------|-------|--------|
| Total | 3,677 | 100.00 |
|-------|-------|--------|

```
. poisson docvis private medicaid age age2 educyr actlim totchr, nolog
```

```
Poisson regression          Number of obs =      3677
                             LR chi2(7)      =    4477.98
                             Prob > chi2     =      0.0000
Log likelihood = -15019.64   Pseudo R2      =      0.1297
```

| docvis   | Coef.     | Std. Err. | z      | P> z  | [95% Conf. Interval] |           |
|----------|-----------|-----------|--------|-------|----------------------|-----------|
| private  | .1422324  | .0143311  | 9.92   | 0.000 | .114144              | .1703208  |
| medicaid | .0970005  | .0189307  | 5.12   | 0.000 | .0598969             | .134104   |
| age      | .2936722  | .0259563  | 11.31  | 0.000 | .2427988             | .3445457  |
| age2     | -.0019311 | .0001724  | -11.20 | 0.000 | -.0022691            | -.0015931 |
| educyr   | .0295562  | .001882   | 15.70  | 0.000 | .0258676             | .0332449  |
| actlim   | .1864213  | .014566   | 12.80  | 0.000 | .1578726             | .2149701  |
| totchr   | .2483898  | .0046447  | 53.48  | 0.000 | .2392864             | .2574933  |
| _cons    | -10.18221 | .9720115  | -10.48 | 0.000 | -12.08732            | -8.277101 |

```
. // std errors may be biased in presence of overdispersion
. poisson docvis i.private i.medicaid age age2 educyr i.actlim totchr, ///
> nolog robust
```

```
Poisson regression          Number of obs =      3677
                             Wald chi2(7)    =      720.43
                             Prob > chi2     =      0.0000
Log pseudolikelihood = -15019.64   Pseudo R2      =      0.1297
```

| docvis | Coef. | Robust Std. Err. | z | P> z | [95% Conf. Interval] |  |
|--------|-------|------------------|---|------|----------------------|--|
|--------|-------|------------------|---|------|----------------------|--|

|            |           |          |       |       |           |           |
|------------|-----------|----------|-------|-------|-----------|-----------|
| 1.private  | .1422324  | .036356  | 3.91  | 0.000 | .070976   | .2134889  |
| 1.medicaid | .0970005  | .0568264 | 1.71  | 0.088 | -.0143773 | .2083783  |
| age        | .2936722  | .0629776 | 4.66  | 0.000 | .1702383  | .4171061  |
| age2       | -.0019311 | .0004166 | -4.64 | 0.000 | -.0027475 | -.0011147 |
| educyr     | .0295562  | .0048454 | 6.10  | 0.000 | .0200594  | .039053   |
| 1.actlim   | .1864213  | .0396569 | 4.70  | 0.000 | .1086953  | .2641474  |
| totchr     | .2483898  | .0125786 | 19.75 | 0.000 | .2237361  | .2730435  |
| _cons      | -10.18221 | 2.369212 | -4.30 | 0.000 | -14.82578 | -5.538638 |

```
. // average marginal effects
. margins, dydx(_all)
```

```
Average marginal effects          Number of obs   =       3677
Model VCE      : Robust
Expression    : Predicted number of events, predict()
dy/dx w.r.t. : 1.private 1.medicaid age age2 educyr 1.actlim totchr
```

|            | Delta-method |           |       |       |                      |
|------------|--------------|-----------|-------|-------|----------------------|
|            | dy/dx        | Std. Err. | z     | P> z  | [95% Conf. Interval] |
| 1.private  | .9701906     | .2473149  | 3.92  | 0.000 | .4854622 1.454919    |
| 1.medicaid | .6830664     | .4153252  | 1.64  | 0.100 | -.130956 1.497089    |
| age        | 2.003632     | .4303207  | 4.66  | 0.000 | 1.160219 2.847045    |
| age2       | -.0131753    | .0028473  | -4.63 | 0.000 | -.0187559 -.0075947  |
| educyr     | .2016526     | .0337805  | 5.97  | 0.000 | .1354441 .2678612    |
| 1.actlim   | 1.295942     | .2850588  | 4.55  | 0.000 | .7372367 1.854647    |
| totchr     | 1.694685     | .0908883  | 18.65 | 0.000 | 1.516547 1.872823    |

