

## Assignment2

### Exercise1

```
9 . set seed 100  
10 . set obs 10000  
      number of observations (_N) was 0, now 10,000  
11 . gen X1= runiform(1, 3)  
12 . gen X2= rgamma(3, 2)  
13 . gen X3= rbinomial(10000,0.3)  
14 . gen eps=rnormal(2,1)  
15 . gen Y=0.5+1.2*X1-0.9*X2+0.1*X3+eps  
16 . gen ydum=0  
17 . replace ydum=1 if Y> 299.4644  
      (5,096 real changes made)
```

### Exercise2

\*The correlation between Y and x1

reg1

| Variable | reg1                    |
|----------|-------------------------|
| X1       | 1.1395885<br>3.0975638  |
| _cons    | 297.17641<br>3.20390815 |

legend: b/se

The coefficients and standard errors of Y on X

| Y     | Coef.     | Std. Err. |
|-------|-----------|-----------|
| X1    | 1.175044  | .0171802  |
| X2    | -.9003673 | .0028711  |
| X3    | .1005889  | .0002157  |
| _cons | .8009973  | .6478174  |

Standard errors of bootstrap(49)

| Y     | Observed         | Bootstrap       |
|-------|------------------|-----------------|
|       | Coef.            | Std. Err.       |
| X1    | <b>1.175044</b>  | <b>.0168205</b> |
| X2    | <b>-.9003673</b> | <b>.0029568</b> |
| X3    | <b>.1005889</b>  | <b>.000259</b>  |
| _cons | <b>.8009973</b>  | <b>.7839713</b> |

Standard errors of bootstrap(499)

| Y     | Observed         | Bootstrap       |
|-------|------------------|-----------------|
|       | Coef.            | Std. Err.       |
| X1    | <b>1.175044</b>  | <b>.017771</b>  |
| X2    | <b>-.9003673</b> | <b>.0028295</b> |
| X3    | <b>.1005889</b>  | <b>.0002219</b> |
| _cons | <b>.8009973</b>  | <b>.6634689</b> |

Exercise4&5

Probit model

|                                    |               |   |                 |
|------------------------------------|---------------|---|-----------------|
| Probit regression                  | Number of obs | = | <b>10,000</b>   |
|                                    | LR chi2(3)    | = | <b>11283.62</b> |
|                                    | Prob > chi2   | = | <b>0.0000</b>   |
| Log likelihood = <b>-1287.8187</b> | Pseudo R2     | = | <b>0.8142</b>   |

| ydum  | Coef.            | Std. Err.       | z             | P> z         | [95% Conf. Interval]              |
|-------|------------------|-----------------|---------------|--------------|-----------------------------------|
| X1    | <b>1.132912</b>  | <b>.0560252</b> | <b>20.22</b>  | <b>0.000</b> | <b>1.023104</b> <b>1.242719</b>   |
| X2    | <b>-.9120145</b> | <b>.0249007</b> | <b>-36.63</b> | <b>0.000</b> | <b>-.9608189</b> <b>-.86321</b>   |
| X3    | <b>.1018701</b>  | <b>.0026759</b> | <b>38.07</b>  | <b>0.000</b> | <b>.0966254</b> <b>.1071148</b>   |
| _cons | <b>-302.3891</b> | <b>7.947723</b> | <b>-38.05</b> | <b>0.000</b> | <b>-317.9664</b> <b>-286.8119</b> |

Note: 1452 failures and 1390 successes completely determined.

Marginal effects of probit model

|    | dy/dx            | Std. Err.       | z             | P> z         | [95% Conf. Interval]             |
|----|------------------|-----------------|---------------|--------------|----------------------------------|
| X1 | <b>.4516502</b>  | <b>.0223285</b> | <b>20.23</b>  | <b>0.000</b> | <b>.4078871</b> <b>.4954132</b>  |
| X2 | <b>-.3635866</b> | <b>.0098969</b> | <b>-36.74</b> | <b>0.000</b> | <b>-.3829842</b> <b>-.344189</b> |
| X3 | <b>.0406119</b>  | <b>.0010656</b> | <b>38.11</b>  | <b>0.000</b> | <b>.0385234</b> <b>.0427003</b>  |

Delta method to compute marginal effects of probit model

```

Expression   : Pr(ydum), predict()
dy/dx w.r.t. : x1 x2 x3
at           : x1          =    2.00771 (mean)
                x2          =    6.012179 (mean)
                x3          =   2999.51 (mean)

```

|    | Delta-method |           |        |       |                      |          |
|----|--------------|-----------|--------|-------|----------------------|----------|
|    | dy/dx        | Std. Err. | z      | P> z  | [95% Conf. Interval] |          |
| x1 | .4516502     | .0223285  | 20.23  | 0.000 | .4078871             | .4954132 |
| x2 | -.3635866    | .0098969  | -36.74 | 0.000 | -.3829842            | -.344189 |
| x3 | .0406119     | .0010656  | 38.11  | 0.000 | .0385234             | .0427003 |

Bootstrap method to compute marginal effects of probit model

| ydum  | Observed  | Bootstrap |        |       |                      | Normal-based |
|-------|-----------|-----------|--------|-------|----------------------|--------------|
|       | Coef.     | Std. Err. | z      | P> z  | [95% Conf. Interval] |              |
| x1    | 1.132912  | .0575623  | 19.68  | 0.000 | 1.020092             | 1.245732     |
| x2    | -.9120145 | .0253808  | -35.93 | 0.000 | -.9617599            | -.862269     |
| x3    | .1018701  | .0027447  | 37.12  | 0.000 | .0964906             | .1072496     |
| _cons | -302.3891 | 8.157659  | -37.07 | 0.000 | -318.3778            | -286.4004    |

Note: 1452 failures and 1390 successes completely determined.

