Economics 113 Professor Spearot
Winter 2013 – Midterm 3

Introduction to Econometrics

Name KEY

ID KEY

Midterm 3 –60 Points

You must answer all questions. Please write your name on every page. The exam is closed book and closed notes. You may use calculators, but they must not be graphing calculators. No cell phones. Do not use your own scratch 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 KEY

Problem 1

The decision to attend college is a very important one, and family characteristics are considered a major factor in educational attainment. To begin our study of educational attainment, we evaluate the impact of the number of siblings, *sibs*, and the order of birth, *brthord* (1 for first, 2 for second…), on the years of education attained, *educ*.

$$\log(educ) = \beta_0 + \beta_1 brthord + \beta_2 sibs + u$$

```
      Source |       SS       df       MS              Number of obs =     659
-------------+------------------------------           F(  2,   656) =   14.22
       Model |  .702496954     2  .351248477           Prob > F      =  0.0000
    Residual |  16.2065079   656  .024705042           R-squared     =  0.0415
-------------+------------------------------           Adj R-squared =  0.0386
       Total |  16.9090048   658  .025697576           Root MSE      =  .15718

------------------------------------------------------------------------------
     logeduc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    brthord |  -.0096447    .005067   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       sibs |  -.0101424   .0034227   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
      _cons |   2.652929   .0113445   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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```

a.) Please interpret the coefficient on *sibs*. Using the 99% confidence level, please test whether it is significantly different from zero. **(10 Points)**

+3

Holding birth order constant one additional sibling reduces education attainment by 1.01%. +2

$H_0: \beta_2 = 0$
$H_1: \beta_2 \neq 0$ +2

$t_{stat} = \frac{-0.01014 - 0}{0.00342} = -2.96$ +2

$t_{crit} = 2.575$ +1

$|t_{stat}| > t_{crit} \Rightarrow$ Reject H_0! +2

Sibs has a significant effect on education.

b.) In part (a), I forget about parental education, which is probably quite important. Specifically, I include mother's education, *meduc*, and father's education, *feduc*, as follows:

$$\log(educ) = \beta_0 + \beta_1 brthord + \beta_2 sibs + \beta_3 \log(meduc) + \beta_4 log(feduc) + u$$

The results from estimating this equation are below:

```
      Source |       SS       df       MS              Number of obs =     659
-------------+------------------------------           F(  4,   654) =   36.58
       Model |  3.09146926     4  .772867314           Prob > F      =  0.0000
    Residual |  13.8175355   654   .02112773           R-squared     =  0.1828
-------------+------------------------------           Adj R-squared =  0.1778
       Total |  16.9090048   658  .025697576           Root MSE      =  .14535

