

Problem Set 6 (SOLUTIONS)

The purpose of the first part of this problem set is to estimate, interpret the results, and compare the results across different binary dependent variable models. In the second part you will estimate and compare different specifications of an endogenous selection model.

First part will be discussed in week 9 and the second part in week 10 of this term.

The data file for this exercise is on Moodle: `mus16data.dta`. It is a subset of the data used by P. Deb, M. Munkin and P.K. Trivedi (2006): “Bayesian Analysis of Two-Part Model with Endogeneity”, *Journal of Applied Econometrics*, 21, 1081-1100. Data is for 2001 and comes from the Medical Expenditure Survey. Sample has 3,328 observations.

The main outcome variable of interest is ambulatory expenditure (**ambexp**) and the regressors are given below.

Since the expenditure data is skewed, we will be using the logged expenditure variable as our dependent variable. You should read Cameron A.C. and Trivedi, P.K. *Micro-econometrics using Stata* to see the pros and cons regarding whether to log the dependent variable or not.

Note, there is one individual who has an **expenditure**=1 and this will get coded as 0 when variable is logged. Since it is only one individual, we will ignore the problem by not doing anything. If there are many individuals like this, you will need to see whether you can say why this might be the case.

Dependent variable

- **ambexp**: Ambulatory medical expenditures (excluding dental and outpatient mental). There are 526 individuals with zero expenditure. There is one individual who has expenditure=\$1. I am going to assume that this individual did not spend any money.
- **lambexp**: $\ln(\text{ambexp})$ given **ambexp** > 0 ; missing otherwise
- **dambexp**: 1 if **ambexp** > 0 and 0 otherwise (binary indicator)

Regressors

- **ins**: health insurance measures, either PPO or HMO type insurance
- **totchr**: health status measures: number of chronic diseases
- **age**: age in years/10
- **female**: 1 for females, zero otherwise
- **educ**: years of schooling of decision maker
- **blhisp**: either black or Hispanic
- **income**: income in USD/1000

Preamble

<IPython.core.display.HTML object>

Create a do-file for this problem set and include a preamble that sets the directory and opens the data. For example,

```
clear
//or, to remove all stored values (including macros, matrices, scalars, etc.)
*clear all

* Replace $rootdir with the relevant path to on your local haddrive.
cd "$rootdir/problem-sets/ps-6"

cap log close
log using problem-set-6-log.txt, replace

use mus16data.dta, clear
```

```
C:\Users\neil_\OneDrive - University of Warwick\Documents\EC910\website\warwick
> -ec910\problem-sets\ps-6
```

```
-----
      name:  <unnamed>
      log:   C:\Users\neil_\OneDrive - University of Warwick\Documents\EC910\we
> bsite\warwick-ec910\problem-sets\ps-6\problem-set-6-log.txt
      log type:  smcl
      opened on:  19 Nov 2024, 17:41:06
```

Questions

Part 1

1.1. Obtain and comment on the descriptive statistics for ambexp, lambexp, age, female, educ, blhisp, totchr, ins, income.

```
su dambexp ambexp lambexp age female educ blhisp totchr ins income
```

| Variable | Obs | Mean | Std. dev. | Min | Max |
|-------------|-----|------|-----------|-----|-----|
| -----+----- | | | | | |

| | | | | | | |
|---------|--|-------|----------|----------|--------|----------|
| dambexp | | 3,328 | .8419471 | .3648454 | 0 | 1 |
| ambexp | | 3,328 | 1386.519 | 2530.406 | 0 | 49960 |
| lambexp | | 2,802 | 6.555066 | 1.41073 | 0 | 10.81898 |
| age | | 3,328 | 4.056881 | 1.121212 | 2.1 | 6.4 |
| female | | 3,328 | .5084135 | .5000043 | 0 | 1 |
| -----+ | | | | | | |
| educ | | 3,328 | 13.40565 | 2.574199 | 0 | 17 |
| blhisp | | 3,328 | .3085938 | .4619824 | 0 | 1 |
| totchr | | 3,328 | .4831731 | .7720426 | 0 | 5 |
| ins | | 3,328 | .3650841 | .4815261 | 0 | 1 |
| income | | 3,328 | 36.80485 | 26.70121 | -90.05 | 237.301 |

1.2. Estimate a LP, Probit and a Logit model to explain dambexp. Store the β coefficients and report them in a table.

```
global xlist age i.female educ i.blhisp totchr i.ins income //Define regressor list $xlist
bys dambexp: su $xlist

** LPM
eststo LPM: reg dambexp $xlist, robust // heterosk needs to be corrected

** probit
eststo probit: probit dambexp $xlist

** logit
eststo logit: logit dambexp $xlist

esttab LPM probit logit, se scalar(N r2 ll) mtitle("LPM" "Probit" "Logit") title(Estimated Coefficients)
```

-> dambexp = 0

| Variable | | Obs | Mean | Std. dev. | Min | Max |
|----------|--|-----|----------|-----------|-----|-----|
| -----+ | | | | | | |
| age | | 526 | 3.695627 | 1.076467 | 2.1 | 6.4 |
| | | | | | | |
| female | | | | | | |
| 0 | | 526 | .7338403 | .4423695 | 0 | 1 |
| 1 | | 526 | .2661597 | .4423695 | 0 | 1 |
| | | | | | | |
| educ | | 526 | 12.48859 | 2.697241 | 0 | 17 |

| | | | | | |
|--------|-----|----------|----------|---|--------|
| blhisp | | | | | |
| 0 | 526 | .5171103 | .5001828 | 0 | 1 |
| 1 | 526 | .4828897 | .5001828 | 0 | 1 |
| totchr | 526 | .0912548 | .3074311 | 0 | 2 |
| ins | | | | | |
| 0 | 526 | .6977186 | .4596837 | 0 | 1 |
| 1 | 526 | .3022814 | .4596837 | 0 | 1 |
| income | 526 | 31.63409 | 23.17116 | 0 | 166.78 |

-> dambexp = 1

| Variable | Obs | Mean | Std. dev. | Min | Max |
|----------|-------|----------|-----------|--------|---------|
| age | 2,802 | 4.124697 | 1.116641 | 2.1 | 6.4 |
| female | | | | | |
| 0 | 2,802 | .4461099 | .4971761 | 0 | 1 |
| 1 | 2,802 | .5538901 | .4971761 | 0 | 1 |
| educ | 2,802 | 13.5778 | 2.513906 | 0 | 17 |
| blhisp | | | | | |
| 0 | 2,802 | .7241256 | .4470336 | 0 | 1 |
| 1 | 2,802 | .2758744 | .4470336 | 0 | 1 |
| totchr | 2,802 | .5567452 | .809943 | 0 | 5 |
| ins | | | | | |
| 0 | 2,802 | .6231263 | .4846893 | 0 | 1 |
| 1 | 2,802 | .3768737 | .4846893 | 0 | 1 |
| income | 2,802 | 37.77552 | 27.20742 | -90.05 | 237.301 |