Logit model

```

Logistic regression                               Number of obs      =     10,000
                                                LR chi2(3)        =    11275.15
                                                Prob > chi2       =     0.0000
Log likelihood = -1292.0526                      Pseudo R2        =     0.8135

```

| ydum  | Coef.     | Std. Err. | z      | P> z  | [95% Conf. Interval] |           |
|-------|-----------|-----------|--------|-------|----------------------|-----------|
| x1    | 2.057558  | .1046452  | 19.66  | 0.000 | 1.852458             | 2.262659  |
| x2    | -1.647092 | .0492343  | -33.45 | 0.000 | -1.74359             | -1.550595 |
| x3    | .1839136  | .0053234  | 34.55  | 0.000 | .17348               | .1943472  |
| _cons | -545.9487 | 15.81095  | -34.53 | 0.000 | -576.9376            | -514.9598 |

Note: 457 failures and 329 successes completely determined.

Marginal effects of logit model

|    | dy/dx     | Std. Err. | z      | P> z  | [95% Conf. Interval] |           |
|----|-----------|-----------|--------|-------|----------------------|-----------|
| x1 | .5137631  | .0261146  | 19.67  | 0.000 | .4625795             | .5649467  |
| x2 | -.4112716 | .0122423  | -33.59 | 0.000 | -.435266             | -.3872771 |
| x3 | .0459224  | .0013272  | 34.60  | 0.000 | .0433211             | .0485237  |

Delta method

|    | Delta-method |           |        |       |                      |           |
|----|--------------|-----------|--------|-------|----------------------|-----------|
|    | dy/dx        | Std. Err. | z      | P> z  | [95% Conf. Interval] |           |
| X1 | .5137631     | .0261146  | 19.67  | 0.000 | .4625795             | .5649467  |
| X2 | -.4112716    | .0122423  | -33.59 | 0.000 | -.435266             | -.3872771 |
| X3 | .0459224     | .0013272  | 34.60  | 0.000 | .0433211             | .0485237  |

#### Bootstrap method

| y dum | Observed  | Bootstrap |        |       |                      | Normal-based |
|-------|-----------|-----------|--------|-------|----------------------|--------------|
|       | Coef.     | Std. Err. | z      | P> z  | [95% Conf. Interval] |              |
| X1    | 2.057558  | .1091902  | 18.84  | 0.000 | 1.84355              | 2.271567     |
| X2    | -1.647092 | .0483982  | -34.03 | 0.000 | -1.741951            | -1.552234    |
| X3    | .1839136  | .0051391  | 35.79  | 0.000 | .1738412             | .1939859     |
| _cons | -545.9487 | 15.27045  | -35.75 | 0.000 | -575.8782            | -516.0191    |

#### Linear probability model

Prob > F = 0.0000  
R-squared = 0.6088  
Root MSE = .31275

| y dum | Robust    |           |         |       |           | [95% Conf. Interval] |
|-------|-----------|-----------|---------|-------|-----------|----------------------|
|       | Coef.     | Std. Err. | t       | P> t  |           |                      |
| X1    | .0818024  | .0053584  | 15.27   | 0.000 | .0712989  | .092306              |
| X2    | -.0601577 | .0009596  | -62.69  | 0.000 | -.0620386 | -.0582767            |
| X3    | .0071021  | .0000648  | 109.56  | 0.000 | .006975   | .0072292             |
| _cons | -20.59574 | .1947444  | -105.76 | 0.000 | -20.97748 | -20.214              |

\*Assignment 3

Exercise1

summarize

| Variable | Obs   | Mean     | Std. Dev. | Min | Max  |
|----------|-------|----------|-----------|-----|------|
| PPk_Stk  | 4,470 | .5184362 | .1505174  | .19 | .67  |
| PBB_Stk  | 4,470 | .5432103 | .1203319  | .19 | 1.01 |
| PF1_Stk  | 4,470 | 1.01502  | .0428952  | .95 | 1.16 |
| PHse_Stk | 4,470 | .4371477 | .1188312  | .19 | .64  |
| PGen_Stk | 4,470 | .3452819 | .0351661  | .25 | .55  |
| PImp_Stk | 4,470 | .7807785 | .1146461  | .33 | 2.3  |
| PSS_Tub  | 4,470 | .8250895 | .0612116  | .5  | .98  |
| PPk_Tub  | 4,470 | 1.077409 | .0297261  | .98 | 1.24 |
| PF1_Tub  | 4,470 | 1.189376 | .0140545  | .69 | 1.47 |
| PHse_Tub | 4,470 | .5686734 | .072455   | .33 | 1.27 |