Note: dy/dx for factor levels is the discrete change from the base level.

```
. //
. //          negative binomial (NB) regression
. //
. nbreg docvis i.private i.medicaid age age2 educyr i.actlim totchr, nolog
Negative binomial regression          Number of obs   =       3677
                                      LR chi2(7)       =       773.44
Dispersion    = mean                  Prob > chi2     =       0.0000
Log likelihood = -10589.339           Pseudo R2      =       0.0352
```

| docvis     | Coef.     | Std. Err. | z     | P> z  | [95% Conf. Interval] |
|------------|-----------|-----------|-------|-------|----------------------|
| 1.private  | .1640928  | .0332186  | 4.94  | 0.000 | .0989856 .2292001    |
| 1.medicaid | .100337   | .0454209  | 2.21  | 0.027 | .0113137 .1893603    |
| age        | .2941294  | .0601588  | 4.89  | 0.000 | .1762203 .4120384    |
| age2       | -.0019282 | .0004004  | -4.82 | 0.000 | -.0027129 -.0011434  |
| educyr     | .0286947  | .0042241  | 6.79  | 0.000 | .0204157 .0369737    |
| 1.actlim   | .1895376  | .0347601  | 5.45  | 0.000 | .121409 .2576662     |
| totchr     | .2776441  | .0121463  | 22.86 | 0.000 | .2538378 .3014505    |
| _cons      | -10.29749 | 2.247436  | -4.58 | 0.000 | -14.70238 -5.892595  |
| /lnalpha   | -.4452773 | .0306758  |       |       | -.5054007 -.3851539  |
| alpha      | .6406466  | .0196523  |       |       | .6032638 .6803459    |

Likelihood-ratio test of alpha=0: chibar2(01) = 8860.60 Prob>=chibar2 = 0.000

```
. margins, dydx(_all)
```



Average marginal effects Number of obs = 3677  
Model VCE : OIM  
Expression : Predicted number of events, predict()  
dy/dx w.r.t. : 1.private 1.medicaid age age2 educyr 1.actlim totchr

Delta-method table with columns: dy/dx, Std. Err., z, P>|z|, [95% Conf. Interval]. Rows include variables like 1.private, 1.medicaid, age, age2, educyr, 1.actlim, totchr.

Note: dy/dx for factor levels is the discrete change from the base level.

```
. //
. // zero-inflated Poisson regression
. //
. use mus17data_z, replace
. summarize er age actlim totchr
```

Variable | Obs Mean Std. Dev. Min Max

er | 3677 .2774001 .6929326 0 10  
age | 3677 74.24476 6.376638 65 90  
actlim | 3677 .333152 .4714045 0 1  
totchr | 3677 1.843351 1.350026 0 8

```
. tab er
# Emergency Room Visits | Freq. Percent Cum.
```

0 | 2,967 80.69 80.69  
1 | 515 14.01 94.70  
2 | 128 3.48 98.18  
3 | 40 1.09 99.27  
4 | 15 0.41 99.67  
5 | 8 0.22 99.89  
6 | 2 0.05 99.95  
7 | 1 0.03 99.97  
10 | 1 0.03 100.00

Total | 3,677 100.00

. poisson er age actlim totchr, nolog

Poisson regression Number of obs = 3677  
LR chi2(3) = 355.22  
Prob > chi2 = 0.0000  
Log likelihood = -2433.4807 Pseudo R2 = 0.0680

Table with columns: er, Coef., Std. Err., z, P>|z|, [95% Conf. Interval]. Rows include variables age and actlim.

|        |           |          |       |       |           |           |
|--------|-----------|----------|-------|-------|-----------|-----------|
| totchr | .2439328  | .022543  | 10.82 | 0.000 | .1997493  | .2881162  |
| _cons  | -2.709086 | .3695379 | -7.33 | 0.000 | -3.433367 | -1.984805 |

```
. zip er age actlim totchr, inflate(age actlim totchr) nolog
Zero-inflated Poisson regression          Number of obs =      3677
                                           Nonzero obs  =       710
                                           Zero obs    =      2967
Inflation model = logit                  LR chi2(3)    =      24.74
Log likelihood = -2330.582                Prob > chi2   =      0.0000
```