Linear regression

Number of obs = 3,328
F(7, 3320) = 69.43

Prob > F = 0.0000
 R-squared = 0.1276
 Root MSE = .34114

| dambexp | Coefficient | Robust std. err. | t | P> t | [95% conf. interval] | |
|----------|-------------|---------------------|-------|-------|----------------------|-----------|
| age | .0216413 | .0056048 | 3.86 | 0.000 | .0106521 | .0326304 |
| 1.female | .1394928 | .0119061 | 11.72 | 0.000 | .1161487 | .1628368 |
| educ | .0143544 | .0025774 | 5.57 | 0.000 | .009301 | .0194078 |
| 1.blhisp | -.0889738 | .0143088 | -6.22 | 0.000 | -.1170288 | -.0609188 |
| totchr | .0830088 | .0057913 | 14.33 | 0.000 | .0716539 | .0943637 |
| 1.ins | .0364663 | .0119311 | 3.06 | 0.002 | .0130733 | .0598592 |
| income | .000443 | .0002215 | 2.00 | 0.046 | 8.70e-06 | .0008774 |
| _cons | .4485313 | .0430509 | 10.42 | 0.000 | .3641224 | .5329402 |

Iteration 0: Log likelihood = -1452.4289
 Iteration 1: Log likelihood = -1218.0426
 Iteration 2: Log likelihood = -1195.6199
 Iteration 3: Log likelihood = -1195.5158
 Iteration 4: Log likelihood = -1195.5158

Probit regression

Number of obs = 3,328
 LR chi2(7) = 513.83
 Prob > chi2 = 0.0000
 Pseudo R2 = 0.1769

Log likelihood = -1195.5158

| dambexp | Coefficient | Std. err. | z | P> z | [95% conf. interval] | |
|----------|-------------|-----------|-------|-------|----------------------|-----------|
| age | .0868152 | .0274556 | 3.16 | 0.002 | .0330032 | .1406272 |
| 1.female | .6635053 | .0609648 | 10.88 | 0.000 | .5440164 | .7829941 |
| educ | .061884 | .012039 | 5.14 | 0.000 | .038288 | .0854801 |
| 1.blhisp | -.3657835 | .0619095 | -5.91 | 0.000 | -.4871239 | -.2444432 |
| totchr | .7957496 | .0712174 | 11.17 | 0.000 | .656166 | .9353332 |
| 1.ins | .169107 | .0629296 | 2.69 | 0.007 | .0457673 | .2924467 |
| income | .0026773 | .0013105 | 2.04 | 0.041 | .0001088 | .0052458 |
| _cons | -.6686471 | .1941247 | -3.44 | 0.001 | -1.049125 | -.2881698 |

Iteration 0: Log likelihood = -1452.4289

Iteration 1: Log likelihood = -1238.914
 Iteration 2: Log likelihood = -1194.7039
 Iteration 3: Log likelihood = -1192.8189
 Iteration 4: Log likelihood = -1192.8089
 Iteration 5: Log likelihood = -1192.8089

Logistic regression

Number of obs = 3,328

LR chi2(7) = 519.24

Prob > chi2 = 0.0000

Log likelihood = -1192.8089

Pseudo R2 = 0.1787

| dambexp | Coefficient | Std. err. | z | P> z | [95% conf. interval] | |
|----------|-------------|-----------|-------|-------|----------------------|----------|
| age | .1618629 | .0496641 | 3.26 | 0.001 | .0645229 | .2592028 |
| 1.female | 1.226724 | .1130182 | 10.85 | 0.000 | 1.005212 | 1.448235 |
| educ | .1080498 | .0210874 | 5.12 | 0.000 | .0667192 | .1493804 |
| 1.blhisp | -.6666381 | .1093362 | -6.10 | 0.000 | -.8809332 | -.452343 |
| totchr | 1.554664 | .1499606 | 10.37 | 0.000 | 1.260746 | 1.848581 |
| 1.ins | .296996 | .1133154 | 2.62 | 0.009 | .0749019 | .5190901 |
| income | .00462 | .0024332 | 1.90 | 0.058 | -.000149 | .009389 |
| _cons | -1.26832 | .3407805 | -3.72 | 0.000 | -1.936237 | -.600402 |

Estimated Coefficients

| | (1) LPM | (2) Probit | (3) Logit |
|----------|------------------------|-----------------------|----------------------|
| main | | | |
| age | 0.0216*** (0.00560) | 0.0868** (0.0275) | 0.162** (0.0497) |
| 0.female | 0 (.) | 0 (.) | 0 (.) |
| 1.female | 0.139*** (0.0119) | 0.664*** (0.0610) | 1.227*** (0.113) |
| educ | 0.0144*** (0.00258) | 0.0619*** (0.0120) | 0.108*** (0.0211) |
| 0.blhisp | 0 | 0 | 0 |

| | (.) | (.) | (.) |
|----------|-------------------------|-----------------------|----------------------|
| 1.blhisp | -0.0890*** (0.0143) | -0.366*** (0.0619) | -0.667*** (0.109) |
| totchr | 0.0830*** (0.00579) | 0.796*** (0.0712) | 1.555*** (0.150) |
| 0.ins | 0 (.) | 0 (.) | 0 (.) |
| 1.ins | 0.0365** (0.0119) | 0.169** (0.0629) | 0.297** (0.113) |
| income | 0.000443* (0.000222) | 0.00268* (0.00131) | 0.00462 (0.00243) |
| _cons | 0.449*** (0.0431) | -0.669*** (0.194) | -1.268*** (0.341) |
| ----- | | | |
| N | 3328 | 3328 | 3328 |
| r2 | 0.128 | | |
| ll | -1139.1 | -1195.5 | -1192.8 |
| ----- | | | |

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

1.3. Estimate the Marginal Effect at the Mean for each model, and report them in a table. You will want to use the `estpost margins` post-estimation command, with the relevant option for MEM. Pay special attention to the treatment of discrete regressors. Hint: check to see any differences in the estimated MEs based on whether you use factor notation; for example, `i.female` vs `female`.

```
est clear

** LPM
qui reg dambexp $xlist, robust
estpost margins, dydx(*) atmean
est store LPM

** probit
qui probit dambexp $xlist
```

```

estpost margins, dydx(*) atmean
est store probit

** logit
qui logit dambexp $xlist
estpost margins, dydx(*) atmean
est store logit

esttab LPM probit logit, se scalar(N r2 ll) mtitle("LPM" "Probit" "Logit") ttitle(Marginal Ef.

