# Homework #8

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## 1 Lab Problems

L1 STATA log:

```
------------------------------------------------------------------------------------------------------------
      name:  <unnamed>
       log:  /Users/shawn/src/econ485/lab8/lab8.log
  log type:  text
 opened on:   1 May 2013, 19:46:55

. /*a. Use OLS regression to estimate the following model.
> i. Dependent variable: approve, this indicates the person had their loan
> approved; explanatory variables are hrat loanprc unem_ind male married dep school cosign chist bankrupt m
> late1 mortlate2 high_vacancy white
> */
>
> regress approve hrat loanprc unem_ind male married dep school cosign chist bankrupt mortlate1 mortlate2 h
> _vacancy white;

      Source |       SS       df       MS              Number of obs =    1129
-------------+------------------------------           F( 14,  1114) =   13.02
       Model |  17.4548957    14  1.24677826           Prob > F      =  0.0000
    Residual |  106.685051  1114   .09576755           R-squared     =  0.1406
-------------+------------------------------           Adj R-squared =  0.1298
       Total |  124.139947  1128  .110053144           Root MSE      =  .30946

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     approve |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        hrat |   -.002343   .0012929    -1.81   0.070    -.0048798    .0001939
     loanprc |  -.2308079    .050282    -4.59   0.000    -.3294659   -.1321499
    unem_ind |  -.0092055   .0042917    -2.14   0.032    -.0176262   -.0007848
        male |  -.0018928    .025833    -0.07   0.942    -.0525795    .0487939
     married |   .0270134    .022177     1.22   0.223        -.0165    .0705268
         dep |  -.0012066    .008995    -0.13   0.893    -.0188556    .0164425
      school |   .0235984     .02298     1.03   0.305    -.0214905    .0686874
      cosign |   .0430834   .0570779     0.75   0.451    -.0689089    .1550757
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       chist |   .0778704   .0266316     2.92   0.004     .0256165    .1301242
    bankrupt |  -.2775626   .0401785    -6.91   0.000    -.3563966   -.1987286
   mortlate1 |  -.1231576   .0622179    -1.98   0.048    -.2452351     -.00108
   mortlate2 |  -.1135754   .0911409    -1.25   0.213    -.2924027    .0652518
high_vacancy |  -.0312386   .0190719    -1.64   0.102    -.0686595    .0061824
       white |   .1307452     .02629     4.97   0.000     .0791617    .1823286
       _cons |   .9709887   .0696573    13.94   0.000     .8343144    1.107663
------------------------------------------------------------------------------

. outreg2 using l1a, excel;
l1a.xml
dir : seeout

. /*b. Use logit to estimate the following model.
> i. Dependent variable: approve, this indicates the person had their loan
> approved; explanatory variables are hrat loanprc unem_ind male married dep school cosign chist bankrupt m
> late1 mortlate2 high_vacancy white*/
>
> logit approve hrat loanprc unem_ind male married dep school cosign chist bankrupt mortlate1 mortlate2 hig
> acancy white;

Iteration 0:   log likelihood = -427.07309
Iteration 1:   log likelihood = -375.10341
Iteration 2:   log likelihood = -359.21725
Iteration 3:   log likelihood = -358.84609
Iteration 4:   log likelihood = -358.84587
Iteration 5:   log likelihood = -358.84587

Logistic regression                               Number of obs   =       1129
                                                  LR chi2(14)     =     136.45
                                                  Prob > chi2     =     0.0000
Log likelihood = -358.84587                       Pseudo R2       =     0.1598

------------------------------------------------------------------------------