| er             | Coef.     | Std. Err. | z     | P> z  | [95% Conf. Interval] |           |
|----------------|-----------|-----------|-------|-------|----------------------|-----------|
| <b>er</b>      |           |           |       |       |                      |           |
| age            | .0008593  | .0080323  | 0.11  | 0.915 | -.0148837            | .0166024  |
| actlim         | .2402562  | .1207042  | 1.99  | 0.047 | .0036804             | .476832   |
| totchr         | .1332187  | .0388752  | 3.43  | 0.001 | .0570247             | .2094128  |
| _cons          | -.8134282 | .6126304  | -1.33 | 0.184 | -2.014162            | .3873054  |
| <b>inflate</b> |           |           |       |       |                      |           |
| age            | -.0125277 | .013236   | -0.95 | 0.344 | -.0384698            | .0134144  |
| actlim         | -.7789124 | .1923261  | -4.05 | 0.000 | -1.155865            | -.4019602 |
| totchr         | -.2172748 | .0663943  | -3.27 | 0.001 | -.3474053            | -.0871444 |
| _cons          | 2.121419  | .9931     | 2.14  | 0.033 | .1749787             | 4.067859  |

```
. //
. //                                zero-inflated negative binomial regression
. //
. nbreg er age actlim totchr, nolog
```

```
Negative binomial regression          Number of obs =      3677
                                           LR chi2(3)    =      225.15
Dispersion = mean                      Prob > chi2    =      0.0000
Log likelihood = -2314.4927            Pseudo R2     =      0.0464
```

| er       | Coef.     | Std. Err. | z     | P> z  | [95% Conf. Interval] |           |
|----------|-----------|-----------|-------|-------|----------------------|-----------|
| age      | .0088528  | .0061341  | 1.44  | 0.149 | -.0031697            | .0208754  |
| actlim   | .6859572  | .0848127  | 8.09  | 0.000 | .5197274             | .8521869  |
| totchr   | .2514885  | .0292559  | 8.60  | 0.000 | .1941481             | .308829   |
| _cons    | -2.799848 | .4593974  | -6.09 | 0.000 | -3.700251            | -1.899446 |
| /lnalpha | .4464685  | .1091535  |       |       | .2325315             | .6604055  |
| alpha    | 1.562783  | .1705834  |       |       | 1.26179              | 1.935577  |

```
Likelihood-ratio test of alpha=0:  chibar2(01) = 237.98 Prob>=chibar2 = 0.000
```

```
. zinb er age actlim totchr, inflate(age actlim totchr) ///
> vuong nolog
```

```
Zero-inflated negative binomial regression          Number of obs =      3677
                                           Nonzero obs  =       710
                                           Zero obs    =      2967
Inflation model = logit                  LR chi2(3)    =      34.29
Log likelihood = -2304.868                Prob > chi2   =      0.0000
```

| er | Coef. | Std. Err. | z | P> z | [95% Conf. Interval] |  |
|----|-------|-----------|---|------|----------------------|--|
|----|-------|-----------|---|------|----------------------|--|

|          |           |          |       |       |           |           |
|----------|-----------|----------|-------|-------|-----------|-----------|
| er       |           |          |       |       |           |           |
| age      | .0035485  | .0076344 | 0.46  | 0.642 | -.0114146 | .0185116  |
| actlim   | .2743106  | .1768941 | 1.55  | 0.121 | -.0723954 | .6210165  |
| totchr   | .1963408  | .0558635 | 3.51  | 0.000 | .0868504  | .3058313  |
| _cons    | -1.822978 | .6515914 | -2.80 | 0.005 | -3.100074 | -.5458825 |
| inflate  |           |          |       |       |           |           |
| age      | -.0236763 | .0284226 | -0.83 | 0.405 | -.0793835 | .0320309  |
| actlim   | -4.22705  | 18.91192 | -0.22 | 0.823 | -41.29372 | 32.83962  |
| totchr   | -.3471091 | .2052892 | -1.69 | 0.091 | -.7494686 | .0552505  |
| _cons    | 1.846526  | 2.071003 | 0.89  | 0.373 | -2.212565 | 5.905618  |
| /lnalpha | .1602371  | .235185  | 0.68  | 0.496 | -.3007171 | .6211913  |
| alpha    | 1.173789  | .2760576 |       |       | .7402871  | 1.861144  |

