Economics 113 Professor Spearot
Fall 2014 – Midterm 2

Introduction to Econometrics

Name AK

ID _____

Midterm 2 –70 Points

The exam is closed book and closed notes. You may use calculators. No cell phones. Do not use your own paper.

You must show your work to receive full credit

I have neither given nor received unauthorized aid on this examination, nor have I concealed any similar misconduct by others.

Signature _____

Problem 1

Many models of labor economics predict hours worked, and many policies depend on the number of hours worked (eg. Affordable Care Act). Suppose we wish to predict hours worked per week, *hours*, using the following regression:

$$\log(hours) = \beta_0 + \beta_1 educ + \beta_2 age + \beta_3 exper + u$$

Education, experience and age are all measured in years. The results from this regression are below.

```
      Source |       SS       df       MS              Number of obs =     935
-------------+------------------------------           F(  3,   931) =    3.77
       Model |  .261139734     3  .087046578           Prob > F      =  0.0104
    Residual |  21.4864901   931  .023078937           R-squared     =  0.0120
-------------+------------------------------           Adj R-squared =  0.0088
       Total |  21.7476298   934    .0232844           Root MSE      =  .15192
------------------------------------------------------------------------------
   log_hours |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        educ |   .0052999   .0026448    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
         age |   .0025309   .0019156    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       exper |  -.0018032   .0015286    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       _cons |    3.63621   .0616024    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

a. Please construct a 99% confidence interval for the effect of education on hours worked. Please interpret this confidence interval. **(10 Points)**

wrong t_{crit} -2

$$\hat{\beta}_1 - t_{crit} \cdot se(\hat{\beta}_1) < \beta_1 < \hat{\beta}_1 + t_{crit} \cdot se(\hat{\beta}_1)$$

$$0.00530 - 2.575 \cdot 0.00261 < \beta_1 < 0.00530 + 2.575 \cdot 0.00264$$

$$-0.00150 < \beta_1 < 0.0121$$

+6 (1)

+4 With 99% confidence, holding age and experience constant, a one year increase in education yields between a -0.15% and 1.21% change in hours worked.

0.15% decrease and 1.21% increase also ok

+2 for these

b. Using the 97% confidence level, please test whether the coefficient on *age* is significantly different from zero. State your null and alternative hypotheses, and briefly interpret your result. Show your work! **(10 Points)**

$H_0: B_2 = 0$ $\quad t_{stat} = \frac{0.00253 - 0}{0.00192} = 1.318$ (2)

$H_A: B_2 \neq 0$ $\quad t_{crit} = 2.17$ (2)) +2 +4

$|t_{stat}| < t_{crit} \Rightarrow$ Fail to reject the Null!!) +2

At 97% confidence, age has an insignificant effect on hours worked.) +2

c. Suppose that we instead estimate the following:

$$\log(hours) = \beta_0 + \beta_1 educ + u$$

```
      Source |       SS       df       MS              Number of obs =     935
-------------+------------------------------           F(  1,   933) =    9.28
       Model |  .214070425     1  .214070425           Prob > F      =  0.0024
    Residual |  21.5335594   933  .023079914           R-squared     =  0.0098
-------------+------------------------------           Adj R-squared =  0.0088
       Total |  21.7476298   934    .0232844           Root MSE      =  .15192

------------------------------------------------------------------------------
   log_hours |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        educ |    .006892   .002263   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       _cons |   3.677639   .0308812   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

Is this model preferred to the model in 'a'? If a hypothesis test is warranted, please test this at the 95% level, stating your null and alternative. If not, please provide other evidence for your answer. Show your work! **(10 Points)**

Nested Model! $\Rightarrow F_{test}$

$H_0: B_2 = 0, B_3 = 0$

$H_A: H_0$ not true) +2

$SSR_{UR} = 21.486$

$SSR_R = 21.533$) (1)

$q = 2$

$df_{UR} = 931$) (1)) +2

$$F_{stat} = \frac{SSR_R - SSR_{UR}}{q} = \frac{21.533 - 21.486}{2} = 1.01$$) +4

-2 if SSR's are reversed.