```

Conditional marginal effects Number of obs = 3,328
Model VCE: Robust

Expression: Linear prediction, predict()
dy/dx wrt: age 1.female educ 1.blhisp totchr 1.ins income

At: age = 4.056881 (mean)
0.female = .4915865 (mean)
1.female = .5084135 (mean)
educ = 13.40565 (mean)
0.blhisp = .6914063 (mean)
1.blhisp = .3085938 (mean)
totchr = .4831731 (mean)
0.ins = .6349159 (mean)
1.ins = .3650841 (mean)
income = 36.80485 (mean)

| | | Delta-method | | | | | |
|----------|--|--------------|-----------|-------|-------|----------------------|-----------|
| | | dy/dx | std. err. | t | P> t | [95% conf. interval] | |
| age | | .0216413 | .0056048 | 3.86 | 0.000 | .0106521 | .0326304 |
| 1.female | | .1394928 | .0119061 | 11.72 | 0.000 | .1161487 | .1628368 |
| educ | | .0143544 | .0025774 | 5.57 | 0.000 | .009301 | .0194078 |
| 1.blhisp | | -.0889738 | .0143088 | -6.22 | 0.000 | -.1170288 | -.0609188 |
| totchr | | .0830088 | .0057913 | 14.33 | 0.000 | .0716539 | .0943637 |
| 1.ins | | .0364663 | .0119311 | 3.06 | 0.002 | .0130733 | .0598592 |
| income | | .000443 | .0002215 | 2.00 | 0.046 | 8.70e-06 | .0008774 |

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

Conditional marginal effects Number of obs = 3,328

Model VCE: OIM

Expression: Pr(dambexp), predict()

dy/dx wrt: age 1.female educ 1.blhisp totchr 1.ins income

At: age = 4.056881 (mean)
 0.female = .4915865 (mean)
 1.female = .5084135 (mean)
 educ = 13.40565 (mean)
 0.blhisp = .6914063 (mean)
 1.blhisp = .3085938 (mean)
 totchr = .4831731 (mean)
 0.ins = .6349159 (mean)
 1.ins = .3650841 (mean)
 income = 36.80485 (mean)

| ----- | | | | | | |
|----------|--|--------------|-----------|-------|-------|----------------------|
| | | Delta-method | | | | |
| | | dy/dx | std. err. | z | P> z | [95% conf. interval] |
| ----- | | | | | | |
| age | | .0152201 | .004837 | 3.15 | 0.002 | .0057396 .0247005 |
| 1.female | | .1184629 | .0112862 | 10.50 | 0.000 | .0963423 .1405835 |
| educ | | .0108492 | .0021305 | 5.09 | 0.000 | .0066736 .0150249 |
| 1.blhisp | | -.0701607 | .0130287 | -5.39 | 0.000 | -.0956964 -.0446249 |
| totchr | | .1395073 | .0102098 | 13.66 | 0.000 | .1194966 .1595181 |
| 1.ins | | .0288089 | .0104412 | 2.76 | 0.006 | .0083445 .0492733 |
| income | | .0004694 | .0002295 | 2.05 | 0.041 | .0000195 .0009192 |
| ----- | | | | | | |

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

Conditional marginal effects

Number of obs = 3,328

Model VCE: OIM

Expression: Pr(dambexp), predict()

dy/dx wrt: age 1.female educ 1.blhisp totchr 1.ins income

At: age = 4.056881 (mean)
 0.female = .4915865 (mean)
 1.female = .5084135 (mean)
 educ = 13.40565 (mean)
 0.blhisp = .6914063 (mean)
 1.blhisp = .3085938 (mean)
 totchr = .4831731 (mean)
 0.ins = .6349159 (mean)
 1.ins = .3650841 (mean)

income = 36.80485 (mean)

| | Delta-method | | | | | |
|----------|--------------|-----------|-------|-------|----------------------|----------|
| | dy/dx | std. err. | z | P> z | [95% conf. interval] | |
| age | .0135771 | .0042044 | 3.23 | 0.001 | .0053365 | .0218176 |
| 1.female | .1068865 | .0107295 | 9.96 | 0.000 | .085857 | .1279159 |
| educ | .0090632 | .0018074 | 5.01 | 0.000 | .0055208 | .0126056 |
| 1.blhisp | -.062462 | .0116115 | -5.38 | 0.000 | -.0852201 | -.039704 |
| totchr | .1304052 | .0093686 | 13.92 | 0.000 | .112043 | .1487674 |
| 1.ins | .0241537 | .0089994 | 2.68 | 0.007 | .0065151 | .0417922 |
| income | .0003875 | .0002043 | 1.90 | 0.058 | -.0000128 | .0007879 |

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

Marginal Effects at the Mean

| | (1) LPM | (2) Probit | (3) Logit |
|----------|------------------------|------------------------|-------------------------|
| age | 0.0216*** (0.00560) | 0.0152** (0.00484) | 0.0136** (0.00420) |
| 0.female | 0 (.) | 0 (.) | 0 (.) |
| 1.female | 0.139*** (0.0119) | 0.118*** (0.0113) | 0.107*** (0.0107) |
| educ | 0.0144*** (0.00258) | 0.0108*** (0.00213) | 0.00906*** (0.00181) |
| 0.blhisp | 0 (.) | 0 (.) | 0 (.) |
| 1.blhisp | -0.0890*** (0.0143) | -0.0702*** (0.0130) | -0.0625*** (0.0116) |
| totchr | 0.0830*** (0.00579) | 0.140*** (0.0102) | 0.130*** (0.00937) |
| 0.ins | 0 | 0 | 0 |

| | (.) | (.) | (.) |
|--------|-------------------------|-------------------------|------------------------|
| 1.ins | 0.0365** (0.0119) | 0.0288** (0.0104) | 0.0242** (0.00900) |
| income | 0.000443* (0.000222) | 0.000469* (0.000230) | 0.000388 (0.000204) |
| ----- | | | |
| N | 3328 | 3328 | 3328 |
| r2 | 0.128 | | |
| ll | -1139.1 | -1195.5 | -1192.8 |
| ----- | | | |

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

1.4. Estimate the Average Marginal Effect at the Mean for each model, and report them in a table. You will want to use the `estpost margins` post-estimation command, with the relevant option for AME.

```
est clear

** LPM
qui reg dambexp $xlist, robust
estpost margins, dydx(*)
est store LPM

** probit
qui probit dambexp $xlist
estpost margins, dydx(*)
est store probit

** logit
qui logit dambexp $xlist
estpost margins, dydx(*)
est store logit

esttab LPM probit logit, se scalar(N r2 ll) mtitle("LPM" "Probit" "Logit") title(Average Marginal Effects)
```