Market share

tabulate choice

| choice | Freq. | Percent | Cum.   |
|--------|-------|---------|--------|
| 1      | 1,766 | 39.51   | 39.51  |
| 2      | 699   | 15.64   | 55.15  |
| 3      | 243   | 5.44    | 60.58  |
| 4      | 593   | 13.27   | 73.85  |
| 5      | 315   | 7.05    | 80.89  |
| 6      | 74    | 1.66    | 82.55  |
| 7      | 319   | 7.14    | 89.69  |
| 8      | 203   | 4.54    | 94.23  |
| 9      | 225   | 5.03    | 99.26  |
| 10     | 33    | 0.74    | 100.00 |
| Total  | 4,470 | 100.00  |        |

tabulate Income choice

| Income | choice |     |    |     |     |    |
|--------|--------|-----|----|-----|-----|----|
|        | 1      | 2   | 3  | 4   | 5   | 6  |
| 2.5    | 19     | 4   | 0  | 2   | 6   | 0  |
| 7.5    | 117    | 54  | 13 | 34  | 19  | 2  |
| 12.5   | 196    | 106 | 41 | 44  | 23  | 9  |
| 17.5   | 318    | 100 | 27 | 111 | 21  | 5  |
| 22.5   | 292    | 123 | 34 | 154 | 123 | 2  |
| 27.5   | 195    | 94  | 9  | 67  | 18  | 6  |
| 32.5   | 209    | 84  | 28 | 64  | 54  | 4  |
| 37.5   | 132    | 34  | 17 | 29  | 23  | 1  |
| 42.5   | 125    | 33  | 33 | 23  | 6   | 20 |
| 47.5   | 83     | 22  | 23 | 16  | 7   | 17 |
| 55     | 47     | 30  | 11 | 32  | 7   | 3  |

|       |       |     |     |     |     |    |
|-------|-------|-----|-----|-----|-----|----|
| 67.5  | 19    | 4   | 1   | 8   | 6   | 2  |
| 87.5  | 9     | 10  | 3   | 1   | 0   | 1  |
| 130   | 5     | 1   | 3   | 8   | 2   | 2  |
| Total | 1,766 | 699 | 243 | 593 | 315 | 74 |

Exercise2&4

```
. asclogit dum c, case(A) alternatives(price)
```

```
Iteration 0: log likelihood = -7559.2014
Iteration 1: log likelihood = -7465.2593
Iteration 2: log likelihood = -7464.9321
Iteration 3: log likelihood = -7464.9321
```

```
Alternative-specific conditional logit          Number of obs      =    44,700
Case variable: A                            Number of cases   =     4470
```

```
Alternative variable: price                  Alts per case: min =       10
                                                avg =      10.0
                                                max =      10
```

```
Log likelihood = -7464.9321                  Wald chi2(1)      =   1458.85
                                                Prob > chi2     = 0.0000
```

| dum   |       | Coef.              | Std. Err. | z      | P> z  | [95% Conf. Interval] |
|-------|-------|--------------------|-----------|--------|-------|----------------------|
| price | c     | -6.65658           | .1742793  | -38.19 | 0.000 | -6.998161 -6.314999  |
| 1     |       | (base alternative) |           |        |       |                      |
| 2     | _cons | -.9543069          | .0500462  | -19.07 | 0.000 | -1.052396 -.856218   |
| 3     | _cons | 1.296968           | .1086515  | 11.94  | 0.000 | 1.084015 1.509921    |
| 4     | _cons | -1.717332          | .0541582  | -31.71 | 0.000 | -1.82348 -1.611184   |
| 5     | _cons | -2.904005          | .0714605  | -40.64 | 0.000 | -3.044065 -2.763945  |
| 6     | _cons | -1.515311          | .1262303  | -12.00 | 0.000 | -1.762718 -1.267904  |
| 7     | _cons | .2517683           | .079164   | 3.18   | 0.001 | .0966097 .4069269    |
| 8     | _cons | 1.464868           | .1180467  | 12.41  | 0.000 | 1.233501 1.696236    |
| 9     | _cons | 2.357505           | .133774   | 17.62  | 0.000 | 2.095313 2.619697    |
| 10    | _cons | -3.896593          | .177419   | -21.96 | 0.000 | -4.244328 -3.548859  |

Marginal effects

$\text{Pr}(\text{choice} = 1 | 1 \text{ selected}) = .41862$

| variable | dp/dx    | Std. Err. |
|----------|----------|-----------|
| c        |          |           |
| 1        | -1.62007 | .045076   |
| 2        | .38092   | .016377   |
| 3        | .156526  | .010709   |
| 4        | .359811  | .016943   |
| 5        | .202435  | .012376   |
| 6        | .04471   | .005301   |
| 7        | .194866  | .011804   |
| 8        | .12222   | .008972   |
| 9        | .14162   | .009996   |
| 10       | .016959  | .002973   |

$\text{Pr}(\text{choice} = 2 | 1 \text{ selected}) = .136696$

| variable | dp/dx    | Std. Err. |
|----------|----------|-----------|
| c        |          |           |
| 1        | .38092   | .016377   |
| 2        | -.785545 | .030158   |
| 3        | .051111  | .003765   |
| 4        | .117491  | .006448   |
| 5        | .066102  | .004433   |
| 6        | .014599  | .001779   |
| 7        | .063631  | .004253   |
| 8        | .039909  | .003145   |
| 9        | .046244  | .003507   |
| 10       | .005538  | .000986   |

$\Pr(\text{choice} = 3 | 1 \text{ selected}) = .056170$

| variable | dp/dx    | Std. Err. |
|----------|----------|-----------|
| <b>c</b> |          |           |
| 1        | .156526  | .010709   |
| 2        | .051111  | .003765   |
| 3        | -.352902 | .02284    |
| 4        | .048279  | .003651   |
| 5        | .027162  | .002319   |
| 6        | .005999  | .000796   |
| 7        | .026147  | .002223   |
| 8        | .016399  | .001554   |
| 9        | .019002  | .001757   |
| 10       | .002276  | .000422   |