Vuong test of zinb vs. standard negative binomial: z = 1.99 Pr>z = 0.0233

```
. //
. //
. //
. //
. // laborsub from IMEUS
. use laborsub,clear
. summarize whrs kl6 k618 wa we
```

| Variable | Obs | Mean   | Std. Dev. | Min | Max  |
|----------|-----|--------|-----------|-----|------|
| whrs     | 250 | 799.84 | 915.6035  | 0   | 4950 |
| kl6      | 250 | .236   | .5112234  | 0   | 3    |
| k618     | 250 | 1.364  | 1.370774  | 0   | 8    |
| wa       | 250 | 42.92  | 8.426483  | 30  | 60   |
| we       | 250 | 12.352 | 2.164912  | 5   | 17   |

```
. regress whrs kl6 k618 wa we if whrs>0
```

| Source   | SS         | df  | MS         | Number of obs = | 150    |
|----------|------------|-----|------------|-----------------|--------|
| Model    | 7326995.15 | 4   | 1831748.79 | F( 4, 145) =    | 2.80   |
| Residual | 94793104.2 | 145 | 653745.546 | Prob > F =      | 0.0281 |
| Total    | 102120099  | 149 | 685369.794 | R-squared =     | 0.0717 |
|          |            |     |            | Adj R-squared = | 0.0461 |
|          |            |     |            | Root MSE =      | 808.55 |

| whrs  | Coef.     | Std. Err. | t     | P> t  | [95% Conf. Interval] |
|-------|-----------|-----------|-------|-------|----------------------|
| kl6   | -421.4822 | 167.9734  | -2.51 | 0.013 | -753.4748 -89.48953  |
| k618  | -104.4571 | 54.18616  | -1.93 | 0.056 | -211.5538 2.639668   |
| wa    | -4.784917 | 9.690502  | -0.49 | 0.622 | -23.9378 14.36797    |
| we    | 9.353195  | 31.23793  | 0.30  | 0.765 | -52.38731 71.0937    |
| _cons | 1629.817  | 615.1301  | 2.65  | 0.009 | 414.0371 2845.597    |

```
. truncreg whrs kl6 k618 wa we, ll(0) nolog
(note: 100 obs. truncated)
Truncated regression
Limit: lower = 0
upper = +inf
Number of obs = 150
Wald chi2(4) = 10.05
```

Log likelihood = -1200.9157                      Prob > chi2 = 0.0395

| whrs   | Coef.     | Std. Err. | z     | P> z  | [95% Conf. Interval] |           |
|--------|-----------|-----------|-------|-------|----------------------|-----------|
| k16    | -803.0042 | 321.3614  | -2.50 | 0.012 | -1432.861            | -173.1474 |
| k618   | -172.875  | 88.72898  | -1.95 | 0.051 | -346.7806            | 1.030579  |
| wa     | -8.821123 | 14.36848  | -0.61 | 0.539 | -36.98283            | 19.34059  |
| we     | 16.52873  | 46.50375  | 0.36  | 0.722 | -74.61695            | 107.6744  |
| _cons  | 1586.26   | 912.355   | 1.74  | 0.082 | -201.9234            | 3374.442  |
| /sigma | 983.7262  | 94.44303  | 10.42 | 0.000 | 798.6213             | 1168.831  |

```
. //
. //
. //
. //
. // womenwk from IMEUS
. use womenwk,clear
```

```
. regress lwf age education married children
```

| Source   | SS         | df   | MS         | Number of obs = | 2000   |
|----------|------------|------|------------|-----------------|--------|
| Model    | 937.873188 | 4    | 234.468297 | F( 4, 1995) =   | 134.21 |
| Residual | 3485.34135 | 1995 | 1.74703827 | Prob > F =      | 0.0000 |
| Total    | 4423.21454 | 1999 | 2.21271363 | R-squared =     | 0.2120 |
|          |            |      |            | Adj R-squared = | 0.2105 |
|          |            |      |            | Root MSE =      | 1.3218 |