Average marginal effects
Model VCE: Robust

Number of obs = 3,328

Expression: Linear prediction, predict()
dy/dx wrt: age 1.female educ 1.blhisp totchr 1.ins income

| | | Delta-method | | | | [95% conf. interval] | |
|----------|--|--------------|-----------|-------|-------|----------------------|-----------|
| | | dy/dx | std. err. | t | P> t | | |
| age | | .0216413 | .0056048 | 3.86 | 0.000 | .0106521 | .0326304 |
| 1.female | | .1394928 | .0119061 | 11.72 | 0.000 | .1161487 | .1628368 |
| educ | | .0143544 | .0025774 | 5.57 | 0.000 | .009301 | .0194078 |
| 1.blhisp | | -.0889738 | .0143088 | -6.22 | 0.000 | -.1170288 | -.0609188 |
| totchr | | .0830088 | .0057913 | 14.33 | 0.000 | .0716539 | .0943637 |
| 1.ins | | .0364663 | .0119311 | 3.06 | 0.002 | .0130733 | .0598592 |
| income | | .000443 | .0002215 | 2.00 | 0.046 | 8.70e-06 | .0008774 |

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

Average marginal effects
Model VCE: OIM

Number of obs = 3,328

Expression: Pr(dambexp), predict()
dy/dx wrt: age 1.female educ 1.blhisp totchr 1.ins income

| | | Delta-method | | | | [95% conf. interval] | |
|----------|--|--------------|-----------|-------|-------|----------------------|-----------|
| | | dy/dx | std. err. | z | P> z | | |
| age | | .0173895 | .0054832 | 3.17 | 0.002 | .0066426 | .0281365 |
| 1.female | | .132906 | .0118133 | 11.25 | 0.000 | .1097524 | .1560596 |
| educ | | .0123957 | .0023862 | 5.19 | 0.000 | .0077189 | .0170725 |
| 1.blhisp | | -.0777517 | .0137954 | -5.64 | 0.000 | -.1047901 | -.0507133 |
| totchr | | .1593929 | .0139062 | 11.46 | 0.000 | .1321371 | .1866486 |
| 1.ins | | .033324 | .0121638 | 2.74 | 0.006 | .0094834 | .0571646 |
| income | | .0005363 | .0002621 | 2.05 | 0.041 | .0000225 | .0010501 |

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

Average marginal effects
Model VCE: OIM

Number of obs = 3,328

Expression: Pr(dambexp), predict()
dy/dx wrt: age 1.female educ 1.blhisp totchr 1.ins income

| | Delta-method | | | | | |
|----------|--------------|-----------|-------|-------|----------------------|-----------|
| | dy/dx | std. err. | z | P> z | [95% conf. interval] | |
| age | .0181007 | .0055261 | 3.28 | 0.001 | .0072697 | .0289317 |
| 1.female | .1357958 | .0117423 | 11.56 | 0.000 | .1127813 | .1588102 |
| educ | .0120829 | .0023248 | 5.20 | 0.000 | .0075264 | .0166394 |
| 1.blhisp | -.0795676 | .0136638 | -5.82 | 0.000 | -.1063481 | -.0527871 |
| totchr | .1738536 | .0164518 | 10.57 | 0.000 | .1416087 | .2060985 |
| 1.ins | .0326182 | .0121752 | 2.68 | 0.007 | .0087552 | .0564812 |
| income | .0005166 | .0002718 | 1.90 | 0.057 | -.000016 | .0010493 |

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

Average Marginal Effects

| | (1) LPM | (2) Probit | (3) Logit |
|----------|------------------------|------------------------|------------------------|
| age | 0.0216*** (0.00560) | 0.0174** (0.00548) | 0.0181** (0.00553) |
| 0.female | 0 (.) | 0 (.) | 0 (.) |
| 1.female | 0.139*** (0.0119) | 0.133*** (0.0118) | 0.136*** (0.0117) |
| educ | 0.0144*** (0.00258) | 0.0124*** (0.00239) | 0.0121*** (0.00232) |
| 0.blhisp | 0 (.) | 0 (.) | 0 (.) |
| 1.blhisp | -0.0890*** (0.0143) | -0.0778*** (0.0138) | -0.0796*** (0.0137) |
| totchr | 0.0830*** (0.00579) | 0.159*** (0.0139) | 0.174*** (0.0165) |
| 0.ins | 0 (.) | 0 (.) | 0 (.) |

| | | | |
|--------|-------------------------|-------------------------|------------------------|
| 1.ins | 0.0365** (0.0119) | 0.0333** (0.0122) | 0.0326** (0.0122) |
| income | 0.000443* (0.000222) | 0.000536* (0.000262) | 0.000517 (0.000272) |
| ----- | | | |
| N | 3328 | 3328 | 3328 |
| r2 | 0.128 | | |
| ll | -1139.1 | -1195.5 | -1192.8 |
| ----- | | | |

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

1.5. Check to see how well the probit model predicts the outcome using the `estat classification` post-estimation command.

```
qui probit dambexp age i.female educ i.blhisp totchr i.ins income
estat classification
```

Probit model for dambexp

| | | ----- True ----- | | |
|-------------------------|--|------------------|-----|-------|
| Classified | | D | ~D | Total |
| -----+-----+-----+----- | | | | |
| + | | 2768 | 469 | 3237 |
| - | | 34 | 57 | 91 |
| -----+-----+-----+----- | | | | |
| Total | | 2802 | 526 | 3328 |

Classified + if predicted Pr(D) >= .5

True D defined as dambexp != 0

| | | | |
|-------------------------------|------------|--|--------|
| ----- | | | |
| Sensitivity | Pr(+ D) | | 98.79% |
| Specificity | Pr(- ~D) | | 10.84% |
| Positive predictive value | Pr(D +) | | 85.51% |
| Negative predictive value | Pr(~D -) | | 62.64% |
| ----- | | | |
| False + rate for true ~D | Pr(+ ~D) | | 89.16% |
| False - rate for true D | Pr(- D) | | 1.21% |
| False + rate for classified + | Pr(~D +) | | 14.49% |
| False - rate for classified - | Pr(D -) | | 37.36% |

| | |
|----------------------|--------|
| Correctly classified | 84.89% |
|----------------------|--------|

1.6. Construct and interpret the LR test for the omission of income in the probit model. Do this in two ways: (1) using the post estimation `lrtest`; (2) manually recreate (1)'s results (both test-statistic and p-value).

```
est clear

** Remove income from xlist
global xlist age i.female educ i.blhisp totchr i.ins

eststo modU: qui probit dambexp $xlist income
scalar logl_U = e(ll)

eststo modR: qui probit dambexp $xlist
scalar logl_R = e(ll)

lrtest modU modR

** Replicate
scalar stat = 2 * (logl_U - logl_R)
scalar pval = chi2tail(1,stat)
scalar list
```

Likelihood-ratio test
Assumption: modR nested within modU

```
LR chi2(1) = 4.30
Prob > chi2 = 0.0382
    pval = .03817363
    stat = 4.297269
    logl_R = -1197.6644
    logl_U = -1195.5158
```

Part 2

Estimate the following models for `lambexp` treating the selection into non-zero `lambexp` value as endogenous using, both Heckman 2-step method and also MLE.

