Probit Regression in R, Python, Stata, and SAS

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- Model Introduction
- Languages

```
library(RStata)
```

Model Introduction

(tab content)

Languages

R | Python | Stata | SAS

```
*Importing data
import delimited https://vincentarelbundock.github.io/Rdatasets/csv/carData/Mroz.csv,
clear
save mroz,replace
use mroz,clear
*List the first six rows
list if v1<=6
```

```
     +-------------------------------------------------------------+
     | v1   lfp   k5   k618   age    wc   hc         lwg      inc |
     |-------------------------------------------------------------|
1.   |  1   yes    1      0    32    no   no    1.210165    10.91 |
2.   |  2   yes    0      2    30    no   no    .3285041     19.5 |
3.   |  3   yes    1      3    35    no   no    1.514128    12.04 |
4.   |  4   yes    0      3    34    no   no    .0921151     6.8 |
5.   |  5   yes    1      2    31   yes   no     1.52428     20.1 |
     |-------------------------------------------------------------|
6.   |  6   yes    0      0    54    no   no    1.556486    9.859 |
     +-------------------------------------------------------------+
```

```
*Change variables with values yes/no to 1/0
gen lfpart =1 if lfp == "yes"
replace lfpart =0 if lfp == "no"
gen wifec =1 if wc == "yes"
replace wifec =0 if wc == "no"
gen husbc =1 if hc == "yes"
replace husbc =0 if hc == "no"
drop lfp wc hc
rename lfpart lfp
rename wifec wc
rename husbc hc
*Get the summary of the data
summ
```

Variable	Obs	Mean	Std. Dev.	Min	Max
v1	753	377	217.5167	1	753
k5	753	.2377158	.523959	0	3
k618	753	1.353254	1.319874	0	8
age	753	42.53785	8.072574	30	60
lwg	753	1.097115	.5875564	-2.054124	3.218876
inc	753	20.12897	11.6348	-.029	96
lfp	753	.5683931	.4956295	0	1
wc	753	.2815405	.4500494	0	1
hc	753	.3917663	.4884694	0	1

```
*Fitting the model by probit regression
probit lfp k5 k618 age lwg inc i.wc i.hc
```

```
Iteration 0:   log likelihood =  -514.8732
Iteration 1:   log likelihood = -452.84838
Iteration 2:   log likelihood = -452.69498
Iteration 3:   log likelihood = -452.69496

Probit regression                                 Number of obs     =         75
> 3
                                                  LR chi2(7)        =      124.3
> 6
                                                  Prob > chi2       =      0.000
> 0
Log likelihood = -452.69496                       Pseudo R2         =      0.120
> 8

------------------------------------------------------------------------------
> -
         lfp |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval
> ]
-------------+----------------------------------------------------------------
> -
          k5 |  -.8747111   .1135584    -7.70   0.000    -1.097281   -.652140
> 8
        k618 |  -.0385945   .0404893    -0.95   0.340    -.1179521    .040763
> 1
         age |  -.0378235   .0076093    -4.97   0.000    -.0527375   -.022909
> 5
         lwg |   .3656287   .0877792     4.17   0.000     .1935846    .537672
> 7
         inc |   -.020525   .0047769    -4.30   0.000    -.0298875   -.011162
> 5
        1.wc |   .4883144   .1354873     3.60   0.000     .2227641    .753864
> 7
        1.hc |   .0571703   .1240053     0.46   0.645    -.1858755    .300216
> 2
       _cons |   1.918422   .3806539     5.04   0.000     1.172354     2.6644
> 9
------------------------------------------------------------------------------
> -
```

```
*Predicting the probability of labor-force  participation
predict prob_lfp
summ prob_lfp,detail
```

```
                            Pr(lfp)
-------------------------------------------------------------
      Percentiles      Smallest
 1%     .0874537       .005691
 5%     .2087887       .0280799
10%     .3134367       .0322375       Obs                 753
25%     .4470239        .056195       Sum of Wgt.         753

50%     .5782336                      Mean           .5705144
                        Largest       Std. Dev.      .1928416
75%     .7189098       .9530371
90%     .8133735       .9554808       Variance       .0371879
95%     .8603116        .966253       Skewness      -.3429077
99%     .9348801       .9744748       Kurtosis       2.709472
```

```
tab lfp hc
*use margins for each level of hc
margins hc, atmeans
```