$\Pr(\text{choice} = 4 | 1 \text{ selected}) = .129120$

| variable | dp/dx   | Std. Err. |
|----------|---------|-----------|
| <b>c</b> |         |           |
| 1        | .359811 | .016943   |
| 2        | .117491 | .006448   |
| 3        | .048279 | .003651   |

|    |                 |                |
|----|-----------------|----------------|
| 4  | <b>-.748524</b> | <b>.031316</b> |
| 5  | <b>.062439</b>  | <b>.00431</b>  |
| 6  | <b>.01379</b>   | <b>.001698</b> |
| 7  | <b>.060104</b>  | <b>.004135</b> |
| 8  | <b>.037698</b>  | <b>.003025</b> |
| 9  | <b>.043681</b>  | <b>.003386</b> |
| 10 | <b>.005231</b>  | <b>.000933</b> |

Pr(choice = 5 | 1 selected) = .07264

| variable | dp/dx          | Std. Err.      |
|----------|----------------|----------------|
| <b>c</b> |                |                |
| 1        | <b>.202435</b> | <b>.012376</b> |
| 2        | <b>.066102</b> | <b>.004433</b> |
| 3        | <b>.027162</b> | <b>.002319</b> |
| 4        | <b>.062439</b> | <b>.00431</b>  |
| 5        | <b>-.44844</b> | <b>.025561</b> |
| 6        | <b>.007759</b> | <b>.001001</b> |
| 7        | <b>.033816</b> | <b>.002681</b> |
| 8        | <b>.021209</b> | <b>.0019</b>   |
| 9        | <b>.024576</b> | <b>.002144</b> |
| 10       | <b>.002943</b> | <b>.000538</b> |

Pr(choice = 6 | 1 selected) = .016044

| variable | dp/dx           | Std. Err.      |
|----------|-----------------|----------------|
| <b>c</b> |                 |                |
| 1        | <b>.04471</b>   | <b>.005301</b> |
| 2        | <b>.014599</b>  | <b>.001779</b> |
| 3        | <b>.005999</b>  | <b>.000796</b> |
| 4        | <b>.01379</b>   | <b>.001698</b> |
| 5        | <b>.007759</b>  | <b>.001001</b> |
| 6        | <b>-.105088</b> | <b>.012245</b> |
| 7        | <b>.007469</b>  | <b>.000963</b> |
| 8        | <b>.004684</b>  | <b>.000634</b> |
| 9        | <b>.005428</b>  | <b>.000726</b> |
| 10       | <b>.00065</b>   | <b>.000136</b> |

$\Pr(\text{choice} = 7 | 1 \text{ selected}) = .06992$

| variable | dp/dx    | Std. Err. |
|----------|----------|-----------|
| c        |          |           |
| 1        | .194866  | .011804   |
| 2        | .063631  | .004253   |
| 3        | .026147  | .002223   |
| 4        | .060104  | .004135   |
| 5        | .033816  | .002681   |
| 6        | .007469  | .000963   |
| 7        | -.432938 | .024519   |
| 8        | .020416  | .001828   |
| 9        | .023657  | .002057   |
| 10       | .002833  | .000518   |

$\Pr(\text{choice} = 8 | 1 \text{ selected}) = .0438597$

| variable | dp/dx    | Std. Err. |
|----------|----------|-----------|
| c        |          |           |
| 1        | .12222   | .008972   |
| 2        | .039909  | .003145   |
| 3        | .016399  | .001554   |
| 4        | .037698  | .003025   |
| 5        | .021209  | .0019     |
| 6        | .004684  | .000634   |
| 7        | .020416  | .001828   |
| 8        | -.279151 | .019602   |
| 9        | .014838  | .001434   |
| 10       | .001777  | .000334   |

$\Pr(\text{choice} = 9 | 1 \text{ selected}) = .0508215$

| variable | dp/dx    | Std. Err. |
|----------|----------|-----------|
| c        |          |           |
| 1        | .14162   | .009996   |
| 2        | .046244  | .003507   |
| 3        | .019002  | .001757   |
| 4        | .043681  | .003386   |
| 5        | .024576  | .002144   |
| 6        | .005428  | .000726   |
| 7        | .023657  | .002057   |
| 8        | .014838  | .001434   |
| 9        | -.321105 | .021545 - |
| 10       | .002059  | .000384   |

$\Pr(\text{choice} = 10 | 1 \text{ selected}) = .006085$

| variable | dp/dx    | Std. Err. |
|----------|----------|-----------|
| 1        | .016959  | .002973   |
| 2        | .005538  | .000986   |
| 3        | .002276  | .000422   |
| 4        | .005231  | .000933   |
| 5        | .002943  | .000538   |
| 6        | .00065   | .000136   |
| 7        | .002833  | .000518   |
| 8        | .001777  | .000334   |
| 9        | .002059  | .000384   |
| 10       | -.040265 | .007011   |