In the main data `lambexp` is missing for values of `ambexp=0`. Before proceeding,

```
replace lambexp = 0 if ambexp==0
```

(526 real changes made)

This will correction will also treat observations with `ambexp=1` as equivalent to `=0`; however, this is only a single observation.

```
** Remove income from xlist
global xlist age i.female educ i.blhisp totchr i.ins
```

2.1. Estimate the Heckman 2-step estimator and store the results. In addition, store the Mills ratio as a separate variable. Use `income` as the excluded variable. This means that `income` appears in the selection equation, but NOT the main equation.

```
eststo heck_2sW: heckman lambexp $xlist, select(dambexp = $xlist income) twostep mills(mills)
```

```
Heckman selection model -- two-step estimates    Number of obs    =      3,328
(regression model with sample selection)         Selected       =      2,802
                                                Nonselected     =       526

                                                Wald chi2(6)     =      193.43
                                                Prob > chi2      =       0.0000
```

| | Coefficient | Std. err. | z | P> z | [95% conf. interval] | |
|----------|-------------|-----------|-------|-------|----------------------|-----------|
| lambexp | | | | | | |
| age | .2024668 | .0242202 | 8.36 | 0.000 | .1549961 | .2499374 |
| 1.female | .2921341 | .0725756 | 4.03 | 0.000 | .1498886 | .4343796 |
| educ | .0123889 | .0115682 | 1.07 | 0.284 | -.0102844 | .0350622 |
| 1.blhisp | -.1828659 | .0653449 | -2.80 | 0.005 | -.3109396 | -.0547922 |
| totchr | .5006332 | .0485548 | 10.31 | 0.000 | .4054675 | .5957988 |
| 1.ins | -.0465097 | .0529742 | -0.88 | 0.380 | -.1503373 | .0573179 |
| _cons | 5.288927 | .288522 | 18.33 | 0.000 | 4.723435 | 5.85442 |
| dambexp | | | | | | |
| age | .0868152 | .0274556 | 3.16 | 0.002 | .0330032 | .1406272 |
| 1.female | .6635053 | .0609648 | 10.88 | 0.000 | .5440165 | .7829941 |

| | | | | | | | |
|----------|--|-----------|----------|-------|-------|-----------|-----------|
| educ | | .061884 | .012039 | 5.14 | 0.000 | .038288 | .0854801 |
| 1.blhisp | | -.3657835 | .0619095 | -5.91 | 0.000 | -.4871239 | -.2444432 |
| totchr | | .7957496 | .0712174 | 11.17 | 0.000 | .656166 | .9353332 |
| 1.ins | | .169107 | .0629296 | 2.69 | 0.007 | .0457673 | .2924467 |
| income | | .0026773 | .0013105 | 2.04 | 0.041 | .0001088 | .0052458 |
| _cons | | -.6686471 | .1941247 | -3.44 | 0.001 | -1.049125 | -.2881698 |
| ----- | | | | | | | |
| /mills | | | | | | | |
| lambda | | -.4637133 | .2825997 | -1.64 | 0.101 | -1.017598 | .090172 |
| ----- | | | | | | | |
| rho | | -0.35907 | | | | | |
| sigma | | 1.2914258 | | | | | |
| ----- | | | | | | | |

2.2. Replicate these results by applying the following steps: (1) estimate the selection equation using a probit model; (2) create the mills ratio; (3) **compare** your mills ratio with the one stored above; (4) estimate the main equation, including the mills ratio.

```
probit dambexp $xlist income
predict index, xb
gen mills = normalden(index)/normal(index)
compare mills mills_a
reg lambexp $xlist mills
```

```
Iteration 0: Log likelihood = -1452.4289
Iteration 1: Log likelihood = -1218.0426
Iteration 2: Log likelihood = -1195.6199
Iteration 3: Log likelihood = -1195.5158
Iteration 4: Log likelihood = -1195.5158
```

| | |
|-----------------------------|-----------------------|
| Probit regression | Number of obs = 3,328 |
| | LR chi2(7) = 513.83 |
| | Prob > chi2 = 0.0000 |
| Log likelihood = -1195.5158 | Pseudo R2 = 0.1769 |

| dambexp | | Coefficient | Std. err. | z | P> z | [95% conf. interval] |
|----------|--|-------------|-----------|-------|-------|----------------------|
| ----- | | | | | | |
| age | | .0868152 | .0274556 | 3.16 | 0.002 | .0330032 .1406272 |
| 1.female | | .6635053 | .0609648 | 10.88 | 0.000 | .5440164 .7829941 |
| educ | | .061884 | .012039 | 5.14 | 0.000 | .038288 .0854801 |

| | | | | | | | |
|----------|--|-----------|----------|-------|-------|-----------|-----------|
| 1.blhisp | | -.3657835 | .0619095 | -5.91 | 0.000 | -.4871239 | -.2444432 |
| totchr | | .7957496 | .0712174 | 11.17 | 0.000 | .656166 | .9353332 |
| 1.ins | | .169107 | .0629296 | 2.69 | 0.007 | .0457673 | .2924467 |
| income | | .0026773 | .0013105 | 2.04 | 0.041 | .0001088 | .0052458 |
| _cons | | -.6686471 | .1941247 | -3.44 | 0.001 | -1.049125 | -.2881698 |

| | | ----- Difference ----- | | |
|-----------------|-------|------------------------|-----------|-----------|
| | Count | Minimum | Average | Maximum |
| mills<mills_a | 1660 | -5.02e-08 | -8.91e-09 | -1.75e-14 |
| mills>mills_a | 1668 | 7.75e-15 | 8.64e-09 | 5.45e-08 |
| Jointly defined | 3328 | -5.02e-08 | -1.10e-10 | 5.45e-08 |
| Total | 3328 | | | |

| | | | | | | | |
|----------|--|------------|-------|------------|---------------|---|--------|
| Source | | SS | df | MS | Number of obs | = | 3,328 |
| Model | | 6325.70678 | 7 | 903.672398 | F(7, 3320) | = | 164.14 |
| Residual | | 18278.1125 | 3,320 | 5.50545557 | Prob > F | = | 0.0000 |
| Total | | 24603.8193 | 3,327 | 7.39519666 | R-squared | = | 0.2571 |
| | | | | | Adj R-squared | = | 0.2555 |
| | | | | | Root MSE | = | 2.3464 |