lfp	hc 0	1	Total
0	207	118	325
1	251	177	428
Total	458	295	753

```
*use margins for each level of hc
margins hc, atmeans
```

```
Adjusted predictions                            Number of obs     =        753
> 3
Model VCE    : OIM

Expression   : Pr(lfp), predict()
at           : k5              =    .2377158 (mean)
               k618            =    1.353254 (mean)
               age             =    42.53785 (mean)
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               0.wc            =    .7184595 (mean)
               1.wc            =    .2815405 (mean)
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)

------------------------------------------------------------------------------
> -
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval
> ]
-------------+----------------------------------------------------------------
> -
          hc |
           0 |   .5693818   .0273369    20.83   0.000     .5158024    .622961
> 1
           1 |   .5917197   .0345427    17.13   0.000     .5240172    .659422
> 1
------------------------------------------------------------------------------
> -
```

```
tab lfp wc
```

lfp	wc 0	1	Total
0	257	68	325
1	284	144	428
Total	541	212	753

```
*use margins for each level of wc
margins wc, atmeans
```

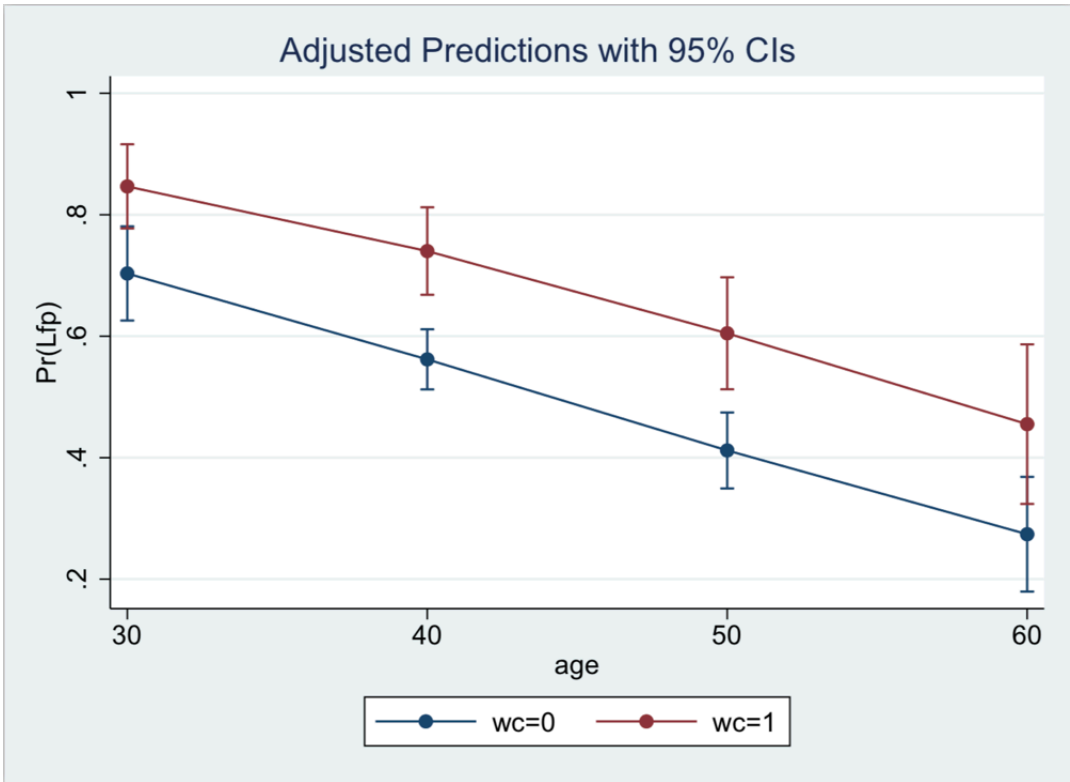
```
Adjusted predictions                            Number of obs     =        75
> 3
Model VCE    : OIM

Expression   : Pr(lfp), predict()
at           : k5              =    .2377158 (mean)
               k618            =    1.353254 (mean)
               age             =    42.53785 (mean)
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               0.wc            =    .7184595 (mean)
               1.wc            =    .2815405 (mean)
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)

------------------------------------------------------------------------------
> -
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval
> ]
-------------+----------------------------------------------------------------
> -
          wc |
          0  |   .5238097   .0241197    21.72   0.000     .4765359    .571083
> 6
          1  |    .708165   .0380449    18.61   0.000     .6335984    .782731
> 6
------------------------------------------------------------------------------
> -
```

```
*use margins for each level of wc and age
margins, at(age=(30(10)60) wc=(0 1)) atmeans vsquish
```

```
Adjusted predictions                            Number of obs     =        75
> 3
Model VCE    : OIM

Expression   : Pr(lfp), predict()
1._at        : k5              =    .2377158 (mean)
               k618            =    1.353254 (mean)
               age             =          30
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               wc              =           0
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)
2._at        : k5              =    .2377158 (mean)
               k618            =    1.353254 (mean)
               age             =          30