Exercise 3&4

|    | dum    | Coef.              | Std. Err.       |
|----|--------|--------------------|-----------------|
| 1  |        | (base alternative) |                 |
| 2  |        |                    |                 |
|    | Income | <b>-.0030887</b>   | <b>.003114</b>  |
|    | _cons  | <b>-.8453241</b>   | <b>.0931354</b> |
| 3  |        |                    |                 |
|    | Income | <b>.0145862</b>    | <b>.0038255</b> |
|    | _cons  | <b>-2.399858</b>   | <b>.1335802</b> |
| 4  |        |                    |                 |
|    | Income | <b>.0040504</b>    | <b>.0030926</b> |
|    | _cons  | <b>-1.201326</b>   | <b>.0971021</b> |
| 5  |        |                    |                 |
|    | Income | <b>-.0012536</b>   | <b>.0042024</b> |
|    | _cons  | <b>-1.690582</b>   | <b>.1269952</b> |
| 6  |        |                    |                 |
|    | Income | <b>.030612</b>     | <b>.004674</b>  |
|    | _cons  | <b>-4.139767</b>   | <b>.210989</b>  |
| 7  |        |                    |                 |
|    | Income | <b>-.0069326</b>   | <b>.0044161</b> |
|    | _cons  | <b>-1.531042</b>   | <b>.1280434</b> |
| 8  |        |                    |                 |
|    | Income | <b>.0228862</b>    | <b>.0036217</b> |
|    | _cons  | <b>-2.848352</b>   | <b>.1393848</b> |
| 9  |        |                    |                 |
|    | Income | <b>.017743</b>     | <b>.0037623</b> |
|    | _cons  | <b>-2.575597</b>   | <b>.13614</b>   |
| 10 |        |                    |                 |
|    | Income | <b>.0107909</b>    | <b>.01013</b>   |
|    | _cons  | <b>-4.28227</b>    | <b>.345792</b>  |

$\Pr(\text{choice} = 1 | 1 \text{ selected}) = .3980171$

| variable        | dp/dx    | Std. Err. | . |
|-----------------|----------|-----------|---|
| <b>casevars</b> |          |           |   |
| Income          | -.001062 | .000487   | . |

$\Pr(\text{choice} = 2 | 1 \text{ selected}) = .15691816$

| variable        | dp/dx    | Std. Err. | . |
|-----------------|----------|-----------|---|
| <b>casevars</b> |          |           |   |
| Income          | -.000904 | .000378   | - |

$\Pr(\text{choice} = 3 | 1 \text{ selected}) = .05406295$

| variable        | dp/dx   | Std. Err. | . |
|-----------------|---------|-----------|---|
| <b>casevars</b> |         |           |   |
| Income          | .000644 | .000183   |   |

$\Pr(\text{choice} = 4 | 1 \text{ selected}) = .13391688$

| variable        | dp/dx   | Std. Err. | . |
|-----------------|---------|-----------|---|
| <b>casevars</b> |         |           |   |
| Income          | .000185 | .000329   |   |

$\Pr(\text{choice} = 5 | 1 \text{ selected}) = .07089742$

| variable        | dp/dx    | Std. Err. | . |
|-----------------|----------|-----------|---|
| <b>casevars</b> |          |           |   |
| Income          | -.000278 | .000264   | - |

$\text{Pr}(\text{choice} = 6 | 1 \text{ selected}) = .0147844$

| variable        | dp/dx   | Std. Err. |
|-----------------|---------|-----------|
| <b>casevars</b> |         |           |
| Income          | .000413 | .000066   |

$\text{Pr}(\text{choice} = 7 | 1 \text{ selected}) = .0710704$

| variable        | dp/dx    | Std. Err. |
|-----------------|----------|-----------|
| <b>casevars</b> |          |           |
| Income          | -.000682 | .000277   |

$\text{Pr}(\text{choice} = 8 | 1 \text{ selected}) = .0434348$

| variable        | dp/dx   | Std. Err. |
|-----------------|---------|-----------|
| <b>casevars</b> |         |           |
| Income          | .000878 | .000138   |

$\text{Pr}(\text{choice} = 9 | 1 \text{ selected}) = .04948833$

| variable        | dp/dx   | Std. Err. |
|-----------------|---------|-----------|
| <b>casevars</b> |         |           |
| Income          | .000746 | .000164   |

$\text{Pr}(\text{choice} = 10 | 1 \text{ selected}) = .0074093$

| variable        | dp/dx  | Std. Err. |
|-----------------|--------|-----------|
| <b>casevars</b> |        |           |
| Income          | .00006 | .000074   |

Exercise 5  
Mixlogit model

|               | dum    | Coef.              | Std. Err.       |
|---------------|--------|--------------------|-----------------|
| <b>price</b>  | c      | <b>-7.547198</b>   | <b>.2223547</b> |
| <b>Normal</b> | sd(c)  | <b>3.649193</b>    | <b>.291882</b>  |
| <b>1</b>      |        | (base alternative) |                 |
| <b>2</b>      |        |                    |                 |
|               | Income | <b>-.0058937</b>   | <b>.0036744</b> |
|               | _cons  | <b>-.8886583</b>   | <b>.1104599</b> |
| <b>3</b>      |        |                    |                 |
|               | Income | <b>.0202033</b>    | <b>.0046021</b> |
|               | _cons  | <b>.3624811</b>    | <b>.2026931</b> |
| <b>4</b>      |        |                    |                 |
|               | Income | <b>.0025691</b>    | <b>.0034659</b> |
|               | _cons  | <b>-2.025266</b>   | <b>.1126402</b> |
| <b>5</b>      |        |                    |                 |
|               | Income | <b>-.003862</b>    | <b>.0045853</b> |
|               | _cons  | <b>-3.383501</b>   | <b>.1540533</b> |
| <b>6</b>      |        |                    |                 |
|               | Income | <b>.0324638</b>    | <b>.0049366</b> |
|               | _cons  | <b>-2.521205</b>   | <b>.2228586</b> |
| <b>7</b>      |        |                    |                 |
|               | Income | <b>-.0061804</b>   | <b>.0047636</b> |
|               | _cons  | <b>.4032681</b>    | <b>.1520697</b> |
| <b>8</b>      |        |                    |                 |
|               | Income | <b>.0292799</b>    | <b>.004687</b>  |
|               | _cons  | <b>.0961353</b>    | <b>.2292829</b> |
| <b>9</b>      |        |                    |                 |
|               | Income | <b>.0258758</b>    | <b>.0051442</b> |
|               | _cons  | <b>.7081915</b>    | <b>.2768591</b> |
| <b>10</b>     |        |                    |                 |
|               | Income | <b>.0065357</b>    | <b>.010873</b>  |
|               | _cons  | <b>-4.412741</b>   | <b>.3674048</b> |