| | | | | | | | |
|----------|--|-------------|-----------|--------|-------|----------------------|-----------|
| lambexp | | Coefficient | Std. err. | t | P> t | [95% conf. interval] | |
| age | | .1628716 | .0410937 | 3.96 | 0.000 | .0823001 | .2434431 |
| 1.female | | .1898127 | .1257893 | 1.51 | 0.131 | -.0568198 | .4364451 |
| educ | | -.0016555 | .0199775 | -0.08 | 0.934 | -.0408251 | .037514 |
| 1.blhisp | | -.1086689 | .1107824 | -0.98 | 0.327 | -.3258776 | .1085397 |
| totchr | | .4202052 | .0839337 | 5.01 | 0.000 | .2556382 | .5847723 |
| 1.ins | | -.0686172 | .0899672 | -0.76 | 0.446 | -.2450141 | .1077796 |
| mills | | -4.592193 | .4582359 | -10.02 | 0.000 | -5.490646 | -3.693739 |
| _cons | | 5.904903 | .5004624 | 11.80 | 0.000 | 4.923657 | 6.886149 |

2.3 Estimate the marginal effects of the selection equation. You can do this using the `margins` command, with `predict()` option `pse1`. This should correspond to a probit model estimation above.

```
qui heckman lambexp $xlist, select(dambexp = $xlist income) twostep
margins, dydx(*) predict(psel)
```

Average marginal effects
Model VCE: Conventional

Number of obs = 3,328

Expression: Pr(dambexp), predict(psel)
dy/dx wrt: age 1.female educ 1.blhisp totchr 1.ins income

| | | Delta-method | | | | [95% conf. interval] | |
|----------|--|--------------|-----------|-------|-------|----------------------|-----------|
| | | dy/dx | std. err. | z | P> z | | |
| age | | .0173895 | .0054832 | 3.17 | 0.002 | .0066426 | .0281365 |
| 1.female | | .132906 | .0118133 | 11.25 | 0.000 | .1097524 | .1560596 |
| educ | | .0123957 | .0023862 | 5.19 | 0.000 | .0077189 | .0170725 |
| 1.blhisp | | -.0777517 | .0137954 | -5.64 | 0.000 | -.1047901 | -.0507133 |
| totchr | | .1593929 | .0139062 | 11.46 | 0.000 | .1321371 | .1866486 |
| 1.ins | | .033324 | .0121638 | 2.74 | 0.006 | .0094834 | .0571646 |
| income | | .0005363 | .0002621 | 2.05 | 0.041 | .0000225 | .0010501 |

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

2.4. Estimate the Maximum Likelihood version of the Heckmann correction (with an excluded variable) and store the results.

```
eststo heck_mlW: heckman lambexp $xlist, select(dambexp = $xlist income) nolog mills(mills_a
```

| | | | |
|--|---------------|---|--------|
| Heckman selection model | Number of obs | = | 3,328 |
| (regression model with sample selection) | Selected | = | 2,802 |
| | Nonselected | = | 526 |
| | Wald chi2(6) | = | 288.88 |
| Log likelihood = -5836.219 | Prob > chi2 | = | 0.0000 |

| | | Coefficient | Std. err. | z | P> z | [95% conf. interval] | |
|---------|--|-------------|-----------|---|------|----------------------|--|
| lambexp | | | | | | | |

| | | | | | | | |
|---|--|-----------|----------|-------|----------------------|-----------|-----------|
| age | | .2119749 | .0230072 | 9.21 | 0.000 | .1668816 | .2570682 |
| 1.female | | .3481441 | .0601142 | 5.79 | 0.000 | .2303223 | .4659658 |
| educ | | .018716 | .0105473 | 1.77 | 0.076 | -.0019563 | .0393883 |
| 1.blhisp | | -.2185714 | .0596687 | -3.66 | 0.000 | -.3355199 | -.101623 |
| totchr | | .53992 | .0393324 | 13.73 | 0.000 | .4628299 | .61701 |
| 1.ins | | -.0299871 | .0510882 | -0.59 | 0.557 | -.1301182 | .0701439 |
| _cons | | 5.044056 | .2281259 | 22.11 | 0.000 | 4.596938 | 5.491175 |
| ----- | | | | | | | |
| dambexp | | | | | | | |
| age | | .0879359 | .027421 | 3.21 | 0.001 | .0341917 | .14168 |
| 1.female | | .6626649 | .0609384 | 10.87 | 0.000 | .5432278 | .7821021 |
| educ | | .0619485 | .0120295 | 5.15 | 0.000 | .0383711 | .0855258 |
| 1.blhisp | | -.3639377 | .0618734 | -5.88 | 0.000 | -.4852073 | -.2426682 |
| totchr | | .7969518 | .0711306 | 11.20 | 0.000 | .6575383 | .9363653 |
| 1.ins | | .1701367 | .0628711 | 2.71 | 0.007 | .0469117 | .2933618 |
| income | | .0027078 | .0013168 | 2.06 | 0.040 | .000127 | .0052886 |
| _cons | | -.6760546 | .1940288 | -3.48 | 0.000 | -1.056344 | -.2957652 |
| ----- | | | | | | | |
| /athrho | | -.1313456 | .1496292 | -0.88 | 0.380 | -.4246134 | .1619222 |
| /lnsigma | | .2398173 | .0144598 | 16.59 | 0.000 | .2114767 | .268158 |
| ----- | | | | | | | |
| rho | | -.1305955 | .1470772 | | | -.4008098 | .1605217 |
| sigma | | 1.271017 | .0183786 | | | 1.235501 | 1.307554 |
| lambda | | -.1659891 | .1878698 | | | -.5342072 | .2022291 |
| ----- | | | | | | | |
| LR test of indep. eqns. (rho = 0): chi2(1) = 0.91 | | | | | Prob > chi2 = 0.3406 | | |

2.5 Compute the marginal effects of each regressor for: (1) probability of selection; (2) the expected value of the outcome; and (3) the expected value of the outcome, conditional on selection. You will need to use the post-estimation command `margins, dydx(*) predict()` with predict options: `psel`, `yexpected`, and `ycond`.

```
qui heckman lambexp $xlist, select(dambexp = $xlist income) nolog

margins, dydx(*) predict(psel)
margins, dydx(*) predict(yexpected)
margins, dydx(*) predict(ycond)
```