     approve |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        hrat |  -.0275274   .0130925    -2.10   0.036    -.0531883   -.0018665
     loanprc |  -2.658952   .5933799    -4.48   0.000    -3.821955   -1.495949
    unem_ind |  -.0798995   .0409675    -1.95   0.051    -.1601944    .0003955
        male |  -.0227519   .2654709    -0.09   0.932    -.5430653    .4975615
     married |   .3085338   .2288233     1.35   0.178    -.1399516    .7570192
         dep |   .0063583     .09827     0.06   0.948    -.1862473    .1989638
      school |   .2104498   .2291448     0.92   0.358    -.2386657    .6595653
      cosign |   .5403811   .6952712     0.78   0.437    -.8223255    1.903088
       chist |   .7160148   .2357092     3.04   0.002     .2540334    1.177996
    bankrupt |  -1.577179   .2959106    -5.33   0.000    -2.157153   -.9972051
   mortlate1 |  -.9114942     .516367   -1.77   0.078    -1.923555    .1005666
   mortlate2 |  -1.006185   .7677763    -1.31   0.190    -2.510999    .4986289
high_vacancy |  -.3248466   .1997244    -1.63   0.104    -.7162992    .0666061
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       white |    .980196   .2207503     4.44   0.000     .5475335    1.412859
       _cons |   3.823727   .7364631     5.19   0.000     2.380286    5.267169
------------------------------------------------------------------------------

. /*c. Estimate the marginal effects of each variable using the mean value of all dependent variables using
> rgins and atmeans.*/
>
> margins, dydx( hrat loanprc unem_ind male married dep school cosign chist bankrupt mortlate1 mortlate2 hi
> vacancy white) atmean;

Conditional marginal effects                      Number of obs   =       1129
Model VCE    : OIM

Expression   : Pr(approve), predict()
dy/dx w.r.t. : hrat loanprc unem_ind male married dep school cosign chist bankrupt mortlate1 mortlate2
               high_vacancy white
at           : hrat            =    24.99965 (mean)
               loanprc         =    .7770578 (mean)
               unem_ind        =    3.933127 (mean)
               male            =    .8193091 (mean)
               married         =    .6651904 (mean)
               dep             =     .789194 (mean)
               school          =    .7767936 (mean)
               cosign          =    .0274579 (mean)
               chist           =    .8467671 (mean)
               bankrupt        =    .0602303 (mean)
               mortlate1       =    .0230292 (mean)
               mortlate2       =    .0106289 (mean)
               high_vacancy    =    .4136404 (mean)
               white           =    .8423384 (mean)

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        hrat |  -.0022873   .0010783    -2.12   0.034    -.0044008   -.0001739
     loanprc |  -.2209402   .0475649    -4.65   0.000    -.3141657   -.1277147
    unem_ind |  -.0066391   .0033977    -1.95   0.051    -.0132984    .0000202
        male |  -.0018905   .0220579    -0.09   0.932    -.0451232    .0413421
     married |    .025637   .0189388     1.35   0.176    -.0114823    .0627563
         dep |   .0005283   .0081643     0.06   0.948    -.0154735    .0165302
      school |   .0174869   .0190367     0.92   0.358    -.0198244    .0547982
      cosign |   .0449019   .0576884     0.78   0.436    -.0681653     .157969
       chist |   .0594958   .0193902     3.07   0.002     .0214917    .0974998
    bankrupt |  -.1310525   .0257742    -5.08   0.000     -.181569    -.080536
   mortlate1 |  -.0757387   .0429695    -1.76   0.078    -.1599574    .0084799
   mortlate2 |  -.0836069   .0637277    -1.31   0.190    -.2085109    .0412971
high_vacancy |  -.0269925   .0165356    -1.63   0.103    -.0594016    .0054167
       white |   .0814474    .018359     4.44   0.000     .0454645    .1174303
```