$F_{crit} = 3$

$F_{stat} < F_{crit} \Rightarrow$ Fail to reject H_0

Model 'C' is preferred) +2

(-2 if wrong test)

d. Suppose that we instead estimate the following:

$$\log(hours) = \beta_0 + \beta_1 educ + \beta_2 iq + u$$

```
      Source |       SS       df       MS              Number of obs =     935
-------------+------------------------------           F(  2,   932) =    5.40
       Model |  .249339979     2  .124669989           Prob > F      =  0.0046
    Residual |  21.4982898   932  .023066835           R-squared     =  0.0115
-------------+------------------------------           Adj R-squared =  0.0093
       Total |  21.7476298   934    .0232844           Root MSE      =  .15188

------------------------------------------------------------------------------
   log_hours |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        educ |   .0052082   .0026405    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          iq |   .0004765   .0003853    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       _cons |   3.652058   .0371631    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
------------------------------------------------------------------------------
```

Is this model preferred to the model in 'a'? If a hypothesis test is warranted, please test this at the 95% level, stating your null and alternative. If not, please provide other evidence for your answer. Show your work! **(10 Points)**

Non-nested Model => Use Adj R^2

Model A : 0.0088

Model D : 0.0093

+6

Model 'd' is preferred since it captures more variation in the dependent variable.

(2)

+4

e. Using the model in 'd', suppose I claim that IQ has a significant effect on hours worked. What is the probability that I'm wrong? **(10 Points)**

$$t_{stat} = \frac{0.000476}{0.000385} = 1.236$$

+4

$$Pr(|T| > 1.236) = 2 \cdot Pr(T > 1.236)$$

$$= 2(1 - Pr(T < 1.236))$$

$$= 2(1 - 0.8925) = \boxed{0.215}$$

+6

Problem 2 (20 points)

Using the same data, but instead using hours worked per week rather than log hours, we estimate the following equation.

$$hours = \beta_0 + \beta_1(educ - 16) + \beta_2(iq - 140) + u$$

```
      Source |       SS       df       MS              Number of obs =     935
-------------+------------------------------           F(  2,   932) =    4.36
       Model |   451.81313     2  225.906565            Prob > F      =  0.0130
    Residual |   48293.528   932  51.8170902           R-squared     =  0.0093
-------------+------------------------------           Adj R-squared =  0.0071
       Total |  48745.3412   934  52.1898728           Root MSE      =  7.1984
------------------------------------------------------------------------------
       hours |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     educ-16 |   .2371403   .1251517    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
      iq-140 |   .0175916   .0182636    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       _cons |   45.21085     .65173    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
------------------------------------------------------------------------------
```

a. Please construct and interpret a 90% confidence interval for the constant in this regression. Show your work!! **(10 Points)**

$\hat{B}_0 - se(\hat{B}_0) \cdot t_{crit} < B_0 < \hat{B}_0 + se(\hat{B}_0) \cdot t_{crit}$

$45.21 - 0.652 \cdot 1.645 < B_0 < 45.21 + 0.652 \cdot 1.645$) +4

$44.13 < B_0 < 46.28$

+1 +2

With 90% confidence, a person with 16 years of education and an IQ of 140 works between 44.13 and 46.28 hours per week

+2 +1

b. Do the variables of the model tell us anything about hours worked? Test this at the 95% level, stating your null and alternative. Show your work! **(10 Points)**

$F_{stat} = 4.36$
$F_{crit} = 3$) +2

$F_{stat} > F_{crit}$ +1

$q = 2$ +1

H_0: $B_1 = 0$, $B_2 = 0$
H_A: H_0 not true) +3

(see Prof Spearot if you wrote H_0: $B_1 = B_2 = 0$)

Some combination of educ and iq have a significant effect on hours worked.

+3 (only +1 if (Reject H_0))

Have a great weekend!