Drop one choice

|               | dum    | Coef.              | Std. Err. |
|---------------|--------|--------------------|-----------|
| <b>price</b>  | c      | <b>-7.005805</b>   | .3085082  |
| <b>Normal</b> | sd(c)  | <b>4.131776</b>    | .4457008  |
| <b>2</b>      |        | (base alternative) |           |
| <b>3</b>      |        |                    |           |
|               | Income | <b>.0280096</b>    | .0057732  |
|               | _cons  | <b>1.078129</b>    | .2589123  |
| <b>4</b>      |        |                    |           |
|               | Income | <b>.0069164</b>    | .004389   |
|               | _cons  | <b>-1.109773</b>   | .1380625  |
| <b>5</b>      |        |                    |           |
|               | Income | <b>.001612</b>     | .0052832  |
|               | _cons  | <b>-2.479984</b>   | .1785247  |
| <b>6</b>      |        |                    |           |
|               | Income | <b>.039115</b>     | .0058909  |
|               | _cons  | <b>-1.707954</b>   | .2473225  |
| <b>7</b>      |        |                    |           |
|               | Income | <b>.0015533</b>    | .0055505  |
|               | _cons  | <b>1.152292</b>    | .1832991  |
| <b>8</b>      |        |                    |           |
|               | Income | <b>.0371097</b>    | .0059475  |
|               | _cons  | <b>.793654</b>     | .2942403  |
| <b>9</b>      |        |                    |           |
|               | Income | <b>.0341178</b>    | .0064737  |
|               | _cons  | <b>1.32835</b>     | .3642326  |
| <b>10</b>     |        |                    |           |
|               | Income | <b>.0117813</b>    | .0111591  |
|               | _cons  | <b>-3.516153</b>   | .3748568  |

Compute stats

Test: Ho: difference in coefficients not systematic

chi2(18) = (b-B)'[(V\_b-V\_B)^(-1)](b-B)  
= 683.28  
Prob>chi2 = 0.0000  
(V\_b-V\_B is not positive definite)

\*Assignment4

Exercise1

tabulate timetrnd logwage if personid == 2

| TIMETRND | LOGWAGE |     |     |      |     |      |
|----------|---------|-----|-----|------|-----|------|
|          | 2.14    | 2.3 | 2.4 | 2.46 | 2.5 | 2.51 |
|          |         |     |     |      |     |      |

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|       |   |   |   |   |   |   |
|-------|---|---|---|---|---|---|
| 6     | 1 | 0 | 0 | 0 | 0 | 0 |
| 7     | 0 | 1 | 0 | 0 | 0 | 0 |
| 8     | 0 | 0 | 1 | 0 | 0 | 0 |
| 9     | 0 | 0 | 0 | 1 | 0 | 0 |
| 10    | 0 | 0 | 0 | 0 | 0 | 1 |
| 11    | 0 | 0 | 0 | 0 | 1 | 0 |
| 12    | 0 | 0 | 0 | 0 | 0 | 0 |
| 13    | 0 | 0 | 0 | 0 | 0 | 0 |
| 14    | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 1 | 1 | 1 | 1 | 1 | 1 |

104 . tabulate timetrnd logwage if personid==4

| TIMETRND | LOGWAGE |      |      |      |      |      |
|----------|---------|------|------|------|------|------|
|          | 1.15    | 1.81 | 1.85 | 1.93 | 2.08 | 2.12 |
| 3        | 0       | 0    | 1    | 0    | 0    | 0    |
| 4        | 0       | 0    | 0    | 0    | 0    | 0    |
| 5        | 0       | 1    | 0    | 0    | 0    | 0    |
| 6        | 1       | 0    | 0    | 0    | 0    | 0    |
| 7        | 0       | 0    | 0    | 1    | 0    | 0    |
| 8        | 0       | 0    | 0    | 0    | 1    | 0    |
| 9        | 0       | 0    | 0    | 0    | 0    | 0    |
| 10       | 0       | 0    | 0    | 0    | 0    | 0    |
| 11       | 0       | 0    | 0    | 0    | 0    | 0    |
| 12       | 0       | 0    | 0    | 0    | 0    | 0    |
| 13       | 0       | 0    | 0    | 0    | 0    | 0    |
| 14       | 0       | 0    | 0    | 0    | 0    | 1    |
| Total    | 1       | 1    | 1    | 1    | 1    | 1    |

| TIMETRND | LOGWAGE |      | Total |
|----------|---------|------|-------|
|          | 2.48    | 2.98 |       |
| 3        | 0       | 0    | 1     |
| 4        | 0       | 0    | 1     |
| 5        | 0       | 0    | 1     |
| 6        | 0       | 0    | 1     |
| 7        | 0       | 0    | 1     |
| 8        | 0       | 0    | 1     |
| 9        | 0       | 0    | 1     |
| 10       | 1       | 0    | 1     |
| 11       | 0       | 1    | 1     |
| 12       | 0       | 0    | 1     |
| 13       | 0       | 0    | 1     |
| 14       | 0       | 0    | 1     |

```
. tabulate timetrnd logwage if personid==6
```