| lwf       | Coef.     | Std. Err. | t     | P> t  | [95% Conf. Interval] |           |
|-----------|-----------|-----------|-------|-------|----------------------|-----------|
| age       | .0363624  | .003862   | 9.42  | 0.000 | .0287885             | .0439362  |
| education | .0843345  | .0102295  | 8.24  | 0.000 | .0642729             | .1043961  |
| married   | .3188214  | .0690834  | 4.62  | 0.000 | .1833381             | .4543046  |
| children  | .3305009  | .0213143  | 15.51 | 0.000 | .2887004             | .3723015  |
| _cons     | -1.077738 | .1703218  | -6.33 | 0.000 | -1.411765            | -.7437105 |

```
. tobit lwf age education married children, ll(0)
```

```
Tobit regression                      Number of obs =        2000
                                         LR chi2(4) =        461.85
                                         Prob > chi2 =        0.0000
Log likelihood = -3349.9685            Pseudo R2 =        0.0645
```

| lwf       | Coef.     | Std. Err. | t      | P> t  | [95% Conf. Interval] |           |
|-----------|-----------|-----------|--------|-------|----------------------|-----------|
| age       | .052157   | .0057457  | 9.08   | 0.000 | .0408888             | .0634252  |
| education | .1149492  | .0150913  | 7.62   | 0.000 | .0853529             | .1445454  |
| married   | .4841801  | .1035188  | 4.68   | 0.000 | .2811639             | .6871964  |
| children  | .4860021  | .0317054  | 15.33  | 0.000 | .4238229             | .5481812  |
| _cons     | -2.807696 | .2632565  | -10.67 | 0.000 | -3.323982            | -2.291409 |
| /sigma    | 1.872811  | .040014   |        |       | 1.794337             | 1.951285  |

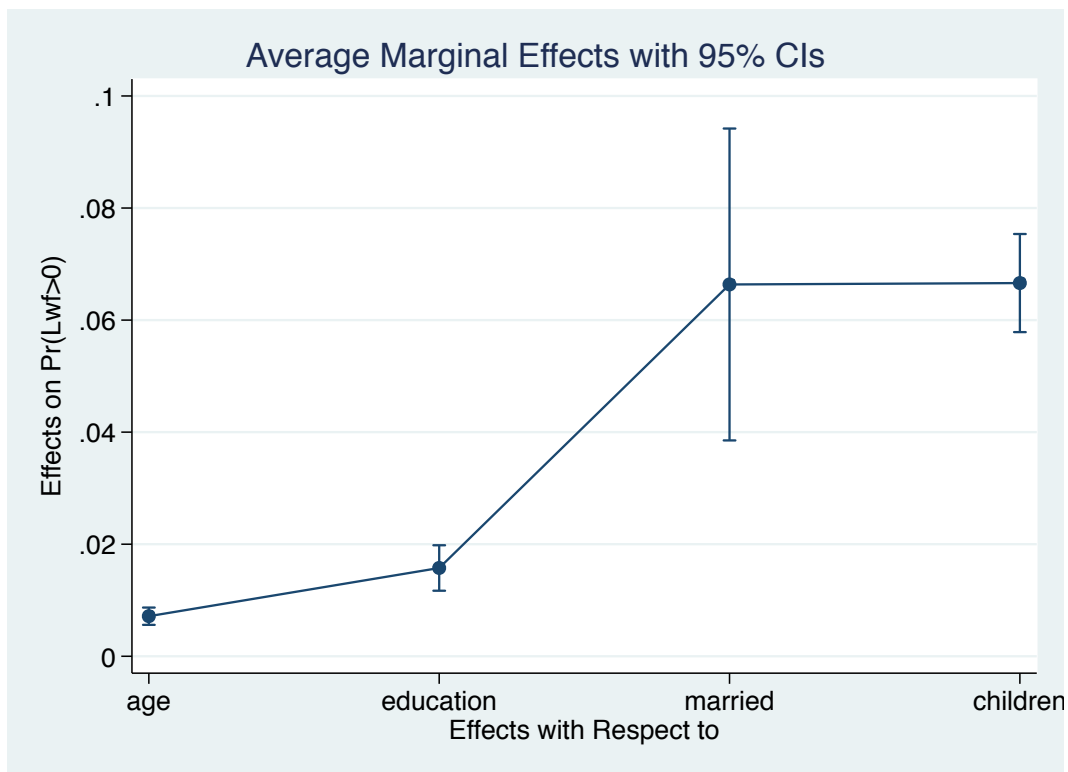
```
Obs. summary:            657 left-censored observations at lwf<=0
                  1343 uncensored observations
                          0 right-censored observations
```

```
. margins, predict(pr(0,)) dydx(_all)
```