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------------------------------------------------------------------------------

. /*d. Estimate the marginal effects of each variable as the average of the marginal effects using margins.
> margins, dydx( hrat loanprc unem_ind male married dep school cosign chist bankrupt mortlate1 mortlate2 hi
> vacancy white);

Average marginal effects                          Number of obs   =       1129
Model VCE    : OIM

Expression   : Pr(approve), predict()
dy/dx w.r.t. : hrat loanprc unem_ind male married dep school cosign chist bankrupt mortlate1 mortlate2
               high_vacancy white

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        hrat |  -.0025541   .0012134    -2.10   0.035    -.0049324   -.0001758
     loanprc |  -.2467099   .0546889    -4.51   0.000    -.3538982   -.1395217
    unem_ind |  -.0074134   .0037948    -1.95   0.051    -.0148511    .0000242
        male |   -.002111    .024632    -0.09   0.932    -.0503888    .0461667
     married |   .0286272   .0212268     1.35   0.177    -.0129767    .0702311
         dep |   .0005899   .0091183     0.06   0.948    -.0172816    .0184615
      school |   .0195265   .0212501     0.92   0.358     -.022123     .061176
      cosign |   .0501391   .0644924     0.78   0.437    -.0762637    .1765418
       chist |   .0664352    .021798     3.05   0.002     .0237119    .1091585
    bankrupt |   -.146338   .0264733    -5.53   0.000    -.1982248   -.0944513
   mortlate1 |  -.0845727   .0477961    -1.77   0.077    -.1782514     .009106
   mortlate2 |  -.0933585   .0711689    -1.31   0.190     -.232847    .0461299
high_vacancy |  -.0301408    .018512    -1.63   0.103    -.0664236     .006142
       white |   .0909471   .0202593     4.49   0.000     .0512396    .1306547
------------------------------------------------------------------------------

. /*e. Since male is a discrete dummy variable, use margins and male = (0 1) to get the marginal effects.*/
> margins, at(white = (0 1));

Predictive margins                                Number of obs   =       1129
Model VCE    : OIM

Expression   : Pr(approve), predict()