Average marginal effects
Model VCE: OIM

Number of obs = 3,328

Expression: Pr(dambexp), predict(psel)
dy/dx wrt: age 1.female educ 1.blhisp totchr 1.ins income

| | | Delta-method | | | | [95% conf. interval] | |
|----------|--|--------------|-----------|-------|-------|----------------------|-----------|
| | | dy/dx | std. err. | z | P> z | | |
| age | | .0176149 | .0054761 | 3.22 | 0.001 | .006882 | .0283479 |
| 1.female | | .1327517 | .0118078 | 11.24 | 0.000 | .1096089 | .1558945 |
| educ | | .0124093 | .0023845 | 5.20 | 0.000 | .0077357 | .0170828 |
| 1.blhisp | | -.0773377 | .0137795 | -5.61 | 0.000 | -.1043449 | -.0503305 |
| totchr | | .159642 | .013898 | 11.49 | 0.000 | .1324024 | .1868817 |
| 1.ins | | .033526 | .0121515 | 2.76 | 0.006 | .0097095 | .0573425 |
| income | | .0005424 | .0002634 | 2.06 | 0.039 | .0000262 | .0010586 |

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

Average marginal effects
Model VCE: OIM

Number of obs = 3,328

Expression: E(lambexp*Pr(dambexp)), predict(yexpected)
dy/dx wrt: age 1.female educ 1.blhisp totchr 1.ins income

| | | Delta-method | | | | [95% conf. interval] | |
|----------|--|--------------|-----------|-------|-------|----------------------|-----------|
| | | dy/dx | std. err. | z | P> z | | |
| age | | .2897346 | .0381846 | 7.59 | 0.000 | .2148942 | .364575 |
| 1.female | | 1.14081 | .0832165 | 13.71 | 0.000 | .9777089 | 1.303911 |
| educ | | .0941877 | .0167238 | 5.63 | 0.000 | .0614096 | .1269658 |
| 1.blhisp | | -.6692709 | .095073 | -7.04 | 0.000 | -.8556106 | -.4829312 |
| totchr | | 1.463455 | .0890935 | 16.43 | 0.000 | 1.288834 | 1.638075 |
| 1.ins | | .1863924 | .0856166 | 2.18 | 0.029 | .0185871 | .3541978 |
| income | | .0034285 | .0016722 | 2.05 | 0.040 | .0001511 | .0067059 |

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

Average marginal effects
Model VCE: OIM

Number of obs = 3,328

Expression: E(lambexp|Zg>0), predict(ycond)
dy/dx wrt: age 1.female educ 1.blhisp totchr 1.ins income

| | | Delta-method | | | | [95% conf. interval] | |
|----------|--|--------------|-----------|-------|-------|----------------------|-----------|
| | | dy/dx | std. err. | z | P> z | | |
| age | | .2165793 | .0222037 | 9.75 | 0.000 | .1730609 | .2600977 |
| 1.female | | .3826391 | .0486389 | 7.87 | 0.000 | .2873087 | .4779695 |
| educ | | .0219597 | .0097532 | 2.25 | 0.024 | .0028438 | .0410755 |
| 1.blhisp | | -.2385954 | .0551014 | -4.33 | 0.000 | -.3465921 | -.1305986 |
| totchr | | .5816493 | .0379133 | 15.34 | 0.000 | .5073406 | .6559579 |
| 1.ins | | -.0212273 | .0499484 | -0.42 | 0.671 | -.1191243 | .0766697 |
| income | | .0001418 | .0001762 | 0.80 | 0.421 | -.0002036 | .0004872 |

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

2.6. Now re-estimate the two-step and MLE approach without an excluded variable, storing the results each time. This means that the same set of regressors enter both equations. i.e. include income in the outcome equation.

```
global xlist age i.female educ i.blhisp totchr i.ins income
eststo heck_2sW0: heckman lambexp $xlist, select(dambexp = $xlist) twostep mills(mills_b)
eststo heck_mlw0: heckman lambexp $xlist, select(dambexp = $xlist) nolog mills(mills_b_mle)
```

```
Heckman selection model -- two-step estimates    Number of obs    =      3,328
(regression model with sample selection)         Selected       =      2,802
                                                Nonselected     =       526

                                                Wald chi2(7)     =      192.92
                                                Prob > chi2      =      0.0000
```

| | | Coefficient | Std. err. | z | P> z | [95% conf. interval] | |
|----------|--|-------------|-----------|-------|-------|----------------------|----------|
| lambexp | | | | | | | |
| age | | .2043022 | .0244086 | 8.37 | 0.000 | .1564622 | .2521422 |
| 1.female | | .2786877 | .0750154 | 3.72 | 0.000 | .1316602 | .4257151 |
| educ | | .0141631 | .0118462 | 1.20 | 0.232 | -.0090551 | .0373812 |
| 1.blhisp | | -.1797416 | .0656337 | -2.74 | 0.006 | -.3083812 | -.051102 |
| totchr | | .4938391 | .049539 | 9.97 | 0.000 | .3967445 | .5909337 |
| 1.ins | | -.0461181 | .053113 | -0.87 | 0.385 | -.1502176 | .0579815 |

| | | | | | | | |
|----------|--|-----------|----------|-------|-------|-----------|-----------|
| income | | -.0007456 | .0010158 | -0.73 | 0.463 | -.0027367 | .0012454 |
| _cons | | 5.306311 | .2901551 | 18.29 | 0.000 | 4.737617 | 5.875004 |
| ----- | | | | | | | |
| dambexp | | | | | | | |
| age | | .0868152 | .0274556 | 3.16 | 0.002 | .0330032 | .1406272 |
| 1.female | | .6635053 | .0609648 | 10.88 | 0.000 | .5440165 | .7829941 |
| educ | | .061884 | .012039 | 5.14 | 0.000 | .038288 | .0854801 |
| 1.blhisp | | -.3657835 | .0619095 | -5.91 | 0.000 | -.4871239 | -.2444432 |
| totchr | | .7957496 | .0712174 | 11.17 | 0.000 | .656166 | .9353332 |
| 1.ins | | .169107 | .0629296 | 2.69 | 0.007 | .0457673 | .2924467 |
| income | | .0026773 | .0013105 | 2.04 | 0.041 | .0001088 | .0052458 |
| _cons | | -.6686471 | .1941247 | -3.44 | 0.001 | -1.049125 | -.2881698 |
| ----- | | | | | | | |
| /mills | | | | | | | |
| lambda | | -.5087361 | .2894687 | -1.76 | 0.079 | -1.076084 | .0586121 |
| ----- | | | | | | | |
| rho | | -0.39250 | | | | | |
| sigma | | 1.2961455 | | | | | |
| ----- | | | | | | | |

| | | | |
|--|---------------|---|--------|
| Heckman selection model | Number of obs | = | 3,328 |
| (regression model with sample selection) | Selected | = | 2,802 |
| | Nonselected | = | 526 |
| | Wald chi2(7) | = | 285.98 |
| Log likelihood = -5836.09 | Prob > chi2 | = | 0.0000 |