Average marginal effects                                      Number of obs = 2000  
 Model VCE : OIM  
 Expression : Pr(lwf>0), predict(pr(0,.))  
 dy/dx w.r.t. : age education married children

|           | Delta-method |           |       |       |                      |
|-----------|--------------|-----------|-------|-------|----------------------|
|           | dy/dx        | Std. Err. | z     | P> z  | [95% Conf. Interval] |
| age       | .0071483     | .0007873  | 9.08  | 0.000 | .0056052 .0086914    |
| education | .0157542     | .0020695  | 7.61  | 0.000 | .0116981 .0198103    |
| married   | .0663585     | .0142009  | 4.67  | 0.000 | .0385254 .0941917    |
| children  | .0666082     | .0044677  | 14.91 | 0.000 | .0578516 .0753649    |

```
. marginsplot, ylab(,angle(0))
Variables that uniquely identify margins: _deriv
```



```
. //
. //
. //           Regression with selection (heckman)
. //
. // note sign switch on children from tobit
. // twostep: note children now insignif in wage eqn
. heckman lw education age children, ///
> select(age married children education) nolog

Heckman selection model                                      Number of obs = 2000
(regression model with sample selection)                    Censored obs = 657
```

Log likelihood = -1052.857

Uncensored obs = 1343  
Wald chi2(3) = 454.78  
Prob > chi2 = 0.0000

| lw        | Coef.     | Std. Err. | z      | P> z  | [95% Conf. Interval] |           |
|-----------|-----------|-----------|--------|-------|----------------------|-----------|
| lw        |           |           |        |       |                      |           |
| education | .0397189  | .0024525  | 16.20  | 0.000 | .0349121             | .0445256  |
| age       | .0075872  | .0009748  | 7.78   | 0.000 | .0056767             | .0094977  |
| children  | -.0180477 | .0064544  | -2.80  | 0.005 | -.0306981            | -.0053973 |
| _cons     | 2.305499  | .0653024  | 35.30  | 0.000 | 2.177509             | 2.43349   |
| select    |           |           |        |       |                      |           |
| age       | .0350233  | .0042344  | 8.27   | 0.000 | .0267241             | .0433225  |
| married   | .4547724  | .0735876  | 6.18   | 0.000 | .3105434             | .5990014  |
| children  | .4538372  | .0288398  | 15.74  | 0.000 | .3973122             | .5103621  |
| education | .0565136  | .0110025  | 5.14   | 0.000 | .0349492             | .0780781  |
| _cons     | -2.478055 | .1927823  | -12.85 | 0.000 | -2.855901            | -2.100208 |
| /athrho   | .3377674  | .1152251  | 2.93   | 0.003 | .1119304             | .5636045  |
| /lnsigma  | -1.375543 | .0246873  | -55.72 | 0.000 | -1.423929            | -1.327156 |
| rho       | .3254828  | .1030183  |        |       | .1114653             | .5106469  |
| sigma     | .2527024  | .0062385  |        |       | .2407662             | .2652304  |
| lambda    | .0822503  | .0273475  |        |       | .0286501             | .1358505  |

LR test of indep. eqns. (rho = 0): chi2(1) = 5.53 Prob > chi2 = 0.0187

```
. heckman lw education age children, ///
> select(age married children education) twostep
```