1._at        : white           =           0

2._at        : white           =           1

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

```
         _at |
          1  |   .7853829   .0274062    28.66   0.000     .7316676    .8390981
          2  |   .8962455   .0096968    92.43   0.000       .87724    .9152509
------------------------------------------------------------------------------

. /*f. Use probit to estimate the following model.
> i. Dependent variable: approve, this indicates the person had their loan
> approved; explanatory variables are hrat loanprc unem_ind male married dep school cosign chist bankrupt m
> late1 mortlate2 high_vacancy white*/
>
> probit approve hrat loanprc unem_ind male married dep school cosign chist bankrupt mortlate1 mortlate2 hi
> vacancy white;

Iteration 0:   log likelihood = -427.07309
Iteration 1:   log likelihood = -360.21513
Iteration 2:   log likelihood = -358.10227
Iteration 3:   log likelihood = -358.09673
Iteration 4:   log likelihood = -358.09673

Probit regression                                 Number of obs   =       1129
                                                  LR chi2(14)     =     137.95
                                                  Prob > chi2     =     0.0000
Log likelihood = -358.09673                       Pseudo R2       =     0.1615

------------------------------------------------------------------------------
     approve |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        hrat |  -.0135664   .0068335    -1.99   0.047    -.0269598    -.000173
     loanprc |  -1.472842   .3234929    -4.55   0.000    -2.106877   -.8388076
    unem_ind |  -.0436724    .022401    -1.95   0.051    -.0875775    .0002328
        male |  -.0022475   .1418946    -0.02   0.987    -.2803558    .2758607
     married |   .1596008   .1218806     1.31   0.190    -.0792807    .3984824
         dep |  -.0005295   .0518209    -0.01   0.992    -.1020967    .1010377
      school |   .1059921   .1251761     0.85   0.397    -.1393485    .3513328
      cosign |   .2868798   .3672053     0.78   0.435    -.4328294    1.006589
       chist |   .3824942   .1328699     2.88   0.004      .122074    .6429144
    bankrupt |  -.9169555   .1734877    -5.29   0.000    -1.256985    -.576926
   mortlate1 |  -.5067942   .2896844    -1.75   0.080    -1.074565    .0609768
   mortlate2 |  -.5938387   .4167723    -1.42   0.154    -1.410697      .22302
high_vacancy |  -.1970612   .1060091    -1.86   0.063    -.4048351    .0107128
       white |    .537414   .1246858     4.31   0.000     .2930342    .7817937
       _cons |   2.154494   .3974403     5.42   0.000     1.375525    2.933463
------------------------------------------------------------------------------

. /*g. Estimate the marginal effects from using probit of each variable as the average of the
> marginal effects using margins.*/
>
> margins, dydx( hrat loanprc unem_ind male married dep school cosign chist bankrupt mortlate1 mortlate2 hi
> vacancy white);
```

```
Average marginal effects                          Number of obs   =       1129
Model VCE    : OIM

Expression   : Pr(approve), predict()
dy/dx w.r.t. : hrat loanprc unem_ind male married dep school cosign chist bankrupt mortlate1 mortlate2
               high_vacancy white

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        hrat |  -.0023444   .0011809    -1.99   0.047    -.0046589   -.0000298
     loanprc |  -.2545185    .055422    -4.59   0.000    -.3631436   -.1458934
    unem_ind |  -.0075469   .0038648    -1.95   0.051    -.0151217    .0000279
        male |  -.0003884   .0245206    -0.02   0.987    -.0484478    .0476711
     married |   .0275803   .0210582     1.31   0.190    -.0136931    .0688536
         dep |  -.0000915    .008955    -0.01   0.992     -.017643      .01746
      school |   .0183163   .0216291     0.85   0.397    -.0240759    .0607084
      cosign |    .049575   .0634456     0.78   0.435    -.0747761    .1739261
       chist |    .066098   .0229046     2.89   0.004     .0212057    .1109902
    bankrupt |   -.158457   .0292084    -5.43   0.000    -.2157045   -.1012095
   mortlate1 |   -.087578   .0499713    -1.75   0.080    -.1855198    .0103639
   mortlate2 |  -.1026199   .0719063    -1.43   0.154    -.2435536    .0383138
high_vacancy |  -.0340537   .0182738    -1.86   0.062    -.0698696    .0017622
       white |   .0928693   .0213516     4.35   0.000      .051021    .1347176
------------------------------------------------------------------------------

. log close;
      name:  <unnamed>
       log:  /Users/shawn/src/econ485/lab8/lab8.log
  log type:  text
 closed on:   1 May 2013, 19:46:57
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## 2 Questions

Q1 Use the results from L1 to answer this question.

a. Assuming you dont have any violations of OLS, interpret the coefficient on white from the regression you ran in L1, part a).

   Being white as opposed to being black increases the probability of being approved for a loan by about 13%, all other things held constant.

b. Use the following values and the coefficients from L1, part a). What is the estimated probability? Hint: Only use statistically significant coefficients with p-values less than 0.10.

The estimated probability is 0.9128844.

c. What is a potential problem with using the model you estimated in L1, part a)?

It was possible for the estimated probability to not be in the interval [0..1].

d. Use your results from the model you estimated in L1, part b). Does there appear to be a positive or negative impact on the probability of getting a loan from being white relative to being black?

Being white appears to have a positive impact on the probability of getting a loan.

e. Use your marginal results from L1, part c). Interpret the marginal effect for the variable white.

Being white increases the probability of being approved for a loan by about 8.14 percent. These are for the mean value of 'white' in the sample but 'white' is a dummy variable that can only take the values of 0 or 1.

f. Use your marginal results from L1, part d). Interpret the marginal effect for the variable white.

Being white increases the probability of being approved for a loan by 9.09 percent.

g. Are the marginal results from parts e) and f) above the same? Explain why there might be a difference, even if it is small.

No, they differ by about 0.85 percent. In L1.d we are taking the calculating the partial effects for each observation and taking the mean whereas in L1.c we are taking the average values of the observations and then calculating the partial effect.

h. Use your results from L1, part e). Calculate the difference between the two estimates. This is the marginal difference between being white and being nonwhite. Compare your answer to your answer in part g).

noop (Although I ran it with white and got a difference of about 0.1108626.)

i. Use your results from the model you estimated in L1, part f). Does there appear to be a positive or negative impact on the probability of getting a loan from being white relative to being black?

There appears to be a positive impact on the probability of getting a loan from being white.

j. Multiply the coefficient from L1 part f) on white by 1.81. How does this compare to the coefficient on white in L1 part b)? Explain.

   0.537414 * 1.81 = 0.97271934
   I do not see any comparison (it is close to the constant in my regression from part b) so I have obviously missed something.

k. Use your results from L1, part g). Interpret the marginal effect for the variable white.

   Being white increases the probability of being approved for a loan by about 9.29 percent.

l. Compare the marginal effect for the variable white as discussed in this question in parts f) and k).[1]
   The answers for the partial effect of white on the probability of being approved for a loan are very close - about .20 precent different.

m. Based on these results, does there appear to be a racial bias in terms of who gets loans approved?

   Based on these result, there certainly appears to be a racial bias in terms of who gets loans approved.

[1] I am assuming that we are being asked about the above answer in part k and not this answer which is part l.