| TIMETRND | LOGWAGE |      |      |      |      |      |
|----------|---------|------|------|------|------|------|
|          | 1.83    | 1.91 | 2.01 | 2.08 | 2.22 | 2.32 |
| 2        | 1       | 0    | 0    | 0    | 0    | 0    |
| 3        | 0       | 0    | 1    | 0    | 0    | 0    |
| 4        | 0       | 1    | 0    | 0    | 0    | 0    |
| 5        | 0       | 0    | 0    | 1    | 0    | 0    |
| 6        | 0       | 0    | 0    | 0    | 1    | 0    |
| 7        | 0       | 0    | 0    | 0    | 0    | 0    |
| 9        | 0       | 0    | 0    | 0    | 0    | 1    |
| 10       | 0       | 0    | 0    | 0    | 0    | 0    |
| 11       | 0       | 0    | 0    | 0    | 0    | 0    |
| 12       | 0       | 0    | 0    | 0    | 0    | 0    |
| 13       | 0       | 0    | 0    | 0    | 0    | 0    |
| 14       | 0       | 0    | 0    | 0    | 0    | 0    |
| Total    | 1       | 1    | 1    | 1    | 1    | 1    |

| TIMETRND | LOGWAGE |     | Total |
|----------|---------|-----|-------|
|          | 2.7     | 2.8 |       |
| 2        | 0       | 0   | 1     |
| 3        | 0       | 0   | 1     |
| 4        | 0       | 0   | 1     |
| 5        | 0       | 0   | 1     |
| 6        | 0       | 0   | 1     |
| 7        | 0       | 0   | 1     |
| 9        | 0       | 0   | 1     |
| 10       | 0       | 0   | 1     |
| 11       | 0       | 0   | 1     |
| 12       | 0       | 1   | 1     |
| 13       | 0       | 0   | 1     |
| 14       | 1       | 0   | 1     |
| Total    | 1       | 1   | 12    |

. tabulate timetrnd logwage if personid==8

| TIMETRND | LOGWAGE |      |      |      |      |
|----------|---------|------|------|------|------|
|          | 1.91    | 2.01 | 2.09 | 2.12 | 2.23 |
|          |         |      |      |      | 2.26 |

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|       |   |   |   |   |   |   |
|-------|---|---|---|---|---|---|
| 0     | 0 | 0 | 0 | 1 | 0 | 0 |
| 1     | 0 | 0 | 0 | 0 | 0 | 0 |
| 2     | 0 | 0 | 0 | 0 | 0 | 1 |
| 3     | 0 | 0 | 1 | 0 | 0 | 0 |
| 4     | 0 | 0 | 0 | 0 | 0 | 0 |
| 5     | 0 | 0 | 0 | 0 | 0 | 0 |
| 6     | 0 | 0 | 0 | 0 | 0 | 0 |
| 7     | 0 | 0 | 0 | 0 | 0 | 0 |
| 8     | 0 | 0 | 0 | 0 | 1 | 0 |
| 9     | 0 | 0 | 0 | 0 | 0 | 0 |
| 10    | 0 | 0 | 0 | 0 | 0 | 0 |
| 12    | 0 | 0 | 0 | 0 | 0 | 0 |
| 13    | 1 | 0 | 0 | 0 | 0 | 0 |
| 14    | 0 | 1 | 0 | 0 | 0 | 0 |
| Total | 1 | 1 | 1 | 1 | 1 | 1 |

| TIMETRND | LOGWAGE |      |      |      | Total |
|----------|---------|------|------|------|-------|
|          | 2.37    | 2.46 | 2.47 | 2.48 |       |
| 0        | 0       | 0    | 0    | 0    | 1     |
| 1        | 0       | 0    | 0    | 0    | 1     |
| 2        | 0       | 0    | 0    | 0    | 1     |
| 3        | 0       | 0    | 0    | 0    | 1     |
| 4        | 0       | 0    | 0    | 0    | 1     |
| 5        | 1       | 0    | 0    | 0    | 1     |
| 6        | 0       | 0    | 0    | 0    | 1     |
| 7        | 0       | 0    | 0    | 0    | 1     |
| 8        | 0       | 0    | 0    | 0    | 1     |
| 9        | 0       | 0    | 1    | 0    | 1     |
| 10       | 0       | 0    | 0    | 1    | 1     |
| 12       | 0       | 1    | 0    | 0    | 1     |
| 13       | 0       | 0    | 0    | 0    | 1     |
| 14       | 0       | 0    | 0    | 0    | 1     |
| Total    | 1       | 1    | 1    | 1    | 14    |

. tabulate timetrnd logwage if personid==12

| TIMETRND | LOGWAGE |      |      |     |      |      |
|----------|---------|------|------|-----|------|------|
|          | 2.16    | 2.39 | 2.41 | 2.6 | 2.61 | 2.79 |
| 2        | 0       | 0    | 1    | 0   | 0    | 0    |
| 3        | 0       | 0    | 0    | 1   | 0    | 0    |
| 4        | 1       | 0    | 0    | 0   | 0    | 0    |
| 5        | 0       | 0    | 0    | 0   | 0    | 0    |
| 6        | 0       | 0    | 0    | 0   | 1    | 0    |