Heckman selection model -- two-step estimates Number of obs = 2000  
(regression model with sample selection) Censored obs = 657  
Uncensored obs = 1343  
Wald chi2(3) = 405.68  
Prob > chi2 = 0.0000

| lw        | Coef.     | Std. Err. | z      | P> z  | [95% Conf. Interval] |           |
|-----------|-----------|-----------|--------|-------|----------------------|-----------|
| lw        |           |           |        |       |                      |           |
| education | .0427067  | .003106   | 13.75  | 0.000 | .0366191             | .0487944  |
| age       | .009322   | .0014343  | 6.50   | 0.000 | .0065108             | .0121333  |
| children  | -.0019549 | .0115202  | -0.17  | 0.865 | -.0245341            | .0206242  |
| _cons     | 2.124787  | .1249789  | 17.00  | 0.000 | 1.879833             | 2.369741  |
| select    |           |           |        |       |                      |           |
| age       | .0347211  | .0042293  | 8.21   | 0.000 | .0264318             | .0430105  |
| married   | .4308575  | .074208   | 5.81   | 0.000 | .2854125             | .5763025  |
| children  | .4473249  | .0287417  | 15.56  | 0.000 | .3909922             | .5036576  |
| education | .0583645  | .0109742  | 5.32   | 0.000 | .0368555             | .0798735  |
| _cons     | -2.467365 | .1925635  | -12.81 | 0.000 | -2.844782            | -2.089948 |
| mills     |           |           |        |       |                      |           |
| lambda    | .1822815  | .0638285  | 2.86   | 0.004 | .05718               | .307383   |
| rho       | 0.66698   |           |        |       |                      |           |

```

sigma | .27329216
-----|-----
. //
. //          Binomial probit with selection (heckprob)
. //
. // hmda from IMEUS
. summarize approve fanfred loanamt vacancy med_income appr_value ///
> black appl_income debt_inc_r, sep(0)

```

| Variable    | Obs  | Mean     | Std. Dev. | Min | Max      |
|-------------|------|----------|-----------|-----|----------|
| approve     | 2380 | .8802521 | .3247347  | 0   | 1        |
| fanfred     | 2095 | .3331742 | .4714608  | 0   | 1        |
| loanamt     | 2380 | 139.1353 | 83.42097  | 2   | 980      |
| vacancy     | 2380 | .4365546 | .4960626  | 0   | 1        |
| med_income  | 2380 | .8294118 | .3762278  | 0   | 1        |
| appr_value  | 2380 | 198.5426 | 152.9863  | 25  | 4316     |
| black       | 2380 | .142437  | .3495712  | 0   | 1        |
| appl_income | 2380 | 13.9406  | 116.9485  | 0   | 999.9994 |
| debt_inc_r  | 2380 | 33.08136 | 10.72573  | 0   | 300      |

```

. heckprob fanfred loanamt vacancy med_income appr_value, ///
> sel(approve= black appl_income debt_inc_r) nolog
Probit model with sample selection          Number of obs   =    2380
                                           Censored obs     =    285
                                           Uncensored obs   =    2095
                                           Wald chi2(4)    =    80.69
Log likelihood = -2063.066                Prob > chi2      =    0.0000

```

|             | Coef.     | Std. Err. | z     | P> z  | [95% Conf. Interval] |           |
|-------------|-----------|-----------|-------|-------|----------------------|-----------|
| fanfred     |           |           |       |       |                      |           |
| loanamt     | -.0026434 | .0008029  | -3.29 | 0.001 | -.0042169            | -.0010698 |
| vacancy     | -.2163306 | .0609798  | -3.55 | 0.000 | -.3358488            | -.0968124 |
| med_income  | .2671338  | .0893349  | 2.99  | 0.003 | .0920407             | .4422269  |
| appr_value  | -.0014358 | .0005099  | -2.82 | 0.005 | -.0024351            | -.0004364 |
| _cons       | .1684829  | .1182054  | 1.43  | 0.154 | -.0631954            | .4001612  |
| approve     |           |           |       |       |                      |           |
| black       | -.7343534 | .081858   | -8.97 | 0.000 | -.8947921            | -.5739147 |
| appl_income | -.0006596 | .000236   | -2.80 | 0.005 | -.0011221            | -.0001971 |
| debt_inc_r  | -.0262367 | .0036441  | -7.20 | 0.000 | -.033379             | -.0190944 |
| _cons       | 2.236424  | .1319309  | 16.95 | 0.000 | 1.977844             | 2.495004  |
| /athrho     | -.6006626 | .271254   | -2.21 | 0.027 | -1.132311            | -.0690146 |
| rho         | -.5375209 | .1928809  |       |       | -.8118086            | -.0689052 |

```

LR test of indep. eqns. (rho = 0):  chi2(1) =    4.99  Prob > chi2 = 0.0255

```