| | | Coefficient | Std. err. | z | P> z | [95% conf. interval] |
|----------|--|-------------|-----------|-------|-------|----------------------|
| ----- | | | | | | |
| lambexp | | | | | | |
| age | | .2137594 | .0232969 | 9.18 | 0.000 | .1680983 .2594205 |
| 1.female | | .342293 | .0615522 | 5.56 | 0.000 | .2216528 .4629332 |
| educ | | .0202746 | .0110032 | 1.84 | 0.065 | -.0012913 .0418406 |
| 1.blhisp | | -.2185104 | .0598099 | -3.65 | 0.000 | -.3357357 -.1012852 |
| totchr | | .5375964 | .0398453 | 13.49 | 0.000 | .459501 .6156918 |
| 1.ins | | -.0287728 | .0511856 | -0.56 | 0.574 | -.1290946 .0715491 |
| income | | -.0005026 | .000989 | -0.51 | 0.611 | -.0024411 .0014359 |
| _cons | | 5.041712 | .229726 | 21.95 | 0.000 | 4.591458 5.491967 |
| ----- | | | | | | |
| dambexp | | | | | | |
| age | | .0878613 | .0274099 | 3.21 | 0.001 | .034139 .1415837 |
| 1.female | | .6628035 | .060929 | 10.88 | 0.000 | .5433848 .7822223 |

| | | | | | | | |
|---|--|-----------|----------|-------|----------------------|-----------|-----------|
| educ | | .0617998 | .0120332 | 5.14 | 0.000 | .0382152 | .0853844 |
| 1.blhisp | | -.3636885 | .0618724 | -5.88 | 0.000 | -.4849562 | -.2424207 |
| totchr | | .7968988 | .0711265 | 11.20 | 0.000 | .6574934 | .9363041 |
| 1.ins | | .1699645 | .0628669 | 2.70 | 0.007 | .0467476 | .2931815 |
| income | | .0027483 | .0013209 | 2.08 | 0.037 | .0001595 | .0053372 |
| _cons | | -.675346 | .1939739 | -3.48 | 0.000 | -1.055528 | -.295164 |
| ----- | | | | | | | |
| /athrho | | -.1419126 | .1535634 | -0.92 | 0.355 | -.4428913 | .1590661 |
| /lnsigma | | .240186 | .0146925 | 16.35 | 0.000 | .2113892 | .2689828 |
| ----- | | | | | | | |
| rho | | -.1409675 | .1505118 | | | -.4160382 | .157738 |
| sigma | | 1.271486 | .0186813 | | | 1.235393 | 1.308633 |
| lambda | | -.1792382 | .1924853 | | | -.5565025 | .1980261 |
| ----- | | | | | | | |
| LR test of indep. eqns. (rho = 0): chi2(1) = 1.02 | | | | | Prob > chi2 = 0.3122 | | |

2.7. Create a table that reports the four models alongside one another and compare the results.

```
esttab heck_2sW heck_2sWO heck_mlW heck_mlWO, se scalar(N) mtitle("2-step,w/" "2-step,w/o" "1
```

Heckman Selection Models

| | (1) | (2) | (3) | (4) |
|----------|----------------------|----------------------|-----------------------|-----------------------|
| | 2-step,w/ | 2-step,w/o | ML,w/ | ML,w/o |
| ----- | | | | |
| lambexp | | | | |
| age | 0.202*** (0.0242) | 0.204*** (0.0244) | 0.212*** (0.0230) | 0.214*** (0.0233) |
| 1.female | 0.292*** (0.0726) | 0.279*** (0.0750) | 0.348*** (0.0601) | 0.342*** (0.0616) |
| educ | 0.0124 (0.0116) | 0.0142 (0.0118) | 0.0187 (0.0105) | 0.0203 (0.0110) |
| 1.blhisp | -0.183** (0.0653) | -0.180** (0.0656) | -0.219*** (0.0597) | -0.219*** (0.0598) |
| totchr | 0.501*** (0.0486) | 0.494*** (0.0495) | 0.540*** (0.0393) | 0.538*** (0.0398) |

| | | | | |
|------------------|-----------------------|------------------------|-----------------------|-------------------------|
| 1.ins | -0.0465 (0.0530) | -0.0461 (0.0531) | -0.0300 (0.0511) | -0.0288 (0.0512) |
| income | | -0.000746 (0.00102) | | -0.000503 (0.000989) |
| _cons | 5.289*** (0.289) | 5.306*** (0.290) | 5.044*** (0.228) | 5.042*** (0.230) |
| ----- | | | | |
| dambexp age | 0.0868** (0.0275) | 0.0868** (0.0275) | 0.0879** (0.0274) | 0.0879** (0.0274) |
| 1.female | 0.664*** (0.0610) | 0.664*** (0.0610) | 0.663*** (0.0609) | 0.663*** (0.0609) |
| educ | 0.0619*** (0.0120) | 0.0619*** (0.0120) | 0.0619*** (0.0120) | 0.0618*** (0.0120) |
| 1.blhisp | -0.366*** (0.0619) | -0.366*** (0.0619) | -0.364*** (0.0619) | -0.364*** (0.0619) |
| totchr | 0.796*** (0.0712) | 0.796*** (0.0712) | 0.797*** (0.0711) | 0.797*** (0.0711) |
| 1.ins | 0.169** (0.0629) | 0.169** (0.0629) | 0.170** (0.0629) | 0.170** (0.0629) |
| income | 0.00268* (0.00131) | 0.00268* (0.00131) | 0.00271* (0.00132) | 0.00275* (0.00132) |
| _cons | -0.669*** (0.194) | -0.669*** (0.194) | -0.676*** (0.194) | -0.675*** (0.194) |
| ----- | | | | |
| /mills lambda | -0.464 (0.283) | -0.509 (0.289) | | |
| ----- | | | | |
| / | | | | |
| athrho | | | -0.131 (0.150) | -0.142 (0.154) |

| | | | | |
|---------|--|--|----------------------|----------------------|
| lnsigma | | | 0.240*** (0.0145) | 0.240*** (0.0147) |
|---------|--|--|----------------------|----------------------|

| | | | | |
|---|------|------|------|------|
| N | 3328 | 3328 | 3328 | 3328 |
|---|------|------|------|------|

Standard errors in parentheses
 * p<0.05, ** p<0.01, *** p<0.001

Postamble

log close

```

      name: <unnamed>
      log: C:\Users\neil_\OneDrive - University of Warwick\Documents\EC910\we
> bsite\warwick-ec910\problem-sets\ps-6\problem-set-6-log.txt
      log type: smcl
      closed on: 19 Nov 2024, 17:41:19

```