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               wc              =           1
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)
3._at        : k5              =    .2377158 (mean)
               k618            =    1.353254 (mean)
               age             =          40
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               wc              =           0
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)
4._at        : k5              =    .2377158 (mean)
               k618            =    1.353254 (mean)
               age             =          40
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               wc              =           1
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)
5._at        : k5              =    .2377158 (mean)
               k618            =    1.353254 (mean)
               age             =          50
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               wc              =           0
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)
6._at        : k5              =    .2377158 (mean)
               k618            =    1.353254 (mean)
               age             =          50
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               wc              =           1
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)
7._at        : k5              =    .2377158 (mean)
               k618            =    1.353254 (mean)
               age             =          60
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               wc              =           0
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)
8._at        : k5              =    .2377158 (mean)
               k618            =    1.353254 (mean)
               age             =          60
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               wc              =           1
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)
------------------------------------------------------------------------------
> -
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval
> ]
-------------+----------------------------------------------------------------
```

```
> -
        _at |
          1 |   .7033095   .0395332    17.79   0.000     .6258258    .780793
> 2
          2 |   .8466704   .0353618    23.94   0.000     .7773626    .915978
> 3
          3 |   .5618684   .0252363    22.26   0.000     .5124062    .611330
> 6
          4 |   .7402195   .0367492    20.14   0.000     .6681924    .812246
> 6
          5 |   .4119518   .0319053    12.91   0.000     .3494185    .474485
> 1
          6 |   .6047985   .0470611    12.85   0.000     .5125605    .697036
> 5
          7 |   .2739992    .048177     5.69   0.000     .1795741    .368424
> 4
          8 |   .4552342   .0670442     6.79   0.000       .32383    .586638
> 4
------------------------------------------------------------------------------
> -
```

```
marginsplot
```