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     logeduc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     brthord |  -.0009342   .0047804 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       sibs |  -.0061294   .0031935 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    logmeduc |   .0752445   .0214354 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    logfeduc |   .1299058    .017919 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       _cons |   2.150804   .0520578 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
------------------------------------------------------------------------------
```

Is this model preferred to the model in 'a'? Please test this at the 95% level, stating your null and alternative hypotheses. Show your work!!! **(10 Points)**

$SSR_{ur} = 13.82$ +0.5

$SSR_r = 16.21$ +0.5

$q = 2$ +1

$df_{ur} = 651$ +0.5

$H_0: \beta_3 = 0, \beta_4 = 0$ +2

H_A: H_0 not true

$$F_{stat} = \frac{\frac{SSR_r - SSR_{ur}}{q}}{\frac{SSR_{ur}}{df_{ur}}} = \frac{\frac{16.21 - 13.82}{2}}{\frac{13.82}{651}} = 56.55$$ +1

$F_{crit} = 3$ ×2

$F_{stat} > F_{crit} \Rightarrow$ Reject H_0 in favor of H_A

c.) Using the regression in 'b', suppose I claim that birth order has a significant effect on education levels. What is the probability that I'm wrong? **(10 Points)**

$$P_{value} = P_r\left(|T| > \left|\frac{-0.0009312 - 0}{0.001476}\right|\right) \quad +4$$

$$= 2\left(1 - P_r(T < .20)\right) \quad +4$$

$$= 2(1 - 0.5793) \simeq \boxed{0.845} \quad +2$$

d.) Please construct a 90% confidence interval for the coefficient on mother's education. Please interpret this confidence interval. **(10 Points)**

$$0.0752 - 1.645 \cdot 0.214 < \beta_3 < 0.0752 + 1.645 \cdot 0.214 \quad +6$$

$$0.0399 < \beta_3 < 0.1104$$

The elasticity of education with respect to mother's education is, with 90% confidence between 0.0399 and 0.1104 +4

OR

with 90% confidence a 1% increase in mother's education yields between a 0.0399% and 0.1104% increase in education

e.) Please **derive** an equation that allows me to test whether the effect of mother's education is the same as father's education. Along with the derivation, please state the null and alternative hypothesis, and write down any Stata commands required to generate new variables and run the regression. **(10 Points)**

$H_0: \beta_3 = \beta_4$ or $\theta = \beta_3 - \beta_4 \Rightarrow \beta_3 = \theta + \beta_4$ +3

$H_A: \beta_3 \neq \beta_4$ or $\theta \neq 0$

$\log(educ) = \beta_0 + \beta_1 brthord + \beta_2 sibs + \beta_3 \log(meduc) + \beta_4 \log(feduc) + u$

$= \beta_0 + \beta_1 brthord + \beta_2 sibs + (\theta + \beta_4)\log(meduc) + \beta_4 \log(feduc) + u$

$= \beta_0 + \beta_1 brthord + \beta_2 sibs + \theta \log(meduc) + \beta_4 [\log(meduc) + \log(feduc)]$ +4

gen log_meduc_feduc = log meduc + log feduc

regress lexeduc brthord sibs log meduc log_meduc_feduc

+3

Problem 2

Using the same dataset as before, I estimate the following equation predicting wage outcomes:

$$wage = \beta_0 + \beta_1(educ - 16) + \beta_2(meduc - 12) + \beta_3(feduc - 12) + u$$

where *wage* is the monthly wage of the respondent. The results from estimating this equation are below:

```
      Source |       SS       df       MS              Number of obs =     722
-------------+------------------------------           F(  3,   718) =   32.61
       Model |  14399607.2     3  4799869.07           Prob > F      =  0.0000
    Residual |   105675187   718  147179.926           R-squared     =  0.1199
-------------+------------------------------           Adj R-squared =  0.1162
       Total |   120074794   721  166539.243           Root MSE      =  383.64

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        wage |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     educ-16 |   46.60749   7.168573   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    meduc-12 |   10.67185   6.272866   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    feduc-12 |   11.04096   5.510691   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       _cons |   1118.009   20.69534   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
------------------------------------------------------------------------------
```

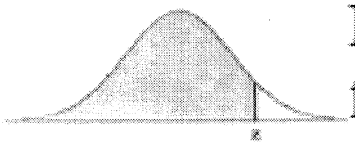
Please construct a 92% confidence interval for the constant. Please interpret this confidence interval. Show your work!!! **(10 Points)**

$1118.009 - 20.695 \cdot 1.75 < B_0 < 1118.009 + 20.695 \cdot 1.75$

$1081.793 < B_0 < 1154.225$ +1

With 92% confidence, a person with 16 years of education, a mother with 12 years of education, and a father with 12 years of education will earn between \$1081.79 and \$1154.22 +6

Have a great weekend!



Normal Distribution from -oo to Z

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

TABLE G.3b

5% Critical Values of the *F* Distribution

	Numerator Degrees of Freedom									
	1	2	3	4	5	6	7	8	9	10
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83

Example: The 5% critical value for numerator $df = 4$ and large denominator df (∞) is 2.37.

Source: This table was generated using the Stata® function invFtail.