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|       |   |   |   |   |   |   |
|-------|---|---|---|---|---|---|
| 7     | 0 | 1 | 0 | 0 | 0 | 0 |
| 8     | 0 | 0 | 0 | 0 | 0 | 0 |
| 9     | 0 | 0 | 0 | 0 | 0 | 0 |
| 10    | 0 | 0 | 0 | 0 | 0 | 1 |
| 12    | 0 | 0 | 0 | 0 | 0 | 0 |
| 13    | 0 | 0 | 0 | 0 | 0 | 0 |
| 14    | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 1 | 1 | 1 | 1 | 1 | 1 |

| TIMETRND | LOGWAGE |       |
|----------|---------|-------|
|          | 3.11    | Total |
| 2        | 0       | 1     |
| 3        | 0       | 1     |
| 4        | 0       | 1     |
| 5        | 0       | 1     |
| 6        | 0       | 1     |
| 7        | 0       | 1     |
| 8        | 0       | 1     |
| 9        | 0       | 1     |
| 10       | 0       | 1     |
| 12       | 1       | 1     |
| 13       | 0       | 1     |
| 14       | 0       | 1     |
| Total    | 1       | 12    |

## Exercise2

|   |   |
|---|---|
| . xtreg logwage educ potexper, re                         | Number of obs = 17,919                          |
| Random-effects GLS regression<br>Group variable: personid | Number of groups = 2,178                        |
| R-sq:   | Obs per group:                                  |
| within = 0.1961   | min = 1   |
| between = 0.1533  | avg = 8.2                                       |
| overall = 0.1578  | max = 15  |
| corr(u_i, X) = 0 (assumed)                                | Wald chi2(2) = 4209.96                          |
|   | Prob > chi2 = 0.0000                            |
| logwage   | Coef. Std. Err. z P> z  [95% Conf. Interval]    |
| educ  | .107938 .0033832 31.90 0.000 .1013071 .114569   |
| potexper  | .0387645 .0007178 54.00 0.000 .0373576 .0401714 |
| _cons   | .5635206 .0438846 12.84 0.000 .4775083 .6495328 |
| sigma_u   | .37207276                                       |
| sigma_e   | .33545728                                       |
| rho   | .5516129 (fraction of variance due to u_i)      |

## Exercise 3

### Between estimators

. xtreg logwage educ potexper, be

|  |                          |
|--|--------------------------|
| Between regression (regression on group means) | Number of obs = 17,919   |
| Group variable: personid                       | Number of groups = 2,178 |

|                               |                    |
|-------------------------------|--------------------|
| R-sq:                         | Obs per group:     |
| within = 0.1962               | min = 1            |
| between = 0.1553              | avg = 8.2          |
| overall = 0.1518              | max = 15           |
| sd(u_i + avg(e_i.))= .3991313 | F(2,2175) = 200.01 |
|                               | Prob > F = 0.0000  |

|          |   |
|----------|---|
| logwage  | Coef. Std. Err. t P> t  [95% Conf. Interval]    |
| educ     | .0930999 .0046685 19.94 0.000 .0839447 .1022551 |
| potexper | .0259987 .0036049 7.21 0.000 .0189294 .0330681  |
| _cons    | .8455688 .0770179 10.98 0.000 .6945324 .9966052 |

### Within estimators

```
. xtreg logwage educ potexper, fe
```

Fixed-effects (within) regression  
Group variable: personid

Number of obs = 17,919  
Number of groups = 2,178

R-sq:

within = 0.1964  
between = 0.1550  
overall = 0.1551

Obs per group:

min = 1  
avg = 8.2  
max = 15

F(2, 15739) = 1923.47  
corr(u\_i, Xb) = -0.1273 Prob > F = 0.0000

| logwage  | Coef.     | Std. Err.                         | t     | P> t  | [95% Conf. Interval] |
|----------|-----------|-----------------------------------|-------|-------|----------------------|
| educ     | .123662   | .0057619                          | 21.46 | 0.000 | .1123681 .1349559    |
| potexper | .0385611  | .0007585                          | 50.84 | 0.000 | .0370744 .0400478    |
| _cons    | .4068016  | .0717348                          | 5.67  | 0.000 | .2661931 .54741      |
| sigma_u  | .40290853 |                                   |       |       |                      |
| sigma_e  | .33545728 |                                   |       |       |                      |
| rho      | .59059603 | (fraction of variance due to u_i) |       |       |                      |

F test that all u\_i=0: F(2177, 15739) = 9.95

Prob > F = 0.0000

First time difference

```
. xtreg logwage_D educ_D potexper_D, fe
```

Fixed-effects (within) regression  
Group variable: **personid**

Number of obs = 15,741  
Number of groups = 2,095

R-Sq:

within = 0.0008  
between = 0.0010  
overall = 0.0010

Obs per group:

|       |     |
|-------|-----|
| min = | 1   |
| avg = | 7.5 |
| max = | 14  |

`corr(u_i, Xb) = -0.0017`

F(2,13644) = 5.32  
Prob > F = 0.0049

|            | Coef.     | Std. Err.                         | t    | P> t  | [95% Conf. Interval] |
|------------|-----------|-----------------------------------|------|-------|----------------------|
| logwage_D  |           |                                   |      |       |                      |
| educ_D     | .0218726  | .0097279                          | 2.25 | 0.025 | .0028047 .0409406    |
| potexper_D | .0114422  | .0047082                          | 2.43 | 0.015 | .0022133 .020671     |
| _cons      | .0419012  | .0064347                          | 6.51 | 0.000 | .0292883 .0545141    |
| sigma_u    | .1752942  |                                   |      |       |                      |
| sigma_e    | .39181966 |                                   |      |       |                      |
| rho        | .16677308 | (fraction of variance due to u_i) |      |       |                      |

F test that all  $u_i = 0$ :  $F(2094, 13644) = 0.49$

Prob > F = 1.0000