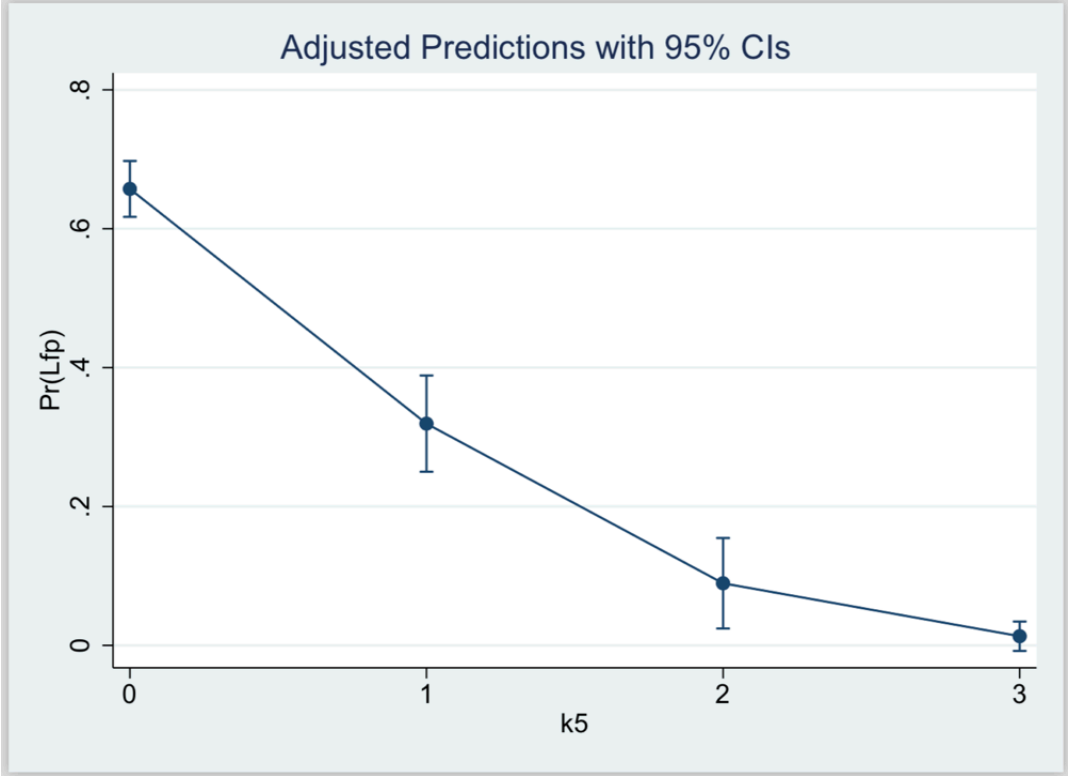

```
tab lfp k5
```

```
           |                    k5
       lfp |         0          1          2          3 |     Total
-----------+--------------------------------------------+----------
         0 |       231         72         19          3 |       325
         1 |       375         46          7          0 |       428
-----------+--------------------------------------------+----------
     Total |       606        118         26          3 |       753
```

```
*use margins for each level of k5
margins, at(k5=(0 1 2 3)) atmeans
```

```
Adjusted predictions                            Number of obs     =        75
> 3
Model VCE    : OIM

Expression   : Pr(lfp), predict()

1._at        : k5              =           0
               k618            =    1.353254 (mean)
               age             =    42.53785 (mean)
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               0.wc            =    .7184595 (mean)
               1.wc            =    .2815405 (mean)
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)

2._at        : k5              =           1
               k618            =    1.353254 (mean)
               age             =    42.53785 (mean)
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               0.wc            =    .7184595 (mean)
               1.wc            =    .2815405 (mean)
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)

3._at        : k5              =           2
               k618            =    1.353254 (mean)
               age             =    42.53785 (mean)
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               0.wc            =    .7184595 (mean)
               1.wc            =    .2815405 (mean)
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)

4._at        : k5              =           3
               k618            =    1.353254 (mean)
               age             =    42.53785 (mean)
               lwg             =    1.097115 (mean)
               inc             =    20.12897 (mean)
               0.wc            =    .7184595 (mean)
               1.wc            =    .2815405 (mean)
               0.hc            =    .6082337 (mean)
               1.hc            =    .3917663 (mean)

------------------------------------------------------------------------------
> -
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval
> ]
-------------+----------------------------------------------------------------
> -
         _at |
          1  |   .6573092   .0205632    31.97   0.000     .6170061    .697612
> 4
          2  |   .3193274   .0353742     9.03   0.000     .2499952    .388659
> 5
          3  |    .089427   .0332266     2.69   0.007      .024304    .154550
> 1
          4  |   .0132433   .0107846     1.23   0.219    -.0078942    .034380
> 7
------------------------------------------------------------------------------
> -
```

```
marginsplot
```


Adjusted Predictions with 95% CIs
Pr(Lfp)
0
.2
.4
.6
.8
0
1
